

## 5.2 PLANTED SANDALWOOD DEVELOPMENTS IN VANUATU

Tony Page,<sup>1</sup> Hanington Tate,<sup>2</sup> Anna Potrawiak,<sup>3</sup> Alick Berry,<sup>4</sup> Clement Bled<sup>5</sup>

<sup>1</sup>James Cook University, Cairns, Australia

<sup>2</sup>Department of Forests, Port Vila, Vanuatu

<sup>3</sup>AP Consultancy, Perth, Australia

<sup>4</sup>Vanuatu Chamber of Commerce, Port Vila, Vanuatu

<sup>5</sup>Institut Polytechnique LaSalle Beauvais, Beauvais, France

### Abstract

The Vanuatu sandalwood industry has a very promising future, where for the first time in its recorded history the resource is expanding. Recent planting activity has resulted in the establishment of between 270 and 550 ha of smallholder plantings and 150 ha of commercial plantings since 2000. While volumes harvested from wild sources are likely to decline over the immediate future the increased sandalwood planting may conservatively result in a sustainable annual yield of approximately 300 tonnes by 2030. At current prices the production of sandalwood by smallholder farmers is economically feasible and perhaps offers the highest returns of any agricultural activity in Vanuatu. With such smallholder sandalwood planting expected to continue, the future harvest of this resource is likely to improve export volumes resulting in improved balance of trade and government tax revenues, but importantly it will also stimulate the local cash economy and ultimately improve ni-Vanuatu livelihoods.

### Introduction

Sandalwood (*Santalum austrocaledonicum*) provides high-value, low-volume, non-perishable products that are in demand on the international market. Although only small volumes are harvested from wild sources in Vanuatu (80–120 tonnes annually representing ~1-2% of world supply) it has contributed significant export revenue and proved lucrative for harvesters. Wild-harvested sandalwood remains the basis of the Vanuatu sandalwood industry, but the natural populations are now severely depleted (Gillieson et al. 2008). While reducing harvest quotas can assist in making the industry more sustainable (Gillieson et al. 2008) another option is to establish a planted resource.

Active promotion of sandalwood planting was undertaken by the Vanuatu Department of Forests (VDoF) during the 1990s and later formalised in the first objective of the department's Sandalwood Policy (2002) where it stated: to 'increase sandalwood stock through replanting'. This policy also proposed that future sandalwood purchasing licenses would only be issued to 'applicants who have ... actively participated in sandalwood reforestation.' (Page et al. 2012) undertook a study to quantify the level of sandalwood planting across Vanuatu to determine the effectiveness of government promotion. This report summarises the main findings of this study, with respect to (a) recent activity in planting sandalwood in Vanuatu, (b) constraints to further industry expansion and (c) commercial feasibility of smallholder sandalwood production.

### Extent of sandalwood plantation estate in Vanuatu

Smallholders in Vanuatu currently demonstrate a preference for establishing sandalwood and whitewood woodlots (Page et al. 2012). The interest in these species is largely due to the strong international demand combined with local processing and export, which stimulates a local demand for smallholder-produced trees. The two species are adapted to contrasting environments with whitewood adapted to areas of high rainfall, and sandalwood adapted to drier areas of Vanuatu. These differing environmental preferences gives most smallholders the opportunity to plant either of the two main commercial forestry species.

Sandalwood occurs naturally on eight main islands of Vanuatu (Santo, Malekula, Efate, Erromango, Aniwa, Tanna, Futuna and Aneityum), but the climatic and edaphic conditions of eight other islands (Malo, Aore, Ambae, Pentecost, Ambrym, Epi, Paama and Shepherd) are also suitable for its production (Gillieson et al. 2008). While the latter eight islands have little to no sandalwood plantings, their suitability represents an opportunity for the industry to increase production over a wider geographical area, which will increase the volumes as well as mitigating the impact of natural disasters such as cyclones.

Smallholders in Vanuatu often plant sandalwood within newly established garden areas with the trees persisting after the garden has been abandoned and adjacent forest trees recaptures the site. This method of establishment is preferred over plantings established in older (3–4 year old) garden areas since the growth of sandalwood trees in the former is invariably greater than in the latter. Sandalwood seedlings are also being established in native forests as enrichment plantings and within the village as 'specimen' plantings.

An annual planting rate of 14,270 sandalwood trees (99,890 trees) was found between 2000 and 2006, which was significantly ( $P < 0.05$ ) greater than the rate of 478 trees (3,346 trees) per year for the period between 1993 and 1999 (Page et al. 2012). Sandalwood farmers participating in a plastic planter bag initiative of the Chamber of Commerce established an average of 327 trees between 2000 and 2006 inclusive. Some smallholder farmers around the country are taking a lead in this area and despite not participating in the planter bag initiative have established an average of 886 trees each. The two licensed sandalwood merchants in Vanuatu combined have planted approximately 150 ha in Efate. Furthermore, recent foreign investment in smallholder sandalwood has resulted in the establishment of 16 joint venture plantings in Erromango and Tanna. The mean number of trees planted (4,000) under these arrangements is 12.5 and 4.5 times the number measured in the 2007 survey and 2008 interviews, respectively. The increase in sandalwood planting rates since 1999 is likely to have been affected by the combined effects of:

- active promotion of tree planting in general, and sandalwood planting in particular (VDoF 2002), helped by research and extension activities of AusAID/SPRIG and ACIAR-funded sandalwood projects (Page et al. 2008)
- the distribution of planter bags free of charge through the Vanuatu Chamber of Commerce
- a decreasing wild resource (Gillieson et al. 2008)
- increasing prices paid to landowners for sandalwood at an annual rate above that of the Vanuatu consumer price index.

### **Projected industry size.**

The medium- to long-term prospects for the industry are considered good due to the projected high value of sandalwood in world markets, the level of sandalwood planting currently being undertaken and the resulting increase in the size of the Vanuatu resource from 2020, as planted stocks begin to mature. In making projections of the annual harvest volume we used a conservative estimate of heartwood content (18 kg at both 15 and 20 years) in planted sandalwood established after 2000 and a projection that wild resources will decline to approximately 30 tonnes by 2015. It is likely that part of the planted resource will start to be harvested from 2014 and combined with a 30 tonne wild harvest will bring production up to approximately 80 tonnes in 2015. This additional planted resource will gradually build over the next decade where the industry may be able to sustain annual production at around 120–150 tonnes between 2020 and 2025 and possibly over 300 tonnes by 2029–30. By this time the planted resource would therefore represent about a fourfold increase in annual harvesting rates and subsequent value of the industry, when compared with the current 80 tonne annual quota. With a continuation of the current planting activity, the Vanuatu industry can consolidate and improve its position as a small, niche producer within the international marketplace.

### **Impediments to the expansion of a planted sandalwood resource**

While seed supply has been a major impediment to increasing the planted sandalwood estate (Lui and Smith 2007), it is likely that this will recede as the seed from plantations becomes increasingly available. Sandalwood seed supply in Vanuatu comes primarily from the southern islands province of Tafea (Tanna, Aniwa, Futuna, Erromango and Aneityum). Most smallholders in the province are able to access enough seed to satisfy their demands for planting. This however, is not the case for the northern islands where there are few natural populations and potential growers find it very difficult to locate sandalwood seeds. The limited availability of planter bags, particularly for smallholders, is also an important constraint to industry development. Boxes of planter bags (~6,000 units) are often not available in the major centres of Luganville and Port Vila, since they are often pre-sold before importation to relatively wealthy urban wage earners, who have planting interests in their home village. Although this interest is encouraging, further competition in the planter bag market is required to ensure people of all demographics have the opportunity to participate in this potentially lucrative agroforestry industry. Opportunity exists for greater competition to meet the high demand for planter bags.

### **Risks to sandalwood cultivation**

The current marketing duopoly operating in Vanuatu does not discourage smallholders from investing their time in establishing sandalwood woodlots; however, it is likely to limit larger scale planting investments in the country and thus the opportunity for the government and domestic economy to benefit from new employment opportunities and increased revenues from the export of product generated from such investments. This policy area requires further review to ensure a balance between the protection of natural populations and open competition can be met.

- Cyclones represent the greatest threat to sandalwood plantings attaining a full rotation. The impact of lower category cyclones can be limited by planting in more sheltered areas, and establishing effective vegetative wind-breaks.

In such protected situations, cyclones may damage the trees without a complete loss, and some salvage may be possible. For an individual farmer there is limited capacity for mitigating the effects of high intensity cyclones. On an industry basis however, spreading the plantings across the many suitable islands in Vanuatu will reduce the risk of outright loss of the sandalwood estate from an individual event.

- The greatest biological threat to sandalwood is the fungal disease *Phellinus noxious* (nawwun) which can kill trees of all ages, and if left unchecked in a planting can kill a large number of sandalwood trees. While no chemical control agents have been registered for use against this disease, a number of traditional methods of control (Page et al. in press) are effective in limiting the spread of the disease within a planting.
- The possibility of sandalwood tree theft is quite real in Vanuatu, particularly for larger plantings and those established in isolated areas. Establishing plantings in areas that are regularly visited and also fencing them will help to reduce the incidences of theft. Some respondents cited that jealousy and subsequent vandalism may be an issue; however, as more people establish small woodlots these issues are likely to be isolated.

### **Productivity of planted sandalwood**

The value of a sandalwood tree is largely determined by the weight of its heartwood and the concentration and composition of the oil contained within it (Doran et al. 2005). Determining the rate of heartwood development in a sandalwood tree is important, since it will largely determine the length of its commercial rotation. The weight of the heartwood is invariably limited by or dependent on the size of the tree. Very little information has been published regarding the rate of growth in *S. austrocaledonicum*.

### **Growth rates and heartwood development**

Given the prevalence of both enrichment and new garden plantings, the number of trees measured in these two categories constituted 84% of the trees sampled. No statistical difference in the mean annual basal increment was found between these two planting types with a basal diameter growth rate of 1.08 cm per year. Sandalwood grown under commercial conditions was found to have significantly greater growth (~1.8 cm/yr) rates than all other management regimes, largely due to the attention to host tree planting and fertiliser additions. Trees planted in old garden areas were found to have (~0.8 cm/yr) significantly slower growth rates than all other management regimes.

### **Heartwood development**

The regression between tree age and heartwood weight indicates that the beginning of heartwood development may occur at 7.5 years, and increase at a rate of approximately 2.5 kg per year thereafter. It is important to note that significant variation in the timing of heartwood induction and rate of development is expected between sites due to differences in genotype and local edaphic and/or climatic conditions. When grown under suitable conditions (Page et al. in press) heartwood production at age 15 has been conservatively calculated at 18 kg which increases significantly to approximately 59kg at age 30 (Page et al. 2012). These authors also reported that heartwood development in *S. austrocaledonicum* may also develop earlier and with greater volumes than similar aged trees of *S. album*.

### **Socioeconomics of sandalwood production**

Using the conservative estimates of heartwood yield at both 15- and 20-year-old *S. austrocaledonicum* the profitability of standard sandalwood planting models can be compared. Sandalwood agroforestry (1 ha planted at 833 stems/ha with a rotation of 15-20 yrs), which combines a food garden with sandalwood, is significantly more profitable than producing sandalwood or food garden alone. This sandalwood agroforest had the highest Benefit-Cost Ratio (BCR) (2.14) and Net Present Value (NPV) (\$21,785.64) of all 1 ha planting scenarios at a rotation of 15-20 years. The return to labour for the 1 ha sandalwood agroforest is US\$4.70/hour, which is equivalent to the average hourly rate for a Technician (CS2.2) employed by the Vanuatu Government. Such a position typically requires an education equivalent to that of a technical college diploma, and therefore sandalwood production represents potential earnings for farmers that is much greater than that of the minimum wage (US\$1.40/hr). The production of sandalwood on a shorter rotation (7 years) for sapwood is not economically competitive with sandalwood agroforestry (15-20 years). Given the ambitious stocking rate of 2,500/ha and the low current farm gate sapwood prices (US\$0.49/kg) the short rotation production of sandalwood is marginal when considering it as an option to improve cash flow. The commercial production of sandalwood within smallholder agroforestry provides an asset, which could be used as collateral to secure microfinance and improve economic development. Sandalwood production is often referred to as the only long-term saving option for smallholders that can improve financial security and ultimately their livelihoods. On a national scale the production of sandalwood may help to alleviate the harvesting pressures of contracting wild stands while providing a source of foreign exchange and government revenue.

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