Review of the

Sandalwood (Limitation of Removal of Sandalwood) Order 1996

Report

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1. Introduction

1.1 Sandalwood

Western Australian sandalwood (*Santalum spicatum*) is a slow-growing, long-lived small woody tree or shrub that occurs naturally throughout the southern part of Western Australia and into South Australia. It is valuable and highly sought after for the oils contained in the heartwood. The process of harvesting sandalwood normally kills the tree which is pulled out of the ground to access the valuable butt and roots.

The ecology and biology of the species are well understood, researched and documented as outlined in *The Management of Sandalwood* (Kealley 1991)[1]. The research literature about the species is summarised in *Historical Review of Sandalwood (Santalum spicatum) Research in Western Australia* (Loneragan 1990)[2].

Sandalwood oil has been used as an aromatic and medicine for centuries. It has been exported from Australia since the 1840s with the industry being regulated since 1929. The industry's history is well documented by Statham (1988)[3] for Australia, and Kealley (1991)[1] for Western Australia. The state's sandalwood industry and legislation are products of this long history.

The Western Australian sandalwood resource is now unique as the world's largest and the only remaining wild resource that has the potential to be managed for the long-term conservation of the species and sustainability of the industry.

1.3 Legislative context

Section 2 of the *Sandalwood Act 1929* provides that the Governor may from time to time issue an Order in Council (OIC) to control the harvest of sandalwood in Western Australia. The *Sandalwood (Limitation of Removal of Sandalwood) Order* limits and restricts the quantity of sandalwood, other than sandalwood grown on a plantation that may be pulled or removed from Crown land and alienated land during a stated period.

Further restrictions on the harvest of sandalwood can be set under the Sandalwood Act Regulations. Under Regulation 8, the minimum size of living trees that can be pulled or removed is prescribed as 400 millimetres in circumference over bark at approximately 150 millimetres above the ground.

Under section 5 of the Sandalwood Act, 'sandalwood' includes any tree of the genera *Santalum* or *Fusanus*, and any other species of aromatic wood that is or may be used as a substitute for sandalwood.

1.2 Existing Order in Council

The existing *Sandalwood (Limitation of Removal of Sandalwood) Order 1996* was published in the Government Gazette of 12 November 1996. It sets the annual quota for the harvest of sandalwood at 3,000 tonnes of wood, being 1,500 tonnes of green and 1,500 tonnes of dead wood. No expiry date is specified in the OIC.

1.4 Parliamentary Standing Committee report

In May 2014, the Legislative Council Standing Committee on Environment and Public Affairs (the Standing Committee) released a report on the findings of its inquiry into the sandalwood industry. The report, titled Report 35 – *Inquiry into the Sandalwood Industry in Western Australia* recommended that the Minister for Environment immediately review the current *Sandalwood (Limitation of Removal of Sandalwood) Order 1996* with a view to reducing the quantity of sandalwood that may be harvested.

The Government's response to the recommendations of the Standing Committee supported a review of the OIC prior to 2016 and specified that the review should consider:

- *future yields from plantations of Western Australian sandalwood* (Santalum spicatum) *and the need to maintain continuity of supply until these plantations produce commercial volumes of high value products; and*
- *the lack of natural regeneration of wild sandalwood. Regeneration is largely dependent on harvest revenue that is used to support the [Forest Products Commission's] FPC's successful seeding program.*

1.5 Terms of Reference for the review

The objective of this review is to provide advice on an appropriate quantity, composition and duration of sandalwood harvest that could improve the conservation outcomes for the species, whilst providing for the range of regional, social and economic objectives sought by government for this industry.

The Working Group has:

a. Examined the current status and range of future pressures impacting on the conservation of the wild sandalwood resource, and identified those factors that can be mitigated by refined settings for the level of harvest;
b. Examined the basis and veracity of the resource estimates and yield projections generated by the FPC for both wild and plantation stands of sandalwood, which could be used to inform a revised level of harvest; and
c. Provided advice on an appropriate level (or range) for future sandalwood harvest, including the relative composition of green wood and dead wood, and the relative proportion of each to be sourced from Crown and private land.

In formulating its advice, the Working Group has had regard to:

a. Those recommendations from the Standing Committee report that have been accepted by Government and are relevant to a revision of the OIC;
b. The likely scope of and provisions in the proposed new Biodiversity Conservation Act that seek to provide an improved basis for the management and regulation of sandalwood as a species (and hence the industry);
c. The principles of Ecologically Sustainable Forest Management (as defined in the *CALM Act 1984* and *Forest Products Act 2000*);
d. The range of conservation, environmental, enforcement and social issues associated with the harvest of sandalwood from Crown and private lands, including the lack of natural regeneration of wild sandalwood; and
e. The need to maintain continuity of supply from wild stands until the existing plantation resource is capable of producing commercial volumes of high value products.

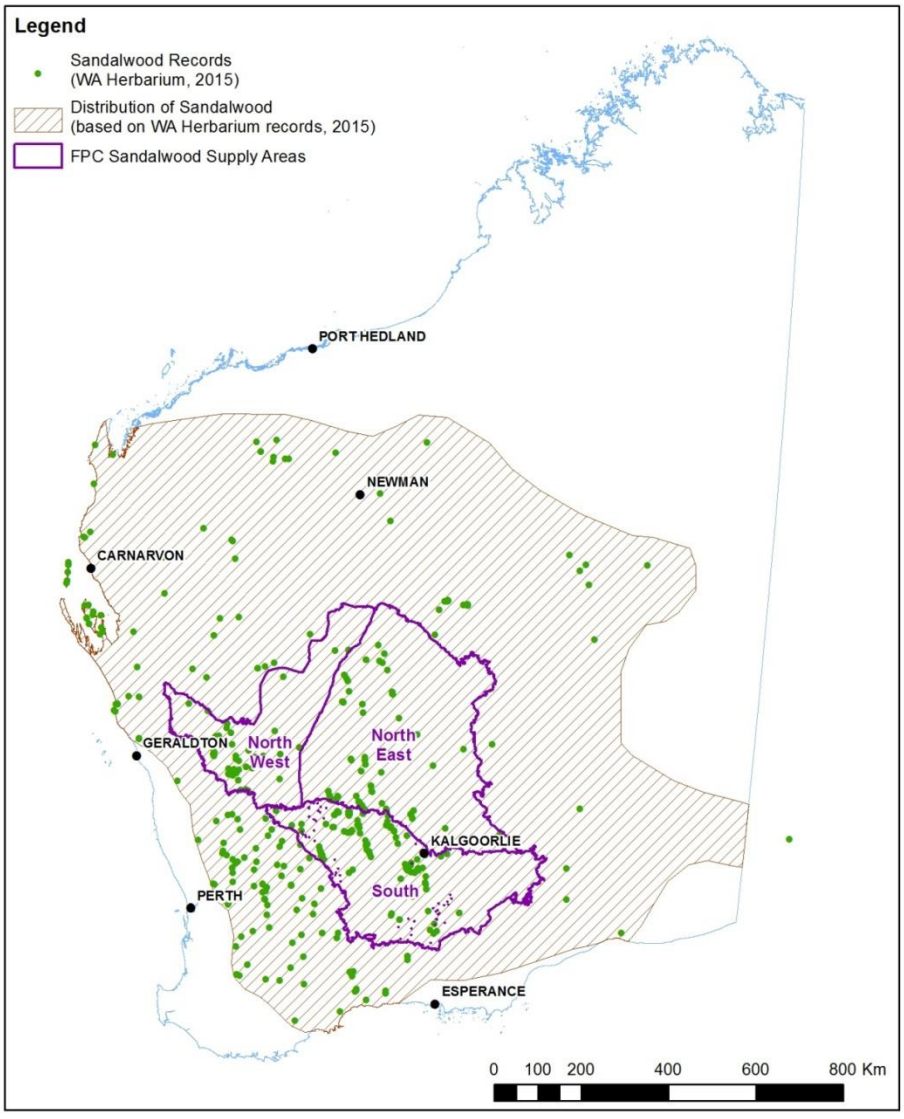
2. The species

2.1 Distribution

Western Australian sandalwood is a hemi-parasitic species which occurs over the southern two thirds of the state and in South Australia as indicated in Figure 1. The species originally occurred throughout the Wheatbelt, but has been reduced to small fragmented populations through agricultural clearing. It does not occur on the Swan coastal plain or in the forested south-west.

Figure 1

Sandalwood (*Santalum spicatum*) Distribution and FPC Sandalwood Regions in Western Australia



Department of Parks and Wildlife

Forest Products Commission WESTERN AUSTRALIA

The Department of Parks and Wildlife does not guarantee that this map is without flaw of any kind and disclaims all liability for any error, loss or other consequence which may arise from relying on any information depicted.

Produced by the Forest Management Branch under the direction of the Director General, Department of Parks and Wildlife.
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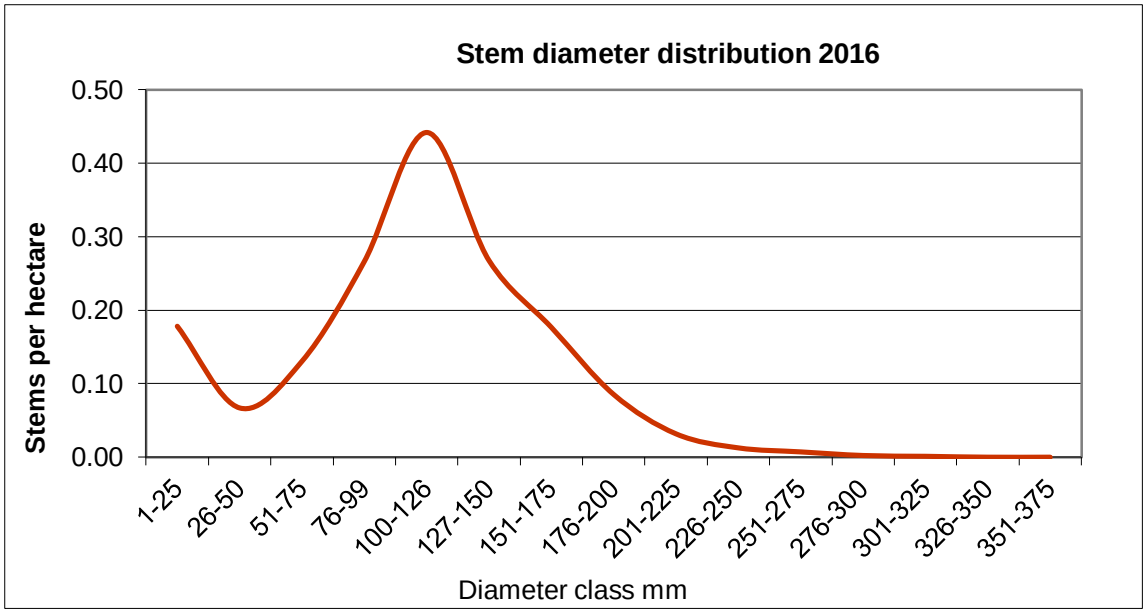
2.2 Tree size classes

The current minimum circumference for living wild sandalwood trees to be harvested is 400 millimetres (over bark) measured at approximately 150 millimetres above ground, equivalent to a stem diameter of 126 millimetres. The frequency distribution of tree sizes across the areas available for harvesting is therefore a key determinant of the potential total quantity of green wood that can be harvested.

The FPC's strategic inventory data indicate that at an aggregated, whole-of-region scale the distribution of trees broadly follows a normal distribution, with a low frequency of stems in the less than 75 millimetre and greater than 175 millimetre size classes as shown in Figure 2.

Figure 2
Frequency distribution of stem diameter for live sandalwood across FPC supply areas in 2016 (Source - FPC)



This pattern reflects historical cumulative impacts of harvesting, drought, grazing, seed dispersal factors and bushfire on the regeneration and survival of younger trees and means there is a low number of trees to grow into the merchantable size classes in the future. The FPC's draft *Industry strategy for the wild sandalwood resource 2016-2025* (referred to here as the draft sandalwood industry strategy) notes that the 1 to 25 millimetre stems in the graph are mostly seedlings under parent trees which are largely expected to perish due to competition.

2.3 Genetic variations

In the draft sandalwood industry strategy, the FPC reports that it has been proposed that Western Australian sandalwood could be divided into northern and southern groups. Northern populations, which contain higher levels of genetic diversity, are found in the 150 to 250 millimetre mean annual rainfall zone. Southern populations are found in the 250 to 600 millimetre mean rainfall zone. Additional research would assist in better understanding sandalwood genetics.

2.4 Threatening processes

The most significant remaining stands of naturally occurring sandalwood are in the Western Australian rangelands, where the species is being severely impacted by fire; harvesting (both legal and illegal); and browsing and grazing by pastoral livestock and feral herbivores (including goats, rabbits and camels) as well as elevated numbers of kangaroos caused by the presence of artificial waters. Climate change, loss of native seed-dispersing mammals and impacts of other land uses such as agriculture, mining and infrastructure development are also negatively impacting the species. One result of these pressures is the failure of regeneration of sandalwood and a consequent decline in occurrence throughout most of its range.

3. The industry

3.1 Brief history

Western Australian sandalwood was the basis of one of the earliest industries in Western Australia with the wood being first exported in 1844. For most of the industry's history, the resource has been derived from natural stands. Both dead and green sandalwood trees are harvested.

In 1929, Western Australia introduced the Sandalwood Act to "regulate the quantity of sandalwood to be pulled or removed from Crown and other land". This legislation is still in force, although the government intends to include regulation of the sandalwood industry within the proposed new Biodiversity Conservation Act and repeal the existing legislation.

3.2 Licensing and regulation

Sandalwood harvesting on Crown land is managed by the FPC under a contract system. The Wildlife Licensing Section of Parks and Wildlife issues a Sandalwood Act Crown land licence to the FPC with the names of all their approved contractors endorsed upon it as 'authorised persons'. Parks and Wildlife regulates the alienated land harvest under a licencing system. Licences are issued by Parks and Wildlife's Wildlife Licensing section under the Sandalwood Act to pull both green and dead wood on private land and under the Wildlife Conservation Act to sell green sandalwood harvested on private land.

Compliance and enforcement for Crown land operations involve significant contributions from Parks and Wildlife which also carries out all compliance and enforcement activities for the alienated land harvest (see section 3.9, *Compliance and enforcement*).

3.3 Employment

The wild sandalwood industry provides both direct and indirect employment for people residing in regional towns and remote rangeland areas. Direct employment includes jobs in the harvesting, regeneration, transport, marketing and processing of sandalwood. For the 2014-15 season, 22 private property sandalwood licences were issued totalling 140.8 tonnes of green and 72.1 tonnes of dead wood. One Crown land licence was issued to the FPC for 1,350 tonnes of dead and 1,350 tonnes of green wood. 24 FPC contractors were listed as authorised persons under this licence. In addition, the sandalwood industry generates employment within the five major wholesaling operations in Western Australia.

3.4 Economic contribution

Sandalwood is a valuable commodity realising in excess of $15,000 per tonne for high-quality wood. According to the FPC's 2013-14 annual report, total sandalwood stumpage revenue (timber sales revenue less charges for administration, in-forest operations and harvest and haulage costs) was $7.96 million. In that year, the FPC's total revenue from sandalwood was $15.015 million with expenses of $8.926 million leaving an operating profit of $6.089 million.

In addition to revenue flows to government, sandalwood contractors, licensees and wholesalers also derive significant financial benefit from their involvement in the industry.

Crown and alienated land sandalwood harvest quantities since 2009-10 are shown in Table 1 (source: FPC annual reports and Parks and Wildlife corporate data).

Table 1 - Sandalwood harvest quantities

Product	2009-10 harvest (tonnes)	2010-11 harvest (tonnes)	2011-12 harvest (tonnes)	2012-13 harvest (tonnes)	2013-14 harvest (tonnes)
Crown land green	1,239	1,139	997	1,086	968
Alienated land green	181	213	150	117	149
Sub-total (green)	**1,420**	**1,352**	**1,147**	**1,203**	**1,117**
Crown land dead	786	867	1,061	1,020	890
Alienated land dead	110	147	85	75	93
Sub-total (dead)	**896**	**1014**	**1146**	**1095**	**983**
TOTAL IN QUOTA	**2,316**	**2,366**	**2,293**	**2,298**	**2,100**
Crown land 3rd grade green (ex-quota)*	304	320	293	208	56
Crown land Green roots (ex-quota)*	242	207	182	221	182
Sub-total (ex-quota)*	**546**	**527**	**475**	**429**	**238**
GRAND TOTAL	**2,862**	**2,893**	**2,768**	**2,727**	**2,338**

*The FPC currently considers products from improved utilisation (i.e. roots and third grade green sandalwood) to be in addition to the quota amount permitted for green wood harvest on Crown land.

3.5 Markets

Sandalwood is exported to South-East Asia for the manufacture of incense or joss sticks and to India for production of oil. It is used as an ingredient in the finest perfumes, and in medicine, incense and soaps, while the timber is valued for craft use. Sandalwood oil is also extracted for export and for use in cosmetic and therapeutic products in Western Australia.

First grade wood is sold for production of oil while second grade material is exported as log products or wood powder for the agarbatti market (incense and joss sticks). There is currently no market for third grade material comprising leaves, bark and small branches (less than 25 millimetres diameter at the large end under bark).

3.6 Standing resource and future yield projections

The FPC's current strategic inventory is a consolidation of several earlier inventories and further work by the Commission to define the geographic occurrence; distribution of tree size; and condition of the standing resource within specified sandalwood supply zones. These supply zones comprise only a portion of the total area of the available Crown land outside of existing and proposed conservation reserves as shown in Figure 1.

The inventory of the standing resource within the supply zones is the basis for projecting the yields arising from varied levels of harvest of native sandalwood. The resource is widely dispersed across a large geographic area at a low frequency of occurrence of individual stems. Consequently, the inventory has a low sample size and the estimate of the total standing resource has a level of precision which is characteristic of such strategic inventories. The Working Group has examined the area stratification, inventory data and the resource calculations maintained by the FPC and is satisfied that this information provides an acceptable basis for regulating the yield.

Areas harvested over the past 20 years (since 1995) are estimated to retain significant quantities of sandalwood trees, albeit at a low frequency and dispersed distribution. However, the FPC has excluded this resource from their consideration of the yields potentially available in the medium term, along with all resource located on alienated lands. Also excluded is the north-west supply zone because the scattered resource is less commercially viable and there is extensive grazing on pastoral leases and excessive feral goat activity that restricts the opportunity for regeneration. Consequently, only a portion of the total standing sandalwood resource within supply zones has been considered in the FPC's projections of longer term yields.

The inventory data for supply zones is modelled to forecast the standing resource; tree diameter class distribution; and number of seed trees arising from varied levels of harvest. The model structure and function was examined by the Working Group and determined to be technically robust. Application of the model requires a range of key inputs concerning 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. This uncertainty can be mitigated by adopting a short planning horizon (10 years) and effective monitoring to inform future reviews of the OIC.

3.7 Regeneration

Natural regeneration of sandalwood is being severely hampered because seedlings are grazed by feral herbivores and stock. In addition, decreases in numbers of seed-caching mammals (such as woylies) are believed to have contributed to lower germination rates as these animals play a role in seed dispersal and burying which improves germination rates. Fires, drought and climate change are additional factors which may be reducing seedling survival. For example, future climate projections to the year 2090 indicate a trend toward decreasing winter rainfall and elevated summer temperatures across the majority of the FPC supply areas[4].

As outlined in the draft sandalwood industry strategy, the FPC has commenced a regeneration program which aims to plant a minimum of 10 tonnes of sandalwood seed (around 3.5 million seeds) per year. It is estimated that, subject to seasonal conditions, this will lead to the establishment of over one million seedlings between 2016 and 2025, a figure well in excess of the number of trees to be harvested.

The FPC regeneration program will initially focus on the southern region (see Figure 1) and may be expanded to northern areas in the future. It is proposed to focus sandalwood regeneration in previously-harvested areas which have suitable soils and limited grazing pressure.

3.8 Illegal activity

Illegal harvesting of sandalwood has been an issue in recent years due to the currently high value of the wood, the lack of adequate deterrent penalties and the low probability of being caught. At present, seized sandalwood is auctioned by Parks and Wildlife with the proceeds being returned to consolidated revenue after Parks and Wildlife recovers costs associated with seizing, transporting and storing the wood.

For many years, illegal activities were on a fairly small scale and mainly involved individuals poaching sandalwood from areas where they were not authorised to take. Escalation commenced around 2008 and peaked in 2013 when a Perth-based sandalwood processor and wholesaler, who was believed to be the main operator in the sandalwood black market, was apprehended in a joint operation involving the Western Australian Police and Parks and Wildlife. Illegal activities (both stealing and receiving) continue with a number of seizures and apprehensions having been made in recent years.

Table 2 indicates quantities of illegally-harvested wood seized between 2011 and 2014.

Table 2 - Quantities of illegally-harvested sandalwood seized

Year	Tonnage seized	Percentage of Crown land green wood quota
2011	8.9	0.66%
2012	165.5	12.26%
2013	17.3	1.28%
2014	308.8	22.87%
Total	**502.8**	
Average	125.7	9.31%

Additional vigilance will be required when plantation sandalwood starts to enter the market as mature harvested trees or thinnings, to ensure it is not used as a means of laundering illegally-harvested wild wood under the guise of it being plantation sandalwood.

3.9 Compliance and enforcement

The FPC administers contracts let for Crown land operations, however compliance and enforcement in the sandalwood industry is predominantly carried out by staff of Parks and Wildlife with responsibility being shared between Nature Protection Branch and the regions in which sandalwood occurs. The department has held discussions with the FPC about the potential provision of additional resources for these activities.

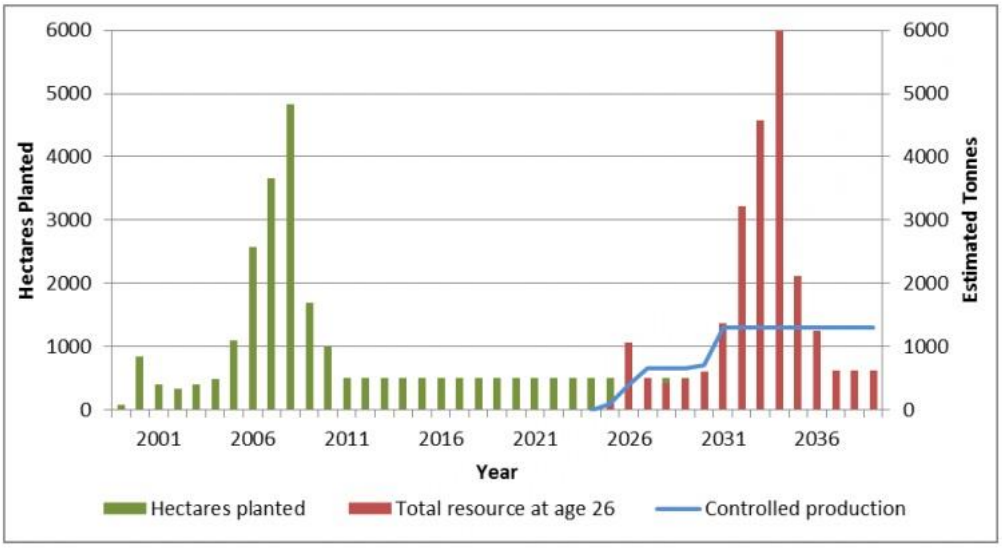
Where resources can be made available, the Western Australian Police work with Parks and Wildlife on enforcement activities associated with illegal harvesting. In 2013, a joint sandalwood investigations team involving staff from Parks and Wildlife and the police raided an illegal operation, seizing about $1.5 million worth of sandalwood and sandalwood product (oil, sandalwood chips and spent charge) and about $500,000 worth of machinery and equipment, including a large chipper and a number of sandalwood stills. The offenders were charged by

the police under the Criminal Code with either stealing, or laundering stolen property. The department has approached the Commissioner of Police seeking to have the combined sandalwood taskforce re-formed to investigate the illegal and fraudulent activities of a new syndicate which has been identified and partly shut down after recent enforcement action.

3.10 Plantations

An estimated total of 20,000 hectares of Western Australian sandalwood plantations have been established in the state, mainly in the Wheatbelt. Of this, approximately 6,000 hectares are owned and/or managed by the FPC. Harvesting is anticipated to commence around 2026, assuming that plantation trees will produce a marketable quality and quantity of wood from 26 years of age as shown in Figure 3.

Figure 3
Projected availability of plantation-grown sandalwood *(S. spicatum)* in Western Australia, with an indicative smoothed supply scenario (source FPC)



It is proposed to delay the harvest of some of these plantations to maintain the supply at a stable level. The FPC sees a continuing need for wild sandalwood harvest to complement the plantation resource, which will be of a lower quality than the wild wood. In addition to the area of Western Australian sandalwood plantation, approximately 10,000 hectares of Indian sandalwood has also been established in Western Australia, mainly in the Kimberley.

While the distribution of area by age class is accurately known for the plantation resource, the age and condition at which the trees will yield commercially viable oil and minor products is less certain. Most of the plantation resource is less than 15 years old (at 2015), and with expectations that tree yields able to substitute for the native wild resource will be available by around age 26, industry and FPC forecasts of plantation resource assume sufficient quantities of plantation resource will accrue by 2026 to complement wild resources in Western Australia. A planning horizon of 10 years has been adopted for this review to provide for the capacity to maintain a stable industry supply whilst transitioning to an increasing proportion of the total supply sourced from plantations over future decades.

3.11 Sandalwood Industry Strategy

The FPC is developing a document titled *Industry strategy for the wild sandalwood resource 2016-25* in accordance with the *Forest Products Act 2000*. The purpose of the document is as follows:

"It presents the current status of harvesting, regeneration, wood utilisation, and markets. By analysing the information learned from three wild sandalwood resource inventory projects over the past two decades, it presents forward looking measures to ensure ongoing social and economic benefits to Western Australia."

4. Discussion and general recommendations

4.1 Acceptable yield

The main task of this review is to determine an acceptable level of harvest for wild sandalwood from available areas. The quota needs to be consistent with silvicultural models and to foster an acceptable age-class distribution for sandalwood. It recognises that the industry is likely to access plantation wood around 2026, thus taking pressure off the wild sandalwood resource.

A range of measures contribute to the persistence of the sandalwood species across the rangelands and to the sustainability of productive potential in those areas available for harvest. These include:

- the extensive representation of sandalwood within existing and proposed conservation reserves from which harvesting of sandalwood is excluded;
- the further exclusion from the resource base of a large proportion of the available area with a low frequency of sandalwood occurrence; and
- silvicultural protocols requiring the retention of seed bearing trees in all harvested areas.

Simulations of the future size class distribution of trees across supply areas indicate a substantially lower frequency of larger trees would arise after several decades if the current level of harvest was continued indefinitely. Improved distributions are indicated following progressive reductions in the level of harvest and better regeneration outcomes.

Consistent with the government's support for the Standing Committee's first recommendation to review the OIC in the light of *"future yields from plantations of Western Australian sandalwood (Santalum spicatum) and the need to maintain continuity of supply until these plantations produce commercial volumes of high value products"*, the Working Group has sought to determine a level of harvest for a defined period that is an acceptable balance between improving conservation outcomes and realising social and economic benefits. Such a level should achieve the following:

- maintain the species and future productive potential, albeit with sandalwood trees at a lower frequency in harvested areas;
- provide for maintenance of an overall industry supply until the plantation resource becomes available;
- encourage maximum utilisation of all trees removed to reduce the number of trees required to supply any specified tonnage of wood; and
- permit increased focus on dead rather than green wood resources if viable markets for dead wood products become available.

Using its sandalwood model, the FPC has derived a reduced quota figure of 1,140 tonnes of green wood from Crown land (down from 1,350 tonnes and therefore approximately 85 per cent of the current green wood harvest level) which it believes can be sustained for the next 10 years until the plantation resource becomes available. Assuming equal quotas of green and dead wood and a 90 per cent allocation of the quota to Crown land, this equates to a total quota of 2,533 tonnes per annum of green and dead wood on Crown and alienated land.

Modelling conducted by the working group found no evidence that harvest levels of up to 85 per cent of the current level for green wood would be unsustainable over the next 10 years. There was limited impact on the tree size class distributions in the supply zones by 2026 for this level of harvest (relative to very low harvest levels) and an improvement in the regenerating size classes if seeding was undertaken in association with the harvesting. However, the projections require a further minor adjustment for illegal removals to date and variations to the total area available for harvest within the FPC supply zones caused for example by excluding existing and proposed reserves from harvest (see recommendations under section 4.3 *Geographic exclusions*).

While a faster transition or an earlier staged reduction in the harvest level may provide some benefits for conservation at a landscape scale, it is notable that improved methods of tree extraction in the industry (which recover more of the below-ground roots) will mean that fewer trees than previously will be required to yield the revised quota. The combined effect of a reduced quota and improved utilisation is estimated to retain more than 70,000 live sandalwood trees in the rangelands over the ten-year duration of the OIC, relative to the level of extraction under the current Crown land quota. In addition, regeneration efforts are proposed to extend beyond harvested areas into existing and proposed conservation reserves and hence will help counteract the decline in natural regeneration in the rangelands.

Given forecast improvements in the technology for locating individual trees and refinements to harvest machinery and efficiency, it will be imperative that silvicultural requirements governing the retention of mature trees in harvested areas are monitored for contractor compliance.

See section 5.1 *Harvest levels* for the Working Group's recommendation on the revised quota.

Recommendation 1: The FPC should commit to an agreed level of annual funding for further research and inventory work during the currency of the OIC. Priorities for this work should be agreed between Parks and Wildlife and the FPC.

Recommendation 2: The FPC must ensure contractor conformance with the silvicultural requirement to retain mature trees in harvested areas.

Recommendation 3: Significantly reduce the quota for wild sandalwood when the plantation resource becomes available for harvest.

4.2 Crown and alienated land

At present, 90 per cent of the annual wild sandalwood quota is allocated to trees growing on Crown land and 10 per cent to those on alienated land. Wild sandalwood in Western Australia occurs over a total area of around 146 million hectares. Of this, approximately 131 million hectares (89.7 per cent) is Crown land, with the other 15 million hectares (10.3 per cent) being alienated land, a ratio which is reflected in the allocation of the quota to the two land tenure categories. Whilst it is recognised that not all of these lands will be harvested, the Working Group recommends that there be no change to the current proportions allocated to Crown and alienated land.

Recommendation 4: The existing ratio of 90 per cent of the total quota for wild sandalwood from Crown land and 10 per cent from alienated land should be retained.

4.3 Green and dead wood

The current OIC specifies that the 3,000 tonne quota for sandalwood is split into 1,500 tonnes of green wood and 1,500 tonnes of dead wood. Varying the ratio of green to dead wood such that the **maximum** green wood quota is 1,500 tonnes would permit a lower green wood harvest (and a higher dead wood harvest).

Such an arrangement would facilitate the commercial salvage of trees killed by extensive bushfires, whilst also leading to seeded regeneration after harvesting in burnt areas, which would otherwise have no future seed source. Additionally, it would provide flexibility in the allocation of dead and living wood for licences issued for alienated land and may assist in responding to changes in emerging market preferences for dead wood (such as whole dead trees) to the overall benefit of conservation due to the retention of more live trees in the landscape.

See section 5.2 *Green and dead wood* for the Working Group's recommendation on the proportions of green and dead wood in the revised quota.

4.4 Geographic exclusions

The majority of the wild sandalwood resource occurs outside existing and proposed conservation reserves. The Working Group supports the continued managed harvest of sandalwood in these areas, but considers that the species should not be harvested on existing and proposed conservation reserves. The one exception is the Credo property, purchased in 2007 for addition to the conservation reserve system, which was the subject of an exchange of letters on this issue between the then Ministers for Environment and Forestry in 2007. The then Minister for Environment gave qualified support to the harvesting of sandalwood on the Credo property subject to four conditions:

- protection of identified high conservation value areas
- FPC funding for the ongoing management of Credo
- sustainable harvesting of sandalwood
- establishment of a joint venture enterprise between the FPC and local traditional owners for the harvesting of sandalwood.

Despite ongoing dialogue between the two agencies, these matters have not been satisfactorily resolved to date. It is the Working Group's position that in view of the unique circumstances with respect to Credo, Parks and Wildlife should continue to work with the FPC to formulate a mutually-acceptable plan for the harvest of sandalwood on the property.

Wild sandalwood removals from alienated land may need to shift toward dead wood rather than live trees in some localities.

Recommendation 5: All existing and proposed conservation reserves, with the exception of the Credo property if satisfactory arrangements can be negotiated, should be excluded from the wild sandalwood harvest.

Recommendation 6: In association with the implementation of Recommendation 1, the FPC should commit to conducting further research and inventory to refine the acceptable level of green and dead wood harvest on alienated land.

4.5 Regeneration and recruitment

Sustaining the presence of wild sandalwood in the long term will require both the successful establishment of new seedlings and their persistence and growth over decades of exposure to threatening processes. Techniques for regenerating sandalwood have been well researched and operationalised by the FPC and if implemented in those years when favourable winter rainfalls occur, should lead to successful regeneration. However, sustained measures to control or mitigate the impacts of grazing herbivores, bushfires, and illegal harvesting are needed to promote the survival and prolonged growth of trees to maturity (see further coverage in section 4.7 *Management of threatening processes*).

In addition to continuation of the seeding program in previously-harvested and other areas, the FPC has offered to extend regeneration activities to selected areas within existing and proposed conservation reserves which are also suffering depletion of sandalwood because seedling survival is not keeping pace with mortality.

Recommendation 7: The FPC should expand its regeneration program to cover agreed areas within existing and proposed conservation reserves.

Recommendation 8: Seed local to regeneration areas must be used for plantings on existing and proposed conservation reserves and preferably in other areas as well.

4.6 Tree size restrictions

The Sandalwood Act Regulations specify that the minimum size at which a green sandalwood tree can be harvested is 400 millimetres in circumference over bark at approximately 150 millimetres above the ground. The Working Group explored the possibility that conservation outcomes might be achieved through varying this constraint. Factors considered included:

- the recommended reduction in the quota;
- a further reduction in the number of green trees required to be harvested due to improved utilisation;
- the silvicultural requirement to retain mature trees in harvested areas.

It was concluded that uncertainty surrounding the quantification of any additional conservation benefits meant that it would not be possible to justify a change to the existing arrangements at this time. Further research proposed in *Recommendation 1* will assist future deliberations on this issue.

Recommendation 9: The minimum size at which a green tree can be harvested should remain at 400 millimetres circumference over bark at 150 millimetres above the ground.

4.7 Wild and plantation resource

The plantation resource is projected to become available from 2026 but until that time, an acceptable yield of wild sandalwood which can be sustained during the transition to a heavily plantation-based industry is required. Market development of the plantation resource will be

required over the period of the OIC to facilitate an increase in its use in the period beyond 2026.

Recommendation 10: The plantation resource should be utilised to reduce the reliance on wild-harvested trees after 2026.

4.8 Management of threatening processes

The FPC's current regeneration program integrates seeding with pest herbivore control activities including fencing, trapping and baiting. The Commission has offered to contribute additional funding to Parks and Wildlife for the management of threatening processes on existing and proposed conservation reserves.

Recommendation 11: The FPC should commit to an agreed level of annual funding to Parks and Wildlife for improved management of processes threatening the long-term survival of Western Australian sandalwood.

4.9 Management of illegally harvested material

Parks and Wildlife currently funds the majority of sandalwood industry compliance and enforcement but does not receive any revenues from the industry. Seized sandalwood is currently auctioned which can cause instability in supply levels.

The Working Group examined the possibility of including tonnages of illegally-harvested sandalwood within the quota (in the year of the seizure or subsequently). It is the Working Group's view that such an arrangement would lead to excessive administrative complexity and that increased effort in compliance and enforcement is a preferable approach to reducing the problem of sandalwood theft.

Recommendation 12: The FPC should provide an agreed level of annual funding for Parks and Wildlife's compliance and enforcement activities.

Recommendation 13: Seized sandalwood should be purchased by the FPC at market price for release to the market in a controlled manner with revenues being retained by the FPC to offset purchase and other costs.

5. Recommendations for the new Order in Council

5.1 Harvest levels

Recommendation 14: Set the annual quota at 2,500 tonnes. This would represent a 16.7 per cent reduction from the existing quota.

5.2 Green and dead wood

Recommendation 15: Set a maximum of 50 per cent green wood, thus allowing for a lower green wood harvest if new markets for dead wood emerge or other factors favour an increased harvest of dead wood. With a total quota of 2,500 tonnes, this would provide for a maximum green wood harvest of 1,250 tonnes comprising 1,125 tonnes from Crown land and 125 tonnes from alienated land.

5.3 Products included

Recommendation 16: Include all parts of the tree in the quota figure except leaves, bark and small branches (less than 25 millimetres diameter at the large end under bark), for which there is currently no market. This will provide an additional incentive to seek markets for currently unsaleable material.

5.4 Duration of the Order in Council

Recommendation 17: The new OIC should remain in place for a period of 10 years during which time additional research and inventory work will be undertaken.

5.5 Review process

Recommendation 18: The OIC should be reviewed by the end of 2024 in the light of the available plantation resource and any additional research findings and inventory results.

6. References

[1] Kealley, I G (1991). *The Management of Sandalwood.* Wildlife Management Program Number 8. Department of Conservation and Land Management. Perth, Western Australia.

[2] Loneragan O W (1990). *Historical Review of Sandalwood (Santalum spicatum) Research in Western Australia*. Research Bulletin Number 4. Department of Conservation and Land Management. Perth, Western Australia.

[3] Statham P (1990). *The Sandalwood Industry in Australia: A History*. In: Hamilton L and Conrad C E ed., Proceedings of the Symposium on Sandalwood in the Pacific, 9-11 April 1990, Honolulu, Hawaii. US Forest Service General Technical Report PSW-122.

[4] CSIRO and Bureau of Meteorology (2015). *Climate Change in Australia Information for Australia's Natural Resource Management Regions*. Technical Report, CSIRO and Bureau of Meteorology, Australia.