

## Western Australian sandalwood and Winnipeg's mosquito wars: a secret weapon?

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**Abstract:** During the summer of 2001 Winnipeg was hit by one of the worst invasions of mosquitoes in recent years, capturing news headlines on several occasions. Proposals for fighting back the mosquito onslaught varied widely. One possible deterrent is the use of sandalwood mosquito sticks, a new product now being manufactured in Western Australia in response to global trends in product specialization, agricultural diversification, niche marketing and other influences. Western Australia is now the world's largest exporter of sandalwood, with the industry actively pursuing research into production and management of the resource and undertaking inventive ways of developing new products and markets. The mosquito stick is just one of these initiatives: oils, balms, unguents and other health spa related items are also promising therapeutic benefits. This paper examines Western Australia's sandalwood industry in the light of these trends.

*Key words: sandalwood, mosquito repellent, agricultural diversification, tree products, health products, regional tourism*

### Introduction

During the summer of 2001 Winnipeg experienced one of its worst mosquito outbreaks for many years. Indeed, so bad was this invasion that local newspapers carried numerous articles on the extent of the problem and what should be done about it. These 'solutions' ranged from pretending that the pests did not exist for fear of discouraging tourists, to alarmist calls for wholesale chemical warfare to prevent the threatened spread of the dreaded West Nile disease, now being carried northwards by birds and mosquito vectors from the southern United States. While there appear to be a range of chemical solutions to the problem, it is probably fair to say that most residents would prefer a more 'clean and green' approach to the problem. According to a number of entrepreneurs in Western Australia,

there is a natural product available that may help to deal with Winnipeg's mosquito invasion – sandalwood – which in a powdered form is used to manufacture mosquito sticks (Figure 1). Sandalwood grows naturally in Western Australia, and while the state has a long history of exporting the unprocessed timber to Southeast Asia, it is now being used to manufacture a range of pharmaceutical and medical products, flavoured boutique wines and, of particular relevance to Winnipeg, mosquito repellents.

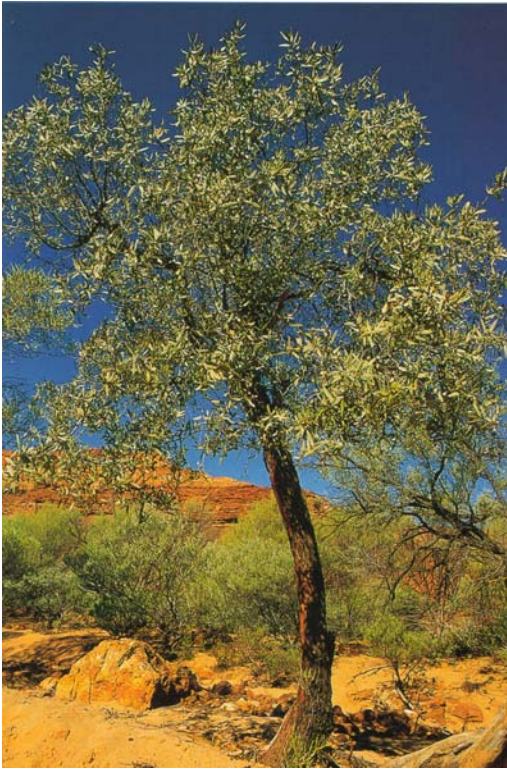
While the capacity of sandalwood to solve Winnipeg's mosquito plague is highly contestable, the resurgence of interest in the species provides a valuable case study through which to consider a number of themes that are of interest to geographers. Indeed, sandalwood provides opportunities to examine far reaching adjustments being made in the world economy as a result of globalization, post-Fordism, the emergence of a 'post-productivist countryside', and a host of new attitudes, values and approaches being pursued in the industrialized world, such as ecological sustainability, the search for alternative medicines and natural products, and a growing demand for 'exotica' on the part of consumers. Rather than dwelling on the prospects of the sandalwood mosquito stick becoming the final solution to Winnipeg's mosquito plagues, this paper will examine Western Australia's sandalwood industry in the light of these much wider trends.

## About Sandalwood

Humans for millennia have exploited aromatic sandalwood (*Santalum spp.*), which is a small, slow growing hemi-parasitic tree requiring a host plant for its survival (Figure 2). There are sixteen different species of the genus of which only two: *Santalum album* and *Santalum spicatum* are of major commercial importance. These species are highly valued in Southeast Asia for their aromatic wood, which is burnt as incense in Buddhist and Hindu religious ceremonies. The wood is also carved into jewellery boxes, fans and fan handles, letter openers, card cases, pen holders and a host of other items. In addition to these uses, sandalwood is prized for its santalol oil, which is distilled from the heartwood of the plant and has traditionally been used as a fixative in soaps and perfumes. Its medicinal properties are valued as well. The oil is used in embrocations and, before the discovery of penicillin, it was a treatment for venereal disease. The northern Australian Aborigines have also long valued the wood and its aroma as elements in their 'sex magic' (Statham 1988).

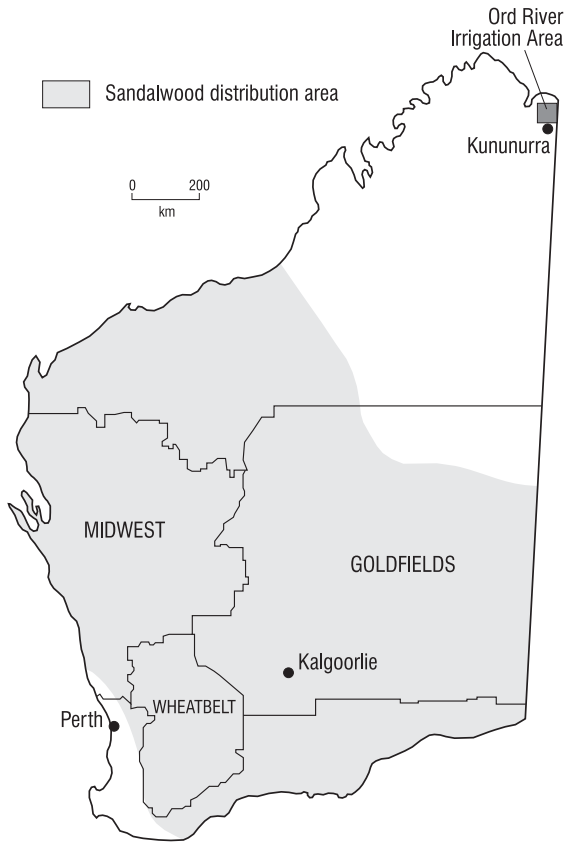


**Figure 1:** The mosquito stick – Australia’s secret weapon .(Photo courtesy Westcorp Inc.)



**Figure 2:** A mature example of *Santalum spicatum*.  
(Photo courtesy CALM)

*Santalum album* is widely distributed through tropical Southeast Asia and, in a commercial sense, is far superior to *S. spicatum*. It is faster growing and produces a higher yielding oil product. *S. spicatum* is a native of Australia and is distributed over 42 million hectares of which the majority is in the state of Western Australia (Shea *et al.* 1998) (Figure 3). Although it is slower growing and less productive than *S. album*, it is now estimated to be the largest reserve of sandalwood in the world, with an approximate resource of 200,000 tonnes (CALM 2001). While the species occurs in a range of climatic zones, the optimum conditions for growth are within the 300-600mm rainfall isohyets (Brand 2000). Extensive clearing of this region for agriculture from the 1820s reduced the sandalwood's range considerably, and it is now concentrated in the lower rainfall parts of the state. It grows on a variety of soil types, preferably loamy soils, but the tree will produce in relatively infertile environments. More important is the



**Figure 3:** The distribution of *Santalum spicatum*. (Source: Shea et al. 1998, 11)

presence of host plants (particularly *Acacia spp.*, *Allocasurina spp.* and *Ermophila spp.*), which supply the parasitic sandalwood with its essential nutrients (Brand et al. 2000). However, even in optimum conditions *S. spicatum* matures very slowly, taking several decades to reach harvestable size. Sandalwood's value lies in the woody parts of the plant's superstructure and roots, especially the heartwood, which contains the sandalwood oil. Both green and deadwood are harvested. Older trees tend to have a much higher oil content than younger plants (Loneragan 1990).

## **Background to the Western Australian Sandalwood Industry**

Commercial exploitation of Western Australian sandalwood dates back almost to the first days of European settlement in 1829. For a short while it was almost the infant state's most valuable export product, second only to wool (Statham 1988). The wood was exported to China, Singapore, and other Asian ports, and sold to Chinese merchants for manufacture into incense. Even in the mid-1800s, demand for the product in the Orient exceeded that region's local supplies, providing a growing market for Australian sandalwood. This caused a boom in Western Australia where there were bountiful supplies of the wood within relatively easy access to the coast. Despite a volatile market, the demand for sandalwood continued well into the twentieth century, resulting in a severe reduction in supplies of wood available from the more productive portions of the southwest area of the state. Stocks were further reduced by agricultural land clearing, demand for firewood and fence posts, and grazing by introduced animals, such as goats, sheep and rabbits. As a result, the state government introduced measures to conserve stocks as early as the 1880s. However, these efforts were largely unsuccessful because of an inability to police the regulations.

The discovery of gold near Kalgoorlie in the early 1890s, and the subsequent opening of the Eastern Railway in 1896, led to another boom as new supplies became accessible. However, the bubble eventually burst when widespread recession in farming and the mining industry encouraged many to turn their hand to sandalwood gathering. This generated a huge over-supply of sandalwood, especially in 1920 when in excess of 14,000 tons were cut, the largest annual harvest ever produced (Statham 1988). Over-harvesting continued over the next few years, creating massive stockpiles of sandalwood that littered railway sidings and the wharves at Fremantle, the state's major port (Figure 4). Consequently, in 1923, more stringent regulations were implemented that effectively put control of the sandalwood industry almost entirely into the state government's hands. Total output was limited to 9,000 tons annually, sandalwood pullers had to obtain a license, strict quotas were introduced, and prices fixed (Kealley 1989). In 1929 the state government passed the Sandalwood Control Act, which closed a number of loopholes in the earlier legislation and, in the following year, established the Australian Sandalwood Company, an amalgam of four pre-existing companies, to be the sole agent for Western Australian sandalwood. Most of this was exported as unprocessed logs merely stripped of their bark, with only about 20 per cent of output being



**Figure 4:** Sandalwood stockpiles at Fremantle harbour c1920. (Photo courtesy CALM)

absorbed by local oil distilleries. However, the last of these ceased operations in 1971, since far higher prices could be obtained for the raw logs overseas than the distillers could afford to pay for the low yielding *S. spicatum*. For example, in 1968 raw logs for the export market were worth A\$731 per ton, while local distillers were paying A\$76 per ton (Statham 1988).

Despite Western Australia being the world's largest exporter of sandalwood, production has been limited to collection of the plant growing naturally in the wild. Virtually no trees were planted to replace those that were ripped out. Any replenishment of the resource was therefore limited to natural regeneration – and that, in turn, was minimized by disease and, more importantly, by overgrazing by mostly feral animals, especially goats (Brand 1999). Although overseas demand was reasonably steady, the industry was small and not a particularly important contributor to the Western Australian economy. Its participants were limited in numbers, generally part-timers who frequently lived on the periphery of the mainstream economy and on the geographic margins of settlement. Sandalwood collection provided a useful supplement to farm income and helped support a few fossickers or prospectors in their search for minerals. For the most part, the collectors' lifestyle was seen to be colourful and romantic in the eyes of the larger population, but of little consequence. These conditions still prevail, although there are now interesting new developments in the industry.

## Current Production in Western Australia

As in many other parts of the world, Western Australia has undergone quite massive economic restructuring over the past few years, particularly in rural regions (Haslam-McKenzie 2000; Tonts 2000; Curry *et al.* 2001). Farmers have become increasingly exposed to international competition as commodity markets have been freed from domestic support prices, import restrictions and various statutory marketing arrangements. For some commentators these trends can be conceptualized as a shift from a Fordist to a post-Fordist agriculture (Lawrence 1996). This perspective holds that there has been a general shift away from Fordist mass production and consumption in favour of specialized 'flexible' production methods and niche markets. According to Harvey (1989), Fordist standardization and modernism have given way to consumption patterns that celebrate difference, ephemerality, fashion and the commodification of culture (see also Lash and Urry 1994). For Australian farmers engaged in the mass production of commodities such as wheat and wool, this has necessitated a shift towards more diverse and flexible production that meets the needs of these new consumption patterns. Initiatives include farm diversification, the identification and exploitation of niche markets and the search for new 'value added' products that bring in higher returns than the more traditional sales of raw materials. Indeed, many Australian farmers have been only too willing to diversify their operations and move away from the narrow 'factory farming' model, and are now engaged in growing organic foods, hemp, seafood, essential oils, timber, goats, emus and kangaroos (Hyde 1998). There is also a growing interest in planting sandalwood as a form of farm diversification.

Despite the potential for the production of sandalwood on farms as part of an integrated form of agroforestry, much of Western Australia's sandalwood is harvested from natural reserves. There are, however, concerns about the sustainability of this resource. Although some conservation and research measures were initiated in the 1920s and 1930s, it was not until the 1980s that the Department of Conservation and Land Management (CALM) began a thorough assessment of the sandalwood resource (Loneragan 1990). Serious efforts were made to establish how much remained and where it was located. More detailed management plans were put into place and experimental plantations established. The agency has also established share-farming arrangements with farmers. This involves CALM providing financial assistance and expertise to farmers interested in establishing sandalwood plantations. In effect, this is a land rental agreement, with CALM taking the majority of the risk and the farmer



receiving a return on investment upon harvest. CALM has estimated that most farmers can expect to receive around 30 per cent of net revenue. For example, one farmer in the southwest of the state has planted 20 hectares of his 4,000-hectare property with 16,000 sandalwood seedlings. Since CALM have provided the seed, expertise and will market the product, the farmer's estimated return will be around A\$100,000, or A\$5,000 per hectare (Henschke 2000).

In addition to providing a valuable economic return, planting sandalwood and the associated host species has the capacity to provide farmers with important environmental benefits. In many parts of Western Australia agricultural regions are suffering severe land degradation in the form of soil salinization, erosion, soil structure decline and diminishing levels of biodiversity (Conacher and Conacher 2000). One of the strategies of farmers in response to these problems has been to engage in various forms of revegetation. A benefit of planting sandalwood is that it not only helps to arrest environmental degradation, but also provides the prospect of a financial return from otherwise unproductive land. In addition to planting degraded agricultural land to sandalwood, farmers can also utilize remnant bushland to grow the tree. Since sandalwood is a native of the region, it is well adapted to the climatic and soil types, as well as the range of potential host species indigenous to the southern parts of Western Australia. In a number of agricultural regions, remnant bushland is a non-commercial resource. That is, it does not generate income, despite providing some environmental services, such as soil salinity and erosion control. Planting sandalwood in stands of remnant vegetation provides an opportunity to derive a financial return from what might otherwise have been a resource that did not generate income. As such, it has the potential to increase farmers' financial security by providing a source of future income as well as adding to both economic and biological diversity.

Another important initiative has been the establishment of faster growing Indian Sandalwood (*S. album*) plantations in the Ord River Irrigation Area (ORIA), in the far north of Western Australia. The ORIA was established in the late 1960s and early 1970s following the construction of two dams on the Ord River. Initially, the ORIA was planned as an extensive agricultural region for the production of crops such as cotton and sugar. However, problems with insecticide resistant pests undermined the establishment of these crops, and for a number of years the project was viewed as a failure. More recently, however, experiments with alternative crops, particularly in horticulture, have helped to revitalize the region. Similarly, growing certain species of trees under irrigation is seen

as an important future industry. Experiments by CALM suggest that the growing conditions in the ORIA are particularly well suited to *S. album*. In addition, there appears to be some potential to grow *S. album* with other commercially valuable species as hosts, such as East African ebony (*Dalbergia melanoxylon*). The production of these trees has the added benefit of ameliorating the imminent problem of a rising groundwater table and the associated process of soil salinization. This will help to ensure the longer-term sustainability of the region's horticultural and other agricultural industries. Thus, sandalwood not only has the potential to diversify the economy of the Ord River region, but to also provide important environmental benefits (Radomiljac and Clews 1996).

## The Changing Use of Sandalwood

Until the mid-1990s, the Australian Sandalwood Company held a contract with the state government to export all sandalwood harvested in Western Australia. While the company provided a degree of stability in the industry, it was widely criticized for simply exporting raw sandalwood rather than adding any value to the product. In 1995, however, the state government abolished the monopoly held by the company and, through a competitive tendering process, awarded the contract to export the sandalwood quota derived from natural supplies to a new player, Westcorp Sandalwood Inc.. This new entrant has brought considerable changes to the industry. Unlike the Australian Sandalwood Company, Westcorp has attempted to diversify sandalwood exports through a series of value-adding ventures. While the main export is still raw logs, the firm is marketing increasing quantities of sandalwood as chips and powder for the manufacture of joss sticks. In 1999, Westcorp established a sister firm, The New Mountain Company, which produces 15,000 joss sticks a day. In 2001 the sticks are expected to generate A\$2.5 million in revenue and A\$10 million in 2002. This is a significant contribution to the export economy, with potential for massive expansion throughout Southeast Asia. The company also markets the sticks in Australia as New Mountain Mosquito Sticks, and has plans to export the product to North America and Europe. This product, like other fumigants that rapidly disperse in the air, has questionable value as a deterrent. However, it is nevertheless finding a market among those searching for something more 'natural' because it is presumed to be healthier than the synthetic, chemical-based mosquito repellents. So successful has the New Mountain venture been that the

workforce will increase from 11 to 25 during 2002 with numbers expected to reach 50 in 2003 (Trott 2001).

Westcorp are also investigating other marketing opportunities for sandalwood based products. For example, the seeds or nuts from *S. spicatum* presently command premium prices of around A\$75 per kilogram from those looking to establish plantations. Although stockmen once used the nuts to control diarrhoea (Statham 1990, 27), they are now being promoted as a specialty food, similar to 'pine nuts'. With 'bush foods' becoming an increasingly profitable niche market in Australia and, to a lesser extent, overseas, sandalwood seeds have the potential to generate income from a part of the tree that had previously been a waste product. In some respects, the expansion of this market in bush foods reflects changing consumer tastes in favour of specialized and often exotic commodities (Fox 1997).

Another recent development, which also reflects these trends, was the establishment of Mt Romance Australia in 1999. Mt Romance is a new sandalwood oil distillery and factory located near Albany, a small port and service town in the southwest of Western Australia. The company has a contract with CALM to take up to 1,000 tonnes of sandalwood a year, estimated to be worth at least A\$40 million over the contract's ten year term (CALM 1999). One tonne of sandalwood produces around 50 litres of sandalwood oil, worth around A\$500 per litre on the world market (Henschke 2000). In addition to extracting the oil for export, Mt Romance is producing a wide range of "...bodycare and therapeutic products; specially created to lift your spirits, heighten your senses, pamper your body and appeal to all that is masculine and feminine within us" (Mt Romance 2001). While sandalwood products have not been approved for ingestion, the oil's supposed curative powers when employed externally are being enthusiastically propagandized. Table 1 provides some examples of Mt Romance sandalwood based products and their claimed benefits.

Quite obviously, the company is seeking to capitalize on the huge and lucrative cosmetics industry market. However, there is also an active and high profile program of research into new uses for the product, especially by the pharmaceutical industry. There is, for example, widespread research into the capacity of sandalwood oil (and its components) to treat skin and other cancers, *Herpes simplex*, *Candida spp*, and the highly antibiotic resistant Golden Staph (*Staphylococcus aureus*) (e.g., Dwivedi and Zhang 1999; Benencia and Courrèges 1999; Hammer *et al.* 1998). The oil is also being tested for its antiseptic properties and as a base for hospital cleaning products.

*Table 1: Examples of Mt Romance sandalwood products.*

<b>Product</b>	<b>Claim</b>
Body Splash	"...refresh[es] your soul and touch[es] your heart ...This superbly fragranced, versatile splash has unisex appeal..."
Slick Shave	"...creates a rich, lasting lather to promote smooth, irritation-free shaving."
Bath Oil	"...oil bathing, an ancient, sensual practice reputed to focus the spirit and provide healthy vitality."
Massage Oil	"...a sensual balm with a rich aromatic base to relax muscles, delight the senses and promote a feeling of well being."
Deodorant	"...Sandalwood oil, Farnesol and Irganolol will inhibit the growth of odour-causing bacteria while preserving natural body flora."

In addition to its production of sandalwood oil and a range of exotic products for niche markets, the Mt Romance factory is being promoted as a tourist attraction in the southwest of the state, already a major tourist destination for domestic and, to a lesser extent, international tourists. While the district's major attractions include the beaches, forests, historic towns, vineyards and a range of craft industries, the sandalwood factory adds to these resources, and its products are seen as an important form of 'regional marketing'. The factory is quite lavishly appointed, with a garden restaurant and a spacious retailing outlet featuring its output. These include those products described above, as well as some more unusual items, such as a sandalwood flavoured 'boutique' wine selection. These initiatives are strongly endorsed by the state government, whose Environment Minister, Cheryl Edwardes sees the operation as bringing "long-term benefits not only for the State's sandalwood industry, but also for regional economies such as Albany" (CALM 1999). Certainly the factory has added to the diversity of the Albany economy. In an era when many regional cities and towns are facing considerable hardship in the face of economic restructuring, such niche industries have the capacity to make a small, though valuable, contribution to local and regional economies.

## **Conclusion**

The sandalwood industry is just one example of the kinds of recent changes and adjustments observed in rural Western Australia. In many respects, the industry represents a shift towards the post-industrial ideals of economic diversity, flexible production, niche marketing and changing consumer habits in favour of natural products and, to some degree, exotica. This is evident not only in the diversification strategies of those farmers investing in sandalwood plantations, but also in the products and marketing of companies such as Westcorp and Mt Romance. However, the current promotion of sandalwood needs to be set against its much longer history as an important contributor to Western Australia's export income, particularly during the nineteenth century. Indeed, sandalwood was a key element in the integration of the state's economy with the global economy. Sandalwood also has a long history as an income supplement when mining and agricultural production has fallen on hard times. Adaptability is not so recent an innovation as is sometimes claimed. Nevertheless, the expansion of plantations, rather than the use of native resources, together with the diversity of sandalwood products are clearly new trends. While the industry may not be able to single-handedly solve Winnipeg's mosquito problem, it is contributing to the rehabilitation of Western Australia's degraded rural landscapes. Furthermore, it provides a useful model showing how a natural resource can be exploited to provide farmers and regions with a source of economic diversity and stability.

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