BIG *Island,* SMALL *Planet*

CHALLENGES AND FAILURES IN CONSERVING HAWAIIAN SANDALWOOD TREES

By Susan Leopold, PhD

Sandalwood *Santalum* spp. Photo ©2015 Steven Foster

"Many problems in managing and protecting endangered species arise not from our ignorance of the species' ecology, but from Human conflicts of interest."

—Bobbi S. Low[1]

When Captain James Cook landed on the Hawaiian Islands in January 1778, they were covered in forests known for sandalwood (*Santalum* spp., Santalaceae) trees. Sandalwood, called '*iliahi* in Hawaiian, is a sacred species found in areas ranging from the islands' coastal lines to its high mountains. Hawaii is home to six endemic species, representing the highest sandalwood diversity of any region in the world.[2] Globally, there are 18 species of *Santalum*.

The Hawaiian sandalwood tree was a source of food with its edible nuts, and the oil and wood were used for waterproofing and scenting clothing, treating skin ailments, and making musical instruments and tools. The primary use of sandalwood transitioned from cultural to economic in the late 1700s, when trade between Hawaii and China ignited and the botanical material became a prized commodity; so important was the plant to the Chinese that they called Hawaii *Tahn Heung Sahn* or "Sandalwood Mountains." Now, just a few lonely fragment populations remain, and even these are threatened, as Hawaii is the only place in the world where there is no legislation specific to sandalwood conservation or governing its trade.[2]

The tragic disappearance of Hawaiian sandalwood is particularly relevant to the discussion of conservation of at-risk medicinal and aromatic plants worldwide, where there is often scant regulation, little consumer awareness, complex environmental, social, and economic pressures, and high demand with finite supply. This is especially challenging when the at-risk medicinal plant is a wild-harvested tree, as is the case with the mountain sandalwood (*S. paniculatum*) endemic to the Big Island of Hawaii. This is the only species out of the six that is being commercially harvested at this time. Compounding its vulnerability is the fact that it is a hemiparasitic species, requiring a host plant for its survival. Other threats in Hawaii include grazing animals, pests, and diseases. The story of sandalwood in Hawaii becomes a lens from which to view what is happening to many species on a global scale.

Understanding the history, ecological threats, and limited legal and regulatory protections for Hawaiian sandalwood is essential to crafting a working, sustainable solution to this problem. Individuals and organizations such as United Plant Savers (UpS) have already begun to address the disappearance of sandalwood. UpS has mapped the recorded populations and used its "At-Risk Assessment Tool" to evaluate mountain sandalwood in the hope that what has occurred can inspire change in how decisions are made in regard to sourcing wild medicinals.

A History of Sandalwood Exploitation

The pressures on native Hawaiian sandalwoods have changed over time, but can generally be understood in terms of three distinct historical periods, each with their own dominant form of exploitation: (1) colonial trade, (2) cattle ranching and the introduction of invasive species, and (3) logging and the modern trade in essential oils.

1. Colonial Trade

The sandalwood export trade began with the legendary figure Kamehameha, who became King of Hawaii in 1791, not long after his encounter with Captain James Cook in 1779. By 1810, King Kamehameha had conquered and unified the islands of Hawaii. During his reign, he welcomed fur traders and whalers who discovered the Hawaiian Islands' sandalwood and knew of the demand for it in China. At the time, the availability of sandalwood trees for the Canton markets had declined because, in 1792, the Sultan of Mysore declared Indian sandalwood (*S. album*) a royal tree, limiting its sale to control the market and to address its overharvesting.[3]

The export trade in Hawaii from 1790 to 1840 changed the economy of the islands and brought about a terrible period of famine known as the Sandalwood Era. Many firsthand accounts from visitors to the islands described native peoples neglecting their fishing and crops to extract sandalwood from the mountainous regions in order to pay the tax the King demanded. The Sandalwood Era was very much driven by the Hawaiian monarchy's obsession with obtaining ships, guns, and traded goods.[4]

2. Cattle Ranching

William Hillebrand was a compassionate humanitarian, physician, and visionary botanist, who established a botanical collection on O'ahu and wrote the first *Flora of the Hawaiian Islands*, published just after his death in 1888. He addressed the monarchy in 1846 with a speech that is still relevant today, titled "The Relation of Forestry to Agriculture." In this speech he said, "Of all the destroying influences man brings to bear upon nature, cattle is the worst."[5] Hillebrand explained the value of native forests for enhancing rainfall and thus supplying water for drinking, irrigation, and the islands' native fish, wildlife, and plants. It is difficult to determine if the monarchy heard his plea to protect the native forests. With the support of the United States government, businessmen interested in land primarily for the sugar industry overthrew Queen Liliuokalani in 1893, just five years before Hawaii's annexation as a US territory.

In 1926, C.A. Judd — who was appointed super-

intendent for the Territorial Division of Forestry in 1915 — published his paper on the conservation of Hawaiian forests, reiterating that "damage to the forest consequent to the trade … was insignificant in comparison with the damage to the native forest wrought by cattle."[6] Cattle had been allowed to roam the islands and multiply since the time of King Kamehameha. Parker Ranch on the Big Island was at one time the largest cattle ranch of any US state. Both Hillebrand and Judd echoed the need to protect the forest, yet even after the sandalwood trade collapsed, the cattle industry and other agricultural pursuits continued despite warnings and an understanding of the islands' unique, fragile ecology. Had the forest been better protected — despite conservation attempts in 1903 via the establishment of the Forest Reserve System (FRS) — the Big Island would be in a position to manage healthy forests filled with sandalwood and other tropical hardwoods such as the magnificent koa (*Acacia koa*, Fabaceae), a native, nitrogen-fixing tree with which sandalwood grows as a hemiparasitic species.

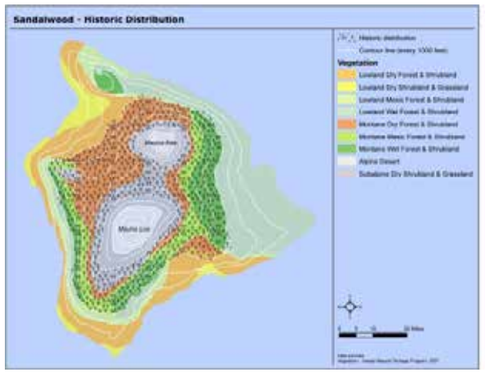
3. Sandalwood Logging

Now 123 years since the United States overtook an independent nation, Hawaii's sugarcane (*Saccharum* spp., Poaceae) plantations have been mostly abandoned, and ungulates (e.g., pigs, goats, and sheep) and non-native birds have been introduced — in most cases, for sport hunting. The military has become a significant landowner, and the cattle industry still dominates the inland landscape of the Big Island. The remaining sandalwood forests, the endemic birds, insects, plants, and unique island ecology all have suffered in ways that are immeasurable. The situation is now poised to get worse. Today, the market for sandalwood essential oil has spurred renewed logging of sandalwood.

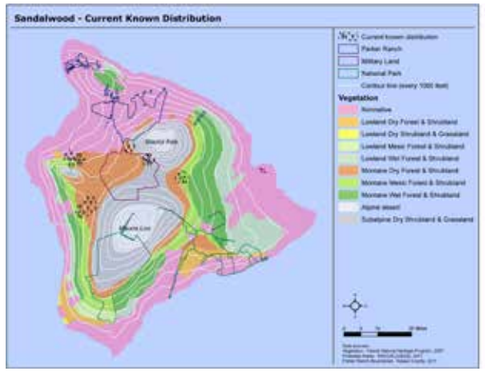
In 2010, the nonprofit publication *Environment Hawai'i*, under the leadership of editor Pat Tummons, first wrote about the logging of sandalwood that had been exposed due to a controversial bankruptcy case just southeast of the Big Island town of Kona. This area was designated on a historical map as the "sandalwood forest" noted to exist in 1906 by surveyors who mapped the *ahupua'a* land divisions of the Big Island. (*Ahupua'a* is a Hawaiian term for the traditional land divisions, usually wedge-shaped sections representing a single watershed, which run from the mountains to the sea.) Despite the agriculture, cattle, logging, and infestation of invasive rats, ungulates, and plants, this forest still persisted. It is important to know the land-use history in order to fully appreciate how fortunate humanity is that sandalwood has survived over the last 300 years of abuse to the landscape. The *Environment Hawai'i* article revealed that 3,000 acres of sandalwood forest had been sold and were actively being logged. Because Jawmin, the company that purchased the property, went into bankruptcy, the sale records of the sandalwood forest became public knowledge. According to the loggers, they had received orders for nearly $15 million in sandalwood from companies in Sri Lanka, Dubai, and China in 2010 upon purchase of the property, compared to merely $25,000 in orders for koa.[7]

An Attempt to Save Sandalwood – UpS At-Risk Listing

Given sandalwood's history and current threats, the UpS's Board of Directors — after working through the "At-Risk Assessment Tool" and evaluating the high score — voted unanimously in November 2011 to add all six native and endemic species (*S. freycinetianum* var. *lanaiense* [listed as federally endangered], *S. haleakalae*, *S. paniculatum*, *S. ellipticum*, *S. involutum*, and *S. pyrularium*) to the UpS's "At-Risk" List.[8,9] The intention in doing so was to create or enhance awareness in the plant community and to encourage landowners and state agencies to engage in stewardship of these living Hawaiian heirlooms.[7] The islands of Hawaii are rich in sandalwood diversity,



This distribution maps is based on the fact that *S. paniculatum* grows in dry woodlands to wet forests at elevations between 450 and 2,500 meters (Wagner et al. 1990).



This distribution map is based on GPS points of populations documented in 2012.

yet these species are very sparse in population density. *Santalum paniculatum*, endemic to the Big Island, is the only species of the six that had a population that was harvestable on any significant scale at the time of the decision.

The logging of sandalwood in recent times is not some burgeoning trend. In fact, the impetus for holding the Sandalwood Symposium at the East-West Center in Honolulu in 1990 was concern over harvesting of sandalwood that had taken place in the same region — though at the time it was owned by the Pace Family and known to most as Hokukano Ranch.[3] The logging taking place on the same property, but under different landowners, prompted the International Sandalwood Symposium (ISS) to be held in 2012,[10] which was co-hosted by UpS and the International Sandalwood Foundation.

At the close of the three-day international gathering, UpS presented the At-Risk Assessment Tool and its use in making the decision to add sandalwood to UpS's At-Risk List.[11] The tool is a series of questions divided into five categories, with each answer corresponding to a numerical value that quantifies the species' level of vulnerability. The first category is the plant's life history. In the case of sandalwood (*S. paniculatum*), it is a long-lived tree than can take more than 40 years to reach maturity. The second category assesses the effect of harvest, which is severe, since harvesting entails extraction of the entire tree, including its root ball. Sadly, almost no reproduction is occurring in the wild, since rats eat the seeds, and young suckers (new sprouts) are devoured by ungulates. The third category assesses the species' abundance and range. As *S. paniculatum* is found only on the Big Island in only a few locations, the tree scores high in this section as well. The fourth considers threats to the plant's habitat, which, for sandalwood, is both scarce and threatened. The fifth category is demand, and few trees are as valuable and in-demand as sandalwood.

After UpS's presentation at the conference, state employees distributed a survey that was used to gather feedback from attendees of the conference. The survey included questions about countries' conservation efforts and the government's role in conserving Hawaiian sandalwood. The opportunity for the state of Hawaii and the federal government to act keeps surfacing, but sadly there appears to be no political will to act. Hawaii, in general, is in an extinction crisis due to terrible land-use choices, which has resulted in the loss of vital habitats for native species and is compounded by an uphill battle in addressing invasive species. Activist Leigh-Wai Doo has been attempting, at the state level, to introduce legislation that would acknowledge the cultural and ecological value of native sandalwood. In 2012, Hawaii Senate Resolution 93 (HI SR93) was passed to form a sandalwood task force to study the possible conservation and regulation of harvesting, but sadly no study or assessment has taken place due to lack of appropriated funds.[12] As recently as 2015, legislation (SB319 and HB647) was again proposed to acknowledge the cultural and ecological significance of sandalwood, but both bills failed to survive the legislative process.[13,14]


Santalum paniculatum flower. Photo ©2015 Susan Leopold

Why Sandalwood Remains At Risk

It is important to recognize how the current dismal state of sandalwood and dry tropical forests is intimately tied to land-use decisions over the last 300 years. The failure to make an effective impact at this time, despite the best efforts of UpS and other interested, environmentally supportive stakeholders, is an essential piece of a much larger puzzle. Overburdened state and federal resources are struggling to keep up with the increasing number of endangered species. Researchers have documented[15] that over 90% of the original dry forest coverage in Hawaii has been elimi-

nated, and that the actual extent of native dry forest cover may be as low as 1%. Internationally, consumer awareness about the current state of affairs of sandalwood trade is low, despite being well-documented and studied.

Lack of Regulatory Protection and Conservation Attention

Even the small South Pacific nation of Vanuatu has laws to help manage native sandalwood, so it is difficult to grasp that the United States has not taken a stand on the conservation and management of such a valuable resource in Hawaii. The irony is that if Hawaii would take action toward sandalwood management, the islands could develop a viable sandalwood industry. Instead, the indifference to act has resulted in the decline of a limited resource that is now on the brink of collapse. Furthermore, there is conflict over the eradication of non-native ungulates on state-owned lands and federal parks. Some locals want to continue to see state lands managed for hunting instead of native species protection. Significant threats to the future viability of endemic sandalwood species include not only logging, but also the uphill struggle to address the tragedy of the endangered dry tropical forests of the Big Island and rapid extinction rates that are taking place. Currently, there are 367 plant species on the brink of extinction in Hawaii, and this list is growing rapidly.[16]

There are many tropical hardwoods that the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is trying to manage in the international wood trade. At the last CITES meeting in 2013, Kenya proposed adding *Osyris lanceolata* (Santalaceae) to Appendix II. (According to CITES, "Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled."[17]) *Osyris* is an unusual addition because its demand in international commerce is as an adulterant or "false/alternate" to sandalwood oil. Looking to the future, more wild-harvested plants, especially trees used in the essential oil industry, will probably be added to CITES. UpS petitioned for Hawaiian sandalwood to be considered for CITES listing in 2013 and re-petitioned in 2015. It has yet to be announced whether the US Fish and Wildlife Service will consider bringing the issue of Hawaiian sandalwood to vote during the next international CITES meeting in 2016. Even if sandalwood is added to CITES, it would not regulate trade to the United States since CITES governs international trade. The United States is the largest consumer of Hawaiian sandalwood oil and, therefore, there is still the need for the State of Hawaii to take a more active position in sandalwood conservation and management.

Lack of Consumer Awareness

Most sandalwood oil or incense consumers are probably not aware of the many endemic species of sandalwood found throughout island nations, or that many of these populations are endangered. For example, *S. fernandezianum*, endemic to the Juan Fernández Islands off the coast of Chile, has gone extinct due to human exploitation in just the last century.[18]

Sandalwood *Santalum* spp. Photo ©2015 Steven Foster

Table 1. Commercial Harvest of Various Sandalwood Species in 2011-2012[10]

Species	Market	Estimated Harvest
S. acuminatum	Australia	250 tons, including 200 illegal
S. album	India and Southeast Asia to Timor	1,250 tons, including 1,000 illegal
S. austrocaledonicum	New Caledonia and Vanuatu	125 tons
S. lanceolatum	Australia	500 tons
S. macgregorii	Papua New Guinea	100 tons
S. paniculatum	Hawaii	600 tons
S. spicatum	Western Australia	3,300 tons, including 800 illegal
S. yasi	Tonga	250 tons; Tonga stated that they did not legally harvest any sandalwood last year, suggesting that 250 tons were poached.

UpS hopes that, through the example of Hawaiian sandalwood, consumers of essential oils will think more deeply about this issue. Certainly, it is not just wild plants that are used in essential oils, as most are from cultivated sources, but the issues for those that are wild-harvested are heightened because of finite populations. In the case of sandalwood, these are long-lived trees that are cut down and take many decades to replenish. People who care about the future of sandalwood and other wild-harvested plants should use the UpS At-Risk Assessment Tool, which, as noted, can help assess the five core aspects that determine the at-risk status of a plant: its life history, effects of harvest, abundance and range, threats to habitat, and current demand.

Elements of the Solution

There is no single piece of legislation or conservation effort that will save sandalwood; rather, the problem must be approached from numerous angles and by a variety of stakeholders. Streamlined resource-extraction techniques and the ease of ordering exotic botanical products online and elsewhere necessitate conscientious action by companies, consumers, nonprofits, and others. Fortunately, responsible parties are already taking steps to address the conservation of wild-harvested plants such as Hawaiian sandalwood.

Sandalwood trees in the wild dying. Photo ©2015 Susan Leopold

When asked why the natural products company Frontier Co-op, which owns the Aura Cacia® brand of essential oils, has chosen not to sell Hawaiian sandalwood products, aromatherapist and educator Tim Blakley explained: "When in doubt, the burden falls to the supplier to prove their harvesting model is sustainable, and in this case we saw no clear evidence that the model they were presenting would guarantee a long-term, steady supply of Hawaiian sandalwood."

As Bobbi Low, PhD, a professor in the University of Michigan's School of Natural Resources and Environment, has noted, "Many problems in managing and protecting endangered species arise not from our ignorance of the species' ecology, but from human conflicts of interest. As humans become ever more numerous, and more efficient in extracting resources, finding workable solutions becomes urgent."[1]

Australia provides an interesting case study of a working solution to such problems, which was prompted by the government's efforts to achieve a sustainable industry. Western Australia's Sandalwood Act of 1929 limited the harvest of the resource and put the majority of the sandalwood (*S. spicatum*) forest in the hands of the state, which facilitated management of the resource by allowing private, contracted companies to harvest, process, and market the trees.[19,20] Today, there is also a significant effort in the northern, wetter part of Australia to establish large plantations of *S. album*.[21] This

effort may help take the pressure off the Indian sandalwood trade — a contentious issue in India, where park authorities killed 20 sandalwood poachers in April 2015.[22]

Australia has put forth a serious effort to devise a long-term forestry management plan that includes intensive replanting for every tree harvested. Though poaching still occurs in Australia, the country has enacted a government-mandated model, making it the only place where wild populations are being managed by a defined regimen of sustainable forestry practices.

On another positive note, UpS acknowledged Mark Hanson, founder of the Hawaiian Reforestation Program Foundation, with the 2013 Medicinal Plant Conservation Award for his work in sandalwood seed collection, propagation, and restoration. Hanson, who has received UpS funding for his sandalwood nursery, is an advocate for a sustainable, sandalwood nut cottage industry as an alternative to harvesting the tree for essential oil. This idea has been launched in Australia, and the WA Sandalwood Nuts company is now actively selling the seeds of native *S. spicatum* as a specialty local food and reviving an indigenous traditional use.

Pressure also must be maintained on the public education front. To this end, UpS has a small video project on its website featuring interviews about key sandalwood conservation efforts, such as an interview with Neil Logan, co-founder of the FARM Center, highlighting his use of *S. paniculatum* as a secondary species in his successional agroforestry system. His interview shows thriving young sandalwood trees with food production in an area that was once a barren field of invasive grasses, demonstrating a successful conversion of cattle land into a food forest with the use of native trees.[23]

UpS also has a more detailed article covering the ISS that provides a more extensive global overview of sandalwood species and trade that was published in the Spring 2014 issue of the *Journal of Medicinal Plant Conservation*. The UpS website also contains information on the At-Risk Assessment Tool and an article detailing a case study of Hawaiian sandalwood.[24] Herb schools, consumers, herb companies, and educators are encouraged to engage the tool when conducting research and making important decisions.

Wild sources of sandalwood are quickly disappearing. Twenty years ago, an estimated 400 tons of sandalwood oil was being produced annually, and now, according to Tim Coakley — an expert on sandalwood trade and the executive chairman of Wescorp Group, which holds the government contract for harvesting and managing Australia's sandalwood lands — production has decreased to approximately 100 tons (See Table 1).[25] The example of Hawaiian sandalwood on the Big Island should be viewed on a global scale, particularly as it is emblematic of other wild-harvested species, especially those in the essential oil and resin trade.

Creating a sustainable future for wild medicinal and aromatic plants will require global awareness and thoughtful intention regarding workable solutions to such problems — considerations that are especially important in regard to forest botanicals. We can no longer afford not to know the full story behind the plants a continually growing world population chooses to use, and we need to be engaged in and supporting workable solutions that safeguard biodiversity. HG

Sandalwood seedlings from Mark Hanson's nursery. Photo ©2015 Susan Leopold

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References

1. Low BS. Human behavior and conservation. *Endangered Species Update*. 2004;21(1):14-22. Available at: http://sitemaker.umich.edu/snre-faculty-bobbilow/files/lowesu.pdf. Accessed July 22, 2015.
2. Subasinghe SMCUP. Sandalwood research: a global perspective. *Journal of Tropical Forestry and Environment*. 2013;3(1):1-8. Available at: http://journals.sjp.ac.lk/index.php/JTFE/article/download/1117/313.
3. Merlin M, VanRavenswaay D, eds. The history of human impact on the genus *Santalum* in Hawaii. In: Proceedings of the Symposium on Sandalwood in the Pacific. 1990:46-60. Available at: www.fs.fed.us/psw/publications/documents/psw_gtr122/psw_gtr122b.pdf. Accessed July 22, 2015.
4. Cartwright B. Extinction of trees soon followed the sandalwood rush—Hawaii's unhappy first export trade. Honolulu, HI: *Paradise of the Pacific*; 1935.
5. Hillebrand W. The relation of forestry to agriculture. In: *Transactions of the Royal Hawaiian Agriculture Society*. Honolulu, HI: Government Press; 1856.
6. Judd CA. The natural resources of the Hawaiian forest regions and their conservation. Territorial Division of Forestry. Unpublished manuscript. 1926:8. Available at: http://ags.hawaii.gov/wp-content/uploads/2013/05/DOAF1969sm.pdf. Accessed July 22, 2015.
7. Tummons P. Dispute over Hokukano sandalwood logging ends up before federal bankruptcy court. *Environment Hawai'i*. October 2010;21:4. Available at: www.environment-hawaii.org/?p=1104. Accessed October 16, 2015.
8. Castle LM, Leopold S, Craft R, Kindscher K. Ranking tool created for medicinal plants at risk of being overharvested in the wild. *Ethnobiology Letters*. 2014;5:77-78. Available at: http://goldensealsanctuary.org/images/pdf/169-741-2-PB.pdf. Accessed July 13, 2015.
9. UpS updates at-risk list. United Plant Savers website. Available at: www.unitedplantsavers.org/2015-02-11-00-43-43/41-221-ups-updates-risk-list. Accessed July 22, 2015.
10. Nageswara-Rao M, Soneji JR, Harbaugh-Reynaud D, eds. *Proceedings of the International Sandalwood Symposium 2012*. Raleigh, NC: Lulu Press, Inc.; 2013:73-74.
11. United Plant Savers at-risk assessment tool. United Plant Savers website. Available at: www.unitedplantsavers.org/10-we1come-united-plant-savers/6-122-united-plant-savers-risk-assessment-tool. Accessed July 22, 2015.
12. Hawaii State Senate. SR 93 SD1: Senate resolution requesting the establishment of a task force to examine state regulation of the harvesting of Hawaiian sandalwood. Available at: www.capitol.hawaii.gov/session2012/Bills/SR93_SD1_.pdf. Accessed July 22, 2015.
13. Hawaii State Senate. SB 319: A bill for an act relating to sandalwood. Available at: www.capitol.hawaii.gov/session2015/bills/SB319_.HTM. Accessed July 22, 2015.
14. Hawaii State House of Representatives. HB 647: A bill for an act relating to conservation of resources. Available at: www.capitol.hawaii.gov/session2015/bills/HB647_.HTM. Accessed July 22, 2015.
15. Cabin RJ, Weller SG, Lorence DH, et al. Effects of long-term ungulate exclusion and recent alien species control on the preservation and restoration of a Hawaiian tropical dry forest. *Conservation Biology*. 2000;14:439-453.
16. US Fish and Wildlife Service. Listed species believed to or known to occur in Hawaii. Environmental Conservation Online System website. Available at: http://ecos.fws.gov/tess_public/reports/species-listed-by-state-report?state=HI&status=listed. Accessed July 1, 2015.
17. The CITES appendices. Convention on International Trade in Endangered Species of Wild Fauna and Flora website. Available at: www.cites.org/eng/app/index.php. Accessed July 22, 2015.
18. Stuess TF, Marticorena C, Rodriguez R, Crawford D, and Silva M. Endemism in the vascular flora of the Juan Fernandez Islands. *Aliso*. 1992;13:297-307.
19. The Government of Western Australia. Sandalwood Act of 1929. Available at: www.slp.wa.gov.au/pco/prod/FileStore.nsf/Documents/MRDocument:5989P/$FILE/Sandalwood%20Act%201929%20-%20[04-a0-06].pdf?OpenElement. Accessed July 22, 2015.
20. Shinerberg D. They came for sandalwood. In: *A Study of the Sandalwood Trade in the South-west Pacific 1830-1865*. Melbourne, Australia: Melbourne University Press; 1967.
21. Facts & figures – plantations. TFS Corporation Ltd. website. Available at: www.tfsltd.com.au/about/facts/. Accessed July 22, 2015.
22. Indian police officers kill 20 illegal loggers over sandalwood exports. April 8, 2015. *South China Morning Post*. Available at: www.scmp.com/news/asia/article/1759743/indian-police-officers-kill-20-illegal-loggers-over-sandalwood-exports. Accessed July 13, 2015.
23. Logan N, Bowart S. *Santalum* in succession agroforestry systems on Leeward Hawaii Island. Integrated Living Systems Design website. Available at: www.rnl3.net/ILSDWeb/Articles/DiverseMesicSuccessionAgroforest_1.pdf. Published 2012. Accessed October 14, 2015.
24. Leopold S. Losing the scent of sandalwood. *Journal of Medicinal Plant Conservation*. Spring 2014:10-21. Available at: www.unitedplantsavers.org/images/pdf/2014Journal.pdf. Accessed July 22, 2015.
25. Staff: Tim Coakley. Wescorp Group website. Available at: www.wescorp.com.au/staff/staff_Tim.htm. Accessed July 22, 2015.