Your Ref: CMS16014:AC01-2016-0005
Our Ref: D16/9835
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Dear Dr Tom Hatton

NOTICE REQUIRING FURTHER INFORMATION
S38A OF THE ENVIRONMENTAL PROTECTION ACT 1986
PROPOSED COMMERCIAL HARVESTING OF WILD SANDALWOOD ON CROWN LAND

Thank you for your correspondence dated 2 May 2016 regarding the referral of the above proposal under s38 on the *Environmental Protection Act* 1986 (EP Act).

The Forest Products Commission (FPC) undertakes the commercial harvest of sandalwood and is the proponent for the proposal.

The sandalwood industry is an important component of the State's forestry industry. FPC has a strategic objective for the sandalwood industry to "facilitate a sustainable ethical industry creating jobs and opportunity in regional Western Australia. Brand confidence and recognition will be strong to enable a smooth transition to a mixed wild and plantation-based sandalwood industry".

The harvest limit is set on advice from the Minister for the Environment and approved by the Governor in Executive Council under the *Sandalwood Act, 1929*. The total amount of the order is 2,500 tonnes per year, and the FPC accesses 90 per cent of the quota on Crown Lands. This Order is made for ten years, and the FPC applies annually for a licence to the Department of Parks and Wildlife. This licence will equate to annual quantities of up to 1,125 tonnes of green wood (harvested from living trees) and the remainder will be from deadwood.

The Wildlife Licencing Section of the Department of Parks and Wildlife issue a single Sandalwood Act licence to the General Manager of the FPC on an annual basis. The licence lists the approved FPC Production

Contractors who are authorised to remove sandalwood from the Crown land operations.

I attach a document that details the FPC proposal for the harvesting of sandalwood. The proposal includes details about the FPC activities in the sandalwood industry that include: harvest, regeneration, quality systems, action on illegal harvesting, transition to plantations strategy, regional and Aboriginal outcomes as well as continuing investment in research.

If you have any questions regarding this information, or would require further detail, please contact Ruth Harvey on 9363 4605.

Yours sincerely

Gavin Butcher
ACTING GENERAL MANAGER

10 June 2016

Att: Forest Products Commission WA Sandalwood Harvesting Proposal 2016-2026.

FOREST PRODUCTS COMMISSION

WA SANDALWOOD HARVESTING PROPOSAL

2016-2026

FURTHER INFORMATION FOR THE ENVIRONMENTAL PROTECTION AUTHORITY

10 June 2016

Contents

1 Introduction

The Forest Products Commission (FPC) is the State Government Agency responsible for maintaining an environmentally sustainable and commercially viable forest products industry that provides economic and social benefits to the people of Western Australia.

The FPC undertakes its activities in accordance with the *Forest Products Act 2000*. It has the function of harvesting and selling forest products. In undertaking its activities it must also ensure:

i. the long-term viability of the forest products industry; and
ii. the principles of ecologically sustainable forest management are applied in the management of indigenous forest products located on public land.

The WA sandalwood industry is an important component of the State's forestry strategy. The FPC's Strategic Objective for the industry is to "*facilitate a sustainable ethical industry creating jobs and opportunity in regional Western Australia. Brand confidence and recognition will be strong to enable a smooth transition to a mixed wild and plantation-based sandalwood industry*".

Currently the WA Sandalwood industry is dependent on wood from naturally occurring WA sandalwood. FPC undertakes the harvesting of sandalwood, and arranges for its processing, marketing and sale. To provide for a sustainable resource FPC has invested in research to understand the causes of regeneration decline and uncovered the role of marsupials in sandalwood ecology. A suite of other initiatives for regeneration, action on illegal harvesting and promotion of plantation sandalwood are being pursued to ensure the long term sustainability of the industry.

The harvest limit for wild native sandalwood (Sandalwood Order) is set on advice from the Minister for Environment and approved by the Governor in Executive Council under the *Sandalwood Act 1929*.[1] The Sandalwood Order to apply for the period 1 July 2016 to 31 December 2026 is 2,500 tonnes per year. Up to half of the Sandalwood Order is for green wood (harvested from living trees, and the remainder is from deadwood).

The Department of Parks and Wildlife (Parks and Wildlife) have indicated that 90 per cent of the Sandalwood Order quantities will be available for harvesting by the FPC. This equates to annual quantities of up to 1,125 tonnes of green and 1,125 tonnes of dead wood.

Parks and Wildlife issue a yearly licence to FPC that reflects the amount in the Order in Council.

The proposal to undertake harvesting of WA sandalwood encompasses:

- The management of the WA sandalwood resource and the environment to promote improved long term viability of the species and the industry;

[1] The Sandalwood Act 1929 is proposed to be superseded by the Biodiversity Conservation Bill 2015. The Bill requires the same level of rigour surrounding the setting of the harvest limit although modernises the approval process, and includes significantly increased penalties for illegal sandalwood harvesting. The Review of the Sandalwood Order in Council recommended a reduced harvest level. This submission is consistent with that recommendation.

- To provide for significant improved regeneration and land management outcomes for WA sandalwood and associated lands;
- To assist in providing additional resources for the management of the rangelands, both in pastoral and conservation areas;
- The socio-economic benefits provided from the development of local industry, particularly in regional Western Australia, and for aboriginal communities; and
- Additional resources to reduce the adverse environmental and socio-economic impacts caused by illegal removal of WA sandalwood.

2 Industry Strategy (the Proposal)

The ongoing objective for the Sandalwood Industry is to facilitate a sustainable, ethical industry creating jobs and opportunity in regional Western Australia. Confidence in the environmental credentials and the delivery of regional benefits, particularly aboriginal communities, are important to maintain the reputation of the 'WA sandalwood" brand and will be valuable for a smooth transition to a mixed wild and plantation-based sandalwood industry over the next ten to twenty years.

Key elements of the strategy for 2016 to 2026 include:

1. Harvesting under annual licence of up to 1,125 tonnes of green and 1,125 tonnes of dead sandalwood on locations agreed with Parks and Wildlife.

2. The implementation of a regeneration strategy developed in collaboration with Parks and Wildlife. The strategy includes sowing seed at the site of each tree removed and broad scale sowing of at least 12 tonnes (approximately 5 million seeds) each year.

3. Achievement of a high standard of on-site environmental performance through a systematic approach for operational planning, field management requirements, monitoring and review of ongoing performance, external audit and certification to Environmental Management System ISO 14001.

4. Investment in systems and enforcement capability to address illegally taken sandalwood through implementation of a Chain of Custody system, and funding of additional enforcement resources in Parks and Wildlife to assist in the effective implementation of the new Biodiversity Conservation Act.

5. Development of a transition to plantations strategy with private growers to use the reputation of wild WA sandalwood to introduce and build the market for plantation wood into the future.

6. Strong emphasis in achieving outcomes for regional communities through greater engagement of pastoralists and aboriginal communities.

7. Continuous improvement supported by ongoing investment into knowledge and research along the supply chain.

3 Significance

EPA Objective for Flora and Vegetation:

To maintain representation, diversity, viability and ecological function at the species, population and community level.

Matters to which the EPA may have regard	How the matters are addressed in the sandalwood harvesting proposal
1) values, sensitivity and quality of the environment which is likely to be impacted;	• The areas proposed to be harvested and regenerated are generally Crown lands either vacant or with associated pastoral and/or mining leases. • The areas to be harvested exclude areas within or proposed by Parks and Wildlife for inclusion in the nature conservation reserve system; (Credo station is the one exception where negotiations continue and areas of high conservation value will be avoided). • These areas have been and continue to be extensively disturbed from their pre-European settlement condition by managed grazing, introduced feral animals, timber harvesting, mining and exploration. Nevertheless, much of the rangelands available for harvesting is considered to be in good condition and relatively resilient to disturbance. • FPC undertakes an operational planning process (Procedure 86, Form FPC446) which identifies areas of environmental sensitivity or containing specific values which are to be excluded or managed during harvesting and regeneration. • FPC operates an environmental management system to ensure that its processes and procedures are effective in achieving its environmental policies and other objectives. This system is independently certified against ISO 140001. (http://www.iso.org/iso/iso14001_revision). FPC currently holds certification to this standard for its operations.
2) extent (intensity, duration, magnitude and geographic footprint) of the likely impacts;	• Integrated harvesting and regeneration operations which remove both green and dead sandalwood and undertake regeneration activities will cover approximately 14,000 hectares per year. This typically occurs in several locations dispersed across the Coolgardie and Murchison IBRA bioregions. It is expected that at any time there would be up to 10 separate integrated harvesting operations. These operation areas typically contain sufficient resource to support harvesting for 5-10 years. • Dead wood harvesting entails the opportunistic gathering of only dead sandalwood trees, and the area affected is more difficult to quantify. It is likely to take place on up to 15 different sites in the Coolgardie and Murchison bioregions. Regeneration activities also occur in the localities where deadwood operations occur. • WA sandalwood disturbed as a result of mining activities will be salvaged and included within the harvest quantities. Typically FPC attains 1 - 2% of its harvest quantity from salvage operations. • Dedicated regeneration activities initially covered about 15,000 hectares per year. This is likely to increase to around 20,000 hectares per year after 2019. Dedicated regeneration activities will occur on 4 to 6 separate sites each year. • The total area accessed in FPC's operations each year represents about 0.3% of the related bioregions. (map)

	• On each harvest site the level of disturbance is low, and the impacts are short-lived. Integrated harvesting and regeneration operations involve two rubber-tyred machines; a front-end loader to remove the harvest-sized sandalwood trees and a vehicle to cart the trees. Harvesting contractors are required to follow detailed procedures that ensure protection of environmental, health and safety in their contracts. • Regeneration operations such as "Operation Woylie" involve a machine ripping a 250 mm deep seedling line into which fresh seed is sown. • While the relative frequency of mature trees varies across the landscape, on average approximately 2.5 trees are harvested per hectare. • FPC is introducing new practices to better utilise the resource by improving the recovery and use of sandalwood roots. If successful this program would see a 10% improvement in the yield per tree, and as a consequence an equivalent reduction in the number of trees required to be harvested to achieve the annual quota.
3) consequence of the likely impacts (or change);	• The Project will see a significant improvement in the long term persistence of WA Sandalwood populations. This will arise from investment in broad scale regeneration activities, and through the control of illegal removals. • Over a 10 year period the population of larger sandalwood trees[2] will be reduced by harvesting by 5% in the regions to be harvested. • Over the same period there will be at least 1,000,000 seedlings and young trees established over 250,000 hectares of the area within these regions. This will provide the foundation for a rejuvenation of the wild sandalwood population. • Part of the regeneration program will be in nature conservation areas which have been degraded by past activity and lack of natural regeneration due to loss of natural seed dispersal vectors such as seed caching marsupials. Parks and Wildlife have nominated areas in their Mid-West, Wheatbelt and Goldfield Regions to receive regeneration treatment.
4) resilience of the environment to cope with the impacts or change;	• the rangeland area to be accessed is used for a range of productive uses which have changed its biology and composition over the past 100 years; • mature sandalwood has been periodically removed from these areas over a long period (first harvesting in WA was 1844) and its regeneration has been adversely affected by other impacts such as feral animals and grazing; • natural mortality is anticipated to reduce the population of mature trees by about 1% each year. In the absence of a cessation of illegal harvesting this level may at a level of 500 tonnes per year,

[2] Trees with diameter greater than 126 mm

	further reduce the population by 2.5% over the next 10 years. • this project will see the re-establishment of young sandalwood populations across approximately 250,0000 hectares of the rangelands (0.7% of the relevant bioregions), including nature conservation areas. • This project will see improved management of areas with the rangelands including conservation areas.
5) cumulative impact with other projects;	Sandalwood harvesting in the rangelands is standalone project. To ensure the success of this project, the FPC works closely with Parks and Wildlife to ensure coordination of activities and collaboration of effort. • regeneration activities are targeted towards areas where protection from grazing can be achieved. This requires collaboration with other land users including the Department of Parks and Wildlife, pastoralists and mining companies. • this project will both reduce the impact of other activity (i.e. illegal harvesting) and reverse some of the adverse effects of other activity, and a history of population decline It is expected that the population structure for sandalwood will move towards greater sustainability as a result of this project.
6) level of confidence in the prediction of impacts and the success of proposed mitigation	The level of confidence in the background biology, mitigation measures and resource projections is good, reflecting several decades of research, inventory and adaptive operational experience in managing the harvest of sandalwood. The greatest risks to a successful achievement of the project are those which threaten the success of regeneration, in particular: • Prolonged drought • Poor control of grazing Confidence is enhanced through ongoing investment in research and monitoring of effectiveness of regeneration activities.
7) objects of the Act, policies, guidelines, procedures and standards against which a proposal can be assessed	EPA Objective: To maintain representation, diversity, viability and ecological function at the species, population and community level.
	The key threat to sandalwood populations in the rangelands of WA is a lack of replacement regeneration to maintain the population structure. The population of mature sandalwood will decline over future decades and, without active replacement, it would be expected that the overall population will reduce significantly over the next 50 years. The project will restore a regeneration cohort and maintain a representation of mature tree to assist in the recovery and persistence of WA sandalwood populations in areas harvested and regenerated.

8) presence of strategic planning policy framework;	• The Biodiversity and Cultural Conservation Strategy for the Great Western Woodlands (2010) provide the strategic framework for managing the range of different uses of the Great Western Woodlands. This includes the removal of some sandalwood from Crown lands in this region which will be harvested under this Project. • A strategic review of the level of the harvest was undertaken by the Parks and Wildlife, which saw a reduction in the level of future harvesting for the next 10 year period and anticipated the further transition towards plantation sandalwood • FPC prepares a Strategic Development Plan for its Minister and Treasurer to gain approval for strategic initiatives to be undertaken by FPC. • FPC is finalising a strategic plan for the Sandalwood Industry to reflect the changes to the Sandalwood (Limitation of Removal of Sandalwood) Order 2015, the changes in the structure of the industry and the management of the resource to reflect the proposals outlined in this proposal. • Parks and Wildlife and FPC have established a Senior Officers Group to oversee the implementation of the programs initiated under this project and initiatives identified in the Review of the Sandalwood (Limitation of Removal of Sandalwood) Order 1996 Report (Parks and Wildlife).
9) presence of other statutory decision-making processes which regulate the mitigation of the potential effects on the environment to meet the EPA's objectives and principles for EIA;	• Legislative Council Environment and Public Affairs Committee Inquiry into the Sandalwood Industry Reports (http://www.parliament.wa.gov.au/Parliament/commit.nsf/RelatedReportsLookup/851396FFA630B66548257CD0001800EA?OpenDocument) • Sandalwood (Limitation of Removal of Sandalwood) Order 2015, published in accordance with the *Sandalwood Act 1929* (https://www.slp.wa.gov.au/gazette/gazette.nsf/searchgazette/5992FC82C93E5E7D48257F2A0019CFC9/$file/Tocgg196.pdf) • Sandalwood Regulations 1993 • Review of the Sandalwood (Limitation of Removal of Sandalwood) Order 1996 Report (Parks and Wildlife) (https://www.dpaw.wa.gov.au/images/documents/plants-animals/licences-permits/Flora/sandalwood_oic_review_report_may_2015.pdf) • Licencing for the harvest of sandalwood by Parks and Wildlife, including associated conditions of licence under the *Wildlife Conservation Act 1950* • Export Licences for sandalwood issued in accordance with Commonwealth's Export Control Act 1982 and any associated conditions. (http://www.agriculture.gov.au/forestry/industries/export#when-do-you-need-an-export-licence) • The *Forest Products Act 2000* Section 12 requires (1) (https://www.slp.wa.gov.au/legislation/statutes.nsf/main_mrtitle_350_homepage.html) *The Commission in performing its functions must try to ensure that a profit that is consistent with the planned targets is made from the exploitation of forest products while ensuring —*

	(a) the long-term viability of the forest products industry; and *(b) the principles of ecologically sustainable forest management are applied in the management of indigenous forest products located on public land.*
10) public concern about the likely effect of the proposal, if implemented, on the environment.	• Public consultation has been conducted through: The Legislative Council Inquiry into the Sandalwood Industry Public submissions were sought and received. Of the 27 submissions only one (Wilderness Society) sought to stop the harvesting of wild sandalwood, others expressed concern about the impact of illegal harvesting on sustainability and the implementation of regeneration programs. FPC engaged Stantons International to consult with the public and industry stakeholders for the future structure of the industry. While the focus of the consultation was on industry structure, some responses which questioned the sustainability of the current level of the harvest. (http://www.fpc.wa.gov.au/sandalwood/new-industry-structure/consultation-stakeholders)

4 Public consultation

This proposal has been developed following an extensive review of the sandalwood industry by the Environment and Public Affairs Committee of the Legislative Council (2012 – 2014). The Terms of Reference for this inquiry were:

a) *the roles of the Department of Environment Regulation, the Department of Parks and Wildlife and the Forest Products Commission in the management and commercialisation of sandalwood;*
b) *how future contracts for the harvesting, marketing and selling of sandalwood can be managed to ensure that all sectors of the industry remain viable and sustainable and the returns to the State are maximised;*
c) *the management of wild sandalwood, including monitoring of the resource and regeneration;*
d) *the government resources required to effectively detect and prosecute the illegal harvesting and exporting of sandalwood, including the transport, storage, purchase, possession and identification of the sandalwood resource; and*
e) *a review of all relevant legislation pertaining to the sandalwood industry.*

The Inquiry sought public submissions into the matters above.

Public submissions and the transcripts of evidence from the proceedings of the Committee are available on the Committee website:

(http://www.parliament.wa.gov.au/Parliament/commit.nsf/(EvidenceOnly)/95A7345F7224493648257A7F0028E615?opendocument)

Two of the 27 submissions express concern about the sustainability of the level of harvesting. One from the Wilderness Society expressed the view that sandalwood was being "over-exploited" and that there was insufficient regeneration.

The other from Hon. Wendy Duncan MLC who indicated that her major concern was "*mismanagement of the State's existing sandalwood will result in plundering of stocks and an industry that is not sustainable. Sandalwood is being illegally harvested and such harvesting is out of the control of the bodies charged with administration of the Act. Replanting and regeneration of harvested areas will not be occurring where illegal harvesting has taken place.*"

Following the publication of the Report of Committee (Report 35), the Government has responded as to acceptance of and action taken in implementing the recommendations of the Committee.

(http://www.parliament.wa.gov.au/Parliament/commit.nsf/RelatedReportsLookup/CA4671DE2BF6606F48257D79000314BF?OpenDocument)

Since then there has been considerably more action undertaken in the implementation of the Committee's recommendations.

FPC understands that Parks and Wildlife took these submissions into account when undertaking its review of the Sandalwood (Limitation of Removal of Sandalwood) Order 1995. FPC has taken these submissions into account in the preparation of its proposal by giving due attention to the need for adequate regeneration and control of illegal removals. It also supports the Wilderness Society's view that future industry strategies need to take

account of the plantation sandalwood resource which is likely to mature over the next 10 to 20 years.

The Forest Products Commission has conducted further public consultation into the future structure of the WA sandalwood industry in the lead up to tendering for new contracts for the processing, marketing, sales and harvesting of WA sandalwood.

FPC engaged an independent consultant to seek public input into the future structure of the sandalwood industry. This consultation included submissions, public meetings and visiting isolated and remote stakeholders who may have an interest in the future of the industry.

A summary of the findings of the submissions has been made public (http://www.fpc.wa.gov.au/sandalwood/new-industry-structure/consultation-stakeholders). Individual submissions have not been made public as they may contain commercially sensitive information.

FPC has considered the views expressed in the submissions in the design and structure of the future industry for tender processes for processing, marketing, sales and harvesting of WA sandalwood. (http://www.fpc.wa.gov.au/sandalwood/new-industry-structure)

In relation to other issues raised in the consultation have also been addressed in FPC's management proposals, in particular:

- *The sustainability of harvesting , including the lack of regeneration*

  FPC accepts that there is a concern about the level of harvest. This has been reviewed by the Parks and Wildlife and is now subject of the most recent Sandalwood Order.

  FPC and its predecessors have conducted extensive inventories and research to ensure that ongoing management of WA sandalwood addresses the recruitment of regeneration and provides for the persistence of the species. .

  A list of relevant research and inventory publications is provided.

  FPC is preparing a Sandalwood Industry strategy document to provide greater clarity on its intentions. This strategy will address the social, economic and environmental dimensions of the industry and be developed when the outcomes of the tender processes are known.

  FPC recognises that regeneration of WA sandalwood is a key issue for its long term survival, and in this proposal has significantly increased its commitment to regeneration activities.

- Control of illegal harvesting

  Illegal removal of sandalwood is a major threat to the industry and to the sustainability of sandalwood across all land tenures. FPC, Parks and Wildlife, WA Police and the Commonwealth Department of Agriculture have been working to develop a range of strategies to combat this threat. FPC is developing a legal verification system to ensure that all wood that is legally produced can be tracked through the supply chain. It has also made a commitment to provide additional resources to Parks and Wildlife for enforcement activities.

  Matters related to changes to legislation have been undertaken through Parks and Wildlife.

5 Baseline Information

5.1 Sandalwood distribution and biology

WA sandalwood is a root hemi-parasitic small tree that typically grows to 4 m in height with a diameter of 200 mm. WA sandalwood occurs naturally in the southern two thirds of Western Australia and into South Australia. Brand et al (1999) showed that tree growth varies with site and climate. Detailed descriptions of its biology and ecology are available in a range of publications.

This map shows the natural distribution of WA sandalwood in Western Australia.

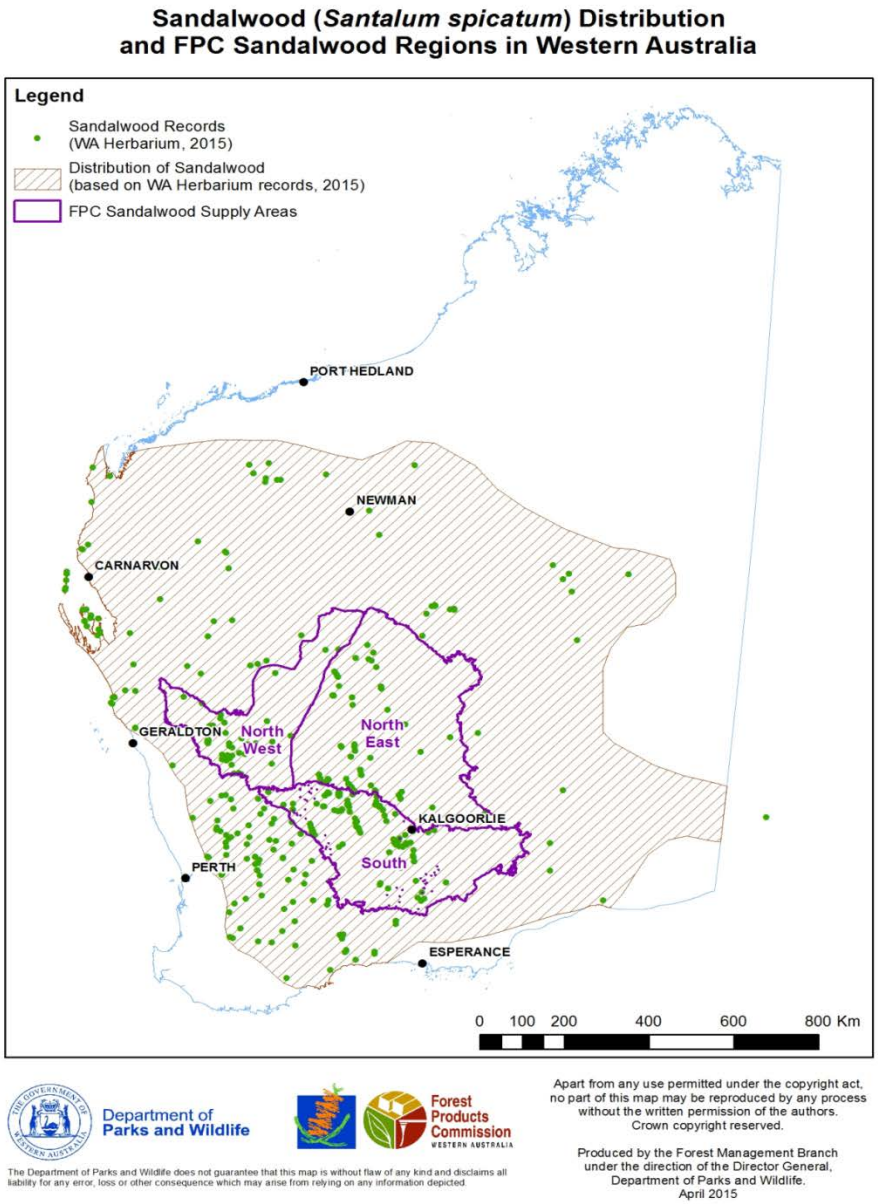

Figure 1 Distribution of sandalwood

Only a portion of this distribution is currently of primary interest to FPC. WA sandalwood populations are heaviest in the three operational regions depicted on Figure 2. Sandalwood grows on only a portion of the vegetation types within these regions.

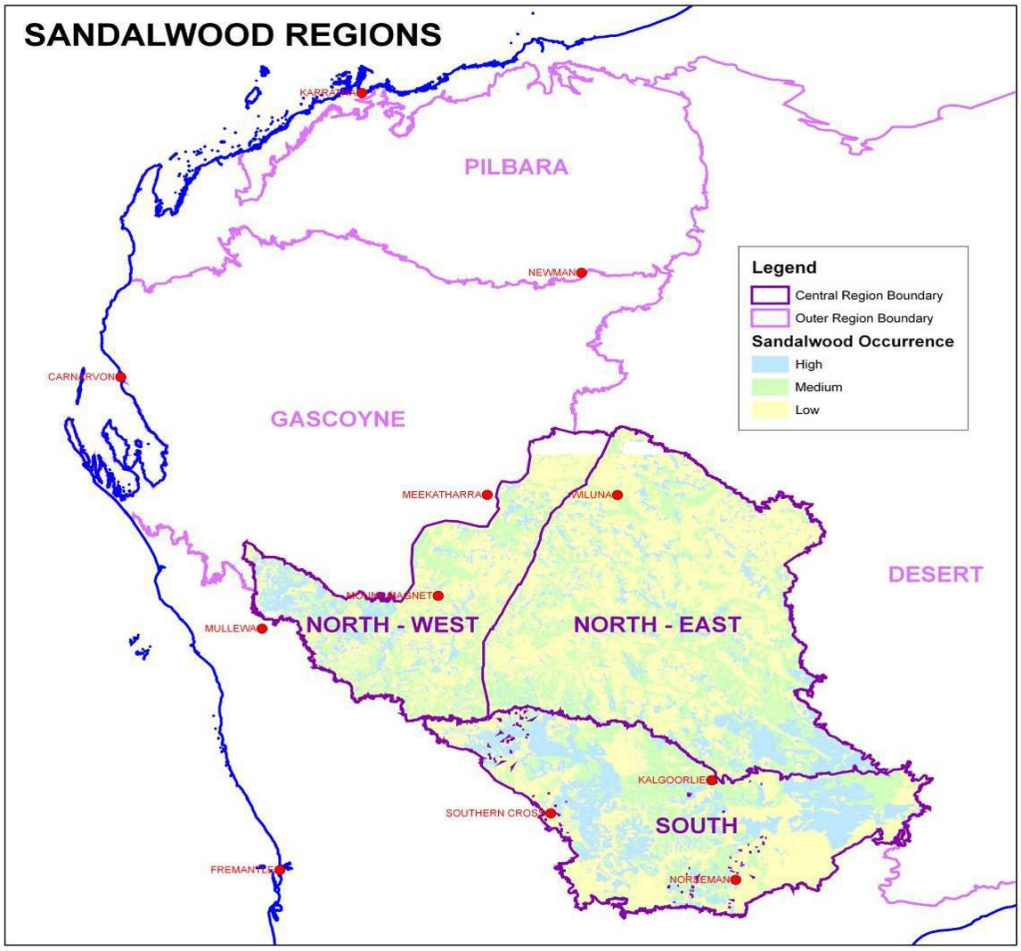

Figure 2: Concentration of sandalwood in regions

These regions have been subject to extensive inventory to help understand the sandalwood resource, which has been classified on the basis of size, with specific reference to the minimum diameter for harvesting of 127 mm diameter. In addition they have supported an understanding the regeneration and recruitment processes within the population. These are fundamental to being able to regulate the harvest and pursue objectives related to sustainable management of the resource.

Harvesting of green (living) sandalwood from 2016 to 2026 period will be focussed on these regions, and where regeneration can be effectively protected from grazing.

Harvesting outside these regions will primarily be dead wood.

5.2 Quantity of resource

Table 1 provides the inventory estimate of the total sandalwood resource on suitable land tenures in FPC's three sandalwood regions. It does not include resource estimates for those land tenures where harvesting will not occur (eg the existing and proposed conservation estate). It does not provide a resource estimate for sandalwood outside FPC's three sandalwood regions.

Table 1: Total sandalwood resource in the 3 sandalwood regions

	Area harvested 1995–2007			Area harvested before 1995		
Region	**Hectares**	**Green**	**Dead**	**Hectares**	**Green**	**Dead**
NW	634 000			1 602 000	15 000	8 000
NE	1 694 000			4 655 000	43 000	24 000
S	1 733 000			3 994 000	106 000	58 000
Total	**4 061 000**	**56 000**	**32 000**	**10 161 000**	**164 000**	**90 000**

These resource figures were derived from ground-based inventories across the three sandalwood regions in 2008. They are based on measured trees with a diameter of greater than 127 mm, and sample measurements of tree weight. On average recovery of sandalwood has been 31 kg per tree. It is planned through stricter requirements for the recovery of roots that this can be increased to 34 kg per tree under current contracts. If successful this will provide for a 10 per cent increase in the total resource, and an equivalent reduction in the area harvested to achieve the licenced quantity.

FPC has made commitments to Parks and Wildlife to undertake further inventory work to continue to quantify the sandalwood resource in these regions and in those areas not previous included.

5.3 Populations of Sandalwood

The inventories undertaken on the sandalwood resource have also provided valuable information on the population structure of sandalwood across the vegetation associations where it occurs within the Coolgardie and Murchison bioregions. While there is significant variation in occurrence and abundance of sandalwood within various vegetation associations, there is a clear pattern of population that is common.

Figure 3 provides a composite of the population as frequency within size (diameter) classes in the southern and north-eastern regions. As a guide sandalwood grows at around 1mm per year, therefore the size in millimetres is also an indicator of age.

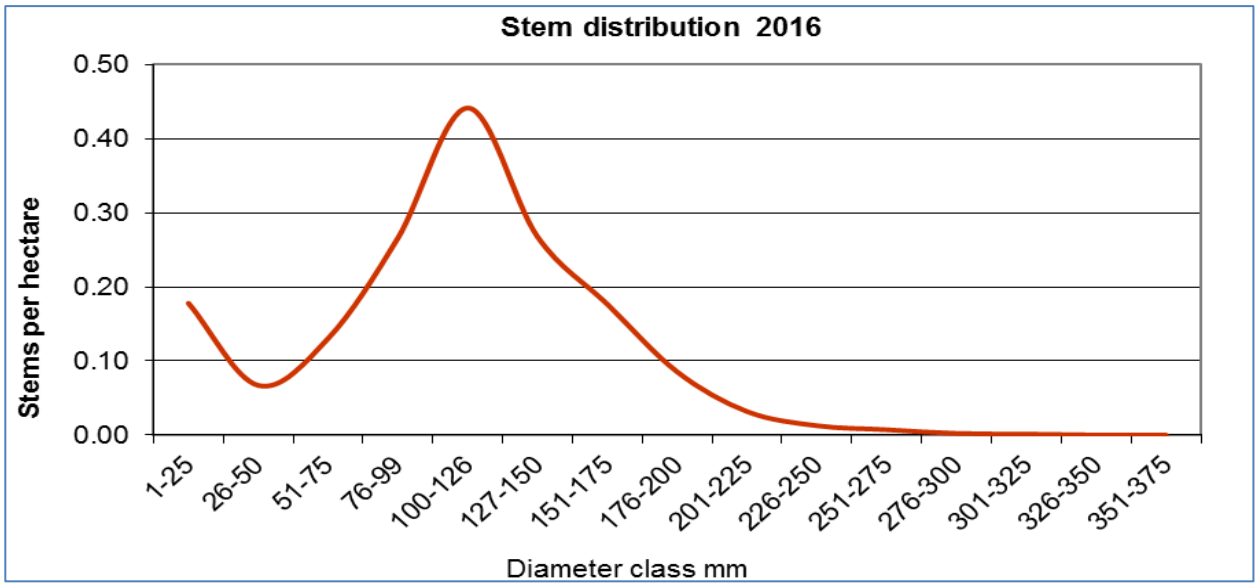

Figure 3: Population frequency

The concern with this population structure is the absence of a younger population of sandalwood that can replace the large, mature trees.

The observed population of sandalwood varies markedly from that expected to be sustainable. Figure 1 indicates there to be a decline in younger trees of less than 100mm in diameter, both in the northern and southern distribution of sandalwood.

The absence of regeneration has been recognised to be a significant issue for future resource management for some time (Kealley 1991). The failure to develop a regenerated cohort to replace the mature population suggests that the population is facing collapse as the existing mature trees age.

As the threat from a lack of regeneration has become apparent FPC (as well as its predecessor, the Department of Conservation and Land Management) has engaged in long term research to understand the causes of this decline and the measures that might be implemented to provide for sustainable management.

Based on studies suggest that using growth rates of 1mm/year provide an indication of the age of trees, suggests that the recruitment of younger trees has progressively declined from about 100 years ago. A population model has been developed to illustrate the structure of natural populations. (figure 2)

The primary causes of the collapse in natural regeneration are considered to be:

- Increased grazing pressure through pastoralism;
- Increased grazing pressure through introduced feral animals, particularly the rabbit in early years, but more recently through goats;
- Decline and eventual loss of marsupials which buried seed following the introduction of feral predators, notably the fox and cat.

5.4 Regeneration

Rangeland sandalwood trees have been observed to produce seed from around three years of age. Seed production is irregular and is strongly influenced by rainfall (Loneragan 1990; Kealley 1991).

Rainfall associated with wild sandalwood distribution varies from 100 to 400 mm per annum. Rainfall affects seed production, germination and survival. Germination requires annual rainfall of greater than 264 mm, including a season break of more than 12.5 mm in May/June (Sawyer, 2013). Germination is strongest if exposed to rain in the first year. However, seed remains viable for two to five years and has been observed to germinate up to eight years after sowing. There is limited information of the effect of drought on the survival of mature sandalwood populations. Mortality of greater than one per cent per annum in large trees has been recorded (Brand et al, 2014).

The woylie and other seed-caching marsupials were a key vector in seed dispersal in WA's pre-European past. Woylies have been shown to disperse seed in shallow diggings (4 to 5 cm deep) up to 80 metres from parent trees (Murphy, et al 2005).

Woylies are understood to have disappeared from the Rangelands by the 1950s because of predation by feral cats and foxes (Burbidge, Johnson et al 1988). The absence of seed dispersing marsupials is now considered to be the major reason for a disproportionately low level of regeneration in a sandalwood population structure. The lack of natural regeneration is a significant problem for the sustainability of wild sandalwood across all tenures including conservation estate.

Once the absence of woylies is overcome through planting programs; lack of winter rainfall and grazing are significant impediments to successful sandalwood regeneration.

New seedlings are vulnerable to grazing by goats, rabbits and sheep and to a lesser extent by cattle, donkeys and camels. Goats have been shown to damage sandalwood by severely browsing leaves and breaking branches up to 1.8 m above ground level.

Most of wild sandalwood is on pastoral lease tenure and has been subject to various levels of grazing over the past 100 years, mostly by sheep. Crown reserves and Unallocated Crown Land are free from grazing by domestic stock, but are exposed to feral goats, particularly where natural water is present.

Fencing to exclude grazing has been shown to increase both survival and development of sandalwood seedlings (Loneragan 1990; Brand 2000). Data from trial sites established in 1996 indicates the survival of germinants in fenced plots is between two and three times greater than in unfenced plots (Brand et al, 2014).

In recent years there has been a shift in the pattern of pastoral activities in the north-east and south. Mining companies have purchased and destocked a significant number of pastoral leases. There has also been a shift from sheep to cattle, which has further reduced the grazing impact on sandalwood. In the north-west grazing pressure remains particularly serious from the very high goat numbers.

Modelling of the WA sandalwood resource has been undertaken using data collected from 1,346 inventory plots established between 2001 and 2011. The stem sizes measured in these plots indicates there is insufficient regeneration in unmanaged populations to replace the natural mortality of old trees i.e. there are not enough seedlings to replace the number of

naturally dying old trees. This trend is occurring regardless of grazing pressure because of the lack of seed caching marsupials to disperse seed

In areas where marsupials still exist such as at Dryandra, there is natural regeneration of populations.

6 Planned Operations

All of FPC's activities are undertaken consistent with the Policies, Procedures and Guidelines in place for Sandalwood Operations. These form part of the System that FPC has audited to the Environmental Management System Standard ISO14001.

Copies of the forms and procedures are considered to be commercial-in-confidence, and can be provided to the Environmental Protection Authority on request.

6.1 Planning

Prior to the commencement of activities FPC undertakes several planning steps to ensure areas are available and suitable for harvesting.

Individual harvest areas are identified in the commercial purposes licences issued by Parks and Wildlife. Proposed areas for harvest and regeneration for 2016/17 are provided in attachment 1.

- FPC's planning checklist (FPC 445) Arid Pre-Operations Checklist and Approval to Commence

  Prior to harvesting, areas are systematically assessed to identify items of cultural heritage, (Aboriginal or European) as well as rare flora, fauna and threatened ecological communities. Harvest plans include management instruction for identified issues. Aboriginal heritage is considered through liaison with spokespeople for the areas proposed for harvest

- Documents Procedure 95

- Sandalwood Operations: Rare Flora Checking Guidelines

- Sandalwood Operations: Rare Fauna Checking Guidelines

6.2 Harvesting

Areas approved for harvesting are assessed for the specific location of sandalwood in order to focus activity on the productive areas and avoid unnecessary disturbance.

Harvesting may take place in three different types of operation: an integrated green and deadwood harvest, a dead wood only or salvage operation, however most sandalwood production occurs in an integrated operation.

FPC undertakes sandalwood harvesting using contractors. Contractors are selected on the basis of a number of criteria including their capability to plan and achieve environmental and safety outcomes.

The harvesting operation in an area may occur over several years. An operational camp is established where harvested sandalwood is stored and processed, and to accommodate the staff.

Trees are harvested based on a diameter limit (minimum of 127mm). Based on inventory data this will remove about one third of the sandalwood trees in any area harvested.

FPC supervising officers ensure that the Harvest occurs systematically throughout the approved areas for harvest. Operators are required to be able to log the movements of their machinery throughout the harvest area with appropriate GPS technology. Attachment 2 provides a GPS record of a sandalwood harvesting operation on Bullabulling Pastoral lease.

Over the ten year period it is expected that FPC will harvest about 140,000 hectares.

Documents that support these processes include:

- FPC1045 - Sandalwood harvesting operation handover and progress certification sheet
- FP3855 – Sandalwood Harvesting Inspection and Action Sheet
- Contract Procedure 801: Sandalwood Operations General Requirements
- Contract Procedure 802: Sandalwood Operation Access
- Contract Procedure 803: Sandalwood Tree Selection and Harvesting
- Contract Procedure 804: Sandalwood Product Preparation and Sorting
- Contract Procedure 805: Sandalwood Loading and Haulage

Figure 4: Harvesting Operation – Goldfields Region 2015

6.3 Regeneration

The aims for sandalwood regeneration are to establish a cohort of young trees in natural vegetation, including all areas which are currently subject to harvesting operations, and additional areas previously subject to harvesting or where sandalwood is in decline.

Management for regeneration is based on the following key elements:

- The sowing of seed in freshly disturbed soil adjacent to host plants to imitate the behaviour of seed-caching marsupials;
- The seed will be sourced from seed orchards, plantation and wild sources. All seed is mature, de-husked, good quality and no more than one year old at the time of sowing.
- Ensuring the seeds are sown in soils and vegetation types where sandalwood grows well and can be adequately protected from grazing.

Broad scale regeneration occurs on extensive areas that had previously been harvested. 15,000 to 20,000 hectares will be seeded by machine which creates a shallow 250mm ripline and sows the seed in freshly turned soil. If necessary fencing or other measures to control grazing will be used to protect regeneration areas. To date 1.25% of seed sown through this regeneration program are established seedlings. The range is 0.01% where there has been insufficient rainfall, and 5.4% in more successful areas and years. The rate of survival is improving as a result of evolving equipment and practices.

A minimum of 12 tonnes of seed (5 million seeds) per year are used on the regeneration programs. Based on monitoring completed to date, this will result in the establishment of more than one million seedlings between 2016 and 2026, which, is anticipated to result in a replacement rate significantly greater than the number of trees harvested.

The area receiving regeneration treatments will be approximately twice the area harvested over the same period.

Figure 5: Broad scale sowing with "mechanical woylie" – Yilgarn Region 2015.

Figure 6: Successful 3 year-old broad scale regeneration at Payne's Find 2015

6.4 Monitoring and Review

The FPC routinely undertakes monitoring of its operation activities to ensure compliance with operation procedures and performance objectives.

Significant deviations from procedure causing actual or potential negative impact are registered formally as an incident in accordance with Procedure 37 – Incident Management. Incidents are investigated to identify and understand the root cause as well as prescribe remedial and preventative actions; and implement systems improvements.

FPC routinely reports on its operational performance and includes some KPI's in relation to sandalwood in its Annual Report. FPC is currently reviewing these KPI's to account for the new Order in Council and regeneration targets.

Based on its current view FPC will be looking to include regeneration performance. Regeneration can be assessed by inputs (eg seeds sown) or outcomes (areas regenerated successfully). It is not always meaningful to interpret individual results as regeneration can be episodic in response to annual climate fluctuations. Measurement in any single year can be misleading.

One option is to have annual KPI's based areas receiving regeneration treatment, and long-term monitoring proposed in the Sandalwood Species Management Plan.

Ongoing population monitoring will continue, both within these sandalwood regions and in elsewhere to continue to build an understanding of the species response to different

environments. The scope of ongoing inventory and monitoring activities will be developed in consultation with the interagency Senior Officers' Group.

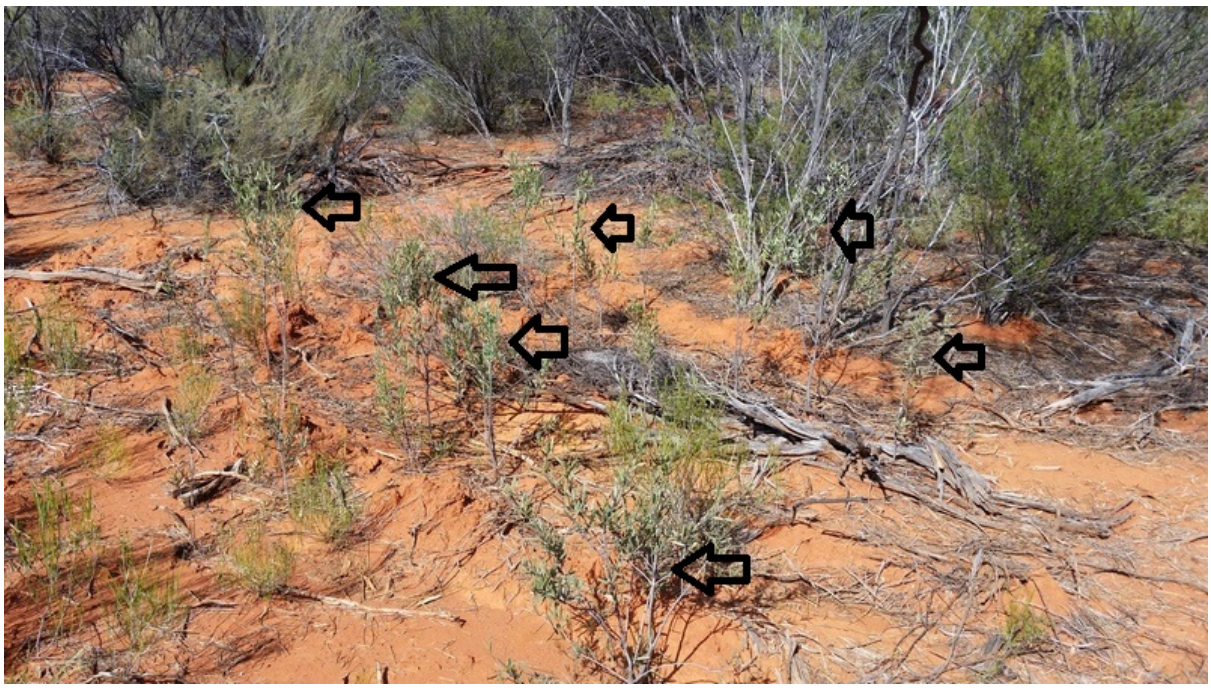

Figure 7: Regeneration at harvest site revisited after two years – Goldfields 2016

6.5 Audit

All FPC operations are routinely audited through both internal and external auditors.

These operations are regularly subject to auditing against ISO 14001.

6.6 Research

The current regeneration procedure is based on the 2007-2010 findings of the research programme "Operation Woylie" that is compiled in Sawyer (2014). Operation Woylie is planned to continue over the timeframe of this plan to further refine techniques for sandalwood establishment.

The scope of research activities developed in consultation with Parks and Wildlife through the interagency Senior Officers' Group.

6.7 Legal Verification and illegal harvesting

Illegal removal of sandalwood is a significant problem for land managers and the industry. It has been estimated that more than 500 tonnes of living sandalwood are being removed each year. Given thieves generally only remove the prime sandalwood above the ground, in doing so wasting the roots, this could be equivalent to at least 700 tonnes of wood from FPC's operations.

Sandalwood theft occurs across all land tenures, including nature conservation areas.

To assist in the control of illegal activity FPC has:

- Developed a legality verification framework for use by the industry and the regulators. This system can ensure that all legal wood will be traceable, giving confidence to buyers as to the source. In industry consultation on this system, FPC received strong support for its implementation from both plantation growers and wood processors.

- Required that all its operations adopt a legal verification system. This will ensure that there is a system in place for at least 90% of the legally-produced wild sandalwood from WA.

- Provided additional funding to Parks and Wildlife to improve its enforcement capability.

7 Impact Assessment

7.1 Site impacts

It is considered that site impacts create low environmental risks.

This is due to:

- The disturbed nature of the landscape;
- The planning undertaken to identify sensitive areas, to avoid affecting them, and to undertake operations in a systematic manner in accordance with its Environmental Management System ISO 14001;
- The low intensity of the activities;
- The measures taken to ameliorate current and past impacts; and
- Effective planning for and treatment of environmental incidents.

7.2 Impact on the population of sandalwood

The most important effect of the proposal will be on the changes to the sandalwood population.

FPC inventory of the populations and research into tree growth and mortality enables it to model the impact of this aging over the next 50 years.

The baseline for consideration of the proposal is what would happen without both the harvesting and regeneration activities.

Over the next 10 years it is projected that the population of large, mature trees (>127mm diameter) will reduce by 10% as a result of mortality. Further if illegal removals continue at the current rate (500t/year) the population will reduce by up to an additional 2%, or a total population decline of 12%.

The proposal would see the harvest of about 5% of the population of mature trees in the FPC sandalwood regions. The net effect of harvesting with control of illegal removals could see the net effect to be 3-4% reduction compared to the base line, or a total mature population decline of 15-16% in these regions.

At the same time the proposal will see intensive efforts to build the young cohort of sandalwood trees. The area sown with sandalwood seedlings will be around 250,000 hectares over the 10 years. Current monitoring indicates expected successful establishment rates of between 2 and 5%. This would see the establishment of 1 to 2 million seedlings and young trees over this period.

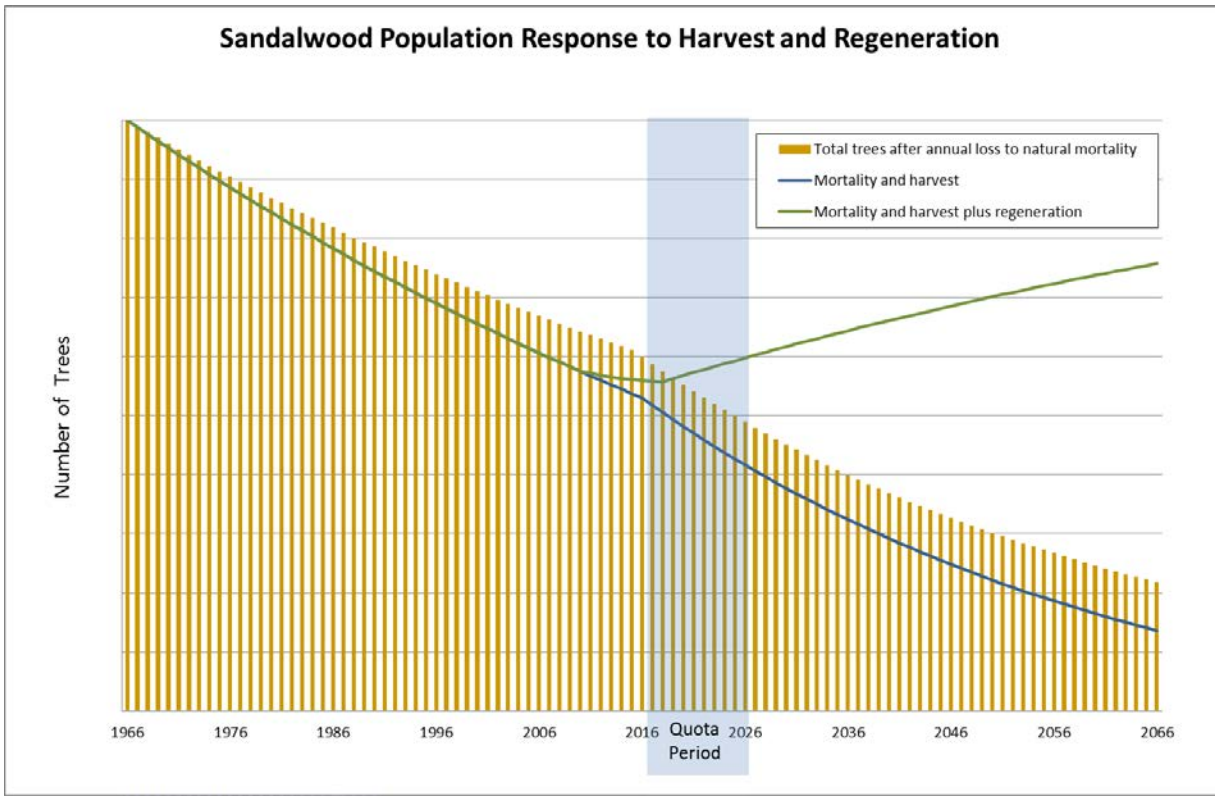

Figure 8: Sandalwood population projections based on proposal

8 Mitigation measures

8.1 Minimisation

The previous described measures will minimise the scale of impact of the proposal. Most notably:

- Consultation with various stakeholders and planning to identify sensitive sites and values to be protected during operations;
- Use of GPS technology to ensure operations are tracked and are spatially aware in relation to specific values;
- Increased root recovery to reduce the number of trees harvested to achieve the licence quantity;
- Field surveillance to identify resource areas and guide harvesting operations avoiding unnecessary vehicle traffic;
- Funding of enforcement activities by Parks and Wildlife to reduce illegal removals;
- Development of the Legal Verification system to assist in identifying legal and illegally harvested wood;
- Undertaking seedling and regeneration activities to provide for long term population recovery;
- Provision of fencing and other infrastructure to assist in the control of grazing for protection of regenerating seedlings and more generally improved rangeland management;

8.2 Rehabilitation

Sites adversely affected through operational activities will be identified in accordance with FPC's Incident Management procedure. Remediation and restitution will be determined and recorded on FPC form 80.

9 Continuous improvement

9.1 Environmental management system

A principle of continuous improvement is embedded in the FPC's Environmental Management System.

The FPC has a strong forest management policy which is tightly integrated into all our operations and commits, in conjunction with other agencies, to provide the resources required to fulfil policy commitments.

Our policy objectives include:

- Maintain a forest management system that is externally certified to IS0 14001.
- Maintain planning, implementation, monitoring and audit systems, supported by regular reviews and an effective reporting system.
- Set objectives and targets to ensure a continuous improvement approach to both management performance and managing environmental, economic, social and cultural impacts and outcomes including the prevention of pollution.
- Operate in accordance with relevant Commonwealth and State Government legislation, as well as applicable codes, standards and other requirements that apply to the FPC's operations.
- Ensure there are no planted genetically modified trees within forests managed by FPC.
- Sustain the contribution to the global carbon cycle.
- Clearly define forest management responsibilities.
- Train staff and contractors in forest management practices.
- Liaise with internal and external stakeholders on forest management issues and performance.
- Provide resources appropriate to the nature, scale and impact of the forest activities.

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Complete list of research papers

This is a list of research papers as provided to the Legislative Council 8 September 2015.

Title: **Caching of sandalwood seeds (Santalum spicatum) by the woylie (Bettongia penicillata) in Dryandra Woodland : implications for the development of a sustainable sandalwood industry in Western Australia**

Author: Murphy, Marie Teresa - Thesis (B.Sc. Hons.), Murdoch University (2002)

Title: **Conserving sandalwood (Santalum spicatum) in the rangelands, Western Australia**

Author: Brand, Jonathan (1999)

Title: **Constituents of Santalum spicatum (R.Br.). A.DC. wood oil**

Author: Joseph J. Brophy, Christopher J.R. Fookes, Erich V. Lassak (1991)

Title: **Does sandalwood provenance selection influence early establishment of sandalwood?**

Author: Bamford, Bella Renee - Thesis (B.Sc.Hons.), Curtin University of Technology (2001)

Title: **Ecotypic variation in the West Australian sandalwood, santalum spicatum**

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Title: **Effects of root nodule bacteria on the performance of plantation-grown Acacia acuminata and Santalum spicatum**

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Title: **Estimating returns on plantation grown sandalwood (Santalum spicatum)**

Author: Jones, Peter, Forest Products Commission (2001)

Title: **Extraction and variation of the essential oil from Western Australian sandalwood (Santalum spicatum)**

Author: Moretta, Paul - Thesis (Ph.D.), University of Western Australia (2001)

Title: **Genetic diversity in Western Australian sandalwood (Santalum spicatum): report to the Forest Products Commission**

Author: Byrne, Margaret, Dept. of Conservation & Land Management (2001)

Title: **Growing sandalwood (Santalum spicatum) on farmland in Western Australia**

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Title: **Have larger sandalwoods killed their hosts and do sandalwoods with multiple hosts grow better?**

Author: Mickle, David Anthony - Thesis (B.Sc.Hons.), Curtin University of Technology (2000)

Title: **Interim report on remnant sandalwood (Santalum spicatum) in the wheatbelt [electronic resource] :soils & vegetation associations**

Author: Casson NE (1991), unpublished report for Dept of Conservation and Land Management

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Author: Millar MA, Byrne M, Barbour E (2012)

Title: **Establishment and growth of sandalwood (Santalum spicatum) in south-Western Australia: the Northampton pilot trial. *Australian Forestry* 62, pp. 33–37**

Author: Brand JE, Ryan PC, Williams MR (1999)

Title: **Phylogeny and divergence in the chloroplast genome of Western Australian sandalwood (Santalum spicatum). *Heredity* 91, pp. 389–395**

Author: Byrne M, Macdonald B, Brand J (2003)

Title: **Regional genetic differentiation in Western Australian sandalwood (Santalum spicatum) as revealed by nuclear RFLP analysis. *Theoretical and Applied Genetics* 107, pp. 1208–1214**

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Author: Maslin B, Byrne M, Coates D, Broadhurst L, Coleman H, Macdonald B (1999)

Title: **The application of herbicide to sandalwood (Santalum spicatum) and two host plants**

Author: Noack, Ann (1995)

Title: **Ecology of sandalwood (Santalum spicatum) near Paynes Find and Menzies, Western Australia : size structure and dry-sided stems**

Author: J.E. Brand (1999)

Title: **Effect of cyanbacterial extract on somatic embryogenesis in tissue cultures of sandalwood (Santalum album)**

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Title: **The effects of management regime and host species on sandalwood (Santalum spicatum) recruitment near Paynes Find, Western Australia**

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Title: **Fruit Production on Sandalwood (Santalum spicatum) trees**

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Title: **An investigation into the Impact of Commercial Harvesting on Recruitment in Natural Populations of Western Australian Sandalwood (Santalum spicatum). Thesis**

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Title: **Review of research into sandalwood (Santalum spicatum) tree farm systems in south-western Australia**

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Title: **The natural regeneration of sandalwood, Santalum spicatum, at Sandford Rocks Nature Reserve**

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Title: **The root parasitism of the Western Australian sandalwood, Santalum spicatum**

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Title: **Sandalwood (Santalum spicatum) and quandong (Santalum acuminatum)**

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Title: **Sandalwood (Santalum spicatum) in Western Australia**

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Title: **Sandalwood (Santalum spicatum (R.Br.) A.DC.) excavation study**

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Title: **Sandalwood (Santalum spicatum) stem coppice and the influence of dune position on seedling survival near Shark Bay, Western Australia**

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Author: Walker, Terrance (1986)

Title: **Same day plantation establishment of the root hemiparasite sandalwood (Santalum spicatum R.Br. A DC: Santalaceae) and hosts**

Author: GS Woodall and CJ Robinson (2000)

Title: **West Australian sandalwood, Santalum spicatum, oil composition during development and change in seed mass**

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SANDALWOOD OPERATION AREAS
2016-17

MENZIES

KALGOORLIE

Legend

- Candidate Seeding Cells
- Harvest Cells
- Conservation Tenure
- Pastoral Lease

N

0 25 50 100 Km

BULLABULLING-NORTH HARVEST AND SEEDING PROGRESS

283 500
6 580 900

279 600
6 580 900

279 800
6 569 900

275 800
6 569 800

275 900
6 564 900

280 000
6 558 100

N

PERTH KALGOORLIE RAILWAY

JAURDI HILLS ROAD

COOLGARDIE NORTH ROAD

BONNIE VALE

MUNGARI

COOLGARDIE

ROCK ROAD

Caenyie Rock

BULLABULLING

Rock Hole Dam

GRETA MINE

Bulla Reservoir

BULLABULLING

Kangaroo Hills Timber Reserv

Goldfields Woodlands Conservation Park

GREAT EASTERN HIGHWAY

NEPEAN ROAD

NEPEAN SPARGOVILLE ROAD

0 5 10 20 Km

Legend

Operation Boundary
Note : Boundary edge of colouring
DAA Registered Aboriginal Site
Ⓐ Other Aboriginal Sites
Seeding Riplines
Harvesting
Non-Indigenous Heritage
Threatened and Priority Flora
Endangered and PriorityFauna
Water Point
Mine
Apiary Sites
Spot Height
Fence
Powerline
Breakaway
Railway Line
Principal Road
Secondary Road
Minor Road
Track
Watercourse
Parks and Wildlife Estate
Other Crown Reserve

Regolith
Exposed rock, saprolite, and saprock
In drainage channels, floodplains, and deltas
Includes ferruginous, siliceous, and calcareous duricrust
Includes lakes, playas, and fringing dunes
Mainly eolian, includes some residual deposits
Slope deposits, including colluvium and sheetwash

275000 280000 285000 290000 295000 300000 305000 310000 315000 320000 325000 330000

6590000 6585000 6580000 6575000 6570000 6565000 6560000 6555000 6550000