GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

Santalum spicatum (Sandalwood) Biodiversity Management Programme

2023

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Front cover photo: Mature sandalwood, Goldfields Region. Benjamin Sawyer (DBCA)

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Acknowledgement

The Department of Biodiversity, Conservation and Attractions (DBCA) acknowledges the Aboriginal peoples that were the first sandalwood custodians and the traditional owners of the lands and deserts from where sandalwood originated and thrived. We respect the connection and knowledge of their Elders past, present and emerging.

Introduction

Santalum spicatum (sandalwood) is variously known as birdilyba, kirti, munyunpa, parnjal, pikarra, tarrtjanpa, tatjan, tujan(pa), thumbuny, walarda, walku, warlka, wirawayin (GALCAC, 2022), uilarac, waang, willarak, wolgol, wollgat (Abbott, 1983), poilyenum (Bindon and Chadwick, 1992)[1], native sandalwood or Western Australian sandalwood.

*S*andalwood is a slow-growing, long-lived small woody tree or shrub that is one of 25 known species of the *Santalum* genus, and one of four that the Western Australian Herbarium (1998-b) lists as indigenous to Western Australia. Sandalwood extends across the southern semi-arid and arid regions of Western Australia and South Australia. 'Wild' sandalwood refers to populations of sandalwood growing among naturally established native vegetation; and 'plantation' sandalwood is cultivated sandalwood specifically grown on previously cleared land as a commercial crop.

Within Western Australia, the sandalwood distribution is across 173 million hectares of the Wheatbelt, Goldfields, Murchison, Gascoyne and southern Pilbara regions, that is the Country of 80 or more Aboriginal clans on lands now classified as either Crown or private (Appendix 1). These lands are managed for purposes that include conservation, mining, pastoralism and the use and benefit of Aboriginal people.

Sandalwood is culturally, medicinally and nutritionally important to the Aboriginal peoples with whom the species co-existed for millennia. While the species was historically utilised, traded and shared between communities and nations, it remained prolific under traditional thresholds of ecologically sustainable use.

Sandalwood is economically valuable and is commercially harvested for the aromatic oils contained in the heartwood. As the heartwood extends throughout the tree, the whole tree (including roots) is removed (taken) and processed.

The need for continued social and economic outcomes from sandalwood includes unique opportunities for traditional owners and their communities. This requires this *Santalum spicatum (Sandalwood) Biodiversity Management Programme* (the Programme) to provide for ecologically sustainable use that limits the species' decline and promotes its recovery, and accounts for pressures on recruitment and population survival.

[1] Phonetic spelling may vary. This is not an exhaustive list of sandalwood names.

Purpose

In accordance with Part 5 of the *Biodiversity Conservation Act 2016* (BC Act), the purpose of this Programme is to provide for the conservation, protection, and management of wild sandalwood. The Programme's intention is to apply ecologically sustainable use principles to prescribe objectives, strategies and actions that will seek to stabilise wild populations. This will be achieved through information gathering, identifying and mitigating threats, regeneration processes, and limiting harvest quantities.

The Programme applies to the management of wild sandalwood on both Crown and private lands across Western Australia. Management actions proposed under the Programme are specific to the management of wild sandalwood and are in addition to routine activities undertaken by DBCA. The Programme does not apply to plantation sandalwood, Indian sandalwood *(Santalum album)* or other *Santalum* species. More information regarding the Programme scope is in Appendix 2.

Public authorities (including State Ministers, State Government departments, State statutory authorities and local governments) must, to the extent that their functions relate to the matters dealt within the Programme, have regard to the Programme when performing those functions.

Legislative framework

State legislation

Sandalwood is defined and controlled as a 'native species', 'flora' and specifically as 'sandalwood' by the Western Australian BC Act and Biodiversity Regulations 2018 (BC Regulations). The objects of the BC Act are to conserve and protect biodiversity and biodiversity components in the State, and to promote ecologically sustainable use of biodiversity components in the State. Biodiversity components include sandalwood as a 'native species'. In the pursuit of these objects, regard must be had to the principles of 'ecologically sustainable development' as set out in section 4 of the BC Act.

The BC Regulations prescribe the requirement for licences to regulate the take, possession for the purposes of supply, processing, dealing and export of forest products, seeds, flowers and leaves from both living (green) and dead sandalwood trees. Once taken, sandalwood of a specific size is regulated as specifically controlled sandalwood, and its transport requires a sandalwood tracking form.

Sandalwood may also be lawfully taken (or cleared) in Western Australia under Parts IV and V of the *Environmental Protection Act 1986* (EP Act) and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations). A licence issued under the BC Regulations provides an exemption to the requirement for an EP Act native vegetation clearing permit (clearing permit).

Sandalwood is also a 'forest product' for the purposes of section 4 of the *Forest Products Act 2000* (FP Act). Therefore, a production contract may be entered into with the Forest Products Commission (FPC) that enables entry to pastoral leases and other 'public land'[2] and the authority to take or remove sandalwood. An FP Act production contract provides an exemption from the requirement for a clearing permit. DBCA has granted a licence under the BC Regulations authorising FPC to supply sandalwood.

[2] 'Crown land' is defined by the *Land Administration Act 1997*. 'Public land' is a sub-set of Crown land and defined in the FP Act. 'Crown land' and 'public land' are not interchangeable terms.

Currently, the take quantity (quantity of wild sandalwood that may be authorised to be taken in any year) is limited by the Sandalwood (Limitation on Removal of Sandalwood) Order (No. 2) 2015 (Sandalwood Order). The take quantity specified in the Sandalwood Order was set on advice from the Minister for Environment and approved by the Governor in Executive Council in 2015 under the now repealed *Sandalwood Act 1929* (Sandalwood Act).

The Sandalwood Order continues to have effect under the BC Act and transitional arrangements in place in the BC Regulations. Regulation 173 provides that: "The sandalwood order is, in relation to sandalwood other than cultivated sandalwood, taken to be an order made by the Minister under section 187(2) of the Act in relation to the species *Santalum spicatum*."

Under section 187 of the BC Act, future sandalwood quantities that may be taken will be established by order made by the Minister, published in the *Government Gazette* and laid before Parliament. This order is subject to disallowance by Parliament.

The Programme is prepared under Part 5 of the BC Act and provides for the management of sandalwood as a native species. It addresses matters of 'ecologically sustainable use' defined as 'use of the biodiversity components in a way and at a rate that does not lead to the long-term decline of biodiversity, thereby maintaining the potential of the biodiversity components to meet the needs of present and future generations.'

Photo 1: Gnarled stems of a wild sandalwood tree

As detailed in Appendix 2, the Programme can not address management of industries that use sandalwood and other non-biodiversity matters including Aboriginal heritage, climate change mitigation and economic returns.

The Programme applies to wild sandalwood occurring on lands to which the *Conservation and Land Management Act 1984* (CALM Act) applies, and all other Crown and private lands as summarised in Table 1. The management of wild sandalwood on DBCA managed land (i.e. categories 1 and 2 in Table 1) will additionally be subject to the CALM Act and management plans made under that Act.

Table 1 Land tenure within the Western Australian geographic distribution of sandalwood as of March 2022.

Category	Land tenure	Hectares (ha) ('000)	% of area
1	Nature reserve and national park	12,085	7%
2	Other DBCA managed lands (including state forest, timber reserve and conservation park)	715	<1%
3	DBCA interest lands (mostly former pastoral lease managed for conservation)	6,236	4%
4	Other Government purpose lands	11,989	7%
5	Unallocated Crown land (UCL)	58,443	34%
6	Crown lease predominantly for pastoral purposes	67,404	39%
7	Private property and other	16,338	9%
All[1]	Total of all tenures	173,211	100%

[1] Includes 30,457ha of Indigenous Protected Areas across other government lands (146ha), DBCA interest lands (563ha), UCL (20,948), Crown lease (6ha) and private property and other (8,794).

Commonwealth legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides the legislative framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, known collectively as matters of national environmental significance. The EPBC Act applies to actions that are likely to have a significant detrimental impact on a matter of national environmental significance. Sandalwood is not listed as a matter of national environmental significance under the EPBC Act, and therefore taking of sandalwood is not subject to the EPBC Act.

Export licences for sandalwood are issued in accordance with the Commonwealth's *Export Control Act 2020* and are subject to any associated conditions.

The *Native Title Act 1993* provides for the recognition of native title rights and interests and establishes ways in which future dealings affecting native title may proceed.

Sandalwood biodiversity

Biology

Sandalwood typically grows to four metres in height with a stem diameter of 200mm (measured at 150mm above the ground). In Kalgoorlie, the length of time required for a sandalwood tree to attain the minimum stem size permitted for take (approx. 127mm diameter) is 59 to 115 years (Loneragan, 1990).

Sandalwood established in the rangelands produce seed (and therefore are reproductively mature) by age ten (Brand et al, 2014). Fruits consist of a leathery tan-brown outer skin (epicarp) and a smooth round inner nut (endocarp) (Loneragan, 1990). The endocarp (seed) may be 10-25 mm in diameter and weigh 2-3 grams. Seeds are dispersed by the seed caching (scatter hoarding) behaviours of ground-dwelling marsupials including woylies (*Bettongia penicillata ogilbyi*) and boodies *(Bettongia lesueur graii)* (Murphy *et al*., 2005, Chapman, 2015). Water flow across and through the landscape is also an important seed dispersal and recruitment vector.

Sandalwood is a root hemi-parasite[3] that requires nitrogen fixing host plants (particularly of the genus *Acacia*) from soon after germination through to maturity. Sandalwood roots connect to host roots through structures called haustoria. Each haustorium can be up to 20mm in length and an individual sandalwood tree can have hundreds of connections. The haustoria function is to supply the sandalwood tree with water and nutrients from its host.

Genome analysis indicates sandalwood has two main genetic groups that are geographically separated, one centred in the northern arid region and the other in the southern semi-arid region (Byrne *et al*., 2003) that are loosely separated by the 250mm rainfall isohyet that extends from Israelite Bay through Kalgoorlie and Yalgoo to Shark Bay. North of this line (<250mm mean annual rainfall), sandalwood is most associated with *Acacia* shrublands. South of the line (250 to 650mm mean annual rainfall), sandalwood is most associated with *Acacia* dominant understories that occur among the broad *Eucalyptus* woodlands.

Photo 2: 11-year-old seed producing sandalwood

Distribution

The Interim Biogeographical Regionalisation of Australia (IBRA) divides the Australian land mass into 89 biogeographic regions and 419 sub-regions. Each region is a land area comprised of a group of interacting ecosystems that are repeated in similar form across that landscape (Thackway and Cresswell, 1995). The sandalwood distribution occurs over the 15 Western Australian IBRA biogeographic regions and 29 sub-regions listed in Table 2 and is illustrated with specimen locations from the Western Australian Herbarium (1998-a) in Appendix 1.

[3] Hemi-parasite: a plant that gains part of its resources through connections with another plant while also photosynthesising.

Table 2 IBRA Western Australian biogeographic regions and sub-regions within the sandalwood distribution.

Biogeographic region	Sub-regions
Avon Wheatbelt	• Katanning • Merredin
Carnarvon	• Cape Range • Wooramel
Central Ranges	• Mann-Musgrave Block
Coolgardie	• Eastern Goldfields • Mardabilla • Southern Cross
Esperance Plains	• Fitzgerald • Recherche
Gascoyne	• Ashburton • Carnegie • Augustus
Geraldton Sandplains	• Geraldton Hills
Gibson Desert	• Dune Field • Lateritic Plain
Great Victoria Desert	• Central Shield
Little Sandy Desert	• Trainor
Mallee	• Eastern Mallee • Western Mallee
Murchison	• Eastern Murchison • Western Murchison
Nullabor	• Carlisle • Nullabor Plain
Pilbara	• Chichester • Fortescue • Hammersley
Yalgoo	• Edel • Tallering

Current situation

The international economic value of sandalwood was recognised by early non-indigenous settlers who began harvesting and exporting the species in the 1840s (Talbot, 1983). By the 1890s, the economic value of sandalwood to the Western Australian Colony (and later State) prompted extensive and ongoing research and inventory that has informed regeneration processes, conservation prescriptions, take limits and resource yield forecasts.

Since the commencement of Western Australia's European colonisation in 1829, sandalwood occurrences within the biogeographic regions have variably, and in some cases, significantly changed. This is most apparent throughout the Avon Wheatbelt and Mallee where extensive agricultural clearing has reduced wild sandalwood occurrence to fragmented populations within conservation reserves and remnant native vegetation on private property.

While sandalwood still broadly occurs across the Coolgardie, Murchison, Gascoyne and Yalgoo biogeographic regions, population numbers and condition vary considerably due to cumulative impacts associated with:

- land use such as grazing by domestic ungulates
- pest and feral species
- lawful and unlawful take
- altered fire regimes
- deterioration of soil and water quality
- climate change.

The FPC (2015 & 2016), as reviewed by Herford et al (2015) and the Appeals Convener (2016), identify that while there is significant variation in occurrence and abundance of sandalwood, there is a clear and concerning pattern within sandalwood populations of the absence of a young sandalwood cohort that is sufficient in number to replace the projected decline of mature sandalwood trees. Brand et al. (2014) projected that unless intervention is taken, wild trees from locations in the Murchison and Yalgoo biogeographic regions will largely disappear within 50 to 60 years.

Intervention includes mechanical establishment of sandalwood seedlings. Extensive sandalwood seed sowing programs among remnant natural vegetation, including on conservation lands, is generating a young cohort within sandalwood populations in >250mm rainfall zones. These programs are an important consideration in assessing wild sandalwood population condition.

The weakness in the current population analysis is that projections are based on data largely collected in the 1990s and 2000s. This data is limited in capacity to inform future sandalwood biodiversity management as it is not attuned to critical influences such as the improved understanding of climate change, the effect of increasing area of the conservation estate, or the extent to which sandalwood regeneration programs will or can contribute to the regeneration cohort at a location or regional level, or across the species' distribution.

The Programme notes that an estimated total of 25,000 hectares of plantation sandalwood has been established mainly in the State's Wheatbelt. Plantations are outside the scope of the Programme as discussed in Appendix 2.

Objectives and strategies

To stabilise the ecological sustainability of wild sandalwood, the objectives and strategies of this Programme (summarised in Appendix 3) seek to conserve, maintain or re-establish self-sustaining sandalwood ecosystems while providing for an ecologically sustainable level of wild sandalwood use (harvest).

Objective: Manage sandalwood take for ecologically sustainable use.

Strategy 1: Protect and manage sandalwood populations throughout its Western Australian distribution through a comprehensive, adequate and representative (CAR) reserve system.

Australia is a signatory to the United Nations Convention on Biological Diversity (CBD). This multilateral treaty is the international instrument for the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources. The fifteenth Conference of the Parties to the CBD adopted the Kunming-Montreal Global Biodiversity Framework (GBF). The GBF includes a target that by 2030, at least 30 percent of terrestrial and inland water areas are effectively conserved and managed through ecologically representative systems of protected areas and area-based conservation measures that recognises indigenous and traditional territories (CBD, 2022). To secure long-term protection for Australia's biodiversity in accordance with the GBF, a CAR national reserve system of protected areas is being continually developed through initiatives such as the State Government's Plan for Our Parks.

In 1988, Western Australia began building on its existing conservation estate (i.e. CALM Act lands including nature reserves and national parks) to establish a CAR reserve system that aligns with national reserve system goals to develop and effectively manage a comprehensive, adequate and representative national system of protected areas to secure long-term protection for Australia's terrestrial biodiversity. To increase rangeland ecosystem representation, DBCA (through its predecessors) purchased pastoral leases and reconfigured their landscapes from commercial agricultural production to management for conservation.

Initial pastoral lease purchases were funded by the Sandalwood Conservation and Regeneration Project. This initiative was to improve the conservation status of sandalwood in Western Australia, partly through developing and managing an effective reserve system to conserve representative areas of sandalwood. Subsequently, the Gascoyne-Murchison Rangeland Strategy provided for further acquisition of pastoral leases. Through these processes, over five million hectares of pastoral leases located across the Gascoyne, Murchison and Goldfields regions were purchased for conservation, many of which contain sandalwood.

While 19 million hectares of the sandalwood distribution are managed by DBCA for conservation (categories 1, 2 and 3 of Table 1), the Western Australian system of terrestrial conservation reserves does not yet meet the nationally agreed CAR representation in many IBRA sub-regions. Consequently, sandalwood is not adequately or comprehensively represented in reserves.

Included within the national reserve system are Indigenous Protected Areas (IPA) that are dedicated to the Union for Conservation of Nature categories 5 and 6 that seek to protect landscapes through balancing nature and sustainable use of natural resources by local communities applying traditional land management systems. Through Commonwealth funding agreements, IPA managers and rangers work as custodians for positive on-Country

biodiversity outcomes. Land management actions on IPAs such as feral herbivore control are important to sandalwood by contributing to threat reduction across the landscape.

Native title must be considered in progressing lands into the CAR reserve system as there may be procedural rights that need to be afforded to registered native title claimants and registered native title bodies corporate for the purposes of the *Native Title Act 1993* (Cth).

Capacity for increasing the size of the CAR reserve system can be diminished by resource development. While under section 24 of the Mining Act a mining lease or general purpose lease cannot be granted over a national park or class A nature reserve without the consent of both Houses of Parliament; mining, including exploration for minerals, may be undertaken in these areas with the consent of the Minister for Mines and concurrence of the Minister for the Environment. Different and less strict requirements apply to conservation parks and non-class A nature reserves (for example, consent of both Houses of Parliament is not required and the concurrence of the Minister for Environment is not required). In some instances, where conservation values are considered to constrain extraction of mineral and petroleum resources, State objectives supporting resource development outweigh conservation values.

Sandalwood on conservation lands in the CAR reserve system is managed for conservation and protected from harvest. The quantity of sandalwood protected from harvest is an important consideration in assessing sustained yield, therefore any activity that can access and disturb sandalwood populations on conservation lands affects the calculations for sustainable harvest and requires active planning and management to mitigate the effect on ecologically sustainable use.

Management actions

a) Continue to manage the CAR reserve system for the protection of sandalwood and other conservation values.

b) Progress the reservation of former pastoral leases purchased for conservation under the CALM Act toward the 17 percent target in IBRA biogeographic regions with sandalwood distribution.

c) Work with native title holders, and joint management partners to establish and protect sandalwood on lands included in the CAR reserve system.

d) Explore opportunities with IPA managers for sandalwood conservation, protection and management.

Strategy 2: Review and potentially revise lawful sandalwood take quantities to maintain productive capacity of sandalwood populations and associated ecosystems.

The BC Act s187(2) states*:* “The Minister may, by order —
(a) fix the maximum quantity of sandalwood that can be taken in a specified period; and
(b) fix the maximum quantity of sandalwood that can be taken in a specified part of the specified period.”

The quantity of wild sandalwood that may be pulled or removed from Crown land and private land is restricted by Ministerial order during the period specified in an order. An order does not restrict the quantity of plantation sandalwood that may be taken.

The current Sandalwood Order took effect on 1 July 2016 and continues until 31 December 2026. The order limits the take from Crown land and private land at 'no more than 2500 tonnes in a single financial year, of which no more than 1250 tonnes may be living sandalwood'.

As the BC Act prescribes a Ministerial order as the mechanism to limit future sandalwood take quantities, is not appropriate for this biodiversity management programme to do so. Rather, this Programme provides the framework to inform DBCA in making recommendations for an acceptable sandalwood yield.

Under section 187(5) of the BC Act, the CEO must ensure that the total quantity of sandalwood authorised to be taken under licence does not exceed the maximum quantities set in an order. DBCA regulates the sandalwood take quantity through BC Act licences issued for both Crown and private lands.

Further terms or conditions that are imposed on sandalwood take are prescribed by BC regulation 67. This includes (and is not limited to), the minimum size of living (green) trees that can be taken 'must not be less than 400mm in circumference when measured over the bark at a point approximately 150mm above the ground'.

Management actions

a) DBCA will determine and recommend a sandalwood take quantity for the Minister to issue an order that will replace the Sandalwood Order in 2027. The framework for recommendations to limit sandalwood take will account for:
   i. strategic inventory, resource and population modelling
   ii. risk analysis of the species potential for persistence within and across its distribution
   iii. scale and effectiveness of sandalwood establishment operations
   iv. living (green) sandalwood having distinct sustainability factors and management requirements to dead sandalwood
   v. regional licence protocols for sandalwood conservation, protection and management (to be developed)
   vi. principles of ecologically sustainable development as defined in Section 4 of the BC Act.

b) DBCA will review regulation 67(3)(c) (that prescribes the minimum size permitted for take of sandalwood) and recommend changes if considered necessary to maintain best practice consistent with contemporary species biology and population knowledge.

Objective: Manage and mitigate pressures on sandalwood and sandalwood populations.

Strategy 3: Limit the impact of pests, feral animals and diseases on sandalwood.

Animal pests and feral animals: predators

Several introduced (or feral) predators have become established within the sandalwood distribution and are having significant impacts on sandalwood populations. Feral predators (particularly feral cats and foxes) prey on native fauna and have been linked to the extinction and/or significant decline of the ground-dwelling marsupials that are important for sandalwood seed dispersal and recruitment. For example, in the Coolgardie biogeographic region, 20 marsupial species that occurred in 1829 are now considered regionally extinct.

Since 1996, fox baiting using 1080 has been carried out by DBCA (and its predecessors) to protect native fauna through the *Western Shield* program (Possingham et al, 2004). *Western*

Shield is one of Australia's largest wildlife recovery programs, aiming to recover and sustain wild populations of native fauna threatened by predation from foxes and feral cats. The program now covers an area of 3.8 million hectares across Western Australia, in lands that include the CAR reserve system within 1.6 million hectares of the sandalwood distribution. Over the last decade, the effect of feral cat predation has become more evident as populations of some threatened species, including the woylie and boodie, that had recovered with fox baiting started to decline. *Western Shield* is now integrating the feral cat bait, Eradicat® with fox baiting to reduce the impact of feral cats on native fauna.

Management action

a) DBCA may undertake additional predator control in locations with known woylie and other sandalwood seed caching marsupial populations within available resources.

Animal pests and feral animals: herbivores

Feral herbivores, particularly goats and rabbits, are widespread in the sandalwood distribution. These animals voraciously graze sandalwood seedlings and trees and have considerable impact on vegetation composition, cover and condition that can lead to increased erosion and habitat destruction. Camels, donkeys, horses and pigs are also present in parts of the sandalwood distribution; however they are not considered to cause the same level of impact to sandalwood as goats and rabbits.

DBCA develops control plans to reduce the range and abundance of feral herbivores that are causing significant detriment to conservation values on DBCA managed land, works with neighbours to integrate feral herbivore control measures across property boundaries, and supports the activities of recognised biosecurity groups in controlling declared pests.

Management of water points is a key strategy to reduce grazing pressure and DBCA's approach is generally to remove artificial water points from lands acquired for conservation. Artificial water points enable numbers of introduced and native animals (such as kangaroos) to increase to unsustainable levels in the surrounding environment.

In contrast to the negative impacts of foxes and feral cats, the increased occurrence of wild dogs—including dingoes, feral/escaped domestic dogs and their hybrids, that are declared pests under the *Biosecurity and Agriculture Management Act 2007* (Biosecurity Act)—has caused localised reductions in goat populations that have allowed vegetation recovery and provided sandalwood the opportunity to re-establish.

Both introduced and native species may be declared as pest animals under the Biosecurity Act and managers of any land are required to carry out control measures for 'declared species' under that Act to contain the damage they cause. Control options for pest animals include ground and aerial baiting, shooting, trapping, fencing, biological control, mustering and removal.

Management actions cont.

b) In land management decisions, DBCA may determine there are locations where wild dog predation of herbivores is more beneficial to native flora conservation than wild dog control measures.

c) Through its Aboriginal joint management policy, DBCA will investigate opportunities for traditional owners to control pests in on-Country sandalwood restoration projects.

d) DBCA may increase feral herbivore controls (including strategic fencing within the CAR reserve system) in areas with established sandalwood seedlings and saplings, within available resources.

Plant pests and weeds

Plant pest and weed infestation in the sandalwood distribution is primarily associated with species introduced through activities related to pastoralism and mining. Many such as buffel grass and ruby dock are now widespread. While not thought to have a direct impact on sandalwood, weed species can add to fire-fuel loads and alter fire regimes in ways that may adversely affect fire sensitive species such as sandalwood. Following the removal of livestock there are many weed species that respond vigorously, particularly in heavily disturbed sites such as near water points and holding yards.

Broadly, DBCA has developed an invasive plant prioritisation process that is an integrated approach to the management of weeds that impact biodiversity. This process provides a ranking of the threat posed by each weed species by region against specific criteria. It aims to consider priorities for control of the threat of environmental weeds within Western Australia based on individual species and more broadly, their impacts on biodiversity assets.

Machinery used for the harvest and haulage of sandalwood has the potential to spread weeds and appropriate hygiene practices are required to minimise this risk.

Diseases

No diseases are currently known to affect wild sandalwood. As a precaution, hygiene measures such as cleaning soil from vehicles and other equipment before performing any work on the conservation estate are required in some areas.

Strategy 4: Manage sandalwood in locations grazed by domestic ungulates.

Sandalwood foliage is often preferentially grazed by livestock. Domestic ungulates, particularly sheep and goats, are widespread pastoral livestock across the western portion of the sandalwood distribution. Through grazing and hard-hoof soil compaction, domestic ungulates have had considerable impact on vegetation composition, cover and condition resulting in soil erosion and habitat destruction. Cattle are currently the predominant livestock throughout the pastoral locations of the eastern part of the sandalwood distribution. Cattle are not considered to cause the same level of impact to sandalwood as sheep and goats.

Sheep and goat grazing on seedlings and young plants and has had a major impact on establishment and recruitment of sandalwood for many decades. Prescription of pastoral stock carrying capacity limits and rangeland condition monitoring under the authority of the Pastoral Lands Board has reduced livestock numbers and pressures on soils and vegetation. Where there is any presence of sheep or goats however, there is little opportunity for sandalwood establishment without exclusion fencing.

Rangeland vegetation and soil condition is subject to the provisions of the *Soil and Land Conservation Act 1945,* is the responsibility of the Commissioner of Soil and Land Conservation, and is administered through the Department of Primary Industries and Regional Development. These provisions include the mitigation and prevention of land degradation, promotion of soil conservation and educating landholders and the public about sound land management.

DBCA has removed livestock from pastoral leases purchased for the CAR reserve system although it is noted that native title holders may desire to reintroduce stock in some locations. This will be further discussed through the development of joint or cooperative management arrangements.

Management action

a) In assessing applications to take living (green) sandalwood, DBCA will apply sandalwood licensing guidelines with specific criteria for locations subject to agricultural sheep or goat enterprises.

Strategy 5: Provide effective compliance and enforcement

Sandalwood trafficking (unlawful take, illegal harvesting, theft, poaching, smuggling) undermines ecologically sustainable use and is a direct threat to the species. Trafficking has been a particularly significant issue since the early 2000s due to:

- sandalwood's attractive and increasing value
- perceived low probability of being caught due to the remoteness of the sandalwood distribution
- some use of sandalwood plantations to launder unlawfully-taken wild sandalwood
- previously inadequate deterrent penalties of the repealed Sandalwood Act.

The BC Act provides contemporary legislation to better protect the species and support its ecologically sustainable use. Maximum penalties for the unlawful take, supply, dealing in, processing and export of sandalwood are $200,000 for an individual person, and $1 million for a corporation. In addition, a court may order an offender to pay an additional penalty amount of $20,000 per tonne (or part of a tonne) of sandalwood involved in the offence.

Management actions

a) DBCA will maintain and, if resources permit, increase wildlife (sandalwood) enforcement operations throughout illegal supply chains from the point of origin.

b) DBCA will continue to undertake compliance and enforcement action to protect sandalwood and support ecologically sustainable use consistent with the provisions of the BC Act.

c) DBCA will explore options with traditional owners to protect sandalwood from trafficking.

Strategy 6: Use and respond to fire to mitigate the impact on sandalwood populations.

Although fire is an endemic event in the Australian landscape, it has the potential to impact biodiversity conservation values. Fire impact is determined by a combination of frequency, intensity, interval, season and size.

Sandalwood is highly susceptible to fire with exposure to moderate to high intensity fire events; or repeated short return fire intervals, resulting in tree mortality.

While the differing vegetation types associated with sandalwood have different fire behaviours and responses, woodland communities appear to burn much less frequently than shrubland or mallee communities due to the widely spaced trees and discontinuous ground fuels, with fire intervals of hundreds of years in some areas. However, recent decades have seen bushfires impact approximately 25-30 percent of eucalypt woodland area (Gosper et al., 2013) and their sandalwood populations. Woodland recovery after bushfire can take hundreds of years (Gosper et al., 2013). Anthropogenic induced climate changes are forecast to lead to increasingly frequent and larger fires, often in milder weather conditions (Burrows et al., 2006).

Under a Memorandum of Understanding (MoU) with the Department of Planning, Lands and Heritage (which has legislative responsibility for management of unallocated Crown lands), fire management responsibilities on unallocated Crown lands (UCL) outside townsites are shared between DBCA and local government authorities (LGAs). DBCA is responsible for fire mitigation, while LGAs, with assistance from the Department of Fire and Emergency Services (DFES), are responsible for suppression of bushfires. DBCA is responsible for all aspects of fire management, including prescribed burning and bushfire suppression, on CALM Act lands while traditional owners, pastoralists, mining companies and other private landowners and leaseholders undertake fire management on lands for which they are responsible.

DBCA, LGAs and DFES work collaboratively to manage bushfires based on known values and risks, weather forecasts, fire behaviour and commitment of firefighting resources across regions and the State. Due to the large and remote areas of sandalwood distribution it is not typically logistically feasible to protect sandalwood areas through direct suppression actions. Satellite, aerial and ground resources for monitoring bushfires are potential resources to monitor and record fire impact on sandalwood habitats.

Management actions

a) DBCA will seek to consider location and potential impacts on sandalwood populations in planning and implementing prescribed burns.

b) When recommending future limits on the amount of sandalwood that can be harvested from the wild, DBCA may consider previous and potential impacts of bushfire derived from relevant monitoring and modelling data.

c) DBCA will develop a ‘sandalwood and fire’ document to assist fire management agencies account for sandalwood in fire planning and suppression activities.

Strategy 7: Adapt sandalwood management to climate change.

In 2015, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Australian Bureau of Meteorology (BoM) released a set of national climate projections for clusters and sub-clusters across the Australian continent. The clusters are defined by groupings of natural resource management (NRM) regions. Sandalwood distribution extends across three of the sub-clusters (refer Appendix 1):

- Rangelands North
- Rangelands South
- Southern and South-western Flatlands West.

For the Rangelands sub-clusters, mean air temperature is projected to increase, the hottest days are projected to become hotter, and the frequency of hot days and duration of hot spells are projected to increase. The number of frost days is projected to reduce. There has been a small decline in winter rainfall in the south since 1960 with natural climate variability predicted to be the main driver of rainfall changes to 2030. However, by 2090, winter rainfall is projected to decrease by up to 45 percent, with changes to summer rainfall possible with the direction not able to be reliably predicted (Watterson et al., 2015).

Similarly, for the Southern and South-western Flatlands West sub-cluster, mean air temperature is projected to increase, the hottest days are projected to become hotter, and the frequency of hot days and duration of hot spells are projected to increase. The number of frost days is projected to reduce. There has been a prolonged period of extensive drying since the 1970s, particularly in autumn and early winter. By 2030, winter rainfall may decrease by 5 to 15 percent. By 2090, winter rainfall may decrease by up to 30 percent (with low carbon

emissions) and up to 45 percent (with high carbon emissions). The frequency and duration of drought is projected to increase (Hope et al., 2015).

Projected declines in winter rainfall are expected to critically impact sandalwood germination due to seed requiring 264mm of annual rainfall that includes an autumn rain event of >12.5mm precipitation (Sawyer, 2013). More broadly, the autumn-winter rainfall quantity for sandalwood germination and establishment (winter threshold) is defined as 100mm between April 1 and August 31 with a pre-June 15 'season-break' of 12.5mm. Any increase in summer rainfall in changing weather patterns may improve seedling survival, however high summer rainfall has not been observed to stimulate sandalwood germination (Brand, 2017).

Seedling establishment processes that rely on the occurrence of winter threshold events are more likely to succeed in the southern sandalwood distribution. To account for declining winter rainfall, seeding programs are required to be sustained over the long-term to respond to fluctuating occurrences of winter threshold events by 'boom' seasons establishing sufficient seedlings to offset increasingly frequent 'bust' seasons.

Management actions

a) DBCA will maintain currency in knowledge and contemporary management approaches in relation to climate change and its possible impacts on sandalwood.

b) Future planning for the management of sandalwood, particularly establishment programs, will adapt to authoritative climate change predictions and data generated from the species response to actual conditions.

c) Aligned with Strategy 12, DBCA may undertake and encourage research into innovative practices for reducing the reliance of sandalwood germination on the winter threshold.

Strategy 8: Minimise the impact on sandalwood from lawful clearing.

Clearing subject to a licence

Subject to section 51C, Schedule 6 of the EP Act, clearing consisting of the taking of flora (sandalwood) by a licence under the BC Act is exempted from the requirement for a Clearing Regulations clearing permit. Issue of sandalwood licences and compliance to licence conditions is the responsibility of DBCA.

Management actions

a) DBCA will develop Sandalwood Licensing Guidelines that are to be read and reviewed with the Programme.

b) DBCA will require and audit licence returns.

c) DBCA will audit licence compliance through the supply chain.

d) DBCA will review the legislation and regulatory framework that governs the take of sandalwood forest products.

Clearing by other lawful authority

Clearing under a production contract entered into and having effect under the FP Act is also exempted from the requirement for a Clearing Regulations clearing permit. The FPC administers FP Act production contracts for public land operations and manages the compliance responsibilities of contractors.

Management actions cont.

e) All public authorities (including the FPC) with lawful authority to take sandalwood other than under a flora taking (sandalwood) licence will liaise with DBCA to ensure that the sandalwood is taken in an ecologically sustainable manner and consistent with the limits in the Sandalwood Order.

Clearing subject to the Clearing Regulations and Mining Act

Mining tenements with active extraction and exploration operations and road reserves with active expansion projects that often impact sandalwood habitats occur within the sandalwood distribution. These clearing activities are made lawful under Part IV Division 2 and Part V Division 2 of the EP Act, the Clearing Regulations and the Mining Act. Clearing for exploration that has been authorised under the Mining Act, and clearing for 'low impact mineral and petroleum activities' as defined in the Clearing Regulations, is generally exempt from the need for a clearing permit under the EP Act or a licence to take sandalwood under the BC Act.

Sandalwood trees are cleared and disturbed in these processes and while sandalwood seed may be included in rehabilitation seed mixes, they are not generally replaced in equivalent number.

DBCA may request that proponents proposing activities on CALM Act lands conduct targeted surveys for sandalwood and recommend measures for sandalwood protection. On lands not defined as CALM Act lands (including lands proposed for addition to the CAR reserve system), DBCA may request measures for sandalwood survey or protection from the impacts of lawful clearing or mineral exploration.

It is important that wherever possible, sandalwood impacted by clearing operations is utilised rather than lost to windrows, mulching or burning.

Management actions cont.

f) DBCA will produce and promote a sandalwood guidance paper for development regulators and proponents, summarising processes for sandalwood conservation through investigation (survey) and planning, involvement of traditional owners, and the importance of resource utilisation where disturbance is unavoidable.

g) DBCA will seek to provide advice, where appropriate, in relation to development proposals where sandalwood has been identified (including, but not limited to, proposals for infrastructure development, exploration and/or extraction of minerals and petroleum resources), with a view to:
    i. minimise the impact on sandalwood populations, sandalwood scientific plots and sandalwood monitoring sites as a result of disturbance; and
    ii. advise the proponent, the FPC and/or licence holders of opportunities to remove sandalwood from approved disturbance locations.

Strategy 9: Protect soil and water quality as fundamentals to sandalwood biodiversity health.

Soil and water conservation is intimately linked to biodiversity conservation and to sustaining the productive capacity and health of ecosystems.

Disturbances from activities associated with sandalwood take, such as tree extraction, road construction, machines accessing the bush, and camp establishment can be detrimental to soil and water resources. Impacts such as compaction, rutting, hydrocarbon contamination

and vegetation breakage can be mitigated through management controls. Conversely, certain types of soil disturbance that loosen and open the soil can assist sandalwood establishment.

DBCA requires licence holders to conduct operations in accordance with operational controls to minimise adverse impacts on soil and water values resulting from sandalwood operations.

Management actions

a) DBCA may undertake both regular and opportunistic monitoring of compliance with licence conditions for soil disturbance limits.

b) DBCA will investigate reports of soil or water contamination resulting from sandalwood operations and take appropriate action.

Objective: Maintain sandalwood's natural distribution and improve population condition.

Strategy 10: Establish sandalwood seedlings to maintain wild sandalwood populations in the long term.

Existing impacts have affected sandalwood recruitment and, consequently, there has been a decline in sandalwood occurrence across most of its range (Herford et al., 2015).

Where threats can be ameliorated, there is an opportunity to establish and recruit sandalwood through seeding operations (Brand, 2000, Brand et al., 2014). To redress the lack of establishment and recruitment that has occurred over many decades, and to replace trees lost through natural mortality, seeding operations must aim to increase the total sandalwood population rather than only replace trees taken under licence or other authority. Incorporating seedling operations as a stipulated condition of a sandalwood licence assists in increasing the total sandalwood population.

By example, the FPC implemented its Operation Woylie sandalwood regeneration program in 2011 and reported a cumulative average of 46,000 seedlings being established through mechanical processes each year since that time (FPC, 2022). The importance of a seeding program being sustained long-term is that establishment success will vary from year to year due to fluctuating rainfall. The cumulative average number of seedlings following successive low rainfall winters is significantly improved by a year that satisfies the winter threshold as was the case in many regions in 2021 (FPC, 2022).

Operation Woylie proceeds mainly through recently harvested locations on pastoral leases with no sheep or goats, and areas of unallocated Crown land where populations of wild dogs control feral ungulate and rabbit numbers. Conservation reserves throughout the Rangelands and Wheatbelt have strong potential for increased sandalwood establishment through seeding programs.

To protect the species' genetic diversity, it is preferred that genetically appropriate, regionally sourced seed is used for planting in conservation reserves. Broader scale plantings in the Eastern Goldfields, Edel, Southern Cross and Tallering IBRA sub-regions may utilise seed sourced from Wheatbelt plantations that are generally of the southern genetic group. Establishment programs in other IBRA sub-regions should use seed known to be of the northern genetic group.

Section 5(1) of the BC Act and BC regulation 4, exclude sandalwood that is regenerated in connection with sandalwood being lawfully taken from the definition of 'cultivated' flora.

Sandalwood satisfying these criteria is therefore legislated wild sandalwood and required to be considered as such in population analysis and future management considerations.

Natural sandalwood regeneration and recruitment may be encouraged by retaining trees capable of producing large quantities of viable seed (seed trees) in areas subject to take. Seed trees have a healthy crown, a stem diameter greater than 50mm, and are located in close proximity to other seed trees. The minimum take size required by the BC Regulations is in part set to preserve a growing stock of seed-bearing trees.

Natural regeneration may occur in small creeks, tributaries or in locations where interrupted overland water flow allows seed to be dispersed and deposited. Locations where seed dispersing marsupials have (or are planned to be) re-introduced also provide opportunity for sandalwood to naturally regenerate. Informal reserves, i.e. locations within proposed harvest areas that are conducive to natural and planted regeneration with retention of seed trees and intensive threat management, can contribute as sandalwood conservation zones beyond the CAR reserve system.

Management action

a) DBCA will develop a sandalwood establishment strategy that:
   i. advises the sandalwood licence conditions of the Sandalwood Licensing Guidelines;
   ii. acknowledges the FPC's sandalwood regeneration operations;
   iii. identifies priority establishment locations that may include the CAR reserve system;
   iv. creates baseline sandalwood data to assess successes/failings of establishment projects and threat controls;
   v. applies appropriate processes and quantities that are scaled to the sandalwood landscape;
   vi. forecasts sustained funding requirements;
   vii. includes sandalwood seeding and regeneration encouragement operations in joint management conservation programs with traditional owners;
   viii. requires sandalwood seeding outcome to be reported against targets;
   ix. complies with tree retention conditions of the Sandalwood Licensing Guidelines;
   x. promotes seed orchard establishment to produce northern genetic group and other specific seed supplies; and
   xi. considers sandalwood establishment in fauna re-introduction locations to renew localised natural sandalwood regeneration cycles; and provide a food source for re-introduced ground dwelling marsupials.

Strategy 11: Set regional protocols for sandalwood conservation, protection and management.

The BC Regulations control sandalwood take through requirement for licences and prescribing minimum sizes for living (green) trees. However, sandalwood varies genotypically and phenotypically across its distribution in response to many different natural and anthropogenic factors. To achieve biodiversity conservation, protection, and management objectives, regionally specific management protocols that account for sandalwood population condition and species threats are required in addition to legislative controls.

Sandalwood management regions may be defined by the IBRA biogeographic regions and sub-regions (Table 2) as the most appropriate foundation due to being the basis for CAR reserve system objectives and as the nationally agreed basis for biogeographical regionalisation.

Managing sandalwood at a biogeographic regional level through the protocols does not compromise the requirement for location specific sandalwood management mechanisms whether the objective is for sandalwood conservation, protection or ecologically sustainable use.

Management actions

a) DBCA will formulate regional protocols for sandalwood conservation, protection and management that set requirements for establishment and protection as well as licence restrictions for sandalwood take in each IBRA region or sub-region within the sandalwood distribution.

b) When issuing licences to take or supply sandalwood, DBCA will apply the regional protocols for sandalwood conservation, protection and management.

c) Proponents of sandalwood operations will be required to submit a sandalwood establishment and sustainability plan for DBCA approval prior to the issue of a licence or commencement of operations. DBCA will develop a 'sandalwood establishment and sustainability plan' template.

Objective: Inform conservation through research and knowledge acquisition strategies.

Photo 3: Machine seeded wild sandalwood

Strategy 12: Identify knowledge gaps in existing research relevant to sandalwood biodiversity conservation.

Sandalwood is a highly studied species with an extensive library of published peer reviewed research and management documents. However, continued demand for the species as a commercial resource under changing environmental conditions requires the highest possible level of understanding to prescribe adaptive management actions for ecologically sustainable use.

It is critical that sandalwood research is not constrained by, or to, a western science framework. Aboriginal traditional owner knowledge that has developed and sustained through innumerable generations connected with Country has intrinsic importance to biodiversity conservation, ecological processes, sustainable resource use and management. Traditional knowledge systems are by their very nature complex, holistic and interdisciplinary. Combining traditional knowledge with western science in a respectful and complementary manner can produce highly successful and innovative outcomes (Milroy, 2013).

Possible deficits in the sandalwood knowledge base may include regional genetic provenances and the importance of sandalwood seed as a food source for ground dwelling marsupials.

Management actions

a) DBCA will instigate a strategic review of existing research and available records to identify knowledge gaps.

b) Respecting principles of free, prior and informed consent, DBCA will seek and integrate available traditional knowledge of sandalwood biology and ecologically sustainable use in decision making processes.

c) DBCA may undertake and encourage research to address identified knowledge gaps in collaboration with other research organisations.

Strategy 13: Quantify and improve sandalwood inventory and population condition monitoring.

Broad sandalwood resource assessments (inventory) were commenced by DBCA's predecessors in 1980 and were continued by the FPC beyond 2000. Yield estimates have been generated in 1991, 2000 and 2015.

The FPC's 2015 strategic inventory and yield model, as reviewed by DBCA, was used to inform the Sandalwood Order. The inventory projections were generated from data collected from Crown lands that were legislatively available for harvest, i.e. not CALM Act lands. This inventory was a consolidation of the earlier inventories and further work by the FPC to define the geographic occurrence, distribution of tree size and condition of the available standing resource. This inventory indicates sandalwood numbers to be in the order of tens of millions. The FPC's longer-term yield projections were contained to their primary wild sandalwood supply area, defined as four of the 29 IBRA sub-regions (Eastern Goldfields, Eastern Murchison, Southern Cross and Tallering) within the total distribution. Other sub-regions were excluded from inventory projections due to:

- the resource being more scattered and less commercially viable
- continued and extensive feral and domestic ungulate grazing preventing opportunity for regeneration
- being in locations with less than 200mm annual rainfall and/or receiving summer dominant rainfall preventing opportunity for regeneration
- insufficient field assessment.

Sandalwood populations are widely dispersed with individual plants in populated areas often being hundreds of metres apart. While sandalwood inventory is based on a small sample size due to the logistics of sampling the large distribution area, estimates of the total standing resource have a level of precision that is characteristic of strategic inventories and provide an acceptable basis for regulating the yield (Herford et al., 2015).

The supply area inventory data was modelled to forecast the standing resource, tree diameter class distribution, and number of seed trees arising from varied levels of take. Application of the model required input of future rates of sandalwood establishment, growth, mortality and recruitment across the various supply zones. While the default values used are generally based on sound data, these key variables are subject to considerable uncertainty over time, generating reduced reliability for long-term projections. To mitigate this uncertainty a short planning horizon (10 years) for the Sandalwood Order was adopted; and effective monitoring to inform future take limits was recommended (Herford et al., 2015).

Management actions

a) To broaden sandalwood population understanding and inventory sources, DBCA will require licence applicants to submit sandalwood inventory as prescribed by the Sandalwood Licensing Guidelines.

b) DBCA will seek to undertake periodic strategic inventory of wild sandalwood populations on lands managed for conservation and/or other lands to confirm conservation status improvement or decline of the species.

c) DBCA will build its database on sandalwood population health for reviews of the Programme and regional protocols for sandalwood conservation, protection and management, and inform future limits on amounts of sandalwood that can be harvested from the wild.

d) DBCA, with traditional owners, may prepare inventory protocols supported by materials and tools to assist Aboriginal communities in their sandalwood management and application of traditional knowledge.

e) Tools and technologies associated with remote sensing will be explored for application to sandalwood inventory and population condition monitoring.

Objective: Engage, implement and review the Programme.

Strategy 14: Provide opportunity for stakeholder and public engagement and participation.

The community needs to have confidence that the highly environmentally and economically valuable sandalwood resource is being managed responsibly and sustainably. DBCA values public participation and recognises the need to continue to consider, in a meaningful way, the knowledge and opinions of others as part of its decision-making process.

Stakeholder and public engagement processes will be transparent, accessible, accountable, inclusive and supported by factual information. Public participation opportunities have been provided in the Programme's preparation. Engagement and participation opportunities will continue through implementation and review stages of the programme, and stakeholder and public views will be considered to develop objectives that reflect community expectations.

DBCA acknowledges that Native Title extends across the vast sandalwood distribution and involvement of traditional owners as partners or joint land managers is vital in implementing the Programme.

DBCA will also engage across government in implementing the Programme.

Management actions

a) DBCA will seek to provide engagement opportunities and consider the views of stakeholders and the wider public in implementing and reviewing the Programme.

b) DBCA will seek opportunities to consult, partner with and empower Traditional Owners in on-Country sandalwood management and joint land management.

Strategy 15: Define agency responsibilities in implementing the Programme.

DBCA is established through the CALM Act and promotes biodiversity and conservation through sustainable management of Western Australia's species, ecosystems, lands and the attractions in it's care. As such, DBCA is the lead agency responsible for implementing the Programme.

Several management actions are intended to be achieved through application of sandalwood licence conditions that DBCA personnel may monitor in the field and/or require licence holders to return records, maps or other evidence that licence conditions have been satisfied.

Management action

a) DBCA will identify measures and targets for management actions where appropriate.

Strategy 16: Prescribe the review process and timeframe.

Management action

a) Consistent with the BC Act s77(2), DBCA will review this Programme toward the end of the initial five-year term. The review will evaluate the extent to which strategies have been achieved by the management actions of the Programme.

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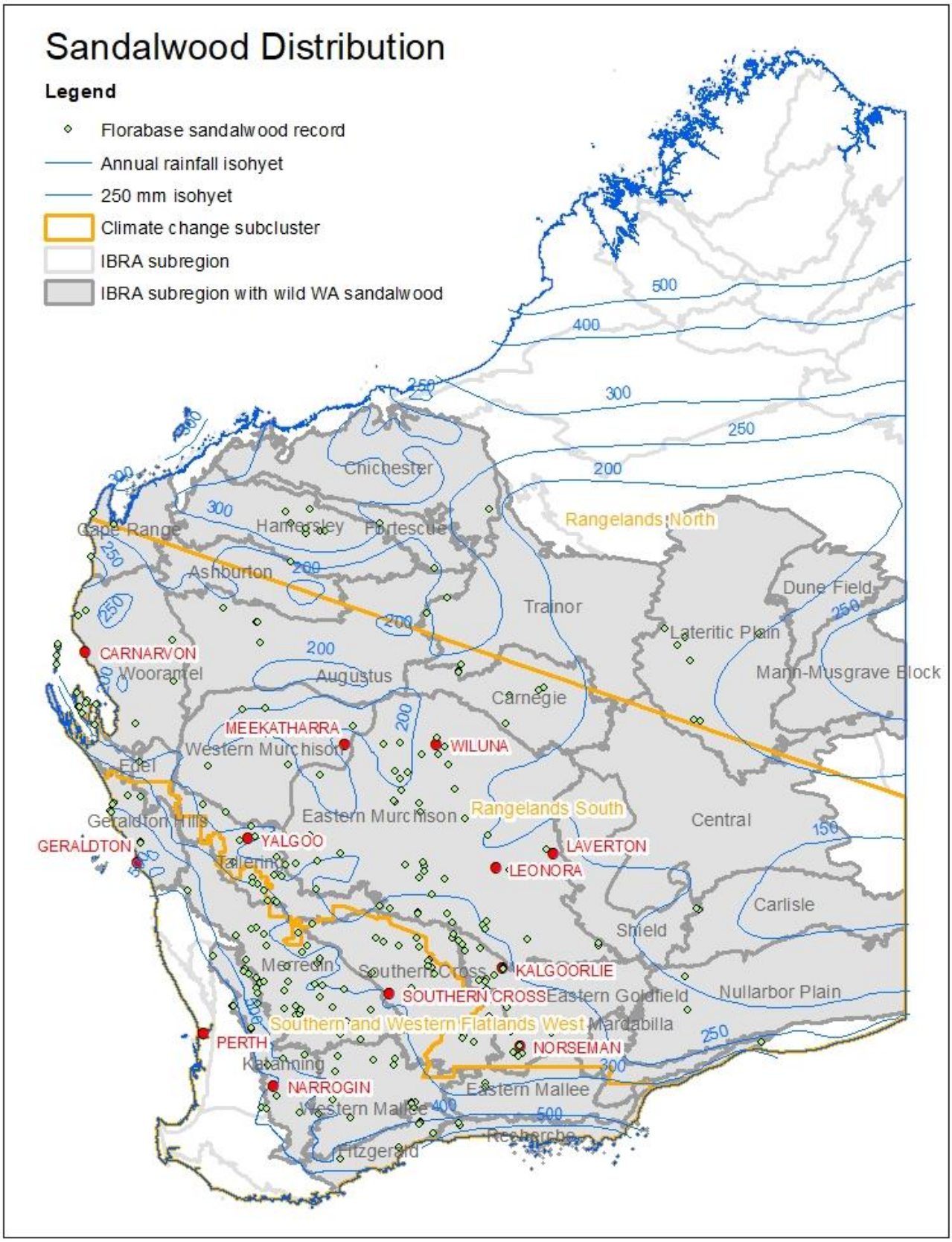
Appendix 1: Sandalwood distribution



Appendix 2: Programme scope

Scope of biodiversity management programmes

The objects of the BC Act are to conserve and protect biodiversity and biodiversity components in the State, and to promote ecologically sustainable use of biodiversity components in the State. One instrument to advance these objects is the biodiversity management programme (BMP).

The BC Act provides that a BMP is a document that provides for the conservation, protection and management of (among other things) one or more native species. Without limiting this broad objective, the BC Act provides that a BMP may deal with specified matters including 'the ecologically sustainable use of native species'. Ecologically sustainable use "in relation to biodiversity components, means use of the biodiversity components in a way and at a rate that does not lead to the long-term decline of biodiversity, thereby maintaining the potential of the biodiversity components to meet the needs of present and future generations.*"* (BC Act, 2016).

The scope of a BMP extends to managing human activities that affect native species but not to management, for social and economic reasons, of industries that make use of native species. For this reason, for example, measures to maximise local economic return from the use of native species are not within the scope of a BMP, and a BMP does not have the same scope as the Montreal Process Criteria and Indicators of Sustainable Forest Management (e.g. as to economic contributions).

Threatened species nomination

Sandalwood is listed as vulnerable on the International Union for Conservation of Nature's red list. DBCA has received a nomination for sandalwood to be listed as a threatened species under the BC Act. As the species occurs in Western Australia and South Australia, the nomination is subject to the national Intergovernmental Memorandum of Understanding – Agreement on a Common Assessment Method for Listing of Threatened Species and Threatened Ecological Communities (see awe.gov.au/environment/biodiversity/threatened/cam). As such, the nomination has been referred to the Commonwealth to facilitate cross-jurisdictional assessment.

The Commonwealth Threatened Species Scientific Committee has *Santalum spicatum* listed on the proposed priority list with assessment intended to be completed by 30 October 2024. Listing under the State's BC Act will be considered once the Commonwealth process is complete.

The processes for assessing species' conservation status are separate to the purpose of a biodiversity management programme, being to set parameters to manage for conservation, protection and ecologically sustainable use. BC Act Section 69 provides: "Content of biodiversity management programme (1) A biodiversity management programme is a document that provides for the conservation, protection and management of — (a) one or more native species (other than threatened species)."

DBCA will assist the Commonwealth in their assessment processes and accordingly, should sandalwood be listed as a threatened species, review the situation consistently with the requirements of the BC Act.

Plantations

Proposed plans to transition from wild to plantation sandalwood are industry strategies for the purpose of sustaining the Western Australian (WA) sandalwood industry into the future. They have not been proposed directly for the purpose of conserving and protecting wild sandalwood. Within the charter of the BC Act (and prescribed scope of a BMP), decisions for changing the levels of wild sandalwood take must primarily be based on the persistence of the species, not the maintenance of industry.

The maturing plantation resource was a component that influenced the settings of the Sandalwood Order. Plantations, with biodiversity elements identified in the Programme, is a consideration within the parameters of the principles of ecologically sustainable development and expected to be an element considered in formulating the next sandalwood order as per Strategy 2 management action (a) v.

Appendix 3: Summary of objectives, strategies and management actions

Objective	Strategy	Management action
Manage sandalwood take for ecologically sustainable use	1. Protect and manage sandalwood populations throughout the species' Western Australian distribution through a comprehensive, adequate and representative (CAR) reserve system.	a) Continue to manage the CAR reserve system for the protection of sandalwood and other conservation values. b) Progress the reservation of former pastoral leases purchased for conservation under the CALM Act toward the 17 percent target in IBRA biogeographic regions with sandalwood distribution. c) Work with native title holders, IPA managers and joint management partners to establish and protect sandalwood on lands included in the CAR reserve system. d) Explore opportunities with IPA managers for sandalwood conservation, protection and management.
	2. Review and potentially revise lawful sandalwood take quantities to maintain productive capacity of sandalwood populations and associated ecosystems.	a) DBCA will determine and recommend a sandalwood take quantity for the Minister to issue an order that will replace the Sandalwood Order in 2027. In limiting the sandalwood take, recommendations will account for: i. strategic inventory, resource and population modelling; ii. risk analysis of the species potential for persistence within and across its distribution; iii. scale and effectiveness of sandalwood establishment operations; iv. living (green) sandalwood having distinct sustainability factors and management requirements to dead sandalwood; v. regional licence protocols for sandalwood conservation, protection and management (to be developed); and vi. principles of ecologically sustainable development as defined in Section 4 of the BC Act. b) DBCA will review regulation 67(3)(c) (that prescribes the minimum size permitted for take of sandalwood) and recommend changes if considered necessary to maintain best practice consistent with contemporary species biology and population knowledge.
Manage and mitigate pressures on sandalwood and sandalwood populations.	3. Limit the impact of weeds, feral animals and diseases on sandalwood.	a) DBCA may undertake additional predator control in locations with known woylie and other sandalwood seed caching marsupial populations within available resources. b) In land management decisions, DBCA may determine there are locations where wild dog predation of herbivores is more beneficial to native flora conservation than wild dog control measures. c) Through its Aboriginal joint management policy, DBCA will investigate opportunities for traditional owners to control pests in on-Country sandalwood restoration projects. d) DBCA may increase feral herbivore controls (including strategic fencing within the CAR reserve system) in areas with established sandalwood seedlings and saplings, within available resources.
	4. Manage sandalwood in locations grazed by domestic ungulates.	a) In assessing applications to take living (green) sandalwood, DBCA will apply Sandalwood Licensing Guidelines with specific criteria for locations subject to agricultural sheep or goat enterprises.

Cont… Manage and mitigate pressures on sandalwood and sandalwood populations.	5. Provide effective compliance and enforcement	a) DBCA will maintain and, if resources permit, increase wildlife (sandalwood) enforcement operations. b) DBCA will continue to undertake compliance and enforcement action to protect sandalwood and support ecologically sustainable use consistent with the provisions of the BC Act. c) DBCA will explore options with traditional owners to protect sandalwood from trafficking.
	6. Use and respond to fire to mitigate the impact of fire on sandalwood populations.	a) DBCA will seek to consider location and potential impacts on sandalwood populations in planning and implementing prescribed burns. b) When recommending future limits on the amount of sandalwood that can be harvested from the wild, DBCA may consider previous and potential impacts of bushfire derived from relevant monitoring and modelling data. c) DBCA will develop a 'sandalwood and fire' document to assist fire management agencies account for sandalwood in fire planning and suppression activities.
	7. Adapt sandalwood management in response to impacts of climate change.	a) DBCA will maintain currency in knowledge and contemporary management approaches in relation to climate change and its possible impacts on sandalwood. b) Future planning for the management of sandalwood, particularly establishment programs, will adapt to authoritative climate change predictions and data generated from the species response to actual conditions. c) Aligned with Strategy 12, DBCA may undertake and encourage research into innovative practices for reducing the reliance of sandalwood germination on the winter threshold.
	8. Minimise the impact of lawful clearing on sandalwood.	a) DBCA will develop Sandalwood Licensing Guidelines that are to be read and reviewed with the Programme. b) DBCA will require and audit licence returns. c) DBCA will audit licence compliance through the supply chain. d) DBCA will review the legislation and regulatory framework that governs take of sandalwood forest products. e) All public authorities (including the FPC) with lawful authority to take sandalwood other than under a flora taking (sandalwood) licence will liaise with DBCA to ensure that the sandalwood is taken in an ecologically sustainable manner and consistently with the limits in the Sandalwood Order. f) DBCA will produce and promote a sandalwood guidance paper for development regulators and proponents, summarising processes for sandalwood conservation through investigation (survey) and planning; involvement of traditional owners; and the importance of resource utilisation where disturbance is unavoidable. g) DBCA will seek to provide advice, where appropriate, in relation to development proposals where sandalwood has been identified (including, but not limited to, proposals for infrastructure development, exploration and / or extraction of minerals and petroleum resources), with a view to: vii. minimise the impact on sandalwood populations, sandalwood scientific plots and sandalwood monitoring sites as a result of disturbance; and

		viii. advise the proponent, the FPC and/ or licence holders of opportunities to remove sandalwood from approved disturbance locations.
Cont… Manage and mitigate threats to sandalwood and sandalwood populations. populations.	9. Protect soil and water quality as fundamentals to sandalwood biodiversity and health.	a) DBCA may undertake both regular and opportunistic monitoring of compliance with licence conditions for soil disturbance limits. b) DBCA will investigate reports of soil or water contamination resulting from sandalwood operations and take appropriate action.
Maintain sandalwood's natural distribution; and improve population condition.	10. Establish and support growth of sandalwood seedlings to supplement and maintain wild sandalwood populations in the long term.	a) DBCA will develop a sandalwood establishment strategy that: i. Complies with the sandalwood establishment conditions of the Sandalwood Licensing Guidelines; ii. identifies priority establishment locations that may include the CAR reserve system; iii. creates baseline sandalwood data to assess successes/failings of establishment projects and threat controls; iv. applies appropriate processes and quantities that are scaled to the sandalwood landscape; v. forecasts sustained funding requirements; vi. includes sandalwood seeding and regeneration encouragement operations in joint management conservation programs with traditional owners; vii. requires sandalwood seeding outcome to be reported against targets; viii. complies with tree retention conditions of the Sandalwood Licensing Guidelines; ix. promotes seed orchard establishment to produce northern genetic group and other specific seed supplies. x. considers sandalwood establishment in fauna re-introduction locations to renew localised natural sandalwood regeneration cycles; and provide a food source for re-introduced ground dwelling marsupials.
	11. Set regional protocols for sandalwood conservation, protection and management.	a) DBCA will formulate regional protocols for sandalwood conservation, protection and management that set requirements for establishment and protection as well as licence restrictions for sandalwood take in each IBRA region or sub-region within the sandalwood distribution. b) When issuing licences to take or supply sandalwood, DBCA will apply the regional protocols for sandalwood conservation, protection and management. c) Proponents of sandalwood operations will be required to submit a sandalwood establishment and sustainability plan for DBCA approval prior to the issue of a licence or commencement of operations. DBCA will develop a 'sandalwood establishment and sustainability plan' template.
Inform conservation through research and knowledge acquisition strategies.	12. Identify knowledge gaps in existing research relevant to sandalwood biodiversity conservation.	a) DBCA will instigate a strategic review of existing research and available records to identify knowledge gaps. b) Respecting principles of free, prior and informed consent, DBCA will seek and integrate available traditional knowledge of sandalwood biology and ecologically sustainable use in decision making processes. c) DBCA may undertake and encourage research to address identified knowledge gaps in collaboration with other research organisations.

Cont… Inform conservation through research and knowledge acquisition strategies.	13. Quantify and improve sandalwood inventory and population condition monitoring.	a) To broaden sandalwood population understanding and inventory sources, DBCA will require licence applicants' to submit sandalwood inventory as prescribed by the Sandalwood Licensing Guidelines. b) DBCA will seek to undertake periodic strategic inventory of wild sandalwood populations on lands managed for conservation and/or other lands to confirm conservation status improvement or decline of the species. c) DBCA will build its database on sandalwood population health for reviews of the Programme and regional protocols for sandalwood conservation, protection and management, and inform future limits on amounts of sandalwood that can be harvested from the wild. d) DBCA with traditional owners, may prepare inventory protocols supported by materials and tools to assist Aboriginal communities in their sandalwood management and application of traditional knowledge. e) Tools and technologies associated with remote sensing will be explored for application to sandalwood inventory and population condition monitoring.
Engage, implement and review the Programme.	14. Provide opportunity for stakeholder and public engagement and participation.	a) DBCA will seek to provide engagement opportunities and consider the views of stakeholders and the wider public in finalising, implementing and reviewing the Programme. b) DBCA will seek opportunities to consult, partner with and empower Traditional Owners in on-Country sandalwood management and joint land management.
	15. Define agency responsibilities for implementation of the Programme.	a) DBCA will identify measures and targets for management actions where appropriate.
	16. Prescribe the review process and timeframe.	a) Consistent with the BC Act s77(2), DBCA will review this Programme toward the end of the initial five-year term. The review will evaluate the extent to which strategies have been achieved by the management actions of the Programme.

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