Australian Sandalwood Sustainability Report

A Summary of Findings

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Purpose: To determine the long-term sustainability of Australian sandalwood essential oil (*Santalum spicatum*) and its potential to provide a solution to the mounting pressure on the world supply of sandalwood.

Situation: Worldwide, there are 16 species of sandalwood of varying uses, economic value and availability. All the species have been exploited—many to the point where little or none remains to be harvested for any purpose. The Aura Cacia sourcing team has become very concerned about the sustainability of Indian sandalwood (*Santalum album,* considered the benchmark species) that we have used for years as our source of essential oil. Working with Frontier's VP of Sustainability, the team has conducted extensive research, including interviews with suppliers and experts, literature review, and in-country visits to determine whether commercially available Australian sandalwood offers a truly sustainable source of sandalwood essential oil.

Sandalwood General Information: Sandalwood is a small, slow-growing evergreen tree. It is semi-parasitic, which means it uses the roots of a host plant for nutrients when it is young (the host dies as the tree grows). The essential oil is found in the heartwood. No essential oil is present in the tree until the heartwood develops—a process that starts when the tree is around 20 years of age and continues until maturity (around 50 years of age, depending on climate and species). Essential oil varies in quality and quantity based on the species of sandalwood, age at harvest, growth rate and conditions of growth. As a rule, the slower the growth (and the more stressed the tree) and the older the tree is at harvest, the more oil is available in the heartwood. The oil is also present at the highest level in the root and decreases as one moves up the tree. The leaves have no essential oil. (Some species have little or no essential oil and are therefore of lower value. These species are often used for joss sticks and powders.)

INDIAN SANDALWOOD AND MINOR SPECIES

Sandalwood is culturally important to many people. It has been used for over 4000 years as a perfume, medicine and in spiritual practice. *Santalum album* (Indian sandalwood), with its high essential oil levels (up to 6%) is the sandalwood that is most prized in the U.S. and around the world. In India, sandalwood is often harvested for local consumption—the wood is sold in small pieces for use by families in ritual, purification and skin care. Sandalwood carvings are also made that range from small trinkets to elaborate furniture and ornate temple doors. Sandalwood oil and products are exported around the world to bring in revenues and even—in the case of one infamous bandit—to fund revolution.

The Indian government has long worked to encourage replanting, control harvesting and stop poaching. But while there are still a lot of sandalwood trees in India, the numbers are declining,

especially of the older, high quality trees. Even though no sandalwood is to be cut without government permission, farmers often harvest trees on their land before maturity to prevent poachers from cutting and stealing them. The quantity of sandalwood trees needed to meet the steadily increasing world demand can't be filled by India. It is imperative that an effective program be put into place to control harvest and replenish supply.

Indonesia and East Timor are also producers of *Santalum album*. In fact, some theories indicate that this species was carried from Indonesia to India many centuries ago. There are several other high quality oil-producing species of sandalwood as well—*S. yasi* (Fiji, Tonga) and *S. austrocaledonicum* (Vanuatu, New Caledonai). While all of these areas are producing some oil, native stands of sandalwood trees are not sufficient to justify any kind of move to use these oils at this time. All of these countries have undertaken conservation measures and are studying methods of regeneration and sustainable management, but they are clearly not in a position to claim successful long-term sustainable production at this time and thus were not seriously considered as sources by Aura Cacia.

AUSTRALIAN SANDALWOOD

The Australian sandalwood tree, *Santalum spicatum*, differs from *Santalum album*, the more familiar species grown in India, but Australian sandalwood essential oil has many of the same chemical components as the Indian. The difference in the aroma of the two oils is most pronounced in the top note. Australian sandalwood has a more resinous, drier and less sweet top note. The aromas of the two oils become more alike in the middle notes, and the all-important base notes (sandalwood is considered a bass-note oil by aromatherapists) are almost identical. Australian sandalwood essential oil can be used like Indian sandalwood in most aromatherapy applications.

The Australian government strictly controls the harvest of Australian sandalwood *(Santalum spicatum)*. Sandalwood grows naturally on Crown land (land owned by the national government) in the arid interior of Western Australia. Only 40% of this land is eligible for sandalwood harvest and a maximum of 2,000 tons are harvested each year. Of that, 1,200 tons is from live trees (greenwood) and 800 tons is from dead trees. The Forest Products Commission (FPC) is the arm of the government that manages sandalwood. Sandalwood grows in Western Australia, therefore that state's FPC handles the management of sandalwood production within the guidelines set by the national government. In spite of rising demands, the Australian government remains committed to maintaining a sustainable sandalwood supply through limits on harvest levels. The government is also funding research on growing methods, seed selection and protection of seedlings in the wild. And planting sandalwood on both government and private plantations started in the late 1990s and is accelerating today—withy the goal of eventually meeting the rising demand for sandalwood with trees grown on plantations.

Forest Products Commisson, Contractors and Harvesting: The Western Australia Forest Products Commission (FPC) ensures the long-term viability of the forest products industry by applying the principles of ecological sustainable forest management and promoting the development of sustainable timber products. With sandalwood, they are responsible for commercial harvesting and regeneration, as well as marketing and developing the industry. The management includes a sandalwood-specific certification system, the Internationally Certified Environmental Management System (ISO 14001). This certification insures a consistent, documented and continuously improving process.

A maximum sandalwood harvest was set in 1929, and it is still in effect today. Each year, potential contractors can apply for a license and a sandalwood quota. However, while there is some turnover among contractors, most contractors are experienced harvesters with a proven record of meeting the requirements of sustainable harvesting and replanting. The FPC currently has 16 contracted lifters (half aboriginal), each with a minimum contract of 25 tons. All contractors are given training each year on the requirements and procedures they need to follow in their assigned region. Three full-time FPC inspectors make sure that the contractors adhere to all requirements.

The areas approved for sandalwood harvest are divided into regions, with a maximum of 25% of the existing trees in a region harvested. Only one tree (which must meet a minimum size requirement) per hectare can be harvested—and once a region is harvested, it is not eligible for harvest again for 150 years.

Harvesting is done by using heavy equipment to lift the whole tree, including its roots, out of the ground. (For this reason, the harvesters are called "lifters" in Australia.) There are two reasons for pulling the entire tree—the roots have the highest level of essential oil, and the FPC wants to ensure that as much of the tree as possible is utilized. Today 82% of the total tree is used (all but bark and leaves), whereas in the past that percentage was only 30 to 40%.

After harvest, the tree is cut up and sorted by grade. The average breakdown of quantity yielded by tree part (listed from highest to lowest quality of oil) is: roots 14%, butts 11%, uncleaned green logs (main trunk) 35%, small green logs (branches) 30% and mini green logs (fine branches) 10%.

Replanting:
Australian sandalwood contractors are required to plant sandalwood seeds for each sandalwood tree they harvest. The contractor usually hires a separate crew to follow behind the lifters to plant the seeds. A suitable nitrogen-fixing host tree is found, and six sandalwood seeds are planted, three on each side of the host in a small trench. For each tree harvested, two of host trees are planted with the set of six sandalwood seeds.

This manual reseeding is necessary because natural seeding is almost non-existent. The last century saw a steady decrease in natural regeneration of sandalwood. Scientists have only recently realized that the nearly extinct woylie, or bush-tailed bettong,(a small marsupial that eats a variety of seeds and fruits, including sandalwood), is important in the natural regeneration of sandalwood. The woylie carries seeds and buries them for future meals—with forgotten seeds growing into trees. With no woylie to fill this role in dispersal and planting of sandalwood seeds, few new trees are started. Over 35% of Australian marsupials such as the woylie and 32% of rodents are extinct or nearly extinct due to predation by feral cats and fox. The woylie, perhaps along with other threatened small marsupial and rodents, are the missing links in the natural regeneration of sandalwood trees.

Seeds germinate with the winter rainfall—but can lie dormant in the soil for five to eight years waiting for rain. The FPC monitors the plantings and has determined that germinations rates as high as 47% are being achieved with a three-year survival rate of 27%. One new problem that the FPC is facing is the changing rainfall patterns associated with global warming. Summer rains cause the seeds to rot rather than germinate, and summer rain is occurring more frequently now in

Western Australia. Other challenges are feral goats that damage or kill sandalwood seedlings by feeding on them. A program is underway to trap and export the goats. Sheep can also damage the trees, so areas where sheep are pastured are not in the approved sandalwood harvesting and replanting regions.

Post-Harvest: The FPC has contracted all sandalwood processing and distribution through a single company since 1997. About half of the green sandalwood the company receives goes to distillers to make essential oil—the rest is powdered. The company also buys back the spent sandalwood material left after oil distillation and incorporates it into various products. The company processes sandalwood oil to customer specifications and ships to foreign and domestic buyers. Around 65% of the oil is exported, with the majority going to Asian markets. The rest goes into the domestic market. In Australia, sandalwood oil is used in body care and therapeutic products or is sold as oil. The wood is used for incense, insect repellant incense sticks, for decorative carving, in crafts. It's also incorporated into some smaller furniture pieces as accent wood.

Poaching: Sandalwood poaching is not a problem in Australia. The sandalwood industry is small, with a limited number of players who all know each other. It is very hard to sell any appreciable amount of poached sandalwood without someone hearing about it—and exporting it is almost impossible.

Government Plantations & Research: The Australian government has around 4,500 hectares of sandalwood in plantations with 3,000 planted just this year, primarily in the moist wheat belt region of Western Australia. The seeds are planted near a host tree – often *Acacia acuminata.* The oldest trees are 12 to 14 years old, with estimates of the earliest availability for harvest at 20 years after planting. Sandalwood grown in plantations grows much faster than the sandalwood in the arid Australian interior where trees can take up to 80 years to reach maturity. However, oil quality and quantity is higher in wild-grown sandalwood.

A study released in the year 2000 estimated sandalwood available in Australia at 200,000 tons plus another 15,000 tons of deadwood. At current harvest rates of 2,000 tons with no replanting, there is currently a 100-year supply of Australian sandalwood. Research into regeneration of sandalwood began as early as 1895—with modern research producing new data starting in the 1980s. Research covers seeding methods, identifying the best host species, seed selection, pest and disease control and fertility. Another research avenue is growing Indian sandalwood (*Santalum album)* in Australia. Research shows this species may mature in 30 years (versus 80 for *Santalum spicatum*) in the wild. Also, it commands a higher price in the market due to the greater quantity of essential oil and the higher santanol content of the oil.

Private Plantations & Management: The FPC estimates around 2,500 hectares of sandalwood in private plantations, with the oldest plantings in the late 1990s. There appears to be some tension among private growers over the government plantations and concerns over future competition as well as full access to government research. Given the relative size of private growers versus Australian government production and impact, there doesn't appear to be a major issue at this time. However, we will monitor this issue again in the event of significant growth in private plantations.

The FPC has enlisted the help of the private sector to protect sandalwood resources. Several projects have been funded to encourage farmers and land managers to facilitate sandalwood regeneration. These programs include encouraging planting and management of sandalwood, control of grazing (cows and sheep) and feral animal control (rabbits, goats).

Notes of Interest: While in Australia, we had the opportunity to taste the sandalwood "nut." Sandalwood starts producing nuts at three to five years of age. As the number of sandalwood trees in plantation production grows, more seed will be produced than is needed for replanting. This creates the opportunity for farmers to develop a market for the seeds and a source of income during the many years it takes to grow the trees. The fruit is mature in August to November and consists of a leathery exterior with a hard, smooth nut inside. Cracking the nut reveals an edible, tasty kernel, similar to an almond or pistachio. We were told the nuts are high in protein and non-saturated fat.

Conclusion: A strong, successful government program, combined with a research program, private and public planting of sandalwood plantations and a proven history of success, demonstrate that Australian sandalwood is sustainable in the short term and that the commitment and programs are in place to create long-term sustainability.

Recommendations:

• that Aura Cacia continue to use only Australian sandalwood (*Santalum spicatum),* promote the sustainable production of Australian sandalwood oil

• that we encourage retailers to switch from Indian sandalwood (*Santalum album)* to Australian sandalwood, at least until India or Indonesia is able to develop and implement a verifiable and successful sustainable production program

• that we audit sandalwood production and programs in Australia every three to five years to ensure that long-term sustainability continues on track.

• that we review sandalwood planting and production on Australian private plantations every five years to assess quantity and future product availability.