

## REVITALIZING PACIFIC SANDALWOOD PRODUCTION

### Introduction

The genus *Santalum* includes the major sandalwoods of international commerce and trade, and indeed some of the most valuable and widely recognized plants in the fragrance and essential oil industries. Sandalwoods have a scattered distribution throughout the entire Pacific Islands region, naturally occurring wherever environmental conditions are favourable. Pacific sandalwood species of commercial trade include *Santalum austrocaledonicum* (Vanuatu and New Caledonia), *S. macgregorii* (Papua New Guinea), *S. insulare* (French Polynesia and Cook Islands) and *S. yasi* (Fiji and Tonga) in the South Pacific; and *S. ellipticum*, *S. freycinetianum*, *S. haleakalae* and *S. paniculatum* from Hawaii in the northern Pacific.

Sandalwoods were traditionally used in the Pacific Islands for carvings, cultural benefits, medicine and scented coconut oil and were also burned as an insect repellent. Nowadays, they are rarely used locally because of their scarcity and high cash value for export. Pacific sandalwoods, such as *S. yasi* and some populations of *S. austrocaledonicum*, produce highly prized sandalwoods, often similar in quality to the well-known *S. album* from India and Indonesia. The sandalwood trade was one of the first reasons to attract Europeans to the South Pacific in the early nineteenth century.

Most sandalwood species have already reached or are fast approaching commercial extinction in their native habitats. They include not only the Pacific Islands species, but also *S. album* from India and Indonesia. Sandalwood plantations being established in many parts of the local range will increasingly substitute the dwindling supplies from native forests.

### The demise of commercial exploitation of natural sandalwood in the Pacific

*Santalum austrocaledonicum* was heavily exploited over about three decades in the middle of the nineteenth century in New Caledonia and Vanuatu and has been utilized periodically ever since. Carvings, incense production and sandalwood oil are the three major current products from *S. austrocaledonicum*. Sandalwood



*Santalum*

harvesting is closely regulated in both countries but, in the case of Vanuatu, the present extraction quota of 80 tonnes of heartwood per year appears unsustainable. A recent inventory of sandalwood resources by the Department of Forests and James Cook University in Vanuatu showed that only about 290 tonnes remain. At today's harvest rates, Vanuatu's sandalwood supply will be substantially reduced in four to five years and will be in short supply until plantation sandalwood is available in 12 to 15 years.

Over the past century, sandalwood from *S. yasi* in Fiji and Tonga has been exported to a limited extent, experiencing short-lived boom periods associated with a buildup of sandalwood stocks. The current high international prices for sandalwood, including *S. yasi*, have led to drastic overharvesting in Fiji and Tonga, mostly illegal and often with no returns for the legitimate owners, for whom the prices paid are variable and often extremely low, e.g. <US\$5/kg. Even immature *S. yasi* saplings are being cut to check whether any heartwood has formed: this practice invariably results in the premature death of the tree, either by blowing over during strong winds or from fungal disease.

With sandalwood now approaching commercial extinction in most parts of the Pacific Islands, there has been renewed interest in replanting it. Sandalwood has two significant factors in its favour for commercial cultivation on remote islands. First, the product has a very high unit value, e.g. US\$10–50/kg and, second, its non-perishable nature means that it is not susceptible to the vagaries of irregular and infrequent inter-island shipping. Planting of sandalwood has now extended

beyond its native range to Pacific islands such as Samoa and the Cook Islands, which is possible because of sandalwood's capacity to grow in more humid zones when cultivated in well-managed, agroforestry configurations that provide adequate sunlight and prevent overtopping by taller trees.

### New plantation sandalwood resources in Australia and the Pacific Islands

Within the next ten to 20 years, it is likely that Western Australia (WA) will dominate sandalwood production and the international export trade in sandalwood products. Large plantations have been established in WA through managed investment schemes (MIS) financed by the private sector. Major players include the Tropical Forestry Services Corporation Ltd, ITC Ltd and Santalol that are growing about 3 700 ha of *S. album* under irrigation in the Ord River region. *S. spicatum* is being planted in the drier zones of WA with the Forest Products Commission aiming to establish 4 800 ha by the end of 2008. The MIS company, Rewards Projects Ltd, has already established 2 700 ha of *S. spicatum* and Emerald Peak Plantations Ltd is planning to establish 495 ha of the same species.

By contrast, new sandalwood plantings in the South Pacific Islands (as detailed below) are much smaller and more dispersed. Pacific Island plantations of sandalwood run considerable risks (from tropical cyclones, fire, *Phellinus noxius* fungus, theft and rights of ownership, etc.) but, compared with the plantations being developed in WA and elsewhere, have several advantages, such as more rapid growth and shorter rotations for the production of valuable heartwood (i.e. rich in santalols), and lower cost structures for production. The greatest opportunities for Pacific Islands sandalwood are likely to involve niche marketing, focusing on unique cultural dimensions and oil profiles (including in some cases elevated levels of the highly fragrant  $\beta$ -santalols).

**Vanuatu.** The most active replanting of sandalwood in the Pacific Islands is taking place in Vanuatu, as a result of active research by the Department of Forests, initially through the AusAID-supported SPRIG (South Pacific Regional Initiative on Forest Genetic Resources) project and more recently through an ACIAR (Australian Centre for Agricultural Research)-funded project with James

Cook University. The latter project demonstrated the variation in heartwood oil quality (santalol content) and quantity between populations and individuals, and the importance of selecting the correct seed source for replanting. A promotional video developed by the Secretariat of the Pacific Community is also sparking interest and informing native landowners about how to grow sandalwood. Surveys by the Department of Forests show that in recent years about 80 ha of native sandalwood (*S. austrocaledonicum*) have been planted by 45 growers on six islands (Aneityum, Aniwa, Efate, Erromango, Malekula and Tanna). Smallholder plantings are mainly undertaken in agroforestry systems, but most of the area planted is by commercial growers on Efate.

**Fiji.** The Forestry Department in Fiji has a target of propagating 10 000 seedlings per year for planting by native landowners. The main species being propagated and planted are the local *Santalum yasi*, with smaller amounts of *S. album*, and the hybrid between these two species. The focus of these plantings is on the two larger islands of Viti Levu and Vanua Levu. Native landowners are propagating and planting small areas of *S. yasi* on the outer islands of Fiji, especially on Kadavu and the Lau Group. A local company, Pacific Reforestation (Fiji) Ltd, has been undertaking research on sandalwood and host species and is currently planting several hectares per year of sandalwood and hosts on Viti Levu.

**Tonga.** The Forestry Division in Tonga has just set a target of propagating 100 000 seedlings per year. To date, there have been relatively few sandalwood plantings, partly because the theft of wild trees in recent years has made landowners reluctant to replant.

**Cook Islands.** The majority of sandalwood plantings are on the island of Mangaia where 10 ha of exotic sandalwoods (8 ha of *S. austrocaledonicum* and 2 ha of *S. album*) have been established in a variety of situations. Survival, tree form and height growth are good, but diameter increment is only moderate.

**Samoa.** Sandalwood was only introduced to Samoa in 2000. Since 2006, several thousand plants (*Santalum album*) have been planted per year on the islands of Upolu and Savai'i: early growth and bole form are outstanding. Together with the development of local seed sources and a major new agroforestry project, it is

expected that the establishment of agroforestry plantings of sandalwood will soon exceed 5 ha per year.

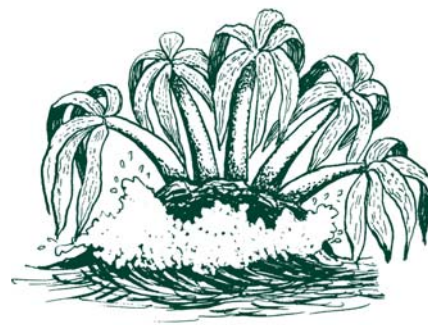
#### A future model?

In Fiji, a promising new model for private-public-community partnerships to develop sandalwood resources is being explored by the Government of Fiji and Pacific Reforestation (Fiji) Ltd (PRF). It has the following features.

- Sustainable and equitable utilization of *Santalum yasi*. Prior to any harvesting of *S. yasi*, the tree/resources owner must be verified by the recognized authority (Native Lands Trust Board in collaboration with local provincial councils and the Forestry Department). An agreed, fixed and fair price is to be paid for sandalwood to the rightful owner(s) with a set proportion going to the Forestry Department for sandalwood extension throughout Fiji, including training and propagation of planting materials. A modest and sustainable harvest rate for the remnant *S. yasi* trees, such as 20 tonnes, should be sustained per year over the next 15 years, until new sandalwood plantings, and plantations come into production. It is proposed that the sustainable harvest rate be regularly reviewed, e.g. every three years, by the Forestry Department.
- Value adding and marketing/branding of Fiji *S. yasi*. There would be a ban on export of unprocessed *S. yasi* heartwood to maximize local value adding and economic benefits for Fiji. The private sector, led by PRF, would develop a marketing and branding strategy to maximize market recognition and appreciation of Fiji *S. yasi* and its essential oil.
- *Santalum yasi* replanting programme. The Forestry Department would expand its current extension programmes for *S. yasi* and PRF would develop commercial partnerships with Fijian *mataqali* (landowner units) to protect and replant *S. yasi*, including provision of information, planting materials and finances.
- Research and development. The Forestry Department and PRF should develop a joint R&D programme for *S. yasi* to identify optimum silvicultural regimes, including propagation systems, most suitable hosts and technologies to initiate earlier heartwood formation.

- Conservation of genetic diversity in *S. yasi*. Update the *S. yasi* conservation and sustainable management strategy and provide private sector backing and support for its implementation. Wherever possible, the genetic material of any cut sandalwood tree should be first conserved in gene conservation stands, either through seed and wildling collection or grafted scions.

A similar model might hold promise for other Pacific Island countries, such as Tonga and Papua New Guinea, where sandalwood resources are being exploited in an uncontrolled and suboptimal manner but with little financial return to resource owners. (The author acknowledges with thanks the input from Pacific forestry colleagues, Mr Ioan Viji, Ms Sanjana Lal, Mr Tevita Faka'osi, Mr Otheniel Tangianau and Mr Tolusina Pouli.)  
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