www.cropwatch.org

THE FIRST TRULY INDEPENDENT WATCHDOG FOR THOSE WORKING WITH NATURAL AROMATIC MATERIALS

E: info@cropwatch.org T: ++44 (0)7771 872 521

UPDATED LIST OF THREATENED AROMATIC PLANTS USED IN THE AROMA & COSMETIC INDUSTRIES.
v 1.07 Sept. 2008.

Assembled from several Cropwatch sources.

Contents:

Quote: Low (2004) "Many problems in managing and protecting endangered species arise not from our ignorance of the species' ecology, but from human conflicts of interest".

Low, Bobbi S. (2004) *Endangered Species* Jan - Mar 2004, **21**(1) p14.

PRE-AMBLE.

There can be few essential oil users globally who are unaware a number of aromatic plants & trees either have been-, or are being-, over-harvested to the point of extinction, particularly in the cases of the agarwood (oud), rosewood, *Cedrela odorata*, cedarwood Kenyan, sandalwood East Indian, costus, Candeila isolates (for α-bisabolol) etc. Yet we still get worrying statements from authors such as Greenwood (2008) who claim "economics & ethics have stopped endangered species from turning up in perfume formulas." Although there are those in industry that would very much like you to think along these lines, in reality, it is simply not the case, and we provide examples of major players using commodities from threatened species in their products in this very account.

In some instances, the production of essential oils can hardly keep up with demand, whilst in other cases specific natural ingredients have virtually been regulated out of common usage on debatable health & safety grounds. In the former situation, supply shortage sets the right opportunity for extending essential oils (adulteration), such that it is the norm, rather than the exception, to be offered adulterated oils from certain geographic sources e.g. in the cases of garlic oil, bergamot oil Furano-Coumarin Free (FCF), and lately even for lemon oil. A full (and we have to say, much plagiarised) account of the commercial adulteration of essential oils is offered by this author at http://www.cropwatch.org/adulterationupdate08.pdf. The rise of "green consumerism" and the increased demand for certain natural aromatic ingredients has also led to an increased pressure for survival from the inevitable higher levels of plant over-harvesting. Secondly, the overall ecological position has worsened due to the collective failure of the perfumery, essential oil, aromatherapy supplier & pseudo-medicinal business sectors to self-police in an ecologically responsible manner. Traders & distributors in scarce commodities invariably fake surprise & become defensive when challenged about their sales portfolios, even 'though some of their operations may be borderline-illegal, unethical, hugely ecologically damaging, and contribute to a tide of human misery in the producing country from which the commodity originates. In spite of living in an age where information is so readily accessible, ignorance of the ecological & socio-political fall-out from trading in scarce or threatened species is depressingly common at all operative levels within the natural ingredient industry.

There are some signs of attitude reform from leading cosmetic concerns, pressurised as they are by an increasingly ethically-green minded customer base, which is increasingly aware of diversity loss & forest depletion, sustainable production policies & indigenous community welfare. But the requirement to incorporate natural ingredients into product lines is exposing commercial

businesses to ingredient scarcity and price variability factors, which some are attempting to overcome by making direct forward-looking supply contract agreements with individual farmer-growers & producers. Balance is required with regards to the capability of an individual country being able supply natural ingredients without damaging its environment via excessive deforestation, over-harvesting or threatening its exiting flora & fauna. Failure to do this is exemplified in the palm oil situation in S.E. Asia (Jha 2007). the associated threat to orangutans and potentially also to tigers, sun bears, cloud leopards and other species (see *Palm oil* entry under alphabetical product listing below) A different example of the same imbalance is seen in Botswana, with the loss of available edible fruits to local peoples from *Berchemia discolor* tree because of over-collecting of the bark to make dyes for the local basketry industry (Sullivan & Regan 2003).

As over-harvesting continues to deplete natural aromatic resources in the wild, specific (& usually the more valuable) items end up stored in seed banks or are cultivated in private plantations owned by rich farmers or investment companies (e.g. for buchu, agarwood & sandalwood), or their useful properties are progressively patented (e.g. for *Coleus forskohlii,* copaiba balsam, turmeric, calamus etc. – see section on biopiracy below). We can all remember how Australia's essential oil bearing plants & trees were abandoned when cheap synthetics replaced essential oils several decades previously, or how competitive marketing chaos, unsuccessful tea tree cloning, and years later, the SCCP's wrong-footed Opinion on tea tree oil, all destabilised the Australian tea tree plantation industry, or how artificial inoculation of trees in Asian plantations produces inferior agarwood products with different compositions to natural agarwood. ***Cropwatch comments:*** We have learned therefore that 'private ownership' of useful natural resources which are depleted in the wild is not necessarily a guarantee of their future survival.

ANIMAL PRODUCTS.
Considerable confusion exists in many countries concerning the exact legal status of animal products intended for use as fragrance or incense ingredients. Cropwatch maintains however, that in these more enlightened times, no respectable aroma organisation will trade or employ animal products, period.

In a development which received media attention (Jan 2008), some leading cosmetic companies (Unilver, Clarins, Boots, Beiersdorf, LVMH, Henkel, Clarins, Sisley & La Mer (Ester Lauder) have indicated they are/have been withdrawing from using the emollient, shark-liver-oil-derived ingredient, squalene, or have never used it in the first place (Oceana 2008). This is presumably carefully timed, since the IUCN is just about to add 9 more shark species to the 126 which are already present on its Red List of Threatened Species (Jha 2008).

According to the Commission Decision 2007/275/EC of 17th April 2007 concerning lists of animals and products to be subject to (vetinary inspection)

controls at border inspection posts under Council Directives 91/496/EEC and 97/78/EC, under CN code Ex 0510 00 00, we find that ambergris, castoreum, civet and musk are listed. The section also covers 'glands and other animal products used in the preparation of pharmaceutical products, fresh, chilled, frozen or otherwise provisionally preserved.' It is not crystal clear whether the inspection applies to extracts – but later under 3001 (20 90) extracts of glands or other organs or of their secretions, & other products of animal origin only are specifically mentioned, & so may include castoreum & civet (?) – Cropwatch is currently checking this with the relevant UK regulatory authority (*Update*: July 2008: the relevant UK competent authority has failed to reply, so is presumably as confused as we are). We had been previously warned (Pitman 2005) that more rigorous EU animal by-product controls (via EC regulation 1774/2002) would be 'more complete & satisfactory for Animal By-Products (ABP) in cosmetics & medicinals'. However the EU's ABP regulations introduced in 2002 mentioned above, were aimed more towards measures to control Swine Fever and BSE, and would, presumably, only principally affect ingredients like tallow for soap-making.

The outfall of a Public Consultation on ABP led EFFA to seek COLIPA's opinion (Fragrance Experts Committee Meeting 14.08.07). COLIPA are reportedly of the opinion that civet & castoreum should not come under the ABP and should **not** be banned. Their position on ambergris was not sought. Supporting members of EFFA have been asked recently about ABP usage. Depending on the exact outcome, this may yet provide an interesting ethical dilemma for any members who are more sympathetic to animal welfare than they are to making profits from this endeavor - watch this space to see if we can identify any!

1. Ambergris.

Ambergris is the pathological exudate of the Sperm Whale *Physeter catadon* L. (syn. *P. macrocephalus* L.), but is present in only 1% of all Sperm Whales. Ambergris is commercially available from certain companies e.g. Cadima Pathé (France); La Via del Profumo (Italy); Bernard Perrin Courtage (France); Ambergris.co.nz (New Zealand), with demand estimated at 4 t/y (Cropwatch 2005). The www.profumo.it website blog section lists Guerlain and other large fragrance houses as customers (downloaded 21.07.08). Ambergris was formerly employed in perfumery as a tincture (usually at 3% in 95% ethanol). Animal product traders argue that the commerce in ambergris does not reduce whale numbers; the use of the material is therefore ethical. Cropwatch believes the opposite is true: that the Sperm Whale was traditionally hunted for whale meat, spermaceti & ambergris, and Rice (2002) of the National Maritime Mammal Laboratory, Seattle, maintains that commercial trading in ambergris results from whale slaughter, not from beach finds. Tennessen & Johnsen (1982) give a number of documented examples of ambergris sales from whale slaughter, supporting this view. The amount of ambergris entering trading circles from beach finds has been put at 4%, opposed to 96% from whale slaughter. However in some very forthright discussion on shark hunting (Watson 2005), Paul Watson

of the Sea Shepherd Conservation Society maintains: “There are no Western whalers hunting whales for ambergris which comes only from the Sperm Whale and the only nation hunting Sperm Whales is Japan.” See alphabetical listing entry on Ambergris in the A-Z section below for further information.

2. Civet.
Civet products were used in less enlightened times in perfumery for their animalic notes, finding use in orientals, heavy florals and chypres. Civet paste is obtained from squeezing or scraping the anal glands of the IUCN Red Listed (critically endangered) African civet cat *Civetticus civetta* (syn *Viverra civetta*), the Indian civet *Viverra zibetha* (India, Indonesia and Malaysia), the Lesser Indian civet (syn Chinese civet) *Viverricula indica* (E. & S. China) and other civet species. *Viverra civettina* (India), *Viverra zibetha* (India) & *Viverricula indica* (India) are all listed under Appendix III of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (CITES 2007).

The promotion of Civet coffee as a luxury beverage, available from selected establishments, has enjoyed some recent publicity (see alphabetical listing entry for Civet below). As an introduction to the topic, the Christmas edition of the *Pharmaceutical Journal* (2003) featured “The story of civet” by William Jackson is available at http://www.pharmj.com/pdf/xmas2003/pj_20031220_civet.pdf

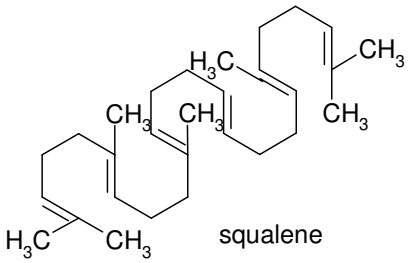
3. Musk.
Musk grains/pods are obtained from the preputial glands of the musk deer (*Moschus* spp.). *Moschus* populations of Afghanistan, Bhutan, India, Myanmar, Nepal and Pakistan are listed under Appendix I of CITES, while other populations are included in Appendix II (since 1979). Musk from *Moschus* deer spp. has been said to be one of the most important ingredients in TCM, demand estimated at 500-2000 Kg/y of which 6 Kg/y is met by captive breeding programs (Parry-Jones & Wu 2001). Zhong & Hui (1996) reported China formerly had 90% of the worlds “musk deer resources”, but that deer populations had reduced from 2.5 million in the 1960’s to 100,000 in 1996 (see also Yang *et al*. 2003). Musk deer are still under threat in China from smuggling activities & loss of habitat. In former times, musk was used in perfumery for its sensual, radiant end-note character, & prepared by mixing 3 to 10% musk powder with potassium hydroxide, dissolving and & dispersing in 96% alcohol. Synthetic musk replacements include nitro-musks & polycylclic musks; some of the more recently marketed macrocylic musks such as Velvione (Firmenich) & Delta Muscenone (also Firmenich) perhaps coming closer to the original musk character.

4. Castoreum. (- Not threatened but mentioned for completeness).
Castoreum qualities are ethylic extracts of the accumulated dried material collected via the secretory glands, in the abdominal pouch of the Siberian beaver *Castor fiber*, and the Canadian beaver *C. canadensis* living in Alaska, Canada and Siberia. Castoreum was once used in perfumery to give leathery animal notes to chypres and to other perfumes. In spite of progress in understanding

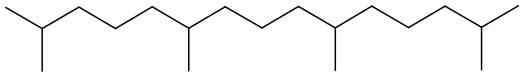
the chemical composition of castoreum, no synthetic replacement or reconstitution comes close to reproducing the in-perfume effects provided by the authentic material.

5. **Emu oil.** (- the emu is Australia's national bird, is not a threatened species as such, but is declining in numbers in the wild, mainly due to habitat destruction). Many misleading beneficial claims, some of which have come to the attention of the Advertising Standards Agency, have been claimed for this oil, which is obtained from the back fat pads and other parts of rendered (farmed) Australian emu's *Dromaius novaehollandiae.* Mount Romance's involvement with emu oil is quite well known (5,000 litres claim to have been produced by the company in 1997). Mount Romance has also funded studies on the effect of emu oil on cultured fibroblast cells and keratocytes (Snowden *et al*. 1997) as part of the investigation of the properties of emu oil with respect to cellular regeneration & wound healing; Stephen Birkbeck's (MD at Mount Romance) has a previous track-record in crocodile & turtle farming. Given this Australian native-animal exploitation scenario, and the growing public aversion to the use of animal products in cosmetics, the alliance between Aveda & Mount Romance will probably not impress many ethically-aware consumers (neither will the recent announcement of an 'ethical sustainability relationship' between Givaudan & Mount Romance for Australian Sandalwood oil). Interestingly, the farm gate value of the emu-farming industry was put at $6-8 million/y (CoAS 2003), compared with a valuation of $12m for the whole of the Australian tea tree oil industry. Opposition to emu farming in Australia by the Australian Royal Society for the Prevention of Cruelty to Animals, can be viewed at http://www.rspca.org.au/pdf/B_policystatements.pdf

6. Shark liver oil. Shark liver oil contains the hydrocarbon pristane, but more importantly, squlaene (CAS No 111-02-4) which is a triterpene hydrocarbon found in small quantities in some vegetable oils such as rice bran oil, and in much larger quantities in the livers of deep-sea sharks. The livers of these animals can represent some 25-30% of the shark's total body weight. Squalene is a natural component of human sebum secretions & a precursor of cholesterol. It can be hydrogenated to squalane, which is used as a skin non-absorbable, bland cosmetic base material. Squalene is still featured in 12 make-up formulas, including eight lipsticks, from the L'Oreal's Shu Uemura range (Merkle 2008).



squalene



pristane

Companies such as Sophim in Peyruis, France, produce squalene from shark species such as *Squalus acanthias* (Scaly dogfish), *Centrophus squamosus* (Leafscale gulper shark), *Centrophus granulosus* (Gulper shark) & *Centroscymnus coelolepis* (Portugese dogfish). Shark cartilage is used as a source of chondroitin & chondroitin sulphate, the latter being used in cosmetics.

Cropwatch asked Rebecca Greenberg, Marine Wildlife Scientist with Oceana (www.oceana.org), to comment on endangered shark species. Arguably, Oceana's agitation on this matter led to the Corporates above to clarify their position with respect to shark liver oil products. Rebecca Greenberg replied as follows (snipped):

"….Below is a list of some of the more endangered shark species.

Great white- vulnerable
Basking shark- vulnerable
Whale shark- vulnerable
Tope shark- vulnerable
Gulper shark- vulnerable
Angel shark- critically endangered
Porbeagle- vulnerable globally and critically endangered in the Northeast Atlantic (because of overexploitation).
Spurdog- vulnerable globally and critically endangered in the NE Atlantic (because of overexploitation).
Hammerhead (great and scalloped): endangered
Makos- vulnerable
Threshers- vulnerable

The full list is quite longer, as about 1/3 of European sharks and related rays are considered threatened with extinction... Please note that the status for hammerheads, makos and threshers have not been updated, but in general they are considered threatened as well."

Cropwatch comments: As Rebecca West foresaw, Julia Baum of the Scripps Institution of Oceanography predicted (at a meeting of the American Association for the Advancement of Science on Feb 17th 2008), that the scalloped hammerhead, smooth hammerhead, shortfin mako, common thresher, big-eye thresher silky, tiger, bull & dusky sharks will be added to the revised endangered IUCN list this year (Jha 2008). . .

7. Turtle oil. Turtle oil is obtained from the body parts (skeletons. carapacea) of sea turtles, almost all of which are protected and/or critically endangered (see Appendix I CITES) although local peoples & countries not signed up to the CITES Treaty often ignore these regulations. The oil is especially produced from high oil-yielding leatherbacks (*Dermochelys coracea*) although other sources include Green Turtles (*Chelonias mydas*) & the Hawksbill Sea Turtle *Eretmochelys imbricata*. Irrespective of source, the commodity has a long &

shameful history of use in cosmetics, for bases in creams & lotions etc. It generally melts at ambient temperature (25°C) & is even available CO_2 extracted from the fat of Chinese soft-shelled turtles.

8. **Other animal-based ingredients**. Of course it is possible to extend this list – mink oil, placenta extracts, lanolin etc. etc. but we'll leave it there for the moment.

AROMATIC INGREDIENTS – CULTIVATION vs. WILD-GATHERING.
Essential oil production has been divided into cultivated & wild-gathered woody-perennial sources (trees, bushes) accounting for approx 65% of the world output, cultivated herbal sources accounting for the remaining 30.6% and wild-gathered herbal sources accounting for just 1.4%, with other sources accounting for the remaining 3.0% (Verlet 1993). To put this in context, it has to be born in mind that the world production of orange oil at 26,000 t/y is some four to six times the annual production volume of any other essential oil, and that the production of many minor essential oils is under 100 Kg/y, with some even at under 10 Kg/y.

BIODIVERSITY ACTION PLAN
189 nations have signed a Biodiversity Action Plan which is a plan for the conservation of habitats and threatened species therein, arising from the 1992 Convention on Biological Diversity. This is particularly daunting task because perhaps less than 10% of the worlds species, especially plants, have been characterised. The work of the Union for Ethical BioTrade (UEBT) should also be mentioned here, where private sector organisations can make a positive contribution to sustainable sourcing & corporate social responsibility. To this end Guidance for the application of the Biotrade Verification Framework for Native Natural Ingredients has been published (2007-09-20).

BIOPIRACY: THE MISAPPROPRIATION OF TRADITIONAL KNOWLEDGE
The intellectual property rights of indigenous peoples in regard to their medicinal plants and healing knowledge has been looted & misappropriated by the pharmacological industry for decades. The patenting of the useful plant properties known to indigenous peoples without recompense to the communities where the plants are found bears witness to this.

Patented plant property / contained molecule	**Botanical Source**	**Identity of Patent Holder**
Vincristine – mitotic inhibitor used in chemotherapy	Madagascar Periwinkle *Catharanthus roseus* (L.) G. Don	E. Lily (originally). Now distributed by APP, Mayne & Sicor etc...
Reserpine - antipsychotic	*Rauwolfia serpentine* Benth., *R. vornitoria* etc.	Extensive range of reserpine pharm. products offered
Neem extracts	Neem tree *Azadirchta indica* A. Juss	WR Grace & US Dept Agric EP436527 – revoked by European Patent Office
P57 – appetite suppressing substance	*Hoodia gordonii* cactus (*Hoodia* spp. now included in	To CSIR (1996) – partnered with Pfizer, then Phytopharm.

	CITES Appendix II unless *obtained through controlled harvesting and production in collaboration with the CITES Management Authorities of Botswana / Namibia / South Africa under agreement no. BW/NA/ZA xxxxxx'.*)	Myriad of other companies have marketed prepns based on plant not P57. CSIR recognized San tribespeople's rights over Hoodia in 2002.
Turmeric	*Curcuma longa* L. *syn C. domestica* Val.	Univ of Mississippi Medical Centre (1995; revoked 1996)
Quinoa	*Chenopodium quinoa* Willd.	Colarado State Univ. US5,304,718
Endod	African Soapberry *Phytolacca dodecandra* L.	Group from Univ of Teledo – did one day's work to prove Endod removed Zebra mussles from pipes of hydro-electric power plants, and patented property*. Endod has been used as an amoebicide in Ethiopia for thousands of years (traditional knowledge).

* Cited by Bunders *et al.* (1996).

Table 1. Principles from plants patented with (allegedly) little or no financial return to the indigenous community of the source country.

Situation in India – some notes.

Some examples of misappropriation for nine Indian medicinal plants were given in a discussion-only document by UNCTAD India Team (2005) as follows:

Plant name	**Patents Revealed (use similar to Traditional Knowledge).**
Acorus calamus L. (Vacha)	3 granted, 7 applied
Adhatoda vasica Nees (Vaska),	1 granted
Andrographis pinacualta Nees (Kalmegh)	3 granted
Commiphora mukul Engl. (Guggul)	11 granted
Curcuma longa L. (Haldi)	20 granted
Phyllanthus amarus L.	4 granted
Rauvolfia serpentina Benth. (Sarpagandha)	19 granted
Swertia chirata Buch. – Ham. Ex Wall (Chirata).	None directly mentioned, but 3 applications need study.
Terrminila chebula Retz (Harar)	3 granted
Withania somnifera Dunal (Aswaganha)	1 granted, 1 applied

Table 2. Medicinal plants with patent claims possibly similar to Indian Traditional Knowledge (adapted from UNCTAD 2005 discussion document).

The authors of this document point out that for most USA patents relating to native Indian plants, the inventors are often Indian people of Indian origin, patenting uses of plants already used for the same purpose in Ayurvedic medicine. This surely must raise questions on whether these particular patenting

authorities are "fit for purpose" by 'mis-granting' patents based on traditional knowledge, & in so-doing, failing to establish whether acts of misappropriation have occurred. A spokesperson for the US Govt. defended the performance of the US patenting authorities on this issue in 2001, stated: "The fault lies not with the patent system, however, but with the inaccessibility of the knowledge involved beyond the indigenous community" (Anon 2001). This feeble excuse for not spotting biopiracy when it stares US officials in the face is simply not an acceptable outcome for a competent authority to maintain, but it certainly illustrates the need for recruitment of the appropriate expertise in this area.

The flurry of US & Japanese patents originating from the pharmaceutical industry, & whose claims are similar to traditional medicinal use is symptomatic of another situation. This is that the high cost of patenting & the scientific instrumentation required to generate supporting data is generally not available to traditional healer associations in non-Western settings (Rukangira 2001). Again, ploys adopted by interested parties in order hide their tracks when obtaining patents based on natural medicines, include not referring to the plant's correct botanical nomenclature, or basing the patent claim around a single named chemical entity or common structural feature within the plant, without direct reference to the originating plant source.

Situation in S. America – some notes.

Further examples of the patenting of species from the S. American rainforest are given by Ethical Boundaries at http://www.amazonlink.org/biopiracy/index.htm who suggests further examination is required to see if traditional knowledge has been misappropriated in any way. Cropwatch has summarised & updated the original search data as follows:

Plant name	**No. of patents**	**'Worrisome' Patents Revealed**
Copaiba *Copaiba officinalis* Jacq.	2 4 1 1 1	Technico-flor SA FR2692480; WO9400105 Hayase Tomoko, Rifure KK JP2005145865; JP2004099536; JP2002308705; JP2308705. Aveda US5888251 Satoko Hayase US2006257441 Simoes Claudia./ Correa Andres BRP10404266
Cupuaçu *Theobroma grandiflorum* Willd. Ex Spreng.	1 4 1	Bodyshop GB 2321644A Ashai Foods JP 2001299278; JP2001348593; EP 1219698A1; WO0125377 Cupuaçu Intl Inc. WO02081606
Açai *Euterpe precatoria* Mart.		Word 'Açai' used as trademark by Ashai Foods – cancelled by Japanese Patent Office (2004)
Andiroba *Carapa guianensis* Aubl.	1 4	Morita Masuru JP11349424 Rocher Yves Biolog Vegetale US5958421; CA2235057; JP10287546; EP0872244
Ayanhuasca	1	Miller Loren S (US) US 5751P (annulled) – see

Banisteriopsis caapi Vault..		http://www.amazonlink.org/biopiracy/ayahuasca.htm

Table 3. Examples of patents relying on properties of rainforest products – extended & modified from Ethical Boundaries website data.

We would also like to draw your attention to an article by Balasubramaniam (2003) who lists a number of companies who are engaged to passing specimens of S. American plants to pharmaceutical, chemical & cosmetic companies. These are as follows:

1. Pharmocognetics of Bethseda – part owned by the Pan American Development Foundation
2. Maxus Petroleum of Dallas – particularly takes from Ecuador's rainforest.
3. Knowledge Recovery Foundation International (New York) – apparently this organisation insists a small royalty must be pledged by clients to indigenous peoples if drug development occurs.

Tunnel-visioned cosmetic trade magazine reporting (where making money from plant commodities irrespective of ecological considerations) is commonly found as an overriding story line. For example, Montague-Jones (2007) reporting on the *Beyond Beauty* exhibition in Paris 2007, sees Brazil as "a garden of plenty boasting potential new active ingredients amongst its 13,000 plant species", in which we can find "a number of traditional raw materials for the fragrance industry, including rosewood, tonka beans and copaiba". The article has plenty to say about Brazil's market potential in cosmetics (already the third largest in the world); but the article has nothing to say about any ecological price paid in achieving this, or about the 26,000 ha/y of Amazonian rainforest disappearing under the loggers chain-saws.

Situation In Peru – some notes.

Joseph Brinckmann (2007) describes, in a detailed article in *Herbalgram*, 33 vegetable biological resources prioritized by the Peruvian National Commission against Biopiracy, which include maca (*Lepidium meyenii*), *Croton lechleri* (dragons blood croton), *Aniba rosaeodora* (rosewood). *Bixa orellana* (anatto). Brinkmann describes in detail the history of the allegations of biopiracy surrounding maca root which began in 2002 after the discovery that US patents had been taken out relating to 'inventions' for the properties of maca root. The Peruvian National Institute for the Defense of Competition & Protection of Intellectual Property (INDECOPI) formed a Working Group of several Peruvian institutions and wrote a report in 2003 entitled "Patents referring to *Lepidium meyenii* & methods of usage." A revised 2005 version of this report was circulated by the WTO Council for Trade-Related Aspects of Intellectual Property. Brickmann goes on to describe patents taken out by Zheng *et al.* of Pure World Botanicals Inc. *viz*. US Patent #'s 6,267,995; 6,428,824 & 6,552,206; the first two of which INDECOPI has analysed, finding they do not meet they do not meet the required inventiveness level, although all may not meet the required novelty criteria. It remains to be seen what progress will be made although sufficient resources to pursue challenges to these inappropriately granted patents may be

a deciding factor. *Update:* According to an article in *ENN News 27.09.07*, maca has now entered the mass market, 9 years after medicine hunter Chris Kilham made a treck to the Peruvian highlands. This is apparently because Wal-Mart now offer 'Medicine Hunter Maca Stimulant®' which is claimed to enable Peruvian cultivators to earn a decent wage.

CITES (: Convention on International Trade in Endangered Species of Wild Fauna and Flora).

Formed as a series of measures at a meeting of the World Conservation Union (IUCN) in Washington DC in 1963, the CITES treaty is an inter-governmental agreement which exists to protect plants & animals from over-exploitation and serious decline via the actions of unscrupulous traders & rogue elements. CITES is now supported by 189 nations, and offers a complex legal regulatory structure from which it seeks to impose its effects. As listed (see http://www.cites.org/eng/app/appendices.html), Appendix I species are not commercially traded (although they can be exported for legitimate reasons e.g. to stock zoos etc). Cultivated Appendix I plants however, are treated as Appendix II items. Appendix II items can be commercially traded, subject to strict monitoring (export permit granted provided trading is not detrimental to survival of species). Appendix III items are listed on request by a member country which already protects the species within its borders, in order to help further control the species. Attempts to enforce CITES rules on the front line (e.g. by government trading officials, or wardens of protected zones) can be a life-threatening task, as organised crime syndicates seek to break these conventions for monetary gain.

Regulations are rendered effectively non-enforceable or impotent in effect by a number of means:

1. Smuggling or black market trading, avoiding any transaction records.
2. Under-reporting volumes traded.
3. Not identifying the plant for trade purposes by its correct botanical Latin name.
4. Passing a restricted/banned item off as another unrestricted commodity
5. Converting the restricted/banned item to a value-added trading commodity which is not restricted e.g. jatamansi herb (banned for export from Nepal) to jatamansi essential oil (not banned for export). Although this is a legitimate operation which brings in much-needed foreign currency to producing nation states, it may be counter-productive to the overall conservation effort. Further, commercial lobbying (or direct financial involvement) of delegates at CITES meetings to enable products & derivatives from threatened species to be traded, may successfully distort CITES decision-making from its proper altruistic intention of conserving species. An example of this is to be found with the outcome of CITES CoP 13, the African elephant (ivory trading) situation, where a trading ban is still in place but with concessions for Namibia, Botswana & South Africa to sell ivory stocks. This effectively means that the black-market in ivory sales operates unhindered due to overt corruption & a lack of political will to actively police the commerce. No further successful proposals to regulate the illegal trade seem to have been subsequently achieved at CITES CoP 14 (see

http://www.ukcites.gov.uk/news/CoP14%20%20Outcome%20Tables.doc).
Update July 2008: In a shameful CITES development, China has won the right to buy 108 tons of stockpiled ivory (said to be collected from dead animals etc.) from a group of African countries – Botswana, Namibia, S. Africa & Zimbabwe (Adetunji 2008), This follows a one-off sale of ivory previously granted to Japan in 1999, which provided a smokescreen for the increased killing of elephants by illegal ivory traders. Actions like these brings into question the trustworthiness of the CITES organisation as a whole, in its primary role to act as a guardian for animal protection & welfare, & shows up a central weakness of CITES, vulnerable to the actions of lobbyists who have personal interests in profit-sharing from unethical trading.

IUCN (- The World Conservation Union).
The International Union for the Conservation of Nature & Natural Resources is the world's largest conservation network. The 2007 IUCN Red List of Threatened Species includes some 41,415 species, of which 16,306 are threatened with extinction, 785 are actually extinct, and 65 exist only in captivity. To date, only about 3% of the world's species have been assessed.

Attention has been drawn to differences between individual status listing designations for the same threatened species between different organisations i.e. between the IUCN compared with the Forests Resources Authority (FRA) listings for individual nations (Garzuglia 2006) – so in the alphabetical section below, multi-sourced conservation status listings are included.

LOGGING COMPANIES.
This seemingly unstoppable army of forest-burners and illegal wood harvesters holds the world to ransom in so many respects, a situation coerced by supreme levels of incompetence & unawareness within many national governments. For example, in the UK, refurbishing of high government offices with illegally-sourced timber from threatened species has happened time after time after time, in spite of UK Govt's feeble pledges not to use illegal & unsustainable sources e.g. by the incumbent Prime Minister in 2001 (ref: Greenpeace's Ancient Forest Destruction Crimefile 2006). Not only does the left hand truly 'knoweth not what the right hand doeth' in UK Govt. circles, but some 50% of timber sold within the EU is similarly illegally logged.

In Australia, the previous Howard government was reported as summarily dismissing a ban on illegal timber importation as impossible to enforce (*Australian* 2007). Murphy considers that illegal timber importation arises because 11 million ha of timber production forest were placed national parks a decade ago (Murphy 2007), but bushfires have subsequently devastated millions of ha of inadequately protected parkland (3 million ha in ACT, NSW & Victoria in 2002-3). But didn't the previous Howard officialdom shown selective deafness when it came to protests about Australian logging activity? We shift the focus to someone who was brave enough to complain publicly about the burn-off after clear felling in Tasmania which was affecting the health of his (asthmatic)

children. The government's subsequence silence on the issue contrasted sharply to the reported death threats & vandalism to the protesters' personal property, courtesy of the local logging neighbourhood (Wyness 2006). This helps illustrate how logging companies have become more powerful than governments. Meanwhile it is announced that in a $2 billion, 20 year agreement, Forestry Timber of Tasmania will provide Gunns pulp mill in N. Tasmania with 1.5 million tons of native & plantation timber per year – half of the state forest harvest. (*ABC News* 19th Oct 2007).

The disadvantages that rain down on unfortunate forest communities courtesy of the illegal activities of loggers now include malaria. Mazan & Vidal (2007) describe how malaria is returning to the Peruvian Amazon after an absence of 40 years, with 64,000 cases reported in Peru country-wide in the lays year. Border areas of Ecuador, Colombia & Venezuela are similarly affected, Brazil chalking up a staggering 379,551 cases country-wide. Loggers are apparently mosquito victims too, with few opportunities to obtain treatment.

NATURAL PRODUCT STATUS.

What is a natural product? Many will take a lead from food/food flavorings legislation:

In the US, 21st Code of Federal Regulation (CFR) 101.22(a)3 – defines natural flavour or natural flavouring and includes the essential oil, oleoresin, essence or extractive, protein hydrolysate, distillate, or any product of roasting, heating or enzymolysis, which contains the flavoring constituents derived from a spice, fruit or fruit juice, vegetable or vegetable juice, edible yeast, herb, bark, bud, root, leaf or similar plant material, meat, seafood, poultry, eggs, dairy products, or fermentation products thereof, whose significant function in food is flavoring rather than nutritional. It assumes natural flavourings as 100% derived from named source.

EEC: Regulation 88/388/EEC (22.6.88) article 1, §2 (b) (i) – natural aromatic substance to be 90% + derived from named source, or refer to article 1, §2 (c) – natural aromatic preparation. Organic certification in the EU is regulated by Council Regulation 2092/91 EEC Rules of production from plants & plant products is set out under art 6 annex 1, rules for inspection requirements from farms or collection (annex !!!, A)

United States Dept. of Agriculture (USDA) National Organic Program (NOP) 7 CFR 205 regulates organic status for US agricultural products in the US; organic certification, requiring an audit trail tracking all handlers from farm to distributor and requires materials to originate from an organism with a genome unaltered by modern biotechnology, and to be produced/processed without synthetic pesticides, synthetic fertilisers, irradiation etc.

and/or fragrance ingredient legislation, as defined under:

ISO 9325 Article 9 Sect 2. The criteria for Natural Cosmetics under guidelines proposed by the Committee of Experts on Cosmetic Products 2000.

The Natural Products Association (NPA), a non-independent trade association has issued guidelines for natural personal care products – see http://www.naturalproductsassoc.org/site/News2?abbr=pc_&page=NewsArticle&id=9942. These guidelines appear unworkable for natural aromatic ingredients/natural perfumes, because:

"Product must be made up of at least 95 percent truly natural ingredients or ingredients that are derived from natural sources" – Cropwatch believes that natural ingredient is either 100% natural, or that it is non-natural, period.

"No processes that significantly or adversely alter the purity/effect of the natural ingredients" – this would eliminate aromatic raw materials such as oakmoss, treemoss, cedarmoss etc who's fragrant principles develop via chemical reaction with alcohol, and arguably ethanolic extracts, tinctures etc. where some less pronounced chemical interaction takes place, but that which does occur markedly alters the odour profile. .

"Ingredients that come from a purposeful, renewable/plentiful source found in nature (flora, fauna, mineral)". This will potentially offend many consumers - Animal products are unethical, period. Wake up!

Processes that are minimal and don't use synthetic/harsh chemicals or otherwise dilute purity This would eliminate whole classes of aromatic raw materials – resinoids, absolutes, solvent extracts etc, and rule out the practice of alcoholic perfumery.

"*Non-natural ingredients only when viable natural alternative ingredient are unavailable and only when there are absolutely no suspected potential human health risks.*" This is nonsense – few, if any, cosmetic ingredients are absolutely without suspected potential health risks. Further the NPA gives free license for non-organics to be incorporated in so called organic products.

Cropwatch concludes the NPA standards would be seen as naïve, amateurish and technically unworkable for the natural aromatic ingredients/natural perfumery sectors (Cropwatch did write to Daniel Fabricant of the NPA recently regarding this matter, but to date, we have received no reply).

The Natural Ingredient Resources Centre (NIRC) also gives us a brief stumble through natural ingredient definitions according to various authorities at http://www.naturalingredient.org/naturalingredients.htm and offers a guidance-definition of its own. Cropwatch would go along with much of this content, apart from the aversion to non-natural solvents, since precluding these would eliminate a whole range of natural ingredients are limit the art of the possible in perfumery (and similarly for phytopharmaceuticals etc). ***Cropwatch comments:*** When we consider that the first successful solvent extraction of flowers with solvents arguably took place in 1835, and by 1890 companies like Charabot, Chiris, Piver, Roure, Vincent & Nandon were making pretty reasonable concretes & absolutes, it puts into context what the NIRC & NPA are trying to do by banning hexane extracts & their like, and therefore putting the clock back 170-odd years.

Cropwatch is more attracted by the listing according to Natural Futures, SA, which includes those ingredients that:

1. Are plant derived (i.e. are non-animal).
2. Occur naturally (i.e. are indigenous)
3. Are wild-harvested or organically cultivated in their natural environment
4. Are sustainably harvested
5. Benefit the poor.

The "benefits the poor" requirement is echoed in a recent development by the Soil Association which will by 2008 demand that organic food producers in

developing countries “contribute substantially to the social needs of communities & workers”, including wage guarantees (Vidal 2007). However the Soil Association shows its business income interests in rejecting calls for a ban on air-freighted organic food, a move which would obviously affect many companies that it already certifies.

Another potential problem relates to fermentation or enzyme reaction products. A whole range of aroma chemical ingredients is now available to the flavourist or perfumer, produced by this technology. In a way this is hardly new – acetic acid in the form of wine vinegar has been traditionally produced for decades by recirculating poor quality wine drizzled over birch twigs coated with *Acetobacter aerogenes* – enzymes within the bacteria performing the microbiological biotransformation of ethanol (wine) to acetic acid (vinegar). Now we can produce raspberry ketone, delta-dodecalactone, alpha-ionone and a host of other natural ingredients by similar (but more sophisticated) reaction sequences. However the FDA has recently disallowed high fructose corn syrup prepared from corn starch hydrolysate not to be called ‘natural’ because the insoluble glucose isomerase enzymes used in the partial biotransformation of dextrose to fructose are ‘fixed’ using synthetic fixing agents (i.e. no birch twigs were involved!). Not only that but if the corn starch hydrolysate was prepared with certain types of acid, they may also be deemed not natural. The FDA gives no guidelines on the term ‘natural’, but apparently judges each case on its merits. Goodness knows what this means for the status of many hundred ‘natural’ aromatic ingredients.

Yet more problems to the definition of natural are caused by artefact formation and the use of chemical reactions to produce “natural” substances. For example it is fairly widely appreciated that the desirable blue substance chamazulene is an artefact formed from natural precursors by thermal means during the steam distillation of various aromatic herbs: Roman chamomile oil *Anthemis nobilis*, tansy oil (*Tanacetum vulgare*) and milfoil oil (*Achilea millefolium*) being 3 examples. According to the definitions of natural according to the food regulations quoted above, there would be no problem, but the NPA guidelines quoted above woulkd` seem to disallow it. But where are we with substances like citriodiol (p-menthane-3,8-diol) produced by acidification of *Corymbia citriodora* essential oil (formerly called *Eucalyptus citriodora*), or from citronellal, its major component? True on aging, citriodiol builds up naturally in the essential oil of *Corymbia citriodora*. But does acidic manipulation of a precursor qualify citriodiol as a natural substance? There are few such natural claim problems with other ex` natural substrates: linalyl acetate ex ho wood oil (produced via chemical esterification), or rhodinol ex geranium oil (by saponification), or with vanillin ex lignin, all of which are universally accepted as synthetic (although some would describe them as ‘part-natural’).

The more noticeable involvement of the ‘ethical greens’ of the cosmetics industry (Aveda, Natura, Origins, Decleor, l’Occitane etc.) which prominently feature a high natural product content in their retailed commodities, and their appearance as interest groups (or lobbying parties) in international regulatory meetings (e.g.

Natura) is something of a more recent development. In whichever guise commercial interests appear, potential for the damaging exploitation of natural products always has to be independently monitored.

NATURALS IN COSMETICS – RISE IN USE.

Mentioning naturals or natural active ingredients in cosmetic advertisements undoubtedly shifts product, but now the multi-nationals are moving wholesale into the natural cosmetics concept area, previously a niche for specialist companies. But at what cost to the environment? Cosmetic companies as a collective group have few identifiable ethnobotanists, ecologists, anthropologists, ethicists, & companies dealing in natural products have been known to re-assure the public about sustainability of their operations, even when the facts prove otherwise (e.g. over the unethical & misleading marketing of the African Cherry *Prunus africana* – see http://www.cropwatch.org/cropwatch13.htm). Further, confused by natural ingredient advertising claims & eco-awareness marketing, cosmetics consumers are frequently under the impression that they are buying a 100% natural product, when the product is comprised mainly of synthetics derived from petro-chemicals. In reality, the actual naturals content of such products can be extremely minor, and likely to be completely ineffective in use. There is clear need for legislation in this area to prevent the public being mislead. This leads on to our next topic….

ORGANIC STATUS AROMATIC MATERIALS.

The failure of regulatory authorities to regulate on natural products has lead to confusion, in-fighting & vying for position amongst self-appointed organic certifying bodies and clusters of organic cosmetic & personal care producers who have set up their own organisational standards for commercial advantage. Reich (2008) describes legal action taken by Organic Consumers Association (OCA) & the soapmaker, Dr. Bronner in the California Superior Court, against Jason Natural Cosmetics and Estée Lauder, along with Stella McCartney's Care and two standards certification organizations, Organic & Sustainable Industry Standards (OASIS) and Ecocert, to "stop them from making misleading organic labeling claims." According to Reich, Dr. Bronner's was part of the working group defining the term "natural", but their definitions have been heavily criticised by Cropwatch as unworkable as applied to natural aromatic products and the art of natural perfumery.

OASIS, co-founded by Karl Halpert of Private Label Select, are said to be supported by the heavyweights: l'Oreal, Estée Lauder, Cognis & Aveda, amongst others, and are working towards two Organic Production Standards for 2010, 'made with organic' with a 70% min. certified organics content, and 'organic' with an initial 85% min. certified organic status, rising to 95% within two further years. The remaining 15% can be non-organic, but a feature on OASIS in the trade press (Anon 2008a) reveals that (presumably synthetic) fragrances must be produced by 'The 12 Principles of Green Chemistry' – referring to Anastas & Warner (1998). This can be briefly listed as:

Prevent waste
Define safer chemicals/products
Design less hazardous chemical syntheses
Use reworkable feedstocks
Avoid chemical derivatives
Use catalysts not stoichiometric reagents
Avoid chemical derivatives
Maximise atom economy
Use safer solvents & reaction conditions
Increase energy efficiency
Design chemicals & products to degrade after use
Analyse in real time to prevent pollution
Mimimise accident potential.

Cropwatch comments: Is there anything new here? Most companies already work in a competitive situation and abide by many or most of the above principles to maintain costs at the lowest level possible. Most responsible companies will also have an environmental policy covering the remainder of the points. This seems to be common sense conveniently adopted as industrial virtuosity.

The article (Anon 2008a) quotes another OASIS founder, Tim Kapsner, over the difficulties of producing wholly organic fragrances: ",,, you need to allow some processing to occur to make plant materials into cosmetic ingredients. Some of that processing would be in the context of this model of green chemistry to create aroma materials." As far as this (natural aromatics) industry is concerned, since 'Organic And Sustainable Industry Standards, Inc. Health and Beauty Products Beta Version #3 – March 11, 2008' fails to define 'essential oils' according to the accepted ISO standard, maybe things do not auger too well just at the moment. Neither do we gain much comfort from the reported activities of companies like Laboratory Monique Remy (LMR). In an article (Anon 2008b) which describes their commendable efforts to grow iris, rose & blackcurrant crops pesticide-free & refers to the 'green chemistry' buzz-phrase, but then the account then goes on to describe LMR's work in developing alternative extraction techniques to the use of hexane. Apparently LMR claim to use a hydrofluorinated solvent instead of hexane to extract a marketed blackcurrant product; Cropwatch regards this as a step in the wrong direction – the build up of fluorinated compounds in the environment is a considerably worse prospect, surely, than using hexane in the first place?

In 2007, discussions were reported between the Soil Association in the UK, the BDIH of Germany, AIAB of Italy and the EcoGarantie of Belgium towards harmonisation of the regulations concerning natural & organic products (Bird 2007): specifications for natural & organic products were promised for June 2008. Other players in this field include the European Natural & Organic Cosmetics Interest Grouping (ENOCIG) who have joined up with IKW (actually the German Cosmetic, Toiletry, Perfumery and Detergent Association) to form NaTrue. certifying group Other organic certifying organisations include & the not-for-profits organisation NSF International. Simples (France), Demeter (Germany), Suolo e Salute (Italy), Agrobio (Portugal), Vida Sana (Spain), CRAE (Spain) & Biotop (Israel).

Cropwatch comments: None of the certifications of any oif these organisations carry the obligations of national legislation, and there is no reason why aromatic ingredient suppliers should not by-pass them & supply their own naturalness certificates to customers on demand – indeed it may be deemed discriminatory for customers not to accept these (it is certainly cheaper!).

Up to this point certifying bodies such as EcoCert and the Soil Association have used inspection & batch tracking systems (but virtually no actual chemical analysis of commodities for pesticide residues, or for disallowed ingredients etc.) to certify natural aromatic materials for their organic status. Many incongruities arise from this situation:

1. It is difficult to understand how some commodities – e.g. steam distilled essential oils - can be certified as "organic" when produced by diesel fuel as energy source, which has sometimes been hauled thousands of kilometers in order to produce them (or to subsequently sell them) (Kobus, 2004). Similar remarks apply to scavenged wood & vegetation as fuel for the distillation process, the gathering of which may cause huge damage to the local eco-system. What's wrong with solar power as a universal energy source for essential oil distillation? Long-distillation times, especially for wood oils and attars, produce massive carbon footprints. Awareness of this situation is reflected by the fact that ylang-ylang essential oil distillers in Commores are currently attempting to shorten distillation times to produce a reduced carbon-footprint product, although a similar scheme has been notified from the Philippines (PCIERD 2007).

2. It is also difficult to understand how threatened aromatic species illegally gathered from the wild (e.g. in Spain, Romania, Turkey, Nepal etc) can be certified as organic, especially as there is a high probability of illegal harvesting. It has been estimated that in the UK recently that only six out of fourteen prominent UK herbal medicine distributors were sourcing non wild-gathered herbs.

3. We make this point against; solvent extracted absolutes, concretes & resinoids are not certified as organic by certain certifying organisations, on the basis that they have been prepared via the use of synthetic solvents, and may contain (miniscule) amounts of solvent residues. Some agencies will, however, certify absolutes solely extracted from aromatic plant material with organic ethanol or carbon dioxide (CO_2). Since absolutes & resinoids have been used in perfumery for up to 140 years, toxicological testing data & the decades of end-user experience exist for many of the traditional materials extracted by 'conventional' means. This is not the case for CO_2 & ethanolic extracts of many natural aromatic materials (which are often of unknown toxicity), which nevertheless are apparently eligible for classification by certain certifying organisations as "organic".

4. Since detailed records of the activities of these organic certifying organisations are not openly available for public inspection, and no-one has ever solved the "who inspects the inspectors" conundrum,

Cropwatch maintains that, so far, the whole organic certifying operation is non-credible for the natural aromatics sector.

SUSTAINABILITY

The ideal of solving ecological sustainability issues for commodities "through the eye of the market" has become a popular concept. Making indigenous forest peoples the custodians of biodiversity; rewarding them appropriately via Fair Trade schemes; promoting initiatives between NGO's and farmers to grow 'at-risk' species commercially are commonly (and perhaps over- simplistically)

reeled off by essential oil sellers as a panacea to the situation. Further, the mention of obscure geographic origins for sourcing these "sustainably produced" aromatic commodities further tends to confuse the true picture. The reality of continuing to trade in at-risk species is, however, much more complex than traders would often have customers believe, and Margolis, in an article which seems almost to have a touch of black humour about it, provides some examples of misguided commercial enterprise in promoting commodities from Amazonian Forest Schemes (Margolis 2004).

Cropwatch offers this definition of sustainability: The capability of natural systems to maintain themselves whilst being used (i.e. equals holistic resource management).

SUSTAINABLE HARVEST

According to Hall & Bawa (1993): "the level of harvest that does not impair the ability of the harvest population to replace itself." This is the most common misconception put about by natural product traders: the definition does not take any account of ecological impact of harvesting. For example Rooibos tea from *Aspalanthus linearis* is widely said to be "sustainably harvested" in S. Africa [e.g. as quoted by Wickens (2000)]. However the species *Agathosma cephalodes* E. May. ex Sond., formerly endemic in the Western Cape, is reportedly affected by the Rooibos tea industry, and may already by extinct according to Golding (2002). Therefore Rooibos tea cannot be said to be sustainably produced, period.

Quote: "The management of a forest for a single product will affect the forest's ability to provide other services or products, so trade-offs have to be made" Higman *et al*. (1999).

SUSTAINABLE YIELD FORESTRY

…basically describes a myth. There are next to no examples of industrial sustainable tropical timber operations in the world, even when using a limited economic definition of yield – i.e. maintaining the volumes of timber available in successive harvests" (WRM 1990).

A study commissioned by the International Tropical Timber Association (ITTO), found that "the amount of sustainable tropical timber harvesting is, on a world scale, negligible."

The above two references would appear to challenge the possibility of sustainable production of essential oils from plant species with very long maturity times e.g. Sandalwood East Indian *Santalum album* (80 years) or Cedarwood Atlas *Cedrus atlantica* (120 years). (N.B. a rotational length of only 20-30 years is claimed for *Santalum album* growing in Indonesia – see Fletcher 1994).

Deforestation: 21 acres of forest are cleared per minute (= 30,200 acres per day) across the globe. Logging machines like the 39-ton Timberking (a cutting machine: TB) can clear-cut 1 hectare of forest per day ref: *Ecologist* June 2003

p16. Countries like Madagascar have lost 95% of their forest cover compared with the situation 100 years previously. Every year, fires consume up to half of Malagasy's vast grasslands and thousands of square kilometers of its rainforests and secondary brush (slash and burn agriculture): Kull (2002). Essential oil crops have been monocultured on land that was previously virgin forest in Madagascar (Cropwatch: unpublished data).

Commercial plantations producing aromatic commodities such as gaharu do not halt the rate of disappearance of gaharu-bearing trees from those areas in which they occur. Selective extractive of trees (e.g. *Aniba* spp. for rosewood oil production) is often regarded as over-expensive & impractical by logging companies, compared with clear cutting.

The NGO's themselves have not escaped criticism either. For example the ITTO has been accused of vested interest and national government bias (Higman *et al.* 1999).

TRIPS AGREEMENT
TRIPSW stands for Trade – Related Intellectual Property Rights, which is an international agreement between participating nations which came about at the end of the Uruguay Round of the GATT meeting in 1994. Unfortunately it has no opinion about the bio-piracy of traditional knowledge & medicinal plants (Balasubramaniam 2003).

ALPHABETICAL INGREDIENT LISTING OF THREATENED AROMATIC SPECIES.

(See glossary to explain Status abbreviations)

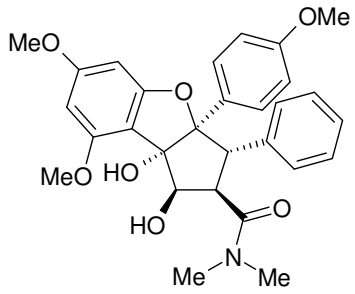
AETOXYLON
A genus of one species producing gaharu-buaya, which includes:

- *Aetoxylon sympetalum*

Puk-puk gaharu.
Distribution: W. Sarawak & Borneo.
Status: No information.

AGLAIA ODORATA
Aglaia odorata (Lour.).
Chinese Rice Flower.
Flower, leaf & seed oils are produced in S. China, Yunnan & Sichuan provinces, but plants are distributed elsewhere, including Cambodia, Laos, Myanmar, Thailand & Vietnam. The twigs & leaves can be extracted for rocaglamide, a natural benzofuran insecticide.

Status: LR/nt. Pannell, C.M. (1998).*Aglaia odorata* In 2007 IUCN Red List of Threatened Species 2007.
Notes: *Agalaia odorata* perfume was used at the Lucerne concert of classical music, Switzerland, to attempt to manipulate audience mood (Rouhi 2003).



rocaglamide

The flower oil is the most valued commodity in perfumery & flavourings, but a floral absolute is also available.

AMBERGRIS
Sperm Whale
Physeter catadon L.
syn. *Physeter macrocephalus* L.
- possibly also from Dwarf Sperm Whale *Kogia breviceps*

Status: VU A1-bd Cretacean Specialist Group (1996, 2000) In: 2000 IUCN Red List of Threatened Species 2000.
Sperm Whale is protected under CITES Appendix I (but not the products from it). At the 33rd CITES meeting in Brussels on 3rd March 2005 (CITES 2005), and citing Note 14 of Reg 1497/2003, a CITES committee agreed that "in principle, urine, faeces and ambergris were not covered by Council Regulation 338/97 (regarding animal trade) unless there was evidence of manipulation." *Cropwatch comments*: this development is not ecologically sound and is a demonstration of the power of trade interests as opposed to animal welfare. Fortunately the development seems to have been ignored by many national government departments responsible for ecological matters.

Australia: Export & import, possession & movement restricted under Part 13A of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) – see Aust. Govt notice (13th Aug 2007). Also interpret CITES Appendix I listing for *P. catadon* as including & restricting Sperm Whale products.

EU: According to EC 2007/275/EC of 17th April 2007 concerning lists of animals and products to be subject to (vetinary inspection) controls at border inspection posts under Council Directives 91/496/EEC and 97/78/EC, under CN code Ex 0510 00 00 we find ambergris is listed However this is intended as an inspection measure, & not a measure for conservation.

USA: In the US the passing of the Endangered Species Act in 1973 consolidated protection for the Sperm whale ***and its products*** that were specifically protected

in 1970. The Act was passed to protect whales – which were slaughtered not only for whale meat and spermaceti, but also for ambergris – and at the time of passing the Act in the US 96% of traded ambergris came from sperm whales and only 4% from shore wash-ups. The website at http://www.rsmas.miami.edu/support/lib/seas/seasQA/QAs/a/ambergris.html states:

"Ambergris, a secretion of the sperm whale intestine, is regarded as a marine mammal product by the U.S. Department of Commerce. Possession of it is prohibited by the Endangered Species Act of 1973, which includes the sperm whale, declared an endangered species on June 2, 1970. The Act states that it is unlawful to possess, sell, deliver, carry, transport, or ship by any means whatsoever any parts or products of an endangered species taken within the United States. This means that, although ambergris is valuable as a fixative in the manufacture of fine perfumes, perfumers in the United States are not allowed to buy or sell it or perfumes containing it. They now use a synthetic substitute. Beachcombers who find ambergris should report it to the nearest state or federal conservation agency. One should keep in mind, however, that pieces of wax, rubber, plastic, or other materials, may, at first glance, be mistaken for ambergris which is opaque and ash-colored. Interesting historical facts about the uses and value of ambergris are presented in "Ambergris - Neptune's Treasure," Sea Frontiers, 4(4): 201-209, November 1958 and "Ambergris - Floating Gold of the Sea Survey" 07 May 1981."

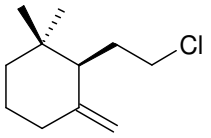
Other affirmations of the illegal status of ambergris trading can readily be found on the Internet: "Today it's illegal to possess, buy or sell ambergris in the United States." - see - http://www.mbayaq.org/efc/living_species/default.asp?hOri=0&hab=8&inhab=191

"Included in Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) since 1985, making trade in products (i.e. sperm oil, teeth, and ambergris) illegal in most countries. Since 1981, importation of sperm oil and other sperm whale products has been banned by the European Union. Importation of marine mammal products in the U.S. has been banned since 1972 (Whitehead 2003)." – see: http://aknhp.uaa.alaska.edu/zoology/species_ADFG/status_reports/ADFG_PDFs/Mammals/sperm_whale_ADFG_web_060205.pdf.

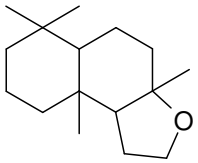
Cropwatch comments: The EPA regulations are not actively enforced in the US, and the US Regulatory authorities including the EPA, marine scientists and prominent University departments with marine interests, would not be drawn on this matter when contacted by Cropwatch.

Notes. Ambergris contains 46% of cholestanol type sterols (Sell 1990) including (+)-epi-coprosterine and the triterpene alcohol (-)-ambreine (25-45%), which is odorless, but this material is the precursor to other fragrant compounds formed by auto-oxidation, sunlight, and seawater such as (-)-γ-cyclogeranyl chloride and

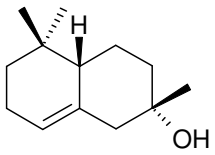
(-)-γ-bicyclohomofarnesal. The material is said to be able to retain its odour for centuries, and generally stays as an amorphous mass, with no tendency to crystallise. Mookherjee and Patel (1977) identified nearly 100 volatile substances in ambergris; they described some of the key components and their associated odours as follows:



gamma homocyclo geranyl chloride

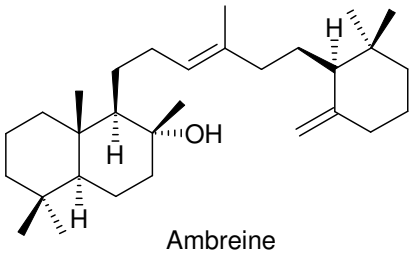


ambrox

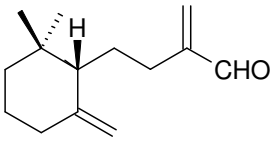


alpha-ambrinol

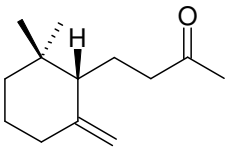
γ-homocyclogeranyl chloride: ozony-seawater (can be towards metallic)
α-ambrinol: moldy-animal-faecal
γ-dihydroionone: weak tobacco
γ-coronal: sea-water
ambroxan: moist, soft, creamy, persistent amber with velvety effect



Ambreine



gamma-coronal



dihydro-gamma-ionone

For more detailed information see http://www.cropwatch.org/ambergris.htm and http://www.cropwatch.org/ambergrisupdate.htm.

AMYRIS OIL

"West Indian Sandalwood".

Amyris balsamifera L.

Distribution: The 3-6m. tree is distributed in S. Florida (where it is severely endangered), Belize; Costa Rica; Honduras; Nicaragua, Caribbean: Cuba; Hispaniola; Jamaica; Puerto Rico, Venezuela, Colombia; Ecuador

Status: Vulnerable Cropwatch (2004). For a number of years there have been predictions that this essential oil will eventually disappear from the market because of over-exploitation of the tree and habitat degradation (e.g. Joulain predicted depletion within 20 years in 1994).

Notes: The volatile oil of amyris is obtained by the steam distillation of the powdered heartwood or collected deadwood of the small tree. Essential oil is mainly produced in S.E. Haiti, with some production in Venezuela and Jamaica, but demand has slowed 2006-7, currently leaving some modest quantities of unsold stock. Some reports of quality decline of late compound the situation. The oil is not greatly valued in perfumery, some former use in soap perfumery, but now limited use in men's deo-sprays & toiletry fragrances.

ANDIROBA
Carapa guianensis Aublet
Distribution: East Amazonia logging frontier
Status: Diminishing accessibility in Capim region due to logging: Shanley & Rosa (2004).
Species subject to uncontrolled salvage logging in Columbia (SFM Tropics 2005).
Indiscriminate heavy logging in the Garupa region: tree numbers in decline, denying local peoples' access to the tree as a source of medicine. .
Notes: **Fixed oil** from tree fruits sold into aromatherapy & cosmetics, & utilised for anti-inflammatory, antibacterial & insect repellent properties (probably due to the natural limonoid content); however the fruit oil is very prone to rancidity, and should be used immediately i.e. to make soap or candles. The item has long been identified as a potential non-timber rain-forest product for exploitation under a controlled management scheme. Promoted by local women's groups like AVIVE in Silves (together with copaiba, rosewood, and lesser known breu oil (*Protium* spp.) & puxuri oil (*Licaria pucheri* [Ruiz &Pavon] Kosterm.) who want "to begin sustainable production of IBAMA approved Amazonian essential oils and natural cosmetics, to earn income without degrading the forest."

ANISE SCENTED MYRTLE syn. ANISEED MYRTLE, AUSTRALIAN
Backhousia anisata Vickery
(now renamed *Anetholia anisata* (Vickery) Peter G. Wilson).
Habitat: Restricted to Bellinger and Nambucca valleys of NE part of NSW, Australia. Some examples of this rare species are protected in the Dorringo National Park.
Status: Vulnerable (Cropwatch 2004).
Briggs and Leigh (1995) list *B. anisata* as a rare or threatened plant, with a geographic range in Australia of less than 100 km. More than 1000 trees of the species exist in natural reserves and Briggs and Leigh (1995) consider the species' status as adequate inside the reserves.
Notes: Some limited nursery cultivation (plants always smaller in cultivation). An essential oil is produced from the fresh leaves locally by micro-scale distillation; cultivated plants said to produce inferior oil.

AQUILARIA SPP. see http://www2.wcmc.org.uk/trees/trade/aqu_mal.htm
All *Aquilaria*, *Gonystylus* & *Gyrinops* spp. added to Appendix II CITES (2004), a move reflected in Commission Regulation (EC) No 1332/2005 of 9 August 2005 amending Council Regulation (EC) No 338/97. 'The Cropwatch files' section has extensive bibliography & supporting information on *Aquilaria* spp. at http://www.cropwatch.org/agarwood.htm.

Aquilaria acuminata (Merr.) Quis.
(originally syn. *Gyrinopsis acuminate*)
Distribution: Philippines?
Status: CITES Appendix II (2004)

A. apiculata Merr.
Distribution: Mindanao: Bukidnon prov.
Status: CITES Appendix II (2004)

Aquilaria audate (Oken) Merr.
syn. *Gyrinopsis brachyantha* Merr.,
syn. *Cortex filarius* Rumph.,
syn. *Pittosporum ferrugineum* var. *filarium* DC.,
syn. *Pittosporum filarium* Oken,
syn. *Aquilaria tomentosa* Gilg,
syn. *Gyrinopsis bracyantha* Merr..
syn. *Gyrinopsis acuminate* Merr.
syn. *A.audate* Quis.J.
Distribution:
Status: CITES Appendix II (2004)

A. baillonii Pierre ex Lamk.
Distribution: Vietnam & Cambodia
Status: CITES Appendix II (2004)

Aquilaria banaensae Pham Hoang Ho
Distribution: Vietnam
Status: VU D2 WCMC (1998). *Aquilaria banaensae* In 2007 IUCN Red List of Threatened Species
CITES Appendix II (2004)

Aquilaria beccariana Van Tieghem.
syn. *Aquilaria cumingiana* (Decne) Ridley var. *parviflora* Airy Shaw
syn. *Acquilaria grandifolia* Domke
syn. *Gyrinopsis grandifolia* Quis (– also found in Borneo, Malaysia, Sumatra).
Distribution: Malaysia, Sumatra, Borneo.
Status: VU A1d WCMC (1998) *Aquilaria beccariana* In 2007 IUCN Red List of Threatened Species..
Vulnerable: (Hilton-Taylor 2002)
CITES Appendix II (2004)

Aquilaria. brachyantha (Merr.) Hall f. *Luzon.*
syn. *Gyrinopsis brachyantha* Merr.
Distribution: Philippines
Status: CITES Appendix II (2004)

A. citrinaecarpa (Elmer) Hall f.
syn. *Gyrinopsis citrinaecarpa* Elmer
Distribution: Mindanao
Status: CITES Appendix II (2004)

Aquilaria crassna Pierre ex H. Lecomte.

syn *Aquilaria agallocha* auct., non-Roxb (1832)
Agarwood (Eng); Eaglewood (Eng)
Distribution: Cambodia, S. Vietnam & Cambodia.
Status: CR A1cd Nghia N.H. (1998). *Aquilaria crassna* In 2007 IUCN Red List of Threatened Species.
Priority tree sp. for Gene Conservation (threatened spp) FRA 2005
CITES: listed in Appendix II (1994).
Vietnam Govt. banned trade and extraction of *A. crassna* in 1987. Harvesting of agarwood banned in Cambodia.
Cambodia: Vulnerable: IUCN listings at national levell (through FRA 2005)
Notes: 10,000 ha of cultivated *A. crassna* trees are growing in Vietnam according to a press release (Mathaba 2007), which tells of plans to similarly add another 30,000 ha. Artificially infected trees so far seem to produce poor quality gaharu, and the process has been shown to produce gaharu of differing composition to that obtained from naturally infected trees. But as is the case with sandalwood oil East Indian, we have a younger generation of end-users who may have never smelled "the real thing", and a generation of 'old hands' who are forgetting what authentic materials used to smell like!

Aquilaria cumingiana (Decne) Ridley
syn. *Gyrinopsis cumingiana* Decne;
syn. *Decaisnella cumingiana* O.K.;
syn. *Gyrinopsis cumingiana* var. *pubescens* Elm.;
syn. *Gyrinopsis decemcostata* Hall.f.;
syn. *Gyrinopsis pubifolia* Quis.
Distribution: Philippines, Borneo, Moluccas
Status: VU A1d WCMC (1998) *Aquilaria cumingiana*. In 2007 IUCN Red List of Threatened Species.
CITES Appendix II (2004)

Aquilaria filaria (Oken) Merill.
Distribution: Philipines, Sumatra, West New Guinea.
Status: CITES Appendix II (2004)
Notes: Indonesia's export quota for so-called "*A filaria*" is 125 t/y since 2003.

Aquilaria hirta Ridley
syn *Aquilaria moszkowskii* Gilg.
Distribution: Malay Peninsula (Trengganu, Pahang, Johore), Singapore, E. Sumatra, Riau and Lingga islands.
Status: VU A1d WCMC (1998) *Aquilaria hirta* In 2007 IUCN Red List of Threatened Species.
Vulnerable (Hilton-Taylor, 2002)
CITES Appendix II (2004)

Aquilaria khasiana H. Hall.
Distribution: India (Khasia)
Status: CITES Appendix II (2004)

Aquilaria malaccensis Lamk
syn. *Aquilaria agollacha* Roxb.
syn. *Agallochum malaccense* (Lamk) Kuntze
syn *Aquilariella malaccensis* (Lamk) v. Tieghem
Agarwood (Eng) Aloewood (Eng) Eaglewood (Eng) Lign-aloes (Eng)
Distribution: India (especially NE India), Burma, parts of Malaysia, Sumatra Bangka, Borneo, the Phillipines, Japan, Thailand, some parts of Cambodia and Vietnam, and other parts of the very Far East. *A. agallocha* found in the forests of S.E. Asia including within India: Assam (Nowgong-cachar), Nagaland (Naga), Meghalaya (Khasi, Karo Hills), Bangladesh, W. Bengal (Darjeeling), the hills of Manipur and Tripur, and elsewhere: Bhutan, Burma, Myanmar, Western China, Japan, Vietnam, Sumatra, Philippines (Luzon), Cambodia, Borneo & Iran. Some regard *A. agollocha* is a truly distinct species – Broad (1995).
Status VU A1cd *Aquilaria malaccensis.* Asian Regional Workshop (1998). In: 2007 IUCN Red List of Threatened Species.
Listed in Red Data Book of Indian Plants (Vol. 2, pp 245) by Nayar and Sastry (2000) Repr. Edn.
Listed under CITES (1995) Appendix II.
Facing genetic erosion: CIMAP (1997)
Extraction of spp. banned/regulated in India according to state under the Indian Forest Act and Administration Order of State Forest Department. Export of wood banned under item 7 of para 158 of prohibited items but it still occurs (and is even officially recorded!).
Vulnerable: IUCN Red List for IR of Iran.
Pre-1994 IUCN Red List: the following populations were considered threatened at the national level: Bangladesh (Endangered), Bhutan (Rare), Myanmar (Vulnerable), Malaysia (Indeterminate), Singapore (Rare), Sumatra (Endangered).
Notes: Production of agarwood oil in India is 800 -1000Kg per annum (Shiva *et al*. 2002)

Aquilaria microcarpa Baill.
syn. *Aquilariella microcara van Tiegh;*
syn *Aquilariella borneensis van Tiegh;*
syn *Aquilariella borneensis Boerl*
Distribution: Malay Peninsula, Sumatra (Sijunjung, Palembang and Lampung), Belitung, Bangka and throughout Borneo
Status: VU A1d WCMC (1998).*Aquilaria microcarpa*. In 2007 IUCN Red List of Threatened Species.
Vulnerable (Hilton-Taylor, 2002).
CITES Appendix II (2004)

Aquilaria moszkowskii Gilg
Distribution: Sumatra
Status: CITES Appendix II (2004)

Aquilaria ophispermum Poir.
Distribution:

Status: CITES Appendix II (2004)

Aquilaria parvifolia (Quis.) Ding Hou
Distribution: Luzon.
Status: CITES Appendix II (2004)

Aquilaria pendantra Blanco.
syn. *Pittosporum brachysepalum* Turcz.
Distribution: Philippines
Status: CITES Appendix II (2004)
Notes: Source of Mamalis oil.

Aquilaria rostrata Ridley
(some say syn. *A. malaccensis* Lam.)
Distribution: Thailand.
Status DD WCMC (1998). *Aquilaria rostrata* In 2007 IUCN Red List of Threatened Species.
Becoming rare (Cropwatch 2002)
CITES Appendix II (2004)

Aquilaria secundana D.C.
Distribution: Moluccas
Status: CITES Appendix II (2004)

Aquilaria sinensis Sprengel
syn. *A. grandiflora* Benth.
Distribution: S. China
Status VU B1+2cde Sun W. (1998) *Aquilaria sinensis* In 2007 IUCN Red List of Threatened Species.
CITES Appendix II (2004)
.
Aquilaria subintegra Ding Hou
Distribution: Thailand
Status: CITES Appendix II (2004)

Aquilaria tomentosa Gilg
Distribution: New Guinea
Status: CITES Appendix II (2004)

Aquilaria urdanetensis (Elmer) Hall f.
syn. *Gyrinopsis urdanetensis* Elmer
Distribution: Mindanao
Status: CITES Appendix II (2004)

Aquilaria yunnanensis SC Huang.
Distribution: China
Status: CITES Appendix II (2004)

The Conference of the Parties 14th CITES Meeting (The Hague 2007) points 14.137 to 14.144 relating to Agarwood taxa:

14.137 Parties involved in trade in agarwood should, in consultation with the Secretariat, identify funds and produce identification materials for all forms of traded products under CITES control.

14.138 Parties concerned should identify and agree on which agarwood products and quantities should be exempted from CITES controls. Once agreed, Parties concerned should agree which range State will prepare and submit a proposal for amendment of the current annotation for agarwood-producing species to be considered at the 15th meeting of the Conference of the Parties.

14.139 Draft standardized units of reporting shall be considered at the 15th meeting of the Conference of the Parties.

14.140 Parties involved in agarwood trade shall prepare a glossary with definitions that illustrate the content of the amended annotations, the terms used and their practical application during enforcement and border controls. The Secretariat should facilitate the preparation and production of these materials, and strategies for incorporating them in training material.

Notes on Agarwood (slightly amended from Cropwatch 2005):
Agarwood qualities are placed in the above section because these products are commonly sold as incense products & as essential oil which is used as an ingredient of fine fragrances (e.g. *M7* & *M7 Fresh* by Yves Saint Laurent & *Euphoria Men Intense* by Calvin Klein).

As well as *Aquilaria* species, *Gonystylus*, *Gyrinops, Aetoxylon, Enkleia, Wikstroemia* and *Phaleria* spp. also produce gaharu. The genus *Gonystylus* comprises 31 species, being chiefly distributed across the Malesion tropical rainforest region, extending to Papua New Guinea, the Solomon Islands and Fiji (Tawan 1999); lower quality gaharu eminating from *Gonystylus* spp. being mentioned by Wollenberg (2001). Yamada (1995) estimated that 2000 tons/year of agarwood pass through the principal agarwood trading centre, Singapore, 70% coming from Indonesia and 30% from other S.E. Asian countries. Of this, 70% is exported to Arab countries and 30% to China, Hong Kong & Taiwan. Japanese merchants go on to trade in agarwood largely via Honk Kong. Steam distilled & CO2 extracted plantation-grown artificially infected agarwood products etc. are / will be available on the oils market, but have yet to gain widespread acceptance (agarwood plantations started seven years previously in Vietnam, also in Laos, Papua New Guinea & other parts of S.E. Asia with the Tropical Rainforest Project Foundation (TRP) – a Dutch NGO funded by EC grants using new technologies to trigger & accelerate resin formation - see www.agarwood.org.vn). It is understood that TRP have taken out a worldwide patent on a resin induction process, and distillation of the “worlds first certified sustainable agarwood oil” is likely to take place in 2005, as claimed by Phillips (2005).

Chakrabarty *et al.* (1994) had earlier described the agarwood trade in India, pinpointing some 200 distilleries in Hojai, Nilbagan and Islamnagar in the Naogoan district of Assam, and describing the distillation process in detail. The authors describe difficulties in establishing the legal licensed basis (if any) for many of the distilleries in the above locations, and similarly for the agarwood extraction businesses in Manipur, and also the problems in estimating the extent of illegally acquired agarwood from India and Bhutan - in addition to that smuggled via Myanmur. The main destination for agarwood, chips and dust appeared to be the United Arab Emirates (especially Dubei), Saudi Arabia, UK and Bahrain.

Harris T. (undated), a US-based businesswoman selling aromatic raw materials including *Aquilaria* qualities, reflects on knowledge of the agarwood situation in Laos, gained via a personal 3-week visit (see http://www.enfleurage.com/ac-agarwood-2.html). Harris argues against a total ban on agarwood oil trading which she maintains is not necessary; the argument seems to be somewhat tenuously reasoned on the hedonistic pleasure that the products give at this present moment in time, although elsewhere in the article Harris refers to very large numbers of plantation trees which exist in Laos, Thailand, Cambodia and Vietnam, thereby implying a continued harvest (presumably of *A. crassna* at least). This was not the conclusion of the Trade & Legislation workshop group at First International Agarwood Conference, Viet Nam, November 2003, which concluded "plantations are not the stand-alone answer to long-term supply of the global Agarwood trade."

A second argument against maintaining the unfettered free trading in this valuable commodity, as even TRP have conceded on their website, is the fact that the establishment of agarwood plantations will not necessarily reduce the demand for agarwood – they may well increase it. Meanwhile it is generally agreed that the natural occurrence of *Aquilaria* spp. in the wild across India, Indonesia etc. generally continues to decline, in spite of the establishment of plantations in various widely-spread locations. A scenario where the survival prospects for *Aquilaria* species are ultimately dependent on privately owned plantations is not a prospect that every ecologically-minded person would relish, and the essential oil trade itself has many disaster stories connected with failed commercial plantations, across a number of oil-bearing species. It is also apparent that although Harris is preoccupied with the survival of *Aquilaria* species *per se*, perhaps in order to continue to be able to market valuable commodities from the genus, the negative effects for biodiversity of slash and burn, creeping agricultural production in forest areas plus agarwood monoculture in these areas, are not clearly spelled out in her article. Thus, whilst arguments surrounding issues solely concerning *Aquilaria* species sustainability might be put forward, true ecological forest sustainability with its existing biodiversity (i.e. holistic forest management) probably cannot. So, my conclusion is that the somewhat profane use of agarwood oil in high-class perfumery – which is the principal issue with which we are concerned here - seems to serve no good

purpose, apart from any attached merchandising gain from its advertised mention as a novelty ingredient, and could be positively harmful to the ecological status of *Aquilaria* spp. by adding to the demand for the commodity.

Harris in her article further describes a highly energy-intensive preparative distillation process for agarwood oil, which is said to occur over 7 days (in contrast to the 30-36 hour Assam process as described by Chakrabarty *et al*. 1994), but fails to mention any relevant carbon neutral issues. Harris also argues to the effect that botanical classification of agarwood species is not currently practical at the point of trade, since (if I understand this correctly), Harris maintains that traded items like oil and chipped wood are impossible to back-classify. This may be a perfectly valid position in countries with an absence, or a refusal to implement, batch-tracking practices. On the face of it, it would not easily be solved in a perfect world even by employing the appropriate advanced analytical botanical & chemical education & training either. However The Plant Bulletin of the Agri-Food & Vetinary Authority of Singapore (Jan. 2004) describes the documentation procedures for the export, import and re-export of agarwood species which were not classified in Appendix II of CITES at the time (such as block, chips powder or oil of *Aquilaria filaria*), suggesting that this might not be such a universal problem as Harris suggests. One can't help feeling that this type of argument cited above reflects a tendency amongst agarwood 'cultists' to resist all methods of scientific investigation & classification - these would be useful tools to demystify areas such as agarwood quality assessment procedures, which are connected to ethnically - & culturally - based rituals.

Finally the article also rails against alleged shortcomings in the evidence leading to IUCN and CITES classifications for *Aquilaria* spp. – again familiar arguments used in incense-product trading circles to justify continued agarwood trading. Nevertheless it has to be remembered that the Republic of Indonesia itself (which claims to be the largest agarwood producer) was the proposer for the inclusion of all agarwood producing species of *Aquilaria* & *Gryrinops* which were currently not in the Appendices of CITES, at the Thirteenth Meeting of the Conference of the Parties on 3-14 October 2004 in Bangkok, Thailand. Further Harris's arguments, from the somewhat rosy-tinted perspective of an agarwood commodity seller, presents a gently indulgent and sanitised picture of agarwood trading – with no mention of gangland, smuggling/illegal trading or any ugly exploitation of indigenous gatherers by exogenous collectors, which is widely reported elsewhere – for example in Central and East Kalimantan, Sumatra, Papua New Guinea etc. Further, as Momberg et al. (2000) infer, threats from outsiders can affect traditional ways of more sustainable gaharu gathering turning them towards more intense & destructive practices.

In spite of these deep misgivings, we recommend readers make their own minds up by reading the article by Trygve Harris at the above mentioned URL, which we feel makes an important contribution to understanding the attitudes and knowledge surrounding agarwood commodity trading.

References:

Chakrabarty K., Kumar A. & Menon V (1994) “Trade in Agarwood” WWF-India/TRAFFIC India, New Delhi

Momberg F. *et al.* (2000) “Exploitation of Gaharu, and Forest Conservation Efforts in the Kayan Mentarang National Park, East Kalimantan, Indonesia” in *People, Plants & Justice – The Politics of Nature Conservation* ed. Charles Zerner Columbia University Press, NY 2000.

Phillips D. (2005) – business advisor to TRP – private communication Jan. 2005.

Tawan C.S. (1999) "A new species of *Gonystylus* (Thymeaceae) from Sarawak, Borneo" Botanical J. Linnean Soc. 130, 65-68.

Wollenberg EK (2001) "Incentives for collecting gaharu in East Kaliantan" *Economic Botany* **55**, 444-456.

Yamada, I (1995) "Aloeswood Forest & the Maritime World" *Southeast Asian Studies* **33**(3), 181-187.

Burkhill I.H. (1966) *A dictionary of economic products of the Malay Peninsula* Vol: 2 Ministry of Agriculture & Cooperatives, Kuala Lumpur, Malaysia

Hou D. (1960) "Aquilaria" *Flora Malesiana* Series 1: 6(1-3) Thymelaceae, pp 6-15 ed. CGCJ van Steenis & Oyen, L.P.A

Hilton-Taylor, C. (2002) IUCN Red List of Threatened Species (2002). IUCN Switzerland

Nguyen, X.D. (1999). *Plant Resources of Southeast-East Asia No. 19. Essential-oil plants*. PROSEA, Bogor, Indonesia

Whitmore TC ed. (1973) *Tree Flora of Malaysia* Longman Group, London

ARGAN

Argania spinosa (L.) Skeels.

[Fixed oil pressed from the kernels in the drupes used in cosmetics].

Distribution: This tree of twisted and convoluted appearance grows the Agadir region (S.W. Morocco) on calcarious and silicaceous soils around 1800 feet and which can reach 10-12 metres.

Status: Cropwatch review (2005) – see http://cropwatch.org/nletart6.htm

UNESCO declares 25,000 sq km of Argan forests a biosphere reserve in 1998.

Vulnerable in Morocco (FRA 2005).

Threats: Animal-grazing, over-collection of wood for fuel, over-collection of drupes, changing agricultural practices replacing argan groves. Against this, argan tree planting policies help halt creeping desertification of the area. However regression of argan woodland in Morocco exceeds 600 ha/y.

The Mohammed V Foundation for Research and Argan Tree Preservation revealed (in 2002) a cooperation agreement between Midi Pyrenees regions and the region of Marrakech-Tensift-El Haouz. This involved a sceme for reforesting 300 ha of argan forest, schemes for upgrading & marketing the oil produced by womens co-operatives, & the setting up of 500 solar ovens, which will save 50 to 100 ha/y of argan forest being used for firewood.

Notes: Two varieties of *A. spinosa* are known: *A. spinosa* var. *apiculata*, found around Essaouria and Agadir, and *A. spinosa* var. *mutica* found between Berkane and Moulouya.

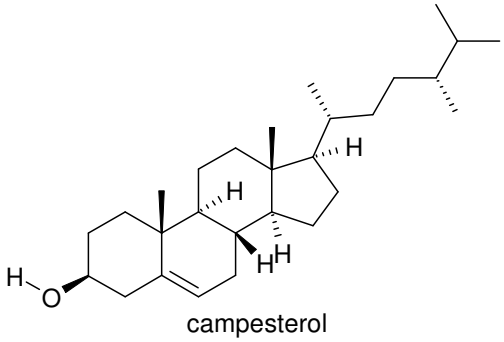
A perfumery absolute is available, made from the drupes.

The fixed oil from pressing the kerenels in the drupes (1,000 to 2,000 t/y from Essaouira region) is widely promoted by cosmetics companies, who emphasise its high anti-oxidant content, its high unsaturated fats content (via linoleic & oleic acidcontaining glycerides) and its high vitamin E content. Argan oil is also exported for cooking purposes, especially to Israel. Berber women have created and run argan oil cooperatives, many overseen by Moroccan scholars, & by experts from organisations in the European Community, by Canadian NGOs like OXFAM Québec, and the IDRC.

The Marrakech-based Kaeline company, with production facilities in France, is an example of an argan oil-based cosmetic company, now selling into the US via Xandra Renouvelle, who is quoted as as saying: "that by selling Kaeline's products in the US it is fighting female poverty and destitution in Morocco. Increasing the production of argan oil has led to the employment of over 1,000 women who would otherwise have few opportunities." (CD-Europe 2007). Cropwatch maintains however that any extra ecological pressure needs close monitoring – a third of Morocco's argan forest has disappeared in the last 100 years, and the tree density is down from 100 to a current 30 trees per hectare.

The pitfalls of commercialising argan oil in S.W. Morocco from slow-growing argan trees, and the relctance of local communities to replant (thereby increasing harvest value of products from existing argan trees) have been discussed – see Lybbert *et al.* (undated).

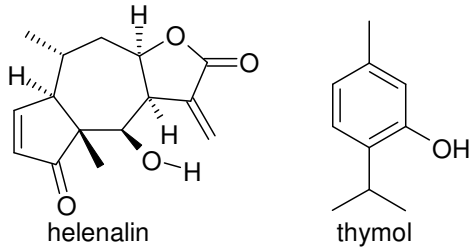
The adulteration of argan oil can be determined from the campesterol content which constitutes less than 0.4% of the total argan seed oil sterols (Hilali *et al* 2007).



campesterol

ARNICA syn. MOUNTAIN TOBACCO
Arnica montana L.
Distribution: 50,000 Kg of dried flowers are traded annually, generally being gathered non-sustainably from the Balkans & European countries, including

Romania, Spain, Denmark & Norway. Germany is the largest importer of the dried flowers.
Status: TRAFFIC (2005) reports the plant as being critically endangered in Belgium, Bosnia, Croatia and Luxembourg; endangered in Belarus and the Netherlands; Vulnerable in Estonia, Germany, Latvia, Lithuania, Portugal and Romania; and near threatened in Denmark and Norway (TRAFFIC Network, 2005).
Protected: Annex D of Council Regulations (EC) No. 338/97
Listed in Annex V(b) of the EU Habitats, Fauna and Flora Directive: (EUROPA 2003).
Notes: The dried flowers of *Arnica montana* are widely used in phytochemistry & in herbalism, especially as a tincture of the flower capitulums. The dried flower heads themselves contain helenalin-type sesquiterpene lactones and their tigloyl and methacryloyl esters (Douglas *et al.* 2004). The sesquiterpene lactone content is associated with anti-inflammatory & cytotoxic properties; the flavonoid content with anti-microbial & anti-rheumatic properties. The roots & rhizomes give a sesquiterpene lactone-free essential oil, mainly containing thymol (to 90%).



helenalin thymol

Helenalin = (3aR,5R,5aR,8aR,9S,9aS)-9-hydroxy-5,8a-dimethyl-1-methylidene-3a,4,5,5a,9,9a-hexahydroazuleno[7,6-d]furan-2,8-dione

The WWF DCP & USAMV initiated a 3 year project in 2005 'Conservation of Eastern European Medicinal Plants: *Arnica montana* in Romania' to develop a model for the sustainable use of medicinal plants from the wild (Kathe 2005).

Arnica chamissonis Less. subsp. *foliosa* is of comparable composition & therefore a good replacement for A*rnica montana* (see Cambornac *et. al*. 1998), a substitution which is official in European & German pharmacopoeia's. Cambornac (2000) expains Yves Rocher's role in initiating & developing this susbtition, and further conserving *Arnica montana* in the Black Forest, with the co-operation of the *Land* Baden-Württemberg. The author further refers to Weleda's role in obtaining sustainable supplies of *A. montana* plants by in vitro-propagation (Cassels *et al.* 1999; Ellenberger 1999). .

ARTEMISIA GRACILIS
Greater Wormwood
Artemisia gracilis L'Her ex. DC
Distribution: European Alps 2400-3500m.

Status: Rare
Notes: Essential oil is flavouring principle of the liqueur 'genipi,' together with, or instead of, the rare *Artemisia genipi* Weber, although the more common *Artemisia unbelliformis* Lam. may now be used. Other distilleries may use *Artemisia glacialis* L. and/or *Artemisia mutellina* Vill.

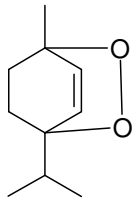
ARTEMISIA VULGARIS
Artemisia vulgaris L.
Common Mugwort
Distribution: Common in S. England, some parts of Europe & N. Africa, China.
Status Vulnerable in some E. European areas (Cropwatch 2004).

ASAFOETIDA
- *Ferula assa-foetida* L.

Asafoetida.
Distribution: Iran: in steppe vegetation at 1000m in Irano-Turanian region, & in steppes of Afghanistan.
Status: Endangered Iran (ref: Red Data Book of Iran: Jalili & Jamzad 1999 p669). Deterioration of habitat in Neiriz Firuz-Abad in Fars province from unsustainable exploitation (Seiiedin-Nejad 1991 through Nadjafi *et al*. 2006).
Notes: Asafoetida is the gum-resin obtained by incision of the living rhizomes and roots of the large perennial herb *F. assa-foetida*, and other *Ferula* spp. growing in Afghanistan, Turkey, West Iran, India and Kashmir. It is used in traditional medicine for its anti-spasmodic properties. It is mainly exported from Iran to India & Arab countries. Dilution of the essential oil reveals an odour profile which is allacious and sulphury in character, but which also possesses a savoury-sweetness, which is sweeter than garlic (it is employed as an ingredient of Worcester Sauce). The essential oil is composed of some 40% (-)-2-butyl-1-propenyl disulphide, but also diallyl disulphide, 2-butylmethyl di-, tri- and tetrasulphides, α - and β -pinene, cadinene and vanillin, amongst others (Burfield 2004). The oil finds some use in trace amounts in oriental perfumes & cosmetics.

BOLDO
Peumus boldus Molina
syn. *Boldu boldus* (Mol.) Lyons
syn. *Boldoa fragrans* Gay
syn. *Ruizia fragrans* Pavon
Distribution: Tree 2-4m. grows in central or coastal regions of Chile, also Bolivia & Peru. Introduced into N. Africa & Med.
Status: Threatened (Cropwatch 2007).
Chile: Supreme Decree No 366 (from 1944) prevents the cutting down or exploitation of certain spp. - specifically boldo can only be cut between Dec & March. Del Fierra & Rivera (2001) through Vogel (2004) stated: "a species in vulnerable conservation state, being in danger of extinction in some zones of its natural habitat".
Notes: 1383 tons of boldo leaves exported from Chile in 1996 (Tacon, 1997). Vogle (2004) reports of 1500 tons of boldo leaves & some boldo bark, 80% is

exported to Brazil & Argentina with 18% to Europe (France & Germany). Internalmarket in Chile is 30t/y (Vogel 2004).
An essential oil, containing up to 40% ascaridole, is distilled from the wild-gathered leaves Boldo leaf oil is one of the most toxic essential oils: acute oral LD_{50} 0.13g/Kg (rats), with 0.07g/Kg causing convulsions. The FDA has approved the use of boldo leaf extracts in beverages. The essential oil is not used in perfumery.

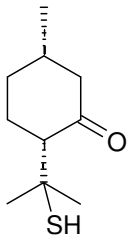


ascaridole

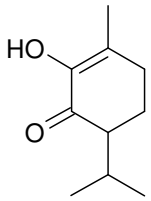
N.B. Boldo is a CNS stimulant, & serious risks are present with its internal use.

BUCHU OILS.
Agathosma betulina (Bergius) Bartl. & Wendl.
syn. *Barosma betulina* (Bergius) Pillands.
& *A. crenulata* (L.) Pillans.
[There is also Long Buchu from *A. serratifolia*, (syn Barosma *serratifolia* Willd.) the essential oil of which has been used in perfumes & flavours].
The essential oil of *A. betulina* – 'Round Buchu' - contains higher diosphenol content and is considered the more commercially valuable commodity. Careless introduction of higher-yielding *A. crenulata* plants into *A. betulina* growing areas in South Africa resulted in hybridization problems, which had to be overcome.
Distribution: SW Cape of S.Africa & KwaZulu-Natal. Pre 1995 all buchu was wild harvested, now annual production 600 tons/yr herb from 120 or so farmers (other sources quote buch leaf oil production at 500-1000Kg/y). Due to high demand through commercialization, the plant is protected in reserves in S. Africa, and permits are required for cultivation & harvesting, which is said to help prevent black market trading in the herb.
Status: Vulnerable: Cropwatch (2003).
A. betulina: Declining – Interim Red Data List of South Africa Oct 2007 – interim entry for 2007.
A. crenulata: Vulnerable - Interim Red Data List of South Africa Oct 2007 – interim entry for 2007.
Buchu is one of a number of threatened African plants targeted for development by A-SNAPP.
Notes: Essential oil from hydrodistillation of dried leaves, terminal branches, stems & flowers used in perfumery, blackcurrant flavourings etc. An absolute is also available. There is a history of medicinal use by indigenous peoples of SA. Leaves used to make Buchu tea, often cited as a factor its decline in the wild. Collins *et al.* (1996) noted that *A. betulina* oils were characterised by high levels of limonene (to 35% compared with 17% for *A. crenulata*: ed.), menthone, isomenthone, 4-diosphenol, diosphenol (to 12%: ed.), *cis*-8-mercapto-p-

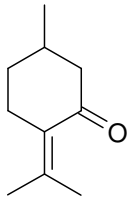
menthan-3-one (3-oxo-*p*-menthan-8-thiol & thiol acetate - TB), 4-hydroxydiosphenol and 1-hydroxydiosphenol which ascribed warm rounded minty-type characteristics, with the catty note down to 8-mercapto-para-menthan-3-one (however other sulphur compounds are also present). Pulegone & pulegone isomer content is higher in A. *crenulata* oil (to 45%) comparted with *A. betulina* oil (to 10%).



8-mercapto-p-menthan-3-one



diosphenol



pulegone

Demise: Poor gathering & increasing demand (Hoegler 2000), but also diminishing habitat & loss of genetic diversity. In a country where one in five people lives in abject poverty (DFID 2002), buchu crop poaching is a problem – see Ferreira (2007) & Yeld & Ellis (2002). The buchu industry has been described as "plagued by Mafia-like hierarchy and overt corruption" (Ashoton 2003). However a rosier picture is painted by Williams's report on socio-economic aspects of sustainable harvesting of buchu (Williams 2005), which include comments from the buchu section head at Grassroots in Gouda.

BURSERA GLABRIFOLIA

Holy Wood

Bursera glabrifolia (HBK) Engl.

Notes: Mexican linaloe oil (which is also distilled from other *Bursera* spp.)

Distribution: Mexico where essential oil from the chipped wood formerly produced in the states of Puebla and Colima. Now introduced into India.

Status: "Over-harvesting has pushed the species to the brink of local extinction several times" Peters *et al*. (2003)

Potentially threatened at national level due to over-exploitation & trading (of wood): Workshop of Specialists in Ethnobotany and Economic Botany (1997).

Notes: Essential oil, resin are commercial items. A quality decline after 1920 (whereby inferior linaloe seed oil etc was mixed in with the wood oil, amongst other things) favoured rosewood oil as a perfumery ingredient, which replaced the usage of linaloe oil.

CALAMUS OIL

Acorus calamus L.

Distribution: Widely distributed across N. Europe & India.

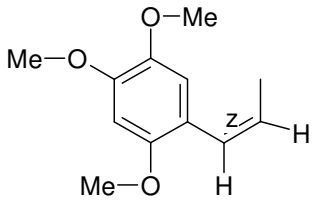
Status: Becoming rare in India: CIMAP (1997).

Endangered: Swat area of Pakistan. (Hamayan *et al*. 2007).

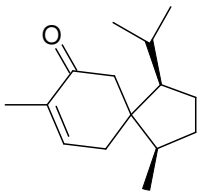
Karnataka: DD; Kerala: EN; Tamil Nadu: VU Threatened Medicinal Plants in S. India based on 4 CAMP workshops.

[*However*, Vod, Mappa & Shankar (undated) point out that the distribution of this (& other named) spp. over N. hemisphere, and its limited cultivation in niche-areas negate the necessity for banning the plant for export from India].

Notes: Essential oil produced from steam or hydrodistillation of the crushed rhizomes. Rhizomes also employed as a traditional incense ingredient. Several chemotypes have been recognized: β-asarone, methyl iso-eugenol and shoybunone for example. The rodent heptacarcinogen β-asarone is present in varying amounts according to chromosome number of the variety. As a rule of thumb the diploid form has little or no β-asarone content, whereas triploid and tetraploid have considerable amounts. Acorenone has been found in the triploid variety at least.



beta-asarone



acorenone

According to the Articles of the European Council's Directive on food flavourings 88/388/EEC, amemded by 91/71/EEC and implemented into UK national law in the Flavourings in Food Regulations 1992 the maximum permitted level of beta-asarone in foodstuffs is 0.1mg/Kg, with a limit of 1mg/Kg for alcoholic drinks & seasonings in snack foods.

Canarium luzonicum – see elemi.

CANDEIA PLANT, BRAZIL

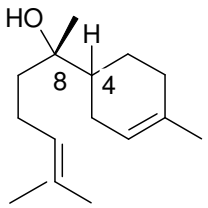
Eremanthus erythropappus (DC) MacLeish

syn. *Vanillosmopsis erythropappa* Schultz-Bip.

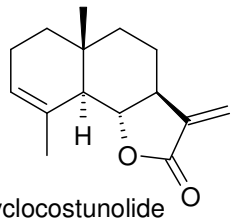
Distrribution: In the Atlantic Brazilian rainforest, mainly south of Minas Gerias State

Status: Becoming rare: after ruthless over-exploitation of *E. erythropappus* as a source of (-)-alpha-bisabolol (0.1%; rarely to 0.5%) by the German pharmaceutical industry (Lopes *et al.* 1991).

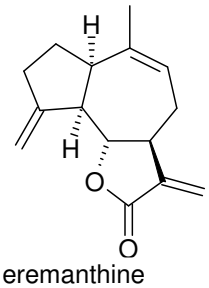
Notes. The German aroma-giant Symrise which uses (-)-alpha-bisabolol in its cosmetics formulations, is working with other Brazilian partnership firns & the Universidade Federal de Lavras to optimize growing conditions for the plant (Prance 2007). This, considering the situation which lead to the demise of the species, is "closing the door after the horse has bolted." Baker *et al*. (1972) had previously described the wood of *E. erythropappus* as containing the compounds costunolide, cyclocostunolide & eremanthine, although other sesquiterpenoids have since been discovered in the oil.



(-)-alpha-bisabolol [4S,8S]



cyclocostunolide



eremanthine

For more detailed information on Candeia exploitation - see Cropwatch feature at: http://www.cropwatch.org/newslet8.pdf

- *Vanillosmopsis arborea* (Aguiar) Ducke
Distrinbution: Caatinga region, Brazil
Also termed the Candeia Plant, but not used commercially for the isolation of alpha-bisabolol.
Status: Indicated as of high priority for germaplasm collection & conservation in Brazil (Vieira 1999).
Notes: An alternative source of alpha-epi-bisabolol is from the South African plant *Salvia stenophylla.*

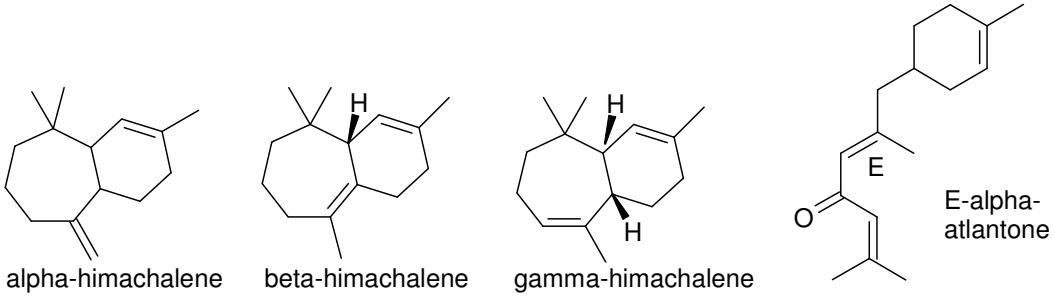
CANARIUM ZEYLANICUM
Canarium zeylanicum (Retz.) Blume
Kekuna
Distribution: Sri Lanka
Status: VU A1c WCMC (1998) In: 2007 IUCM Red List of Threatened Species.
Notes: Oleoresin used as incense.

CEDARWOOD ATLAS
Cedrus atlantica (Endl.) Manetti ex Carr
Distribution: At 1400-2500m. in the Moroccan Middle Atlas, Rif Central and Grand Atlas Oriental and Middle Atlas Oriental mountains (Mardaga 1999).
Status: LR/lc Conifer Specialist Group (1998). *Cedrus atlantica* In 2007 IUCN Red List of Threatened Species.
Reported as vulnerable in Morocco (FRA 2005).
Endangered: FAO Panel of Experts 5th Report on Forest Gene Resources 7th Appendix.
Conifer forests of N. Morocco (largely consisting of *C. atlantica*) which cover some 133,653 ha have been classified by WWF as Critical/ Endangered.
While cedarwood Atlas trees are well conserved in specific protected areas, the ecosystem is very fragile, and often the margins are subject to degradation by erosion, demineralization, dehydration, and desertification, occasionally resulting in areas of complete desolation, in spite of heroic attempts by the Moroccan authorities to maintain them (Cropwatch 2004).
Notes: Essential oil produced by steam distillation of the waste wood, or sawdust of the tree. An absolute is also commercially available. Production of essential oil 70 t/y in 1985 (Lawrence 1985), now approx 1 t/y.

One identified cosmetics company (at least) claims that the cedarwood oil Atlas oil used in its fragrance "is from cedar trees subject to selective cutting", being "part of a sustainable development approach approved by the (Moroccan) Water and Forestry Service".
Cedarmoss gathering to make as perfumery absolute from branches of mature *C. atlantica* trees also causes further damage. Feral grazing is another contributory status threat, with underestimated consequences. In spite of serious concern about fragility of conifer forest (for full details see http://www.cropwatch.org/cedarwood.htm), EcoCert & Soil Association continue certify cedarwood Atlas essential oil.

Some small & micro-scale production of essential oil from *C. atlantica* f. *glauca* in mid- and S. France from either chipped wood, bark or leaves (needles), according to producing site. Both winter bark-stripping and leaf distillation are claimed 'not to threaten trees' but no authoritative and impartial impact assessment exists to verify this (Cropwatch 2005).

The essential oil of *C. atlantica* contains up to 70% α-, β- & γ-himalchenes as well as α- and γ-atlantone isomers, especially (*E*)-(+)-a-atlantone to15%, the latter being sweet smelling woody odourants which especially contribute towards the odour of the oil).



alpha-himachalene beta-himachalene gamma-himachalene E-alpha-atlantone

For balance we note that Aberchane *et al* (2004) estimatete Moroccan cedar plantations yield 100,000 m^3 wood per annum, and that cedar waste runs to 30% - potentially giving 18,000 y/t sawdust from which essential oil could be produced.

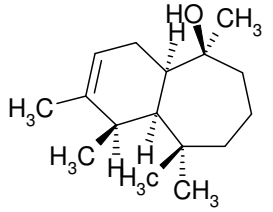
CEDRELA ODORATA
Cedrela odorata L.
Cigar-box wood.
Distribution: Antigua & Barbuda, Argentina, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, Cayman Islands, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Netherlands Antilles (Curaçao), Nicaragua, Panama, Paraguay, Peru, Puerto Rico, St Kitts & Nevis, St Lucia, Suriname, Trinidad & Tobago, Venezuela. (UNEP-WCMC). Also Uganda (Cropwatch 2008).

Status Scarce; wood export illegal; plantations failed from insect attack Maia *et al*. (2000). However, species subject to uncontrolled salvage logging in Columbia (SFM Tropics 2005).
VU A1cd+2cd. Americas Regional Workshop (1998) (Conservation & Sustainable Management of Trees, Costa Rica). *Cedrela odorata* In: 2007 IUCN Red List of Threatened Species
Threatened in Panama; Vunerable in Nicaragua & in Peru (FRA 2005).
Rare & Endangered Mexico: F. Patiño V. - through FAO Panel of Experts 5th Report on Forest Gene Resources, Appendices.
Listed in Appendix III CITES (2004) (request of Peruvian & Columbia populations). Applies to logs, sawn wood & veneer sheets. Attempts to list under Appendix II falied at CITES CoP 14 (see below).
EC Reg 1332/2005 (amending 338/97) applies to logs, sawn wood & veneer sheets
Plantations fail from insect attack: Maia B. *et al.* (2000).

CITES (2007):.The Conference of the Parties (The Hague 2007) under 14.146 adopted the Action Plan attached as Annex 4 to these Decisions of the Conference of the Parties 14th CITES Meeting: Decisions, to complete knowledge on the status of conservation of, trade in and sustainable use of *Cedrela odorata* (Action Plan Appendix IV) to be proposed at the 15th CITES meeting of the Conference of the Parties.
Notes: see also http://www2.wcmc.org.uk/trees/trade/ced_odo.htm

CEDAR, CYPRESS
Cedrus brevifolia (Hook. F.) Henry
Status: VU D2 1998 Conifer Specialist Group (1998) *Cedrus brevifolia*. In 2007 IUCN Red List of Threatened Species.

CEDARWOOD HIMALAYAN
Cedrus deodara (D. Don) G. Don. f.
Distribution: At 1650 2400m in Western Himalaya slopes from E. Afghanistan to N. India & Pakistan.
Status: LR/lc Conifer Specialist Group (1998) *Cedrus deodara*. 2007 IUCN Red List of Threatened Species.
Threatened (Farjon *et al.* 1993).
Notes, Crude & rectified essential oils from sawdust & wood shavings, as well as a needle oil & an absolute are commercially obtainable, but production down in recent years from 20t/y to 1 t/y. Destructive distillation of the wood gives a product used in local vetinary medicine. Popular aromatherapy oil, little used in perfumery. Heartwood contains centarol, which has spasmolytic activity.



Centarol

CEDARWOOD KENYAN.
syn. East African Pencil Cedar.
Juniperus procera Hochst. ex Endl.
Habitat: Mountains of Central Kenya, Ethiopia at 1000 to 3000m.
According to UNEP-WCMC: Democratic Republic of the Congo, Djibouti, Ethiopia, Kenya, Malawi, Saudi Arabia, Somalia, Sudan, Uganda, United Republic of Tanzania , Yemen , Zimbabwe.
Status: Endangered: FAO Forestry Dept. (1986).
LR/nt WCMC (1997) *Juniperus procera.* In 2002 IUCN Red List of Threatened Species 2002; WCMC
Endangered in Saudi Arabia (FRA 2005)
Malawi: Endangered ENB1B2cD2 Evidence of poor regeneration from fire exclusion. Malawi: ENA1abcdB1B2abcde. Restricted to Mount Mulanje. Habitat threatened by pitsaw activities: Southern African Plant Red Data Lists 2002.
Endangered: FAO Panel of Experts 5th Report on Forest Gene Resources 7th Appendix.
Notes: The essential oil, once a commonly traded fragrance ingredient, now unobtainable, although small packets traded internally on the African market at least until the late 1990's.
Ciesla W.A. (2002) discusses the FAO listing & the die-back of the species, & mentions aphis & beetle infestations in N. central Kenya, as well as cattle over-grazing in Juniper forests as possible factors. The true reason for die-back remains uncertain however. The tree has been introduced into parts of India (the Nilgiris), and waste wood from trees cut down for furniture making may be distilled on a very limited scale to produce oil for local use.

CEDRUS SPP.
See Cedarwood

CHAULMOOGRA
- *Hydnocarpus pentadra* (Buch.-Ham.) Oken
  & other *Hydnocarpus* spp. such as *Hydnocarpus kurzii* (King) Warb.

Distributn (*H. pentandra*): Western Ghats & Karnataka.
Status: Vulnerable (*H. pentadra*) First Red Data List for S. India. (through Majundra 1997).
Facing genetic erosion (*H. pentandra*) CIMAP (1997) & in general *Hydnocarpus* spp. facing decline through habitat erosion.
Lack of adequate regeneration, habitat loss, regeneration loss (Mathachen 2004)
Notes: Fixed oil of chaulmoogra is produced in Burma, Sri Lanka Bangladesh, Nigeria & Uganda, & is/was used medicinally as an initial cure for leprosy before the advent of pharmacological drugs (Parascandola 2003). However, Oomen *et al.* (1999) report that chaulmoogra oil also possesses a positive wound-healing effect, not found with other anti-leprotic drugs.

- *Hydnocarpus kurzii* (King) Warb.

Distribution: India & Myanmar.

Status: DD CAMP Workshops on Medicinal Plants, India 1998. *Hydnocarpus kurzii*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*
Chakravarti (2002): Has to be considered endangered in India, only left in 20 locations.
Notes: Tree population thought to have declined 50% in last 10 years (source IUCN 2007). There is no cultivation as such, only wild-gathering. The oil is used locally with some export to China & Argentina

- *Hydnocarpus macrocarpa* Warb
  & *H. macrocarpus macrocarpa* ssp. *macrocarpa* Warb.

Distribution: S. India
Status: Vulnerable: *First Red Data List of Threatened South Indian Medicinal Plants* pub Foundation for Revitalization of Local Health Traditions Research Department (through Shankar and Majundar 1997).
Endangered: Walter & Gillet (1998)

- *Hydnocarpus nana*

Distribution: Malaysia
Status: LR/nt. Chua, L.S.L. (1998). *Hydnocarpus nana*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*
Threats: Habitat loss/degradation from clear-cutting.
.

CINNAMOMUM SPP.

Certain essential oil-bearing spp. of *Cinnamomum* genus.
Distribution: China; India
Status: Vulnerable: Some Chinese essential oil-bearing spp: Zhu *et al.* (1994)
Notes: 24 *Cinnamomum* spp. currently red listed by IUCN.

- *Cinnamomum camphora* L. var. *linaloolifera*
  & *Cinnamomum camphora* Sieb var. *glavescens* Hayata

Ho wood.
Status: Trees blocked from cutting/harvesting by Chinese authorities (2007).
Notes: Ho wood oil is blend of essential oils produced by the steam distillation of *Cinnamomum camphora* L. var. *linaloolifera* and *Cinnamomum camphora* Sieb var. *glavescens* Hayata (Fam. Lauraceae). Rectification of this oil produces a product often marketed as Ho Wood Oil, used as a source of natural *laevo*-linalool. Lawrence (1995) puts the production of ho oil from China in 1995 at 800t/y. Acetylated ho oil is produced from ho wood oil by esterification with acetic anhydride, and is used to construct synthetic essential oils, extend lavender oil, or used as an aroma ingredient in its own right (as natural linalyl acetate).

- *Cinnamomum cecidodaphne* Meissn.

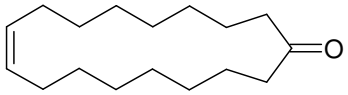
syn. *Cinnamomum glaucescens* Nees
Suganda kokila
Distribution: Mid-western Nepal
Status: The plant has threatened status within Nepal, and products can only be exported after processing within the country.

- *Cinnamomum parthenoxylon* (Jack) Meisn.
Source of Sassafras oil Vietnam ?
Distribution: Rain forests of N. Vietnam, in Quang-tri in central Vietnam, possibly into Sumatra. Also in Yunnan, China.
Status: DD Asian Regional Workshop (1998). *Cinnamomum parthenoxylon* In: 2007 IUCN Red List of Threatened Species.
CR A1cd: Vietnam.
Trees prevented from being harvested for safrole production in China by Chinese authorities (2007).
Notes: becoming Critically Endangered in Vietnam (Cropwatch 2007) where it is harvested for essential oil (>95% safrole) is produced. Safrole is now mainly used to manufacture piperonyl butoxide.

- *Cinnamomum tamala*: (Buch. Ham.) Nees & Eberm.
Tejpat oil
Distribution: in N. India: Sikkim, Assam, Meghalaya, Himal Pradesh, Uttar Pradesh etc. as well as Nepal & Bhutan.
Status "Nearly threatened": CIMAP (1997) by habitat destruction & over-exploitation. Market demand for *C. tamala* 16 t/y in India (Tiwari *et al*. 2004).
Notes: Leaves widely employed as spice in N. India; essential oil from steam distillation of leaves is an article of commerce.

CIVET
Civet paste is obtained from scraping or squeezing the anal glands of:
Civetticus civetta - African civet cat
syn *Viverra civetta*
Viverra zibetha - Indian civet (from India, Indonesia and Malaysia)
Viverricula indica - the Lesser Indian civet (syn. Chinese civet) (from East and South China) and other civet species.
Status: Listed in Appendix III (CITES 2003). .
Notes: The African civet, once widespread throughout Africa is now confined to N. Ethiopia. Civet farms operate in China, Ethiopia, Kenya, Congo, Guinea, Senegal and India. Animals are keep in small cages, civet paste being collected every 9-15 days (or every 2-3 days in the case of the Indian civet) by seizing the animal by the rear & squeezing the exposed perineal gland, or by scraping with spoons, invariably causing the animal acute distress. Civet was formerly stored in hollow zebra horns, but is now shipped in aluminium containers. Production of 12 Kg/y civet paste was reported by Yingkang (1991) from Hangzou Zoological Gdns China, which equates to 32 to 35g per annum per animal.
Civet as used in perfumery is normally obtained by alcoholic extraction of civet paste, followed by chilling & filtration, & removal of alcohol under vacuum (to give civet absolute). Civet resinoid is also used obtained by solvent extraction – acetone is often employed as the extracting solvent. However, civet has traditionally been accessed as an alcoholic tincture (*e.g.* at 3% to 6% in 95% alcohol). In former times civet preparations found wide a usage in fine fragrance,

imparting an unsurpassable radiance and sensuality to extraits, particularly heavy chypres and orientals and sultry florals (Burfield 2000).
Chinese civet appears to contain civetone, cyclopentadecanone and cyclohexadecanone as principle components.

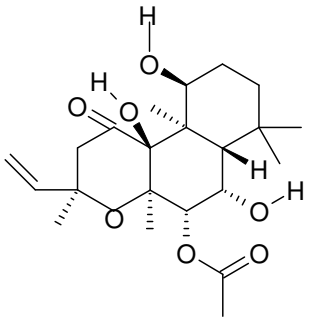


civetone

The odour profile of civet from other sources includes a skatolic (animalic, fecal) aspect as it contains small amounts of methyl indole or skatole, and also indole itself together with 1,3-dimethyl indole. As with Chinese civet, it also contains several musk-like lactones such as cyclohexadecanone and cycloheptadecanone, and (*Z*)-9-cycloheptadecen-1one (civetone), as well as various fatty acids which contribute to the odour profile.

Civet coffee is produced with the help of *Paradoxurus hermaphroditus* (Asian Palm Civet or Common Palm Civet) – which is classified on IUCN Red List Data-Base as LR/lc, although *Paradoxurus hermaphroditus* ssp. *lignicolor* is classified as Vulnerable [ref: Mustelid Specialist Group 1996. *Paradoxurus hermaphroditus*. In: IUCN 2007. 2007 IUCN Red List of Threatened Species]. The civet cats prowl the coffe plantations in Java & Bali, and consume coffee beans which are excreted undigested, which are collected then washed, cleaned, roasted & ground to produce Kopi Luwak or Coffee Luwak. This process is said to produce a superior, less bitter-tasting coffee. ***Cropwatch (possibly unwisely) comments***: brings a new meaning to the phrase "frappacrappachino"! Civet coffee is also produced in Vietnam & the Philipines see http://news.bbc.co.uk/1/hi/world/asia-pacific/4896230.stm), with planned expansion to Taiwan & North America. However it is doubtful if world production currently exceeds 0.5 t/y.

COLEUS FORSKOHLII
Coleus forskohlii (Willd) Briq.
syn. *Pectranthus forskohlii* Willd.
syn. *Coleus barbatus* (Andr.) Benth.
Distribution: Aromatic perennial to 0.6m. distributed across plains & some hill districts of India where is is native, & in Bepal, Burma, Thailand. Introduced into Brazil as a minor medicinal crop; now exists in several different chemotypes.
Status: Status: Endangered in India: banned for extraction, but not for cultivation. Minor cultivation in Tamil Nadu, Gujurat & Karnataka.
Notes: Contains the labdane diterpene forskolin. Plant derivatives are the subject of several international patents by Sabinsa Corp. (see Cropwatch Newsletters). *C. forskhohli* isolates Inhibit melanin formation hence use in cosmetic formulations as skin whitener. Activates adenyl cylclase rection & lowers blood pressure.



forskolin

COMMIPHORA SPP.

Status: *Commiphora* spp are listed as vulnerable in Oman (FRA 2005).

- *Commiphora guidotti* Chiov. ex Guidottii

Opopanax/scented myrrh.

Distribution: Ethiopia, S. Somalia.

Status: LR/nt ver. 2.3 (1994) Thulin, M. 1998. *Commiphora guidottii*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*

Notes. A source of opoponax together with *Commiphora erythraea* (Ehrenb.) - Engl. syn. *Commiphora erythraea* Engl. var. *glabrescrens* Engl., and from *C. kataf* (Forsk.) Engl. & *C. holtziana.* The resin exudes naturally from the bark of the tree, which is collected in higher yield by making incisions in the bark of the tree. It is a yellow oil, with a very powerful odour that is sweet, oily, and balsamic with almost terpenic top-note. The components are mainly sesquiterpenoids; characterising components have been said to be bisabolenes, especially Z-α-bisabolene, (E)-α-bergamotene and α-santalene. Baser *et al* (2003) analysed the oils of several *Boswellia* & *Commiphora* spp. including *C. guidottii* finding the major components of the latter oil to be *E*-β-ocimene (33.0%), α-santalene 15.8% and *cis*-α-bisabolene 22.2%.

Uses: Opoponax (*C. guidottii*) is used in Somali traditional medicine for the treatment of diarrhea: Claeson, P. (1990. It is also used for its wound-healing properties.

- *Commiphora parvifolia* Engl.

Distribution: Native to Soqotra; Eritrea.

Status: NT Miller, A. (2004) *Commiphora parvifolia*. In: 2007 IUCN Red List of Threatened Species.

Potentially immensely threatened by livestock grazing (Bein 1998, Ogbazghi 2001) & drought (Ogbazghi 2001).

- *Commiphora pseudopaolii* J.B. Gillet

syn *C. paollii* Chiov.

Distribution: N.E. Kenya

Status: LR/nt Thulin, M. (1998) *Commiphora pseudopaolii*. In: 2007 IUCN Red List of Threatened Species.

Rare: Walter & Guillet (1997).

Notes: Source of opoponax. Used as tick repellent in USA (Gachathi 1997).

- *Commiphora wrightii* (Arn.) Bhandari

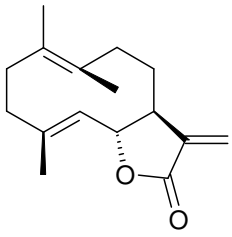
syn. *C. mukul* (Hook ex Stocks) syn. *Balsmododendron mukul*
'Guggul'
Indian bdellum.
Distribution: Native to India (esp. Gujrat, Rajasthan, Berur & Mysore states) & Pakistan (Sindh & Baluchistan states).
Status: Endangered; export of the species is banned from India.
DD ver 2.3 (1994) CAMP Workshops on Medicinal Plants, India 1998. *Commiphora wightii*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*
VU/R: First Red Data List S. Indian medicinal plants (Based on CAMP report IUCN ver 2.2).
Vulnerable: Walter & Gillet 1998.
Threats: Once common in Rajasthan & Gurjurat. According to Bhatt *et al*: 1989: endangered from slow growing nature, poor seed setting, lack of cultivation, poor seed germination rate and excessive and unscientific tapping for its gum resin by the pharmaceutical industries (- guggul collectors Ed.) and religious purposes.
Notes. Is the gum-oleoresin obtained from the bark ducts of 3m. woody tree known as the Indian Bdellum tree, widely used in India for its pharmacological properties (up to 500 tons per annum was once produced). Used as incense; fumes are inhaled for the treatment of fever, bronchitis etc. Oleo-resin is obtained by tapping the bark making 1.2 cm circular incisions, up to 30cm apart, and collecting the resin between November and March. Oleo-resin ducts also occur in the leaves. The oleo-resin is pale-yellow to brown or dull-green in colour & does not contain benzoic or cinnamic acids or esters, but rather is composed of diterpenes, sterols and aliphatic esters, *E*- and *Z*-guggusterone constitute 2% of the steroids and are believed to have a lipid-lowering activity. Resin is obtained by solvent extraction of the gum oleoresin. Gum from *C. stockesiana* is sometimes sold as Guggul and is said to be superior in properties. Guggul is often adulterated with other resinoids e.g. *Commiphora myrrha, Boswellia serrata* etc. Apart from minor use in incense, Guggul is not specifically much used as an aromatic raw material. There is an Indian government ban on the export of the tree, due to declining numbers.
Uses: Used to control arthritis, obesity & peptic ulcers in Ayervedic medicine and considered one of most important imported herbs in West, where it is used to control high cholesterol. Extracts have shown to possess hypocholesteremic, hypolipidimic (Kapor *et al*. 1979), anti-inflammatory, anti-rheumatic & anti-fertility properties It has been alleged that there are eleven patents granted in US & European Patent Office claiming similar uses to traditional Indian medicine (UNCTAD-Govt India-DFID draft document 2005).

COPAIBA SPP..
Copaiba balsam is obtained by tapping a small hole about 1 m. from the gound to release the balsam which accumulates in reservoirs the core of the tree, from several *Copaiba* spp. esp. *C. reticulate* Ducke*, C. guianensis* Desf., *C. multijuga*

Hayne & *C. officinalis* Jacq. Is the main source of balsam in Colombia, Venezula & the Guianas. *C. langsdorffii* Desf. is the cerrado balsam source. High vacuum distillation of the balsam affords copaiba oil. Worryingly, *Copaiba* spp. are now known as 'S. American diesel tree' by bio-fuel enthusiasts.
Distribution: Amazonian forests.
Status: Diminishing accessibility in Capim region due to logging: Shanley & Rosa (2004)
Situation needs watching: Cropwatch (2004).
Copaifera paupera - vulnerable in Peru (FRA 2005).
Notes 'Extraction (of Copaiba balsam) low' - 414 tons from Brazilian forests in 2001 - see http://www.bioversityinternational.org/publications/pdf/1046.pdf
Plowden (2003) studied production ecology from 3 copaiba types in the E. Brazilian Amazon. Some evidence that local S. American communities have stopped cutting down copaiba trees, but indiscriminate logging gangs and 'get-rich quick' individuals counter this initiative. Gramosa & Silveira (2004) summarise previous work on copaiba analysis & report on hydrodistilled oils from various parts of the tree. Of note is the confirmation of the complete autoxidation of beta-caryophyllene to caryophyllene oxide, previously reported by Gramosa (1994).
Copaiba oil is used for medicinal purposes (carminative, antiseptic, expectorant, diuretic & anti-microbial (Veiga Jnr. & Pinto 2002), and as a fixative in perfumery.

COSTUS
Saussurea lappa C.B. Clarke
syn. *Saussurea costus* (Falc.) Lipschitz.
Distribution: India: Himachal Pradesh (Chamba), Jammu & Kashmir; W. Himalayas, Sikkim) and now grows in SW China. Cultivated in Uttar Pradesh, Kashmir & Lahul.
Status: Threatened in Pakistan (FAO 2003' through FRA 2005).
Protected CITES (2003) Appendix I
Endangered in Jammu & Kashmir: India: Red Data Book Plants of India (Nayar & Sastry 1987-88).
Critically endangered in Jammu & Kasmir (incl. Ladakh). *CAMP Workshop for high altitude medicinal plants of Jammu-Kashmir and Himachal Pradesh meeting in Kullu* (Ved & Tandon 1998 'through Pordie 2000)
Listed in the Negative List of Exports of the Ministry of Commerce, Government of India.
Listed in the 'Schedule VI' of the Wildlife Protection Act of India (1995)
Notes: The essential oil is obtained from the water or steam distillation of the warm water-macerated dried roots (which themselves can extend to 0.6m) from this large erect perennial herb ("Kuth") which grows up to 2.5 m The expensive essential oil, the concrete (confusingly = costus resinoid), absolute, resin (= still residues) & anhydrol (= molecular distillate of extract) are all commercial items, although the oil has been banned IFRA since 1974 on skin sensitivity grounds due to the sesquiterpene lactone content.. This hasn't stopped production of up to 12 t/y of the oil in recent times. Costus qualities were considerably used in

high-class perfumery in small quantities (until banned IFRA1974, amended 1982) to impart animalic and sebaceous notes, and some would say, coupled with orris-like effects. Safer (sesquiterpene lactone free) products are commercially available these days, but this development seems to have escaped IFRA's attention.



costunolide

The essential oil is frequently offered by aromatherapy oil traders, in spite of its threatened status. Some cultivation of costus occurs in Jammu, Kashmir & Garhwal and roots are collected by the State Trading Corporation. It is also grown as a regular crop in Lahul, as collected by the Lahul Kuth Growers Society and supplied to the State rading Corporation (Gulati 1982). Export of roots from Himal Pradesh is allowed if the roots are accompanied by a certificate sugned by the State's Chief Wildlife Warden (Guha & Pramanik 2005).

DRAGONS BLOOD

Note: The term 'Dragons Blood' refers to a product obtained from the resin layer consisting of diterpene acids found on the surface of fruits of the climbing palms of the *Daemonorops* genus found in SE Asia, and often sold out of Sumatra, Malaya & Borneo. These reddish resinous products (usually encountered as granules, powder, lumps ("cakes"), or sticks ("reed") used in folk medicine as an astringent and for wound healing etc., and in other applications for colouring essential oils red to dark brown, in varnishes, staining marble, for jewelry and enameling work, and for photo-engraving. Mabberley (1998) suggests Dragons Blood was produced originally from *Dracaena cinnabari*, later from *D. draco* and more recently from *Daemonorops* spp.; Zheng *et al.* (2004) confirm this view and suggests substitutes for *Dracaena* spp. include *Pterocarpus* spp., *Daemonorops draco* and *Croton* spp. - for further details see http://www.cropwatch.org/dragonsblood.htm

Dracaena cinnabari Balf. F.

Distribution: Fragmented distribution (forms characteristic woodlands) on the island of Socotra, Yemen mainly in the Haggenhar mountains at 500 to 1500m.

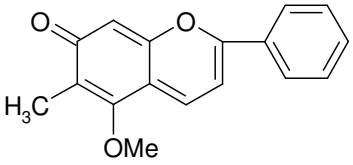
Status: VU B2ab(ii) Miller A. (2004). *Dracaena cinnabari* In: 2007 IUCN Red List of Threatened Species.

Threats: Under threat from over-exploitation and possibly the drying out of archipeligo (?).

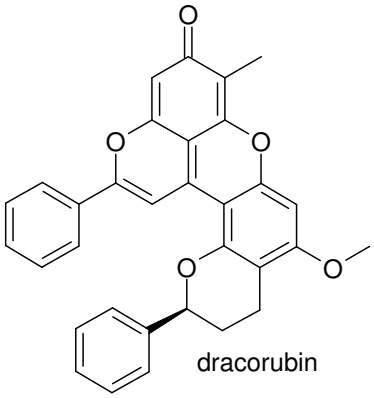
Notes: Cinnabar, the dried red resin of the tree, was used as a varnish or paint pigment, for staining marble & glass & for treating burns & dysentry.

Dracaena draco Blume

Distribution: Present in 5 of 7 Canary Islands (especially La Gomera), but only a few hundred trees remain (see http://www.globaltrees.org/reso_tree.asp?id=32).
Status: VU A1abcde Banares A. *et al*. (1998) *Dracaena draco* In 2007 IUCN Red List of Threatened Species.
Listed as Endangered in Red Data Book of Cape Verde where it is extinct on Brava & Santiago & critically endangered on S. Vicente. Some *D. draco* trees also found on Ilha das Flores in the Azores, and in Western Morocco (*D. draco* subsp. *ajgal*) & Madeira.
Notes. Hsu (1986) gives the composition of *D. draco* as consisting of red pigments: dracorubin and dacorhodin; of resins: including dracoalban and dracoresene and red pigments: including dracoresinotannol. Some of this information appears exactly identical to that published by Dietrich (1920). Trease and Evans (1978) note the diterpene acids as consisting of pimaric, isopimaric, dehydroabietic acids possibly quoting from Piozzi et al.'s original findings (Piozzi *et al.* 1974).



dracorhodin



dracorubin

DROMAIUS NOVAEHOLLANDIAE (- Not threatened, but numbers declining in wild)
Emu
Notes: Emu oil, used in cosmetics, is produced from the fat of rendered Australian emu's *Dromaius novaehollandiae*.
Status: The Emu's habitat is declining due to land encroachment by farmers. Eggs are stolen, illustrated & sold as souvenirs. Wild Emus are formally protected in Australia under the Environment Protection and Biodiversity Conservation Act 1999.
The emu is endangered in the NSW Coast Bioregion & Port Stephems LGA. Evaluated as LC on the IUCN Red List ref: Bird Life International 2004. *Dromaius novaehollandiae*. In: *IUCN 2007. 2007 IUCN Red List of Threatened Species ref. NSW Scientific Committee (2002).*
Ref: Emu population in the NSW North Coast Bioregion and Port Stephens LGA - Endangered population determination - final. DEC (NSW), Sydney.
Notes. For emu farming in Australia – see Introduction above: *Animal Products*.

ELEMI
Canarium luzonicum (Blume) A. Gray

syn. *Canarium commune* L.
Distribution: Philippines and Moluccas, but also as far as Papua New Guinea & some Pacific islands. Elemi trees are planted as windbreaks around nutmeg plantations in Indonesia.
Status: Habitat loss, poor regeneration prospects: Cropwatch (2004)
VU A1cd WCMC (1998) *Canarium luzonicum* In IUCN Red List of Threatened Species 2007.
Notes: Elemi essential oil is steam distilled from the pathological resinous gum exudate ("Manila elemi") from a dioecious evergreen tree that can grow to 30m. Elemi oil is used in small amounts to freshen the top notes of Eau de Colognes and in lemon blends for soaps and detergents, buts its expense limits its further application A resinoid is produced by solvent extraction of the gum (used in medicinal plaster & ointments); and a CO_2 extract is also produced as a perfumery ingredient. 221 t. of elemi gum were exported from Philippines in 1998; 75% going to France. Cropwatch estimated elemi gum production at 350t/y in 2003.

ENKLEIA
A genus of 3 species; those producing gaharu include:

- *Enkleia malaccensis*

Distribution: Adamantan/Nicobar Islands, Borneo (Ganung Palung).
Status: - no information.

FIR, BALSAM, syn FIR CANADIAN.
Abies balsamea (L.) Mill.
Status: LR/lc Conifer Specialist Group (1998). *Abies balsamea* In IUCN Red List of Threatened Species 2007
Notes: A steam distilled essential oil from the twigs & needles, and the balsam absolute are commercial items. The Canada balsam industry was centered around Quebec, and pooled balsam from draining resin blisters was adjusted for refractive index, for use in mounting biological specimens for microscopy, as it dries to a translucent fixative. Its other major use is as a varnish, and for medicinal products.

FIR, NORDMAN
Abies nordmanniana (Steven) Spach – **Crimean Fir**
& *Abies nordmanniana* subsp. *nordmanniana* – **Black Sea Fir.**
Status: LR/lc Conifer Specialist Group (1998). *Abies nordmanniana* In 2007 IUCN Red List of Threatened Species.
Notes: Needle & twig oils produced from both types.

FIR, SILVER
Abies alba (L.) Mill.
syn. *Abies pectinata* (Lam.) DC
Status: LR/lc. Conifer Specialist Group (1998). *Abies alba* In IUCN Red List of Threatened Species 2007

Critically endangered in Belarus (FRA 2005)

Notes: A steam distilled oil from the cones or the needles & twigs are commercial items. The oil has been used in fresh piney and pine-herbal fragrances for foam-baths and shower products, and has been used in medicinal applications such as in products for inhalation. It also finds application in men's fragrances for its' fine fresh piney-balsamic notes. The oil is frequently adulterated.

GALBANUM

- *Ferula gummosa* Boiss.

syn *Ferrula galbaniflua* Boisser & Buhse

syn. *Ferula erubescens* Boiss.

Barijeh (name refers to gum & dried latex)

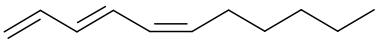
Distribution. Pakistan, Turkmenistan. N/N.E. Iran (Markazi, Isfahan, Zanjan, Tehran, Semnan, Khorasan, Golestan, & Mazandaran provinces) & N.W. India.

Status LC in Iran-Turanian region of Iran (ref: Red Data Book of Iran Jalili & Jamzad 1999 p669).

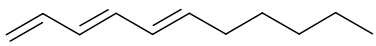
Locally extinct from unsustainable over-exploitation in Abade and Eqlid in Fars province (Seiiedin-Nejad S.H 1991 through Nadjafi *et al*. 2006).

Notes: Local use as expectorant & anti-spasmodic in Iran. Exported to Europe (mainly France & Germany) – Shad reports over 109,408 t gum exported in 1992 (Shad 1995 through through Nadjafi *et al*. 2006). Galbanum oil is used in perfumery for its green top notes & obtained by steam distillation of the air-dried extruded gum oleoresin exudate from cuts made above the root of the plants *Ferula galbaniflua* growing in N. Iran & N.W. India, and *F. rubricaulis* Boiss growing in S. Iran, and other *Ferula* spp. growing in Iran & Afghanistan (for example from *F. badrakema* K. Pol and from *F. kokanica* Reg. et Schmalh) with some production also from Turkistan (from *F. ceratophylla* Reg. et Schmalh).

The gum is steam distilled to produce an essential oil, or solvent extracted to produce an absolute, a resinoid or a CO_2 extract. Although the major component of steam-distilled galbanum essential oil is β-pinene (to 60%), the main odour character components of the oil are considered to be the isomers of 1,3,5 undecatriene, the all-*trans* isomer (1,3,5-*tr*) in particular possesses the intense green odour of Galbanum.

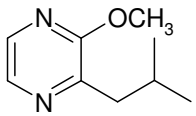


1,3-trans-5,cis-undecatriene



1,3-trans,5-trans-undecatriene

2-Methoxy-3-secbutyl-pyrazine with its intense green bell pepper odour is also an important contributor to the odour of the oil, as is 2-*sec*-butyl-3-methoxypyrazine and constituents such as *sec*-butyl-3-methylbut-2-ene thioate.



2-methoxy-3-sec-butyl pyrazine

Later fractions of galbanum oil obtained under prolonged heat may contain the blue-coloured substances isoguaiazulene and guaiazulene

GENTIANA SPP.
Status: Many of 300 *Gentiana* spp. rare or threatened (IUCN 2000).

- *Gentiana lutea* L.

Distribution: Mountainous areas of Central Europe.
Status: *G. lutea* is listed in the Red Book Data listings for Bosnia, Romania, Portugal, Bulgaria, Albania, Germany, Czech Republic, Ukraine and Poland.
Notes: Commonly used as a source material for gentian absolute in perfumery. Employed as a bittering agent in alcoholic beverages, but the more economically important use for the dried roots and rhizome of the plant is to produce bitters to stimulate the digestive system. Lange (1998) estimated demand for dried roots at 1500 t/y, mainly wild gathered in France, Spain, Turkey, Bavaria, Albania and Romania. Lange also noted that wild harvesting of *G. lutea* in Spain proceeds in contravention of existing legislation.
An absolute is produced from the roots & rhizomes – this is thought to be a principle flavouring component of Angostura bitters.

GINGER LILY
syn. Butterfly Lily
Hedychium coronarium Koenig
Distribution: Eastern Himalayas, SE Asia (India), Hawaii, China.
Status: Endangered in some areas: CIMAP (1977).
Endangered in Amarkantanka in Madhya Pradesh and Chhota Nagpur in Bihar from where it has been extensively collected (Kumar *et al*. 1997).
Notes: An essential oil and an absolute are produced commercially (India, S. China), and usage has been promoted by perfumery companies as a floral theme for launches in the 'nineties.
[The ginger-lily *Hedychium philippinense* is listed in CITES Appendix 1]
[N.B. Do not confuse with Longosa oil from steam distillation of rhizomes *Hedychium coronarium* J. Koenig var. *flavescens* syn. *H. flavum* Roxb., or Longoza absolute, derived via solvent extraction of flowers, both produced in Madagascar].

GONYSTYLUS SPP.
Species producing gaharu (of lower quality according to Woolenberg 2001) include:

- *Gonystylus bancanus* (Miq.) Kurtz.

Distribution: Pelambang, Java
Status: VU A1cd: WCMC (1998). *Gonystylus bancanus* In 2007 IUCN Red List of Threatened Species
CITES Appendix II (2004).

- *Gonystylus macrophyllus* (Miq.) Airy Shaw

Distribution: Java, Indonesia (Bali, Irian Jaya, Kalimantan, Maluku, Sulawesi, Sumatra), Malaysia (Peninsula Malaysia), Papua New Guinea (N. Solomons), the Solomon Islands.

Status: VU A1cd: WCMC (1998).*Gonystylus macrophyllus* In 2007 IUCN Red List of Threatened Species.

CITES Appendix II (2004)

GURJUN

Gurjun 'balsam' (the term is a misnomer – there are no cinnamic or benzoic acids present) is obtained from *Dipterpcarpus* spp. growing in Indonesia (Sumatra), Malaya and Thailand, with minor production also occurring in India. Prosea (2000) indicates *D. alatus*, *D gracilis*, *D grandiflorus* & *D. kerris* are used for oleoresin, and that populations of *D. kerris* have fast dwindled (like other *Diptrocarpus* spp.) due to logging. It is further mentioned that all large *Dipterocarpus* trees have disappeared, just leaving saplings & small individuals. The oil obtained by steam distillation or, more often, vacuum fractional distillation of the 'balsam' ,consists mainly of sesquiterpenes, principally α-gurjunene, calarene, β-caryophyllene, α-humulene and allo-aromadendrene, although oil from individual trees of the same species is thought to vary widely in composition

- *Dipterocarpus alatus* Roxb. ex G. Don

Distribution: Philippines, Burma, Cambodia, Laos, Thailand & Vietnam.

Status: EN A1cd+2cd, B1+2c Ashton, P. (1998). *Dipterocarpus alatus*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species*

Notes: Prosea (2000) indicates that 22.5 to 31 litres oleoresin/tree is obtained in Laos.

- *Dipterocarpus costatus* Gaertner f.

Status: EN A1cd+2cd Ashton, P. (1998). *Dipterocarpus costatus*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*

- *Dipterocarpus intricatus* Dryer

Status: LR/lc Asian Regional Workshop (Conservation & Sustainable Management of Trees, Viet Nam) (1998). *Dipterocarpus intricatus*. In: *2007 IUCN Red List of Threatened Species*

- *Dipterocarpus tuberculatus* Roxb.

Status LR/lc Ashton, P. (1998). *Dipterocarpus tuberculatus*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*

- *Dipterocarpus turbinatus* Gaertner f.

Distribution: East Indies & India

Status: CR A1cd+2cd Ashton, P. (1998). *Dipterocarpus turbinatus*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*

Notes: An oil is obtained from steam distillation (or vacuum distillation) of the gum-oleoresin. Used as perfume fixative, for waterproofing boats & baskets, and as varnish.

GYRINOPS SPP.
Species producing gaharu include:

- *Gyrinops audate* (Gilg) Domke
syn. *Brachythalamus versteegii* Gilg
syn. *Aquilaria versteegii* Hall.f.
Distribution: Distribution area New Guinea (Sidai, Mt. Arfak)
Status: CITES Appendix II (2004)

- *Gyrinops decipiens* Ding Hou
Distribution: Central Celebes (Wavatoli, Palarahi)
Status: CITES Appendix II (2004)

- *Gyrinops ledermanii* Domke
Distribution: New Guinea (Sepik R., Mt. Pfingst).
Status: CITES Appendix II (2004).
Notes: 18.3 tons gaharu legally exported from PNG mainly to Singapore (small proportion to Malaysia & Indonesia) from 1999-2002. Illegal exports are many times this figure.

- *Gyrinops moluccana* (Miq.) Baill.
syn. *Lachnolepis moluccana* Miq.
syn. *Aquilaria moluccana* Hall.f.
Distribution: Buru and Halmahera
Status: CITES Appendix II (2004)

- *Gyrinops podocarpus* (Gilg.) Domke
syn. *Brachythalamus podocarpus* Gilg.
syn. *Aquilaria podicarpus* Hall.f.
syn. *Gyrinops ladermanii* (non Donke) Merr & Perry
Distribution: West New Guinea (Ramoi, Sorong, Monep, Idenburg)
Status: CITES Appendix II (2004)

- *Gyrinops salicifolia* Ridl.
Distribution: Western New Guinea (Utakwa, Nabire)
Status: CITES Appendix II (2004)

- *Gryrinops versteegi* (Gilg). Domke & other ssp.
syn. *Gyrinops walla* (non Gaertn.) Koord.
syn. *Branchythalamus versteegii* Gilg
syn. *Aquilaria versteegii* Hall.
Distribution: Lesser Sunda Islands (Lombok, Sumbawa, Flores, Sumba); North Celebes (Minahasa) and West New Guinea.
Status: Appendix II of CITES (2004)

Notes: *Gyrinops versteegii* plantations established in Indonesia, Vietnam & Cambodia.

Hedychium spicatum Smith – see Kapur Kachari.

HINOKI WOOD
Chamaecyparis obtusa (Siebold & Zucc.) Endl
Distribution: Central Japan
Status: Protected by Japanese Govt. from 1982 – only recycled wood from rebuilding of temples or from trees which have died can be used.
LR/nt: Conifer Specialist Group 2000. In 2007 IUCN Red List of Threatened Species.
Notes: Large stocks of wood are available, stockpiled for decades before the govt. ban. An essential oil is produced from sawdust, waste & off-cuts; root & leaf oils are also marketed. The wood's famed resistance to termite attack is believed to be due to the carvacrol content.

INCENSE JUNIPER
syn. Spanish Juniper
Juniperus trurifera L.
Distribution: Moroccan Atlas & Rif; & scattered in W. Med. including Algeria, Spain & Corsica.
Status: Only 20,000 ha of *J. thrurifera* bearing land remain in Morocco: Degradation of *J. thruifera* forest attributed to slow growth and heavy use of forest habitat (Ciesla 2002).
LR/lc Conifer Specialist Group (1998) *Juniperus thruifera.* In 2007 IUCN Red List of Threatened Species.
Vulnerable: FRA (2005)
Notes: An incense tar is produced for the medicinal market in Morocco. *J. thruifera* tar is mainly used in medicinal & vetinary applications; rarely redistilled to produce essential oil useful for leathery notes in perfumery.

INULA RACEMOSA
Poshkar moola
Inula racemosa Hook f.
Distribution: Alpine W. Himalaya, India, Afghanistan, & Nepal (where it is cultivated).
Status: Vulnerable in hills of Jammu & Kashmir. Red Data Book of Plants of India (Nayar & Sastry 1987-88)
Under threat in Himal Pradesh: Chauhan (1988)
Notes. A tough herb growing to 1.5m. The herb is often found as an adulterant of Kuth roots (*Saussurea lappa* CB Clarke), together with *Inula obtusifolia* Kerner and *Inula royleana* Clarke and if used for essential oil production, will be contaminated with essential from these sources.
The whole plant is distilled, including the roots, to give a camphoraceous odoured essential oil that is inhaled to ease the symptoms of respiratory diseases (bronchitis, asthma) in India. The roots give off an aromatic odour which

protects clothes from insects. The plant is of interest because of its potential anti-diabetic properties (insulin potentiating effects). The root oil is known to contain the sesquiterpenic ketones, atlantone and isoatlantone. The oil is frequently offered by aromatherapy oil traders.

JUNIPERUS SPP.
Juniperus oxycedrus L.
Prickly Juniper.
Distribution: Across Mediterranean & S. Europe from Portugal, France & Morocco to N. Iran & W. Syria. Farjon (2005) considered that *J. oxycedrus* had 4 subspecies: subsp. *oxycedrus*, subsp. *macrocarpa* Sibth. & Sm.) Ball, subsp. *badia* (H. Gay) Debeaux & subsp. *transtagana* Franco.
Status: LR/lc Conifer Specialist Group (1998) In: 2007 IUCN Red List of Threatened Species.
Endangered: Albania (FRA 2005)
Conserved: Regional Ministry of the Environment of Andalusia
Notes. Cade oil is obtained by destructive distillation of the wood & branches of this shrub. Only the rectified oil (polynuclear hydrocarbon free) is approved IFRA.

Juniperus oxycedrus L. ssp. *macrocarpa*
Distribution: S.W. Spain
Status: Conserved: Regional Ministry of the Environment of Andalusia

Juniperus phoenicia L.
Status: Endangered Jordan (through FRA 2005).

Juniperus procera Hoechst. ex Endl – see Cedarwood Kenyan

JURINEA (DHOOP)
Jurinea dolomiaea Boiss.
syn. *J. macrocephala* (Royle) C.B. Clarke
Distribution: India, Nepal, Pakistan.
Status: Depletion in most areas: CIMAP (1977).
Threats: Animal grazing, over-gathering
Notes Roots, rhizomes of this prostrate herb are articles of commerce being gathered in large quantities for incense making for domestic purposes & for use in temples. Additionally used to treat stomach ache & diarrhea in Dolpa.

KAEMPFERIA GALANGA
Lesser galangale.
Kaempferia galangal Jacq.
Distribution: Cultivated in Taiwan and Yunnan, as well as occurring in India, Malaya, the Moluccas and tropical Africa.
Status: CR/R First Red Data List S. Indian medicinal plants (Based on CAMP report IUCN ver 2.2)
Facing extinction due to indiscriminate & unsustainable harvesting in the wild: Swapna *et al*. (2004).

India: On Negative List of Export (Governenment of India) so ban on trade & export of wild collected material.
Notes: The tuberous rhizomes sold in the local drug markets: a minority are distilled for essential oil. Essential oil employed as a hallucinogen in New Guinea. Leaves & rhizomes used to prepare perfumed hair washes and as deodorant, and as insect repellent for stored clothes. (Selvam & Bandyopadhyay 2005).
Rhizomes display diuretic, carminative, stimulat & expectorant properties; powdered rhizomes also show stomachic & anti-inflammatory properties. Leaves used in poutices & lotions against sore eyes, sore throat, swellings, rheumatism & fevers – for full list of applications see Selvam & Bandyopadhyay (2005).

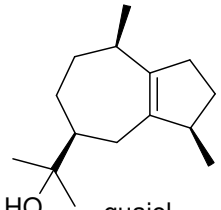
KAEMPFERIA ROTUNDA
Kaempferia rotunda L.
Himalayan Crocus
Distribution: Tropical Asia
Status: Becoming rare through over-exploitation.
Notes: Used as a spice, especially for vegetables.

KAPUR KACHARI
Spiked ginger-lily.
Hedychium spicatum Smith
Distribution: India: parts of the Punjab and Central and Western Himalaya (Assam, Nepal, Bengal etc.) Malaysia, Japan.
Status: Vulnerable through over-exploitation especially in Uttar Pradesh & Himachal Pradesh CIMAP (1997)
Notes: An essential oil is produced commercially from distillation of the dried roots & tubers of this annual herb which finds limited use in perfumery. The use of the rhizomes in indigenous perfumery as incense etc) & in local vetinary medicine etc. has lead to ruthless exploitation such that its status in Uttar Pradesh and Himachal Predesh has been described as vulnerable as indicated above. Rhizomes are traded in the drug markets, (being sold in thin slices) for the preparation of the fragrant coloured powder *abhir* which is used on religious occasions. The rhizomes can be divided into two varieties, var. *acuminatum* and var. *ellipticum.*
Used as an anti-inflammatory in Ayurvedic medicine, and potentially from the cinnamate content, the herb has been suggested as having potential sun-screen properties

LARCH
Larix decidua Miller.
Distribution: Central Europe, Alps & Carpathians, as well parts of E. Europe.
Status LR/lc Conifer Specialist Group (1998) *Larix decidua* In 2007 Red List of Threatened Species.
Notes: Larch essential oil & larch turpentine are articles of commerce, larch turpentine being traditionally associated with S. Tyrol & N. Italy. Red List status is as a result of degradation of habitats due to extraction.

MELANJE CEDARWOOD OIL
Widdringtonia whytei Rendle.
Distribution: Tropical Africa.
Status: EN A 1 abcd B1+2abcde Conifer Specialist Group (1998). *Widdringtonia whitei* In 2007 IUCN Red List of Threatened Species.
Malawi: ENA1abcdB1B2abcde. Restricted to Mount Mulanje. Habitat threatened by pitsaw activities: Southern African Plant Red Data Lists 2002.
Notes: Survived in a ten-mile area until it was replanted from Mulanje Mountains Forest Reserve in the 1960's to former Nyasaland, Tanganyika and Kenya. Now over-used as timber, sawdust is collected from timber-yards and distilled to obtain oil for local use.

MICHELIA CHAMPACA
Michelia champaca L.
Champaca
Distribution: Native to S.E. Asia, being particularly common in Tibet and Yunnan, and in tropical Asia, i.e., the Philippines, as well as parts of India including Assam and the Eastern Himalayas.
Status: LR/lc VU: CAMP Report (1994). *Michelia champaca* In IUCN Version 2.2
Endangered in Nepal (FRA 2005).
Red listed in India.
Critically endangered in Nepal: CAMP Report (2001) Pokhara.
Restrictions on collection for export imposed by the Government of Nepal under Forest Act 1993.
Endangered Nepal (through FRA 2005).
Notes: Champaca Absolute Red, India, is produced in Paralakhemundi in the Ganjam district of India, by solvent extraction of the blossoms from the *M. champaca* tree which can grow to 30m. Products described as 'Champaca oil' (or more often 'Michelia oil') can also be produced from *M. alba* (see above) although in India *M. alba* is often grafted onto a *M. champaca* rootstock. The essential oil cannot be produced by steam distillation from the flowers due to decomposition, but instead is distilled in 27% yield from the concrete, itself obtained in 0.26% yield by using harmful solvents such as benzene. Sapu woof from *M. champaca* is known to contain guaiol.



guaiol

In the Philippines'Champaca' oil is produced from *M. longifolia* Macbr. (although some authorities maintain *M. alba* L. is syn. *M. longifolia* MacBr.), whilst Javan champaca oils may be obtained from mixed blossoms of the local white *M. alba* and yellow-hued *M. champaca.* In practice, commercial champaca oil may result from a mixture of floral sources.

In India *M. champaca* is often grown around Hindu temples for use in religious ceremonies

MUSK
Moschus spp.
Distribution: Widely distributed
Status: Spp. from Afghanistan, Bhutan, India, Myanmar, Nepal and Pakistan are listed under Appendix I of CITES (2003); spp. from other destinations are listed under Appendix II.
Notes: This animal product has been replaced by synthetic musk ingredients. Zhou *et al.* (2004) have reviewed the distribution, status & consertvation of musk deer in China.

OCOTEA ODORIFERA
Ocotea odorifera (Vell.) Rohwer – syn. *O. pretosia* (Nees) Mez. (see below)
Canella Sassafras
Distribution: Atlantic forest of Brazil.
Status: High priority for germaplasm collection & conservation in Brazil (Vieira 1999)
Listed: IBAMA (1992) - Portaria nº 37-N, de 3 de abril de 1992 (Lista Oficial de Espécies da Flora Brasileira Ameaçada de Extinção).

Ocotea pretiosa (Nees) Mez.
Brazilian Sassafras.
Distribution: Brazil (Atlantic Rain Forest); possibly Paraguay.
Status: VU A1cd Varty N. (1998). *Ocotea pretiosa* In 2007 IUCN Red List of Threatened Species.
O. pretosia is listed in an official list of threatened plants compiled by IBAMA (1992); however loggers ignore the trees' protected status.
Notes: Sassafras oil Brazil was obtained by steam distillation of the chipped trunkwood, roots and branches of the tree, produced at a rate of 1,500 t/y. Do not confuse with *Ocotea cymbarum* .
As early as 1966 Mors and Rizzini noted that *O. pretosia* was becoming scarce in Santa Catarina due to uncontrolled exploitation and the natural slow growth of the tree, stating production to have declined to 250 tons per annum from the previous 500 tons per annum Mors & Rizzini (1966). Now Brazilian Sassafras oil is virtually unobtainable & Vietnam is leading supplier of Sassafras oil – probably from *Cinnamomum parthenoxylon* Meisn.
N.B. Ocotea oil Brazil was commonly and incorrectly referred to as *Ocotea cymbarum* oil, the wood oil of which contains no safrole.

OLIBANUM syn. FRANKINCENSE
Boswellia carterii Birdw.
syn. *B. sacra* Flueckiger
Source of 'beyo' - 'Somalian type' Frankincense, according to some authorities.
Distribution: Somalia, Oman (Dhofar) & Yemen (but this is disputed: Wood 1977).

Status: LR/nt IUCN Assessed Thulin M. (1998) *Boswellia carterii*. IUCN List of Threatened Species 2007.
Critically endangered in Oman: (FRA 2005).

Boswellia papyrifera (Del.) Hochst.
Source of 'Eritrean type' Frankincense, according to some authorities.
Distribution: Ethiopia (in 332,562 ha of Tigray & 604,000 ha. in the Amhara), Nigeria, Cameroon, Central African Republic, Chad, Sudan, Uganda & Erithrea.
Status: Endangered Ethiopia (TRAFFIC). Decline of tree numbers in Tigray over past 20 years.
Endangered Sudan - see Rijkers *et al* (2006). Rijkers *et al*. maintain that repeated tapping for resin results in limited flower & fruit production and non-viable seeds.
Tree numbers declining in Eritrea as woodlands are converted to agricultural use (Ogbazghi *et al* 2006). Stem barks of a large number of trees are greatly damaged by the repeated unskilled incision to collect the gum - Khalid *et al.* (undated). Gebrehiwot *et al* (2007) show in their study, that protection from livestock grazing is essential for the growth & survival of seedlings. .The authors maintain that use of closed areas is an effective way of promoting natural regeneration
Notes: Trees tapped 8 x from Sept to June, giving 1-3Kg gum oleoresin/tree. An essential oil is produced by steam distillation of the air-dried gum-oleoresin. 1500-2000 t/y gum oleoresin produced in Ethiopia. An absolute and a resinoid are also produced..

ORCHIDACEAE
Orchids are already sufficiently rare in many European countries to have protected status, and the family Orchidaceae is listed under Appendix II of CITES and Annex B of Regulation (EC) 338/97 (CITES 2003). Some examples of threatened species still use are the ladies slipper *Cypripedium parviflorum* var. *pubescens*, which is used in herbal medicine & is listed in the British Herbal Pharmacopoeia 1983, and *Ophyris insectifera*, used in "salep", an ingredient in Turkish delight and ice cream.

ORIGANUM SPP.
Several individual sp. of *Origanum* such as *O. barygyli* from Syria and *O. dictamnus* L. and *O. vetter* from Greece are rare or threatened.

- *Origanum dictamnus* L.

Dittany of Crete
Status: Vulnerable IUCN Red List 2006.
Greece: Vulnerable (Red Data Book of Rare and Threatened Plants of Greece) & Strictly Protected (Revised Appendix 1 of the Bern Convention in 1990).
Notes: Used as culinary herb but no commercial production of essential oil.

PALM OIL – NOT ENDANGERED,

Err….AND NOT SUSTAINABLE!

Elaeis guineensis Jacq.

Status: The establishment of oil-palm plantations in Malaysia was responsible for 87% of the deforestation in Malaysia between 1985 and 2000, and threatens 1,000 species bedsides thousands of orangutans which have been wiped out (see FoE's "The Oil for Ape Scandal" www.palmoil.org.uk). Indonesia intends to overtake Malaysia in palm oil production by increasing from its 16 m acres to 64 million acres by 2025 (Vidal 2007).

Notes: Palm oil from the pericarp (mainly palmitic, oleic and linoeic esters) is widely used in applicns. from soap to candles. Term more usually refers to the kernel oil which contains mainly contains mainly myristic and lauric acid esters & is used in cosmetics & foodstuffs (e.g. from lipstick to margarine).

Ethical concerns. Given the situation described above, it seems inexplicable that the July 2005 Society of Cosmetics Scientists Singapore (SCSS) outing was - to where exactly ? - to NatOleo: the Naturals Oleochemical Palm Oil plant in Johor, Malaysia. The visit which is featured in *IFSCC Magazine*: 'the Global Publication of the International Federation of Cosmetic Scientists', & reportedly included a visit to a 1200 hectare Palm Oil Plantation and a crude Palm oil mill (Lumain 2005). The article also discusses plans for expansion of the business so that NatOleo may become the largest oleochemical producer in Malaysia. Friends of the Earth in a separate report (FoE 2005) reveal that a high number of environmental pollution (air/water) contraventions were made by 68 of the Palm oil mills in Johor. Cropwatch invited the SCSS & SCS in 2005-2006 to explain its actions, but our communications were ignored.

Subsequently Weleda representative Bas Schneiders (Montague-Jones 2007b) has announced that they are able to offer 'sustainable' organic certified palm oil to the cosmetics trade. With the world markets virtually awash with this product, Cropwatch sees this move as regrettable. However Body Shop justify their purchase of sustainable palm oil and their role in the Roundtable on Sustainable Palm Oil (RSPO) at http://clients.ctn.co.uk/bodyshop_csr_2007/index.asp?lvl1=8&lvl2=3&lvl3=0&lvl4=0

Advertisements by the Malaysian Palm Oil Council claiming 'sustainable production' were criticized as misleading by the advertising watchdog following complaints from FoE (Benjamin 2008), and Dr Graeme Buchanon of the RSPB claims that up to 10 spp. of birds in New England, New Guinea are close to extinction after forest clearing for "sustainable" palm oil production (*Metro* 9th Jan 2008).

PARMELIA (LICHEN)

Parmelia nepalensis Tayl. Hook,
& *Parmelia nilgherrensis* Nyl.
& *Parmelia tinctorium* Nyl.

Distribution: Himalayan Nepal, India

Status: Export of all three above named plants banned: Nelapese Govt 1993. Ban does not apply to processed material.
Notes: Approx 1000 t/y. *Parmelia* lichens (including *P. tinctoris* & *Usnea* spp which may be co-extracted with *P. nepalensis*) processed for aroma & incense industry – up to 800 tons + imported into India.(Cropwatch: unpublished information).
Lichen "oil" W. Nepal is actually an oleoresin produced by ethanolic extraction of the lichen.
'Jhyan' consists of a mixture of several lichen species, such as *Parmelia*, *Ramalina* & *Usnea.*

PHALERIA SPP.
A genus of some 20 species. Those producing gaharu in Papua New Guinea include:

- *P. macrocarpa* (Scheff.) Boerl.

Puk-puk gaharu.
Status: No information

PINUS SPP.
A staggering 225 spp are listed as threatened (although many of these are in the low risk category) in the 2007 IUCN Red List, which represents a quarter of all *Pinus* spp. The following species are of more particular interest in the aroma industry:

PINE, ALLEPPO
Pinus halepensis Miller
Distribution: Found in warmer parts from Spain to Syria
Status: LR/lc Conifer Specialist Group 1998. *Pinus halepensis*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*
Notes: Gum-oleoresin used to manufacture turpentine. Tunisia exports 10,000 t/y of *P. halepensis* seeds (FAO 1998)

PINE, AROLLA
Pinus cembra L.
Distribution: Native to European Alps. Commonly grown as ornamental in Europe and N.E. US, and grown for timber in Scandinavia.
Status LR/lc Conifer Specialist Group (1998). *Pinus cembra* In: 2007 IUCN Red List of Threatened Species.
Notes: The needle & twig oil is produced in the Alps, Cartharpian Mountains and Siberia.

PINE, CHIR
Pinus roxburghii Sarg.
Distribution: Native to the valleys of the Himalayas at 500 to 2500m and other bordering parts of India and Pakistan. Introduced into S. Africa

Status: LR/lc Conifer Specialist Group 1998. *Pinus roxburghii*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*
Notes: Source of Indian turpentine, rich in longifolene (to 30%) & (+)-δ-3-carene (to 50%), themselves starting materials for the production of synthetic aroma chemicals.

PINE, MERKUS
Pinus merkusii Jungh et de Vriese
Distribution: Indonesia
Status: VU B1+2cde: Conifer Specialist Group 2000. *Pinus merkusii*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*
Notes: Gum-oleoresin used to manufacture turpentine.

PINE, MONTEREY
Radiata Pine.
Pinus radiata D. Don
Distribution: S.W. of N. America to California.
Status: LR/cd Conifer Specialist Group 1998. *Pinus radiata*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*
Endangered: FAO Panel of Experts 5th Report on Forest Gene Resources 7th Appendix.
Notes: Demand: 190 t/y. *P. radiata* is popular choice in many countries for new timber plantations.

PINE, OREGON
Pseudotsuga menziesii (Mirbel) Franco
Douglas Fir/Oregon Pine
Status: LR/lc Conifer Specialist Group 1998. *Pseudotsuga menziesii*. In: *2007 IUCN Red List of Threatened Species.*
Protected Nevada: *Pseudotsuga menziesii* (Mirbel) Franco var. *glauca* (Beissn.) Franco & *Pseudotsuga menziesii* (Mirbel) Franco var. *menziesii* (source: USDA)
Notes: Von Rudloff (1973) described two types of essential oil from the needles & twigs: a bornyl acetate-containing "Rocky-mountain type" (var. *glauca* above) and a "Coastal type" (var. *menziesii* above) without bornyl acetate.

PINE, SIBERIAN DWARF
Pinus pumila (Pall.) Regel
Status: LR/lc Conifer Specialist Group 1998. *Pinus pumila*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*

PINE, SCOTCH
Pinus silvestris L.
Distribution: Austria, Sweden, Norway, and former USSR, also cultivated in the USA. It grows widely throughout Europe and parts of Asia.
Status: LR/lc. Conifer Specialist Group (1998). *Pinus sylvestris*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*

Endangered: Albania (FRA 2005)
Notes: Needles & twigs steam distilled to produce a flagship pine needle & twig essential oil, used in fresh accords for men's fragrances and in herbal blends, and also to add fresh notes to fougeres. Used to treat skin complaints and previously a source material for Stockholm tar, lampblack, rosin, turpentine & charcoal. An absolute is also employed in perfumery.

PINE, SIBERIAN
Pinus sibirica Du Tour.
Distribution: Native to NE Russia
Status: LR/lc Conifer Specialist Group (1998). *Pinus sibirica*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*
Notes: A minor essential oil is produced from the needles & twigs, which is often confused with Silver fir needle oil from *Abies siberica* Ledeb.

PINE, SLASH
Pinus elliottii Englm.
Status: LR/lc Conifer Specialist Group 1998. *Pinus elliottii*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species.*
Notes: Gum-oleoresin used to manufacture turpentine.
Two subsp. known: var. *densa* – Florida Slash Pine & var. *elliottii* – Honduras Pine.

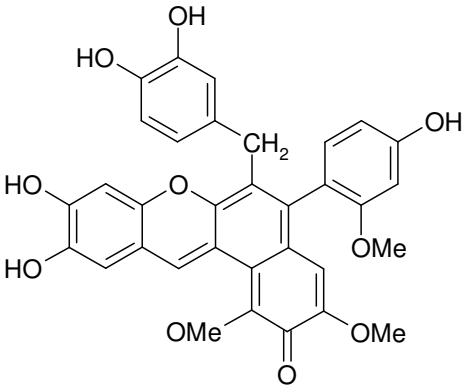
PINE, EASTERN WHITE
Pinus strobus L.
Eastern White Pine (Eng).
Distribution: Widely distributed over N.E. US & SE Canada.
Status: LR/lc Conifer Specialist Group (1998) *Pinus strobus* In 2007 IUCN Red List of Threatened Species.
Becoming rare in Indiana: USDA
Notes: Dried inner bark approved by FDA as flavouring. Extracts formerly used in the UK as an expectorant & official in the BPC.

POPLAR
Populus nigra (Eng)
Black Poplar
Distribution: Throughout Europe, N. Africa & Central & West Asia.
Status: LC Participants of the FFI/IUCN SSC Central Asia regional tree Red Listing workshop, Bishkek, Kyrgyzstan (11-13 July 2006) 2007. *Populus nigra* 2007 IUCN Red List of Threatened Species.
Severely threatened in China (Gantie *et al.* undated).

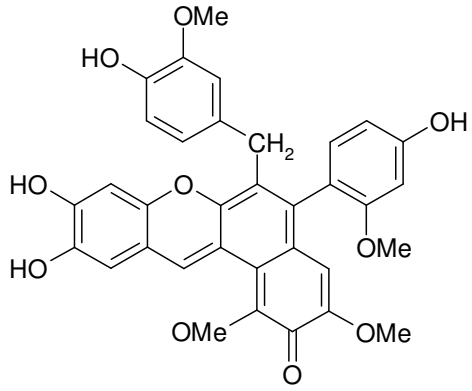
PROSTANTHERA SPP.
Australian, New Zealand or Tasmanian Mint bushes/native mints.
Distribution: Approx. 100 spp. distributed throughout Australia & New Zealand.

Status: 16 spp listed as threatened from 90 Australian native species. (Kerry S. Walter, Harriet J. Gillett IUCN Red List of Threatened Species 1997).
P. granitica (mint-bush) & *Proanthera rotundifolia* - native mint. Listed as vulnerable in Tasmania.
Notes:
Mint bushes, see for info on *Prostanthera askania*, *P. hindii*, *P. junonis* & *P. palustris* in NSW - see plantnet.rbgsyd.nsw.gov.au/emuwebnswlive/objects/common/webmedia.php?irn=1699&reftable=ebibliography
Prosanthera essential oil yielding spp. have previously been identified as suitable for exploitation by Australian aromatherapy oil industry, and are actively marketed by a number of Australian micro-scale oil distillers & small traders.

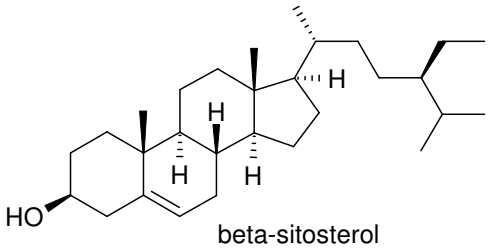
PTEROCARPUS SANTALINUS
Pterocarpus santalinus L. f.
Red Sanders; Red Sandal.
Distribution: Small to medium deciduous tree to 11m. with light brown scented heartwood, native to S. & S.W. India, specifically Andrah Pradesh, Tamil Nadu, Karnataka & Kerala at 150 to 900m. .
Status: EN B1+2de CAMP Workshops on Medicinal Plants, India (1998). *Pterocarpus santalinus*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species*
Endangered: Walter & Gillet (1998).
CITES: Appendix II.
Notes: Prepared by powdering heartwood and extracting with alcohol. Used as a spice, cosmetic and food colourant (production volume 50t/y) especially for fish products e.g. pickled herring. Also used to impart colour to essential oils (contained in Compound Tincture of Lavender USP 1911 & Compound Tincture of Lavender BP 1911).
Red pigments include santalin A & santalin B; santalins (quinonoids) to 16% in wood. Used in the Indian folk & Uyervedic systems of medicine. Triterpenes include β-amyrin, β-sitosterol, acetyl oleanilic anhydride. Sequiterpenes include β-santalol, pterocarotriol & pterocarpol. Singh *et al*. (2005) reveal Red Sandal's biological activities as including anti-diabetic, anti-inflammatory, anti-oxidant, anti-oxidant, anti-UV effect, anti-hyperlipidemic, anti-androgenic, anti-androgenic, anti-bacterial & anti-tumor.



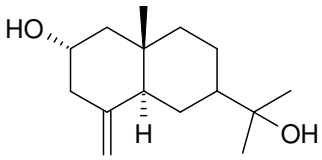
santalin A



santalin B



beta-sitosterol



Pterocarpol

RAVENSARA

R. anisata Danguy et Choux (pseudonym for *R. aromatica*).

Distribution: Madagascar.

Status: Destructive harvesting of bark (100 t/y) for production of essential oil from stem-bark threatens the species (Rasoanaivo 1997).

Notes: Do not confuse with Ravensara leaf essential oil produced in Madagascar from previously introduced (& now naturalized) *Cinnamomum camphora* spp. Commercial production of Ravensara leaf oil now apparently available certified organic agencies such as Ecocert. Some evidence that previous bark gathering activities for oil distillation have been scaled down.

ROSEWOOD – SOME COMMENTS.

Rosewood essential oils from S. American *Aniba* spp. have become widely appreciated examples of unethicaly traded commodities from threatened species in recent years, but continue to be used by many leading fragrance houses. The use of rosewood oil in fragrances (and formerly in luxury soaps) has been the target of some criticism [e.g. French opposition to the alleged use of Rosewood oil by Chanel in *Chanel 5* as reported by Osava (1997 & 1998)]. Major purchasers of Rosewood oil are believed to be the local representatives of fragrance sector multinationals, who have taken up to 100 tons per annum of oil since the 1980's. Irrespective of criticisms of unethical behaviour, fragrance launches have continued to feature Brazilian Rosewood [e.g. *Presence d'une Femme* by Mountblanc (2002); *Trussadi Skin* by Trussadi (2002); *Lagerfield Jako* by Lagerfield (1999) etc.], although availability of rosewood oil 'spot' in more recent years (2006-2008) is becoming more difficult as IBAMA manages to close down illegal stills, leaving just four licensed operative stills in Manaus. Successful Brazilian companies, however, such as O Boticario and Natura have featured

traditional Brazilian ingredients (such as rosewood oil) as part of their policy for developing home-market cosmetic product ranges, seemingly without adverse comment.

Coppen (1996) indicated the chief importer of Rosewood oil was the US, followed by Switzerland (presumably by Givaudan), France & other EC countries. Barata (2007) maintained that Brazilian rosewood oil production is presently 38 t/y, worth $2.8 million, which represents the unsubstainable loss of 4,000 rosewood trees per year. This annual production figure is well down on the 1992 annual production figure of 66 tones (Coppen 1995) or with the Brazilian situation of the nineteen sixties, where fifty or so Brazilian distilleries provided 500 tons per year of oil (Ohashi 1997). Lupe *et al*. give rosewood oil exports at 38.5t for Aug 2005 to Aug 2006 (down from a quoted 360t/y from 1945 to 1974). All these authors fail to say if these are official figures from licensed still production, or if they include illegal production, of which Osava (1998) says "illegal export of the oil occurs via "a variety of yet unknown routes."

Barata (2007) also maintains that rosewood leaf oil production is currently 1000L/y from a 30 ha experimental plot, chiral analysis showing the produced oil to be 90% *dextro*- and 20% *laevo*- (linalol?) quoted figures which seems to be missing some ancillary scientific explanation – like for example, why don't the percentage figures quoted add up to 100%? (Cropwatch wrote to the authors 10/2007 for an explanation – so far, no reply). If it is deemed that a high proportion of *dextro*-linalol is necessary in a rosewood-like essential oil commodity suitable for high-class perfumery, then a far cheaper cheaper and less ecologically damaging recourse would be to isolate *dextro*-linalol from coriander oil, and develop this route instead. In spite of what Barata appears to be saying, it would seem to Cropwatch that the perfumery value of rosewood oil is much more to do with the minor character compounds & modifying components to the odour profile, rather than the enantiomeric purity (of linalol), which is much less important.

The May & Barata (2004) paper on sustainable Rosewood production prospects has been widely quoted, but has been critiqued by Cropwatch for its many scientific errors at http://www.cropwatch.org/cropwatch6.htm.

Update July 2008. For some reason which completely escapes us, the trade magazine *Perfumer & Flavourist* have seen fit to publish a paper from Lupe, Souza & Barata entitled "Seeking a sustainable alternative to Brazilian Rosewood" (Lupe *et al*. 2008). In the paper the authors examine the possibility of directly substituting the linalol-containing essential oils of *Lippia alba*, *Ocimum basilicum* & rosewood leaf oil, for rosewood oil itself - the sort of exercise you might set for a perfumery beginner on their very first day in the industry. From the information given, the authors seem to have made their judgements merely by comparative analysis of the components of the individual oils. The entirely predictable conclusion of the investigation was that of the oils chosen, rosewood leaf oil had the closest composition profile to rosewood oil; at variance with the

previous finding of one of the authors who had co-written a paper previously where it was found that rosewood leaf oil was differently odoured to rosewwod oil (May & Barat 2004 – Cropwatch extensively criticised the paper at http://www.cropwatch.org/cropwatch6.htm). It should also be mentioned that the authors did not even attempt to concentrate up the 40% linalol content of *O. basilicum* to the linalol concentration level typically found in Rosewood oil (approx 85-90%) for a slightly more realistic comparison, because "…it would be necessary to conduct a fractional distillation of *O. basilicum* oil, which is a relatively complex and expensive process…" As you can see, the technical level of this paper puts us firmly back in the 1870's.

As we noted above, the authors fail to understand the underlying factors contributing to the perfumery value of rosewood oil, and continue with this wrong-headed obsession about the chiral purity of linalol.

ROSEWOOD – ANIBA SPP.

aka Bois de Rose

Aniba rosaedora var. *amazonica* Ducke & other *Aniba* spp :

Aniba fragrans Ducke;
Aniba canelilla (HBK) Mez.
Aniba.parviflora Ducke.

Distribution: Brazil (Amapá, Amazonas, Pará), Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, Venezuela.

Status EN A 1d+2d Varty N. (1996). *Aniba rosaedora* In: 2007 IUCN Red List of Threatened Species.

Threatened in Brazil: IBAMA (1992)

Threatened in Columbia (Calderton 1997)

Threatened in Surinam (Werkhoven 1997).

Endangered: FAO Panel of Experts 5th Report on Forest Gene Resources 7th Appendix.

Largely eliminated in French Giuana by 1930; a few trees still exploited for essential oil up until the 1980's (Cropwatch 2007).

Loss of germ plasm diversity and narrowing of the genetic base is already believed to have occurred, although a germ plasm collection is believed to be in operation via the efforts of the Faculdade de Ciensias Agrarias do Para at Belem, Brazil.

Refs & further reading.

Barata L.E.S. (2001) "Rosewood leaf oil (*Aniba rosaedora* Ducke): sustainable production in the Amazon." *IFEAT 2001 Int Conference, Buenos Aires (2001).*

Barata L.E.S. & Discola KF (2002) "Scents of Amazon aromatic plants" Presented at *33rd Int. Symposium on Essential Oils, Lisbon, Portugal.(2002).*

Cambell de Araujo V. *et al* " (1972) Óleos Essencias de Especies do Gêneor Aniba" An. Acad. Brasil. Cienc., 44 (Suppl), 303-306 (1972); Acta Amazonia 2(1), 1-4 (1972) through Lawrence B.M. (1984) "Progress in Essential Oils" Perfumer & Flavourist Vol 9 (Oct/Nov 1984) p87-8.

Coppen J.J.W. (1996) *Flavours & Fragrances of Plant Origin* FAO Rome 1996.

Cropwatch (2004) "Roswood sustainability." – see http://www.cropwatch.org/cropwatch6.htm

Lupe F., Souze R & Barata L. (2008) "Seeking a sustainable alternative to Brazilian rosewood." Perf & Flav. 33 (July 2008) pp40-43. ***Cropwatch comments:*** critiqued above.

Maia N.B., Bovi O.A., Perecin M.B. Marques M.O.M. & Granja N.P. (2004) "New crops with potential to produce essential oil with high linalool content helping preserved A. rosaedora – an endangered Amazonian species." *Acta Hort*. (2004), 629.

Margolis M. (2004) "Jungle Economics: Environmentalists though they could save the rain forest and make money at the same time. They were wrong." *Newsweek International* 16.02.2004

May P.H. & Barata E.S (2004). "Rosewood Exploitation in the Brazilian Amazon: Options for Sustainable Production" *Economic Botany* **58**(2) pp257-265. .***Cropwatch commenta:*** Cropwatch extensively critiqued this paper for its many scientific errors at http://www.cropwatch.org/cropwatch6.htm

Mitja D. & Lescure J.-P. (1996) "Du bois pour da parfum : le bois de rose doit-il disparaître?" In L. Emperaire ed. Le forêt en jeu l'extrativisme en Amazonie Centrale UNESCO)-ORSTOM, Paris pp93-102. through May & Barata (2004) above.

Mors Walter B. & Rizzini Carlos T. (1966) *Useful Plants of Brazil* pub Holden-Day Inc 1966 p69

Ohashi S.T., Rosa J.A., Santana J.A., Green C.L. (1997) "Brazilian Rosewood Oil: sustainable production and oil quality management" *Perfumer & Flavourist* **22,** 1-5. ***Cropwatch comments:***: excellent insightful article on rosewood oil sustainability – recommended reading.

Osava M. (1997) "Brazilian-Biodiversity: crackdown on eco-pirates." *Inter Press Service English News Wire* 15.08.1997

Osava M. (1998) "Brazil-Trade: Perfume Makers Accused of Pirating Amazon Resources" *Inter Press Service English News Wire* 19.08.1998

Zeller B.D.A., Prestl M.L., Barata L.E.S., Dugo P. & Mondello I. (2006) "Evaluation of leaf-derived extracts as an environmentally sustainable source of essential oils by using gas chromatography-mass spectrometry and enantioselective gas chromatography-olefactometry." *Anal. Chem.* **78**, 883-890..

ROSEWOOD – OCOTEA SPP.

Ocotea caudata (Nees) Mez.
& other *Ocotea* oils

Distribution: Brazil, French Guinea

Status: Many *Ocotea* oils endangered Cropwatch (2004).

Notes: Other 'rosewood oils' - e.g. from *Ocotea* spp., especially *Ocotea caudata* - are sometimes also sold as Rosewood oil, but have often been of very low odour value.

SANDALWOOD – SOME COMMENTS.

"The Australian Sandalwood industry is set to dominate the world supply of sandalwood oil" – writes M. Clarke of AgEonPlusPty Ltd, talking-up the industry (Clarke 2007). These comments apparently follow on from the extensive marketing of sandalwood Managed Investment Schemes, which prompts speculation that Australian plantations will supply 130 t/y oil of *Santalum album*. & 60 t/y *Santalum spicatum* extract, by 2023 – see the full report at http://www.rirdc.gov.au/reports/EOI/06-131sum.html. Since Australia is

historically a fragrance ingredient supplier, rather than ever having its own established fragrance industry, the report is understandably geared towards describing an ability to supply large volumes, rather than exploring whether the quality of sandalwood oils that will ultimately be offered will satisfy market expectations, or even whether such highly expensive ingredients have a future in an increasingly cost-conscious industry. It remains a fact that *Santalum album* oil from Indonesian sources *is* (or should we say *was*) a pale shadow of the olfactorily superior East Indian oil, in spite of their analytical similarities, and a thorough examination of Australian plantation-produced *Santalum album* oil quality & performance remains an important factor in acceptability, yet to be addressed by Clarke. A preliminary (and it has to be said, non-independent) report on 14-year old *Santalum album* plantation trees at Kununurra, W.A. by Brand *et al*. (2006) of the Forest Products Commission, WA, showed small amounts of 'good quality oil' by core sampling & chip sampling twenty trees. However whole trees need to be harvested & extracted to estimate the oil content with accuracy and 20 trees seems a small sample to base such predictions upon. As far as we can understand from the article, the assessment of 'good quality' sandalwood oil only seems to be based on α- & β- santalol content. As conceded by the authors, the observed variability in heartwood percentage, oil yield and santalol content between similar aged trees growing under the same conditions needs further evaluation.

Even more puzzling is Clarke's use of statistics to calculate Indian sandalwood oil production, where it is assumed that sandalwood heartwood harvest tonnages can be converted to sandalwood oil by applying a 6% conversion factor, although in fairness Clarke suggests this is an "at best" factor, & that smuggling may hide the true figures, which may represent an additional 400% of the official figure. We make Clarke's quoted figures, give, for example, give a total Indian content production for sandalwood oil of 129t for 1990, 150t for 2000, and 200t for 2005. We have merged Clarke's figures (in brackets in purple) with our previously published figures gleaned from *Parfums Cosmetiques Actualites* No 187, Feb/Mar 2006 p32 (figures ascribed to *FAFAI Journal* Oct-Nov 2004: "Manufacturing of Sandalwood oils Market Potential, Demand & Use"). As you can see the two sets of figures do not sit well with one another:

Year	Sandalwood production	Sandal oil production	Sandal oil exports
1950	4000	150	90
1970	2500	100	60
1980	2000	80	50
1990	1200	50 **(129)**	30
2000	1600	30 **(150)**	10
2004 2005	70	- **(200)**	-

The puzzle is not so much with the difference between the figures, but with the fact that Clarke's gleaned data suggests that sandalwood oil production in increasing, whereas the Cropwatch figures suggest the opposite trend – that it is

actually decreasingly rapidly. This latter downward trend would appear to be borne out by the fact that traded lots of sandalwood oil EI "spot", are now rare to non-existent. Furthermore, Clarke makes no mention of sandalwood adulteration, whereas Cropwatch knows for a fact that hundreds of tons of West African sandalwood logs (and the distilled oil thereof) make their way to Indian distilleries every year (see below).

Again, in spite of an earlier Australian-funded marketing campaign, experienced perfumers have seen through the early sales hype, and failed to be persuaded to replace the increasingly expensive Sandalwood oil E.I. from *Santalum album* with the inferior Australian Sandalwood (oil) (extract) from *Santalum spicatum* (Bleimann 2007). Indeed it was not until Webb (2000) revealed the details of the Mount Romance Australian sandalwood solvent extraction process, followed as it is by co-distillation with an inert solvent, that some customers began to realise that they were not actually buying a steam distilled essential oil. Perfumers nowadays are apparently preferring (or forced) to use instead the far cheaper range of sandalwood synthetic ingredients (Isobornylcyclohexanol, Sandalore®, Bacdanol®, Polysantol® etc. or the more powerful Ebanol or Javanol) to achieve a sandalwood fragrance impression. One of the many sloppy statements in the Clarke report is that "synthetic sandalwood oil" (an incorrect descriptor: Clarke means synthetic sandalwood odourants) has similar properties to natural oil…". Cropwatch doesn't think that many will agree with this opinion, considering obvious differences in psychophysiological effects, composition, odour profile, & performance in product.

Update 2008. Cropwatch is hoping to bring in an account of the recent Sandalwood conference at the Kimberly Grande Hotel in Kununurra Western Australia from conference attendees, who will give a more expert-eyed account than the trade press, which merely seem to have obediately copied out the organisers up press statements (see Sandalwood biblio at xxxx)

Elsewhere, we hear that attempts have been, or are being made by companies with a 'high naturals' product image (e.g. Aveda) to extensively 'buy in' to Sandalwood oil futures from other minor sources such as New Caledonia etc. etc. However any prospects for expansion of volumes produced from many of these smaller sources, look doubtful.

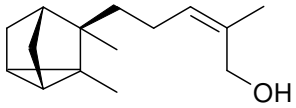
SANDALWOOD, (SW) AUSTRALIAN
Santalum spicatum (R. Br.) A. DC
Distribution: Northern S. Australia & S.W. Australia. The Forest Products Commission (FPC) suggests that distribution area of *S. spicatum* is 161,000 ha of which 80,000 ha is protected. The FPC further state that 2,000 t/y of dead or green sandalwood are exported to S.E. Asia for joss-stick making, or to India for distillation.
Status: Much reduced (in wild) through exploitation: (Mabberley 1998).

"…once grew throughout the medium- to low-rainfall areas of the south-western agricultural region of Australia; however, this resource has been exhausted by over-exploitation" Woodall & Robinson (2003)
Protected in some reserves. Non-sustainably harvested in wild. Plantations not yet productive; no impact assessment (CALM 2003). First 14-year plantation assessment results (2007) show low oil yield (see above).
Sandalwood smuggling in Queensland previously reported.
Notes: Biggest user of Australian sandalwood (production volume 12,000 t/y) is Australia (9,000 t/y). Poor performance record of *S. spicatum* 'oil' usage by perfume houses (N.B. as initially traded, this product was not a true essential oil, but a fractionated solvent extract). Bleiman has noted the oil from *S. spicatum* is not a direct substitute for the superior Sandalwood E.I. oil (see Bleiman 2007). This curiously contrasts with older reports that Australian sandalwood extract was / is reportedly used by the fragrance houses Christian Dior, Calvin Klein and Yves Saint Laurent (Anon 2003). After discovering Indian sandalwood was unsustainable, and its use unethical, Aveda (reportedly) switched to Australian sandalwood qualities from the aboriginal community, Kutabubba (according to Hancock 2005).
Valder & Neugebauer (2003) analysed *S. spicatum* oils from various parts of the tree and pronounced them different from essential oils from *S. album* – noting that oils from *S. spicatum* have lower concentration of *cis*- α-santalol & *cis*-beta santalol, higher conc of (Z)-*trans*-α-bergamotol & *epi*-β-santalol Regarding the bisabolol contents, the main isomer in *S. spicatum* oil was found to be (6R, 7S)-*epi*-β-bisabolol whereas in the oil of *S album* it is 6R, 7S-β-bisabolol

SANDALWOOD, EAST AFRICAN.
Osyris lanceolata Hochst. & Steud ex. A. DC
- some say syn *Osyris tenuifolia* Engl.

"Bastard sandalwood."
Distribution: Eastern Arc Mountains, Tanzania. Also Algeria, Zimbabwe, Swaziland.
Status: Endangered in Kenya (Githae *et al*. 2007). Exploited as a Sandalwood oil source, leading to its decline in Tanzania (Burgess *et al*., 1998; Mbuya *et al.* 1994; Ruffo *et al*. 2002; through Mwang'ingo *et al.* 2006). Threatened status of *Osyris lanceolata* in the Eastern Arc mountains of Tanzania can be viewed at http://global.finland.fi/julkaisut/group_3.htm.
Made a protected species in Tanzania in 2005, so chips/logs cannot be exported, ***but*** ban does not apply to essential oil from tree. Cropwatch has identified one company in 2004 who admitted to shipping 150t/yr logs to India from Mumbai, as well as 750-800Kg East African Sandalwood oil ***per month****!* – see http://www.cropwatch.org/cropwatch3.htm. Domestication of tree encouraged by Tanzanian authorities to safeguard against exploitation.
Notes: Uprooted *Osyris* trees from Tanzania & other African countries reportedly shipped & distilled for essential oil within Tanzania, exported through Mombassa to Indonesia, India & Germany & Far East (Muthui 2005).

East African Sandalwood oil is used to adulterate E.I. Sandalwood oil (*Santalum album*), and is used as a fragrance ingredient in its own right. According to Xinhua News Agency (2004), Tanzania has 44 million ha of forest including ebony & East African sandalwood trees, but is loosing it at the rate of 400,000 ha per annum.
Imported *Osyris tenuifolia* logs are distilled and CO_2 extracted in India by Maplewood Trading, Mumbai.
Cropwatch comments: Scented *Osyris lanceolata* wood from this 8-10m. tree native to S. Africa, makes an interesting oil, having an initial strong sickly sweet note which rapidly gives way to a metallic-rubbery-woody note slightly reminding of Cedarwood. The profile lacks the sensuality of E.I. Sandalwood oil. The dry-own is a smooth somewhat sweet creamy woody note, much less crude and more pleasant than the top note and more similar to E.I. Sandalwood, but as noted for the top note, still lacking the sensual quality of E.I. Sandalwood oil. Its high-ish concentration of santalols (probably 32% max) and high santalyl acetate content (approx 35% typical) may make it seem an attractive proposition to some.

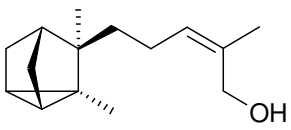


(+)-Z-alpha-santalol

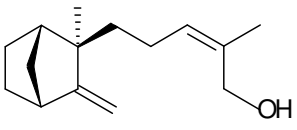
SANDALWOOD EAST INDIAN
Santalum album (Eng.)
Distribution: India, Timor, some Indian Ocean Islands, Indonesia, Philippines, Australia. [Introduced into China, Sri Lanka & Taiwan].
Status: VU A1d Asian Regional Workshop (1998) *Santalum album* In 2007 IUCN Red List of Threatened Species.
Endangered (Maharastra): CAMP meeting Prune Feb. 2001
Priority spp. for in situ conservation: FAO (1984)
Oil export controlled by Madras & Mysore Govts.
Critically endangered in Timor Leste.
Notes: Spike disease greater threat than exploitation (Green 1995), but has not affected N. Indian sandalwood forests e.g. those in Tamil Nadu.
Traditionally Sandalwood has been obtained from the forests of Mysore, Coorg and the Bombay Presidency, and distillation is carried out at Mysore, and to a lesser extent at Kuppam (Andhra Pradesh), Mettur, Bombay, Kanauj and Karkal. (Ram 1997). According to Swaminathan (undated – 2003?) at one time India accounted for 99% of sandal oil production in the world; the area of Sandal under cultivation was given as 9000 km^2 The rate of production of scented heartwood in natural populations was given as 450-600 g/ha/y". Assuming the yield of sandalwood oil on distillation to be 4 to 8%, and the area of sandalwood under cultivation to be <130,000 hectares (in 2003), Cropwatch estimates that the rate of abstraction has been several times the rate of natural production for many years. Worse, by 2004 the number of Sandalwood trees in Kerala's Marayur Forest had dropped from 62,000 to 55,000 from smuggling, disease, fires &

animal grazing causes. Thompson (1997) indicated that exports of *S. album* oil from Indonesia was 17t/y but this source seems to have completely dried up. In E. Timor, 244 tons of sandalwood were exported in 1981, 1 ton in 1985 and none since, due to depletion in wild through over-exploitation. Sandalwood oil exports were 8 tons in 1981 and less than 2 tons in 1996 (da Costa 2003).

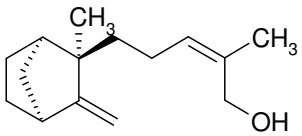
The chemistry of the sandalwood oil odour profile is complex although the weakly odoured (+)-Z-α-santalol should constitute 41% to 55% of the EI oil, and the more important odour impact compound (-)-Z-β-santalol should be present at 16% to 24% according to ISO 3518, which also lists *tr*-α-bergamotol & epi-β-santalol as additional components of the oil.



(+)-Z-alpha-santalol



(-)-Z-beta-santalol



(+)-epi-beta-santalol

SANDALWOOD NEW CALEDONIA

Santalum austrocaledonicum Vieill. var. *austrocaledonicum* has a scattered distribution across New Caledonia, with many natural stands now missing or depleted. See section on *Santalum austrocaledonicum* below for other geographic sources (: Isle of Pines, Loyalty Islands) and for information on other varieties (S. *austrocaledonicum* var. *pilosulum* & *S. austrocaledonicum* var. *minutum*)

Distribution: New Caledonia.

Status: Depleted (Cropwatch 2004). Has undergone extensive over-exploitation and destruction of some types of habitat (sclerophyll forest and low-altítude scrub). Some private planting by farmers & families.

Notes: Cropwatch (2004) reviewed sandalwood production in New Caledonia in its Sandalwood Update http://www.cropwatch.org/cropwatch3.htm, and considered the province could only produce 2 t/yr sandalwood *of oil* sustainably (see below). However Thompson (1997) previously indicated that the market for New Caledonian sandalwood oil was 17-22 t/y, with demand attributed to France, Germany & USA. The Provincial Government has set a sustainable harvest limit of 40 t/year *of wood* (Robson 2004). Lush (UK) alone claims to use 1t/yr of New Caledonian sandalwood oil as an ingredient in its products. Of the other varieties: S. *austrocaledoniciim* var. *pilosulum* is restricted to Noumea (Veillon & Jaffre 1995).

S. *austrocaledonicum* var. *minutum* was found in north-west New Caledonia (Koumac, Tiébaghi, Poum, Tanié), but now is only found in one location, and is endangered according to Veillon & Jaffre (1995).

Cropwatch commented *(in May 2004):* Cherrier (1993) reported on the difficulties of sandalwood cultivation in New Caledonia noting heartwood development was proportional to proper development (fast growing trees producing less heartwood). On the narrower subject of sustainability, Ehrhart (1997) presented a fairly optimistic report on the status of known consistent

sandalwood stocks in New Caledonia (in contrast to the depleted situation in many/most other South Pacific locations), and makes the point that surveyed sustainable logging management should be possible in these circumstances (yearly quotas have been set at 55 to 60 tons of wood). However, apart from illegal cropping & fire damage, the danger is that of over-exploitation – the bio-resources of New Caledonia to supply Sandalwood oil are unlikely to be able to supply more than a few percent (i.e. probably no more than 2 tons max.) of the total Sandalwood oil demand – which will be severely tested now that leading French aroma houses are currently offering oil from this origin. Further, as indicated above, whilst the emphasis in the sales propaganda by Sandalwood oil salesmen has largely centered on examining tree sustainability, the negative aspects concerning the total environmental impact of the operation can easily be overlooked.

References:

Cherrier, J-F (1993). "Sandalwood in New Caledonia". In F.H. McKinnell (ed) *Sandalwood in the Pacific Region. Proceedings of a symposium held on 2 June 1991 at the XVII Pacific Science Congress*, Honolulu, Hawaii. Canberra: ACIAR Proceedings No.49. pp19-22.

Ehrhart Y. (1997) "Descriptions of some Sandal Populations in the South West Pacific: Consequences etc." *ACIR Proc.* **84**, 105-112.

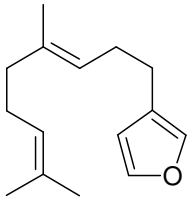
SANDALWOODS, OTHER

Santalum acuminatum (R. Br.) A. DC
(Sweet Quandong)
Distribution: Temperate & Western Australia.
Status: Once common in Australia, becoming rare. Protected: in S. Australia (but law not respected) Holiday (1989)
Notes: Species not used for essential oil production, but is being developed for cultivation as a native food crop – the fruit being used for preserves (see http://www.rirdc.gov.au/reports/NPP/07-027.pdf). The Boots company have advertsed the employment of the fruit ingredient in their cosmetic range (July 2008).

Santalum. affine Pilger ex Skottsb.– no data
Santalum angustifolium – no data

S. austrocaledonicum Vieill
Distribution: Loyauté Islands, Isle of Pines (uncommon on Grande Terrer); Vanuatu (maily on Erromango, on Espirito Santo's W. coast and on Tanna, Ainwa, Futuna, Malakula, Efate & Aneityum); and three varieties in New Caledonia (see above),
Status: Threatened: FAO.
Insufficient data: Cropwatch (2004)
Vanuatu: change of govt. policy in 1977 encouraged sandalwood management, restricted sandalwood log exports & encouraged planting.

Notes: Essential oil and a perfumery absolute produced from heartwood gathered from Loyauté Islands & Isle of Pines (one of main sandalwood regions). Producers sell sandalwood chips directly to the distillers (2 distilleries were established at Port Vila using pressurised steam). On Vanuatu, production in 2003 was 0.5 ton/annum of crude oil, potential thought to be up to 2 tons/annum)..However technical problems have dogged crude oil production, which still had to be rectified & topped slightly (especially to remove over-sweet detracting components such as dendrolasin) in modern vacuum stills
to yield an acceptable perfumery-grade product. At present 2 pressurised stills operate at Port Vila, and a program is in progress to identify stock for replanting sandalwood forests on Vanuatu (Page *et al*. 2006).



dendrolasin

Santalum boninense (Nakai) Tuyama
Distribution: Bonin Islands, Japan.
Status – no data

Santalum ellipticum ('iliahi) Gaud.
"Coastal sandalwood" – according to Wagner *et al.* (1990).
Distribution: Hawai'i Islands.
Status: Insufficient data to establish status: (Cropwatch 2003). Stemmerman (1990) advises *S. ellipticum* **extinct** on Laysan & Kaho'olawe (probably due to animal over-grazing), but present on Kaua'i, O'ahu, Moloka'i, Lana'I, Maui & Hawai'i.
Notes: Also subspecies:

Santalum ellipticum Gaudich. var. ellipticum – present on O'ahu.
Santalum ellipticum Gaudich. var. *latifolium* (A.Gray) Fosb. (Hawaii Islands)
Santalum ellipticum Gaudich. var. *littorale* (Hillebrand) Skottsb (Hawaii Islands) – present on O'ahu.

Santalum fernandezianum F. Philippi
Distribution: Formerly in Juan Fernandezianum Islands.
Status: **Extinct** WCMC (1998). *Santalum fernandezianum.* In 2007 IUCN Red List of Threatened Species.
Notes: *S. fernandezianum* was exploited since 1624 for its valuable sweet-scented wood, and according to Lucas and Synge (1978) the last specimen of this species was last seen alive by Skottsberg in 1908.

Santalum freycinetianum Gaud.
Forest Sandalwood; Freycinet Sandalwood.

Distribution: Polynesia
Status: Insufficient data (Cropwatch 2004). At one time thought very close to extinction.
Notes: several variants known:
S. *freycinetianum* var*. auwahiense*
Santalum freycinetianum var. *freycinetianum* Gaud. ('iliahi). Found on O'ahu, Moloka'I (Stemmermann 1990).

S. *freycinetianum* var. *lanaiense* Rock. Found on Laysan & Maui.
S. *freycinetianum* var. *latifolium*
S. *freycinetianum* var*. longifolium*
S. *freycinetianum* var*. pyrularium.*(Gray). Found on Kaua'i (Stemmermann 1990).
One of the two last stands of *S. freycinetianum* var. *lanaiense* Rock is located within the dry-forest Kanepu'u area on the island of Lana'i (Merlin & VanRavenswaay (1990).

S. fusanus - no data

Santalum haleakalae Hbd.
Haleakala Sandalwood.
Distribution: Hawai'I: specifically only on Haleakala on East Maui.
Status: VU D2 WCMC (1998) *Santalum haleakalae* In 2007 Red List of threatened Species.
Only a few hundred trees left in existence in E. Maui (Kelper 1985). Critically endangered: only 600 trees now exist: Cropwatch (2004).

Santalum insulare Bertero ex A. DC.
Distribution: French Polynesia, Cook Islands, Pitcairn
Status: Insufficient data to establish status: Cropwatch (2004)
Notes: Used to fragrance coconut oil "ahi monoi".
According to Fosberg & Sachet (1985) through Butand (2004).the distribution of *S. insulare* varieties across East Polynesian islands is as follows:

S. insulare var. a*lticola* Tahiti
S. insulare var. *deckeri* Nuku Hiva, Hiva Oa, Tahuata, Fatu Hiva
S. insulare var. *hendersonense* Henderson.. Pitcairn.
S. insulare var. *insulare* Tahiti
S. insulare var. *marchionense* Nuku Hiva, Hiva Oa, Tahuata, Ua Pou
S. insulare var. *margaretae* Rapa
S. insulare var. *mitiaro M*itiaro
S. insulare var. *raiateense* Raiatea, Moorea
S. insulare var. *raivavense* Raivavae

Santalum insulare var. *hendersonensis* Bertero ex DC
Distribution: Henderson Island (Pitcairn)
Status: Vulnerable

Santalum insulare var. *marchionense* Betero:
Distribution: Nuku Hiva, Hiva Oa, Tahuata, Ua Pou (Marquesas).
Status: Vulnerable on Mont Mauru (Tahiti, Society Islands): Meyer & Florence (1997)
Vulnerable:: Florence, J. (1998). *Santalum insulare* var. *marchionense*. In: 2006 IUCN Red List of Threatened Species (***Cropwatch comments:*** we have been unable to confirm this Red Listing).
Notes: French Polynesia: The decree n° 296/CM of 18 March 1996 included certain species on the list of protected species relevant to category A. Among the 19 protected plants is *Santalum insulare* var *insulare* & *Santalum insulare* var. *margaretae.*
Bertero: Critically endangered (French Polynesia).

Santalum insulare var. *deckeri* Fosberg & M.-H. Sachet
Distribution: Nuku Hiva, Hiva Oa, Tahuata, Fatu Hiva in Marquesas Islands.
Status: - no data

Santalum lanceolatum R. Br. (Hewson & George 1984).
"Plum bush"
Distribution: Australia: Queensland, NSW, Victoria, W. Australia
Status: Endangered in Victoria & Queensland.
A threatened taxon under Schedule 2 of the Flora and Fauna Guarantee Act (1988)
Notes: Has been previously exploited for essential oil production. According to Fergeus (2000) a sample of *S. lanceolatum* was found to contain 43% *cis*-lanceol, 13% *cis*-nuciferol and 12% *trans*-nuciferol, and only 2% *cis*-α-santalol. The high negative rotation (typically - 45°) has made it useful as an additive to Australian sandalwood oils to ensure compliance to essential oil standards.

Santalum leptocladum Gand. – no data

Santalum macgregorii F v. Mueller.
Distribution: Papua New Guinea.
Status: EN A1cd, C1 Eddowes PJ. (1998) *Santalum macgregorii* In 2007 IUCN Red List of Threatened Species.
Notes: New plantations set up with international economic aid in Tamilnadu. Some reports of wasteful collection of immature plants from plantations.

Santalum murrayanum (T.L. Mitchell) C.A. Gardner
“Bitter Quandong”
Distribution: Temperate & W. Australia
Status: Protected: in S. Australia but law not respected: Holiday (1989).
Notes: Little, if any, essential oil produced.

Santalum obtusifolium R.Br.
Distribution: NSW & Queensland.

Status – no data

Santalum paniculatum Hook & Arnott.
Hawai'I Sandalwood.
Distribution: Hawai'i
Status: Stands of *S. paniculatum* on Hawai'i harvested without regulation (Merlin & VanRavenswaay (1990).
Notes: In 1998 it was reported that 300 tons of *S. paniculatum* logs were sold to China sourced from Hokukano Ranch (formerly the W.C. Greenwell Ranch) on the slopes of Mauna Loa above Kealakekua on the island of Hawai'I according to TenBruggencate (1988) through Merlin & VanRavenswaay (1990). Felgelson (1990) gives a first hand account of the revival of the trading in *S. panicularum* on Hawai'I since 1988.
Stemerman (1990) advises:

Santalum paniculatum var*. paniculatum* found on Hawai'i.
Santalum paniculatum var *pilgeri* also found on Hawai'i. Some seedling planting on Pu'u Huluhulu.

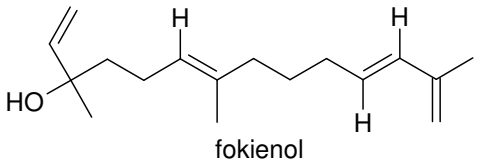
Santalum papuanum Summerh.
Distribution: Papua New Guinea. Reports of cultivation in China.
Status: Little data available. Some reports of indiscriminate logging affecting tree numbers.

Santalum yasi Seem.
Distribution: Tonga, Fiji (Bua coast grassland areas; Vannu Levu in N. Lau, & on Viti Levu), Niue.
Status: Depleted, sites often inaccessible (Cropwatch 2004).
Surveys in 1981 (Usumaki 1981) & 1984 for Bua & Vannu Levu indicate total standing weight equivalent of 1,000 t heartwood only (through Jiko 2000). Some private plantings by farmers & individual families.
Notes: Over-harvesting of sandalwood on Tonga in the 1960's & 1970's led to a ban on exports until the late 1990's (Kaufusi *et al.* 1999). A small amount of *S. yasi* wood sold from Tonga in 1996-7. However individual lots of debarked sandalwood yasi now seem to be offered for sale on the Internet e.g. by The Opal Factory, Cairns, Queensland (downloaded Sept 2007). N.B. The website photograph accompanying the sandalwood lot details above feature a man wearing a mask to obscure his identity. Why do you think this is?
Thompson (1997) of the CSIRO notes that introduced *S. album* grows more rapidly in Fiji than *S. yasi*. *S. yasi* will also hybridise spontaneously with *S. album*. Thompson also notes that *S. yasi* is not distilled for oil from lack of wood supply - however Cropwatch has (poor quality) unsolicited *S. yasi* sandalwood oil samples from several aromatherapy essential oil suppliers.

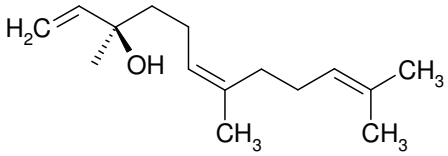
SHOREA ROBUSTA
Shorea robusta Gaertn.f.
Sal tree.

Distribution: Nepal
Status: Tree banned for felling, transportation or export in Nepal.
Notes: Source of salresin (or Chua oil). Sal dammar gum is exudated from the stem of *Shorea robusta* in India**,** a large semi-deciduous tree forming dense area of woodland in monsoon areas, especially in Orissa, and used in caulking boats and in shoe polish. Up to 1 ton was used per day in Kanaj to produce incense & attars according to Ram (1997). Sawdust, & resin of *S. robusta* tree ('dhuno') & gum of tree ('khagar') used to prepare incense sticks sold in Lataguri market (Bandyopadhyay *et al.* 2005).
Other *Shorea* species are tapped in Thailand, Cambodia and Laos; *S. javanica* K. & V. is tapped in Sumatra; *S. lamellate* Foxw.; in Malaya, Sumatra & Borneo, *S. guiso* (Blanco) Bl. in several locations including the Phillipines.

SIAM WOOD
syn Pe Mou
Fokienia hodginsii (Dunn) A. Henry & H. Thomas
Distribution: S.E. China, N. (Dai Son) & W. Central Vietnam, S. Vietnam (Lam Dong) and parts of N. Laos.
Status: LR/nt Conifer Specialist Group (1998). *Fokienia hodginsii* In 2007 Red List of Threatened Species.
Notes: Older wood, tree roots distilled for essential oil. Commonly used in China in spite of Red List status. Wood used for coffin making & furniture in Taiwan. Weyerstahl *et al.* (1999) found the wood to contain 35% *E*-nerolidol, 26% fokienol and 3% dauca-8(14),11-dien-9-ol.



fokienol



(S)-*cis*-nerolidol

SPIKENARD
Nardostachys grandiflora (Jones) DC.
Distribution: Himalayas, Tibet, Bhutan, W. China.
Status: Annex V of the EU Habitats, Fauna and Flora Directive: (EUROPA 2003)
Banned for export from Nepal (Forest Act 1993) & Uttah Pradesh.
Vulnerable in Nepal: CAMP meeting Pokhara (2001).
Listed in Appendix II CITES (1997) at the request of India. Due to poor implementation & enforcement of previous CITES rules, the German delegation tabled a series of recommendations at the 16th meeting of the CITES Plants Committee (PC16) held 3-8 July 2006 in Lima (Peru) which was upheld by the Plants Committee to be forwarded to the Secretariat for further action.
Endangered: Swat area of Pakistan.
Notes: Habitat destruction & over-exploitation of the plant (gathered for medicinal properties of the tubers) have caused steady decline in plant numbers. Some limited cultivation in Indian & China. For more details see http://www.ansab.org/News_Fol/plantprofile.htm.

An initiative for *Nardostachys* spp. cultivation between an NGO & Nepalese farmers is currently in place, but carries no environmental impact studies (Cropwatch: unpublished information). This initiative has brought about pharmaceutical interest (certain *Nardostachys* spp. constituents have a sedative effect on the CNS) and may not ultimately benefit the oil market. Previously the commercial harvesting of medicinal aromatic plants and the shortcomings of Nepal's forest legislation with respect to detrimental effects on farmers had been discussed Olsen & Helles (1997); Malla YB "Sustainable Use of Communal Forests in Nepal." *J. of World Forest Resources Management* **8**, 51-74.

SPRUCE, NORWAY
Picea abies (L.) Karst.
syn. *P. excelsa* Link.
Distribution: Distributed over 14 countries in Central & NE Europe including Norway & Poland, Balkans etc.
Status: LR/lc Conifer Specialist Group (1998) *Picea abies*. In 2007 IUCN Red List of Threatened Species.
Notes: Spruce beer still made from tree. Spruce needle & twig oils are used in perfumery. *Picea alba* trees were used to make Burgundy Pitch for plasters.

SPRUCE, BLACK
Picea mariana (Mill.) Britt, Sterns & Pogg.
syn. *Picea nigra*
Distribution: Native to Canada & NE USA.
Status: LR/lc Conifer Specialist Group (1998) *Picea mariana*. In 2007 IUCN Red List of Threatened Species.
Notes: Needle & twig oil used in perfumery to impart fresh notes to men's fragrances and in piney-herbaceous bath products.

STYRAX, 'AMERICAN.'
[Also referred to as Storax].
Liquidambar styraciflua L.
or *Liquidambar styraciflua* L. var. *macrophylla*;
L. *styraciflua* L. var. *orientalis*
L. *styraciflua* L. var. *integriloba*
L. *styraciflua* L. var. formosana H. (local use in China, Vietnam, only)
Distribution: United States: Belize; Guatemala; Honduras; Mexico (Chiapas, Hidalgo, Oaxaca, Veracruz); Nicaragua; SE USA
Status: LR/lc Americas Regional Workshop (Conservation & Sustainable Management of Trees, Costa Rica) 1998. *Liquidambar styraciflua.* IUCN 2007. 2007 IUCN Red List of Threatened Species.
Notes: Gum oleo-resin produced mainly in Honduras, extracted to produce resinoid; resinoid in turn is steam or vacuum distilled to produce styrax oil. Styrax pyrogenée is produced by dry distillation of resinoid. Styrax qualities used to be heavily used as fragrance ingredient; IFRA requirements to produce a skin-neutral product have resulted in ingredient with less useful attractive odour characteristics, so fragrance ingredient use has plummeted. Styrax resinoid is

used as fixative in oriental fragrances, and in chypres. It is also useful in constructing hyacinth notes.
N.B. Gum styrax oleoresin is also produced in Turkey [15t/y Tanker *et al.* (1993).; however General Directorate of Forestry in Turkey says 2000 tons (?) produced in 1999 ref: Ozugurlu & Duzgun (2003)] from *Liquidambar orientalis* Miller, the trees growing in forests near Koycegiz and Marmaris. The gum resinoid has always been imported into the US in lesser amounts than the Honduras material.
Lawrence recently reviewed the composition of styrax oils from Hondoras & Turkey (Lawrence 2007).

THYMUS SPP.
In Spain almost 100% of harvested *Thymus* spp. are collected from the wild, especially in SE Spain. Collection and trade of several *Thymus* species are subject to authorisation in Andalucia and Valencia (TRAFFIC: http://www.traffic.org/plants/species-15.html), whilst *Thymus loscosii*, *T .albicans* and *T. carnosus* are protected under Spanish law (Lange 1998). This protection doesn't include rare spp. such as *Thymus antoninae, T. herba-barona* subsp. *bivalens* & *T. richardii.* Lange further claimed in *Thymus* herb gathering in Spain is not monitored and that the true status of *Thymus* spp. is not known. Threatened species include:

- *Thymus baeticus* Boiss. ex Lacaita
Spanish Lemon Thyme.
Distribution: S.E. Spain
Status: In decline (Blanco & Breaux 1997).
Notes: Essential oil offered by aromatherapy oil traders such as Oshadi.

- *Thymus moroderi* Pau ex Martínez
Distribution: Alicante & Murcia area of Spain.
Status: Threatened (Blanco & Breaux 1997)

- *Thymus serpylloides* Bory subsp*. serypylloides*
Distribution: Spain
Status: Protected by Spanish & international authorities.

- *Thymus zygis* Loefl. ex L. subsp. *gracilis* Boiss R. Morales
Distribution: Spain
Status: Threatened: no monitoring by authorities (Lange 1998).
In decline: (Blanco & Breaux 1997).
Notes: Essential oil traditionally produced in Tomillaires (heath region) of Spain, but production in other major producing countries includes Algeria and Morocco, Turkey (also formerly Israel, Portugal, and Yugoslavia).

TOLU
Myroxylon balsamum (L.) Harms. var. *genuinum.* Baill**.**

Distribution: Genuine Tolu balsam is the exudate obtained by incising the trunks of the large 25m. trees, which grow wild in Columbia and Venezuela, and which are cultivated in Cuba

Status: Cropwatch 2007: Not enough data. Offical listings do not distinguish sufficiently botanically between *M. balsamum* variants e.g Red Mahogany Costa Rica (not exploited for balsam), Tolu-balsam (*Myroxylon balsamum* (L.) Harms. var. *genuinum* Baill.) & Peru balsam (*M. balsamum* var. *pereirae* (Royale) Harms). bearing variants.

Notes: Tolu resinoid absolute (as used in cough medicines, confectionary) were and are still now invariably constructed from other ingredients – such as benzoin resinoid (60%), styrax and peru resinoids; a formula for artificial tolu essence which was added in small amounts to increase the odour value consists of 28% vanillin, 11.0% coumarin, 22% ethyl cinnamate and 39% benzyl alcohol – in practice aromatic additives might be be further added to pass BPC 1973 or USP test requirements. Tolu resin absolute is also used in perfumery to conbsruct chocolate like notes, and in sweet balsamic orinbental accords, and also finds use in joss stick perfumes.

VALERIANA JATAMANSI

Valeriana jatamansi Jones

syn. *Nardostachys* j*atamansi* (Jones) DC. – according to some.

Sugandhawal

Distribution: This once abundant small perennial herb grows to 0.7m in the Indian Himalayas (Nepal, Tibet, Sikkim and Bhutan) on open slopes and rock ledges at 3000 to 5000m (other sources say 1200 to 4000m.)..

Status: Endangered: Swat area of Pakistan.

Vulnerable in Nepal: CAMP Report (2001) Pokhara.

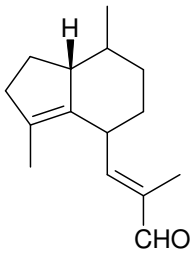
Limited Domestication program exists in Nepal.

Restrictions on collection for export imposed by the Government of Nepal under Forest Act 1993.

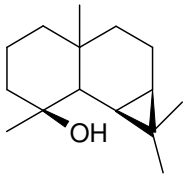
Notes. Herb used to treat nervous conditions by indigenous population (epilepsy, hysteria) and for asthma, leprosy, cholera & skin diseases, but considered medicinally inferior and as a substitute for *Nardostachys grandiflora.* Used as a sedative & tranquiliser from consideration of presence of valepotriates. Steam distillation of the dried rhizomes gives jatamansi oil. Amatya & Sthapit (1994) expressed concern about over-exploitation of the species, calling for increased levels of cultivation, further commenting that export volumes of exported oleoresin & essential oil are often inaccurately reported, to avoid payment of government tax.

The essential oil contains contains α- & β- pinene, δ-3-carene, 1(10)- and 9-aristolene, α- and β-patchoulene, seychellene, valerenal, nardastachone, calarenol, γ-cadinol, maaliol, nardol, elemol, β-eudesmol, and jatamansic acid amongst others (Tauteges 1967, Makeswari & Saxena 1974). A more recent analysis by Okuda (1991) on plants gathered in Nepal showed the presence of β-patchoulene, d-nardostachone, aromadendrome, δ-cadienene and valeranone, and minor amounts α-pinene, β-pinene, limonene, 1.4-cineole, linalol, α-

gurjunene, β-guaiene, tr-pinocarveol, β-bisabolene, α-curcumene, β-ionone, and humulene oxide



valerenal



maaliol

WHITE SAGE OIL
Salvia apiana Jepson.
Distribution: S. California, USA
Status: Threatened: Cropwatch 2004
Listed as "To Watch" Virginia Plant Savers (2007)
Listed as "To Watch" United Plant Savers (2007)
Notes: Robert Seidel reports on distillation of 445 lbs of (wild gathered?) White Sage herb at http://guerilla-distiller.blogspot.com/2007_09_01_archive.html

WIKSTROEMIA
A genus of fifty species. Those producing gaharu include:
.
- *W. adorosaemifolia*

Distribution: East Nusa Tenggara
Notes: Known as "cue" or "sue". (Universitas Nusa Cendana-UNC 1996).

- *W. polyantha* :

Distribution: West Papua in Manojwari
Notes: Known as gaharu sirsak. (Mai and Suripatty 1996).

- *W. tenuiramis* :

Distribution: West Papua in Manojwari
Notes: Known as gaharu cengkeh (Mai and Suripatty 1996).

WINTERGREEN OIL
Gaultheria fragrantissma Wall.
Distribution: India (Western Ghats, NE Himalayas), Java, W. Nepal, China (Yunnan area).
Status: Considerable depletion in the wild esp. in S. India CIMAP (1977)
China: Authorities have (allegedly) prohibited plant gathering from the wild (Bleimann 2007). This may cause subsequent commercial non-availability.
Notes: Demand for oil-bearing plant material (Nepal): 5,000 Kg/y (Tiwari *et al*. 2004).
In the Indian & Nepalese processes, to liberate essential oil (99% methyl salicylate) leaves are macerated with warm water and fermented 2-3 days prior

to steam distilling (5hrs). In the Chinese process hot or cold solvent extraction is used, leading to two different oil qualities.

REFERENCES:

Aberchane M, Fechtal M. & Chaouch A. (2004) "Analysis of Moroccan Atlas Cedarwood Oil (*Cedrus atlantica* Manetti)." *J. Essent. Oil Res*. **16**, 52-547.

Adetunji J (2008) "New fears for elephants over ivory sale to China." *Guardian* 16th July 2008 p15.

Amatya G. and Sthapit V.M. (1994). "A note on *Nardostachys jatamansi." Journal of Herbs, Spices and Medicinal Plants* **2**(2): 19-47.

Anastas P. & Warner J. (1998) *Green chemistry theory & practice.* Oxford Univ. Press NY 1998.

Anon (2001): US General Declaration to the First Meeting of the WIPO Committee 1st May 2001 'thro Balasubramaniam K.. (2003), q.v.

(Anon 2003) "Winning exporters". *Soap Perfumery & Cosmetics* Jan 2003.

Anon (2008a) An Oasis in the land of confusion." *Perf & Flav*. **33** (May 2008), 36-39.

Anon (2008b) "Editing nature." Perf & Dlav. 33 (June 2008), 38-39.

Ashoton G. 2003 "Out of Africa" *Natural Medicine – South African Journal of Natural Medicine* at http://www.naturalmedine.co.za/sajnm_main/article.php?story+20031008161804109

Australina, The (2007) "Labour talks tough on illegal timber imports." Australian 04.10.07 - see *http://www.illegal-logging.info/item_single.php?item=news&item_id=2360&approach_id=8*

Baker P.M. *et al.* (1972) "Chemoprophylactic agents in schistosomiasis: eremanthine, costunolide, a-cyclocostunolide and bisabolol." *J. Pharm. Pharmac*. **24**, 853-857.

Balasubramaniam K. (2003) *"Intellectual Property Rights & Herbal Medicine" Sri Lanka Association for the Advancement of Science Annual Scientific Sessions, December 2003. Theme Seminar "Herbal Medicines for the People"* Sri Lanka Foundation Institute 10th December 2003.

Bandyopadhyay S., Nandi S., Bose A., Chakrabortty T. & Mondla MS "Some less known useful plants from Lataguri, Jalpaiguri district, Wsst Bengal" *Envis Newsletter* **10**(1&2), 2005

Barata L. (2007) "Amazon Scents: Replacing Rosewood in Perfumery? Part II" *P&F Now* April 4th 2007.

Baser K.H.C., Demirci B, Dekebo A. & Dagne E. (2003) "Essential oils of some *Boswellia* spp, Myrrh and Oppoponax" *Fl & Frag J* **18**, 153-6.

Bein E. (1998) "The effect of deforestation on climate change in Eritrea." Paper presented to *Initiation of Climate Change DoE* Dept 3-4 Australia.

Benjamin A. (2008) "Watchdog criticises misleading Malaysian palm oil advert" *Guardian* Wed 9th Jan 2008.

Bird K. (2007) "European harmonisation of organic and naturals to become reality" *Cosmetics-Design.Europe*. 04.10.2007

Blanco & Breaux (1997) "Results of a study of commercialisation, exploitation and conservation of medicinal and aromatic plants in Spain" - unpublished report for TRAFFIC Europe through Lange, D. (1998) *Europe's Medicinal and Aromatic Plants: their use, trade and conservation*. Traffic Europe 1998.

Bleiman K. (2007) “Things You Won’t Hear From Your Boss” transcript of address to WFFC, NJ, 2007.

Brand J., Kimber P. & Streatfiekd J. (2006) “"Preliminary analysis of Indian sandalwood (*Santalum album* L.) oil from a 14-year-old plantation at Kununurra, Western Australia." *Sandalwood Research Newsletter* Issue **21**, 1-3.

Brinckmann J. (2007) “Peruvian maca & allegations of biopiracy.” *Herbalgram* **75**, 45-53.

Broad S (1995) “Agarwood Harvesting in Vietnam.*” TRAFFIC Bulletin- Wildlife Trade Monitoring Unit* 1995 **15**(2), 96 Traffic International.

Briggs J.D. & Leigh J.H. (1995) *Rare or Threatened Australian Plants* revised edn. 1995 CSIRO Australia p103.

Bunders *et al.* (1996) through Swaminithan (1998) Research foundation Chenna – see Rukangira E. (2001) below.

Burgess N.D., Nummelin M., Fjedsa J., Howel K.M., Lukumbuzya K., Mhando L., Phillipson P. & Vanden B.E. (1998) " Biodiversity and conservation of the Eastern Arc Mountains of Tanzania and Kenya. Working group report. *Journal of East African Natural History* (special issue), **87**, vii-xxii.

Butaud J.F. (2002) “Autécologie et Phytosociologie des Santals de Polynésie française.” *Proceedingsof the Regional Workshop on San-dalwood Research, Developmentand Extension in the Pacific Is-lands and Asia*, 7-11 October, 2002, Noumea, New Caledonia

Caldertin E. (1997) *Lista de plantas Colombianas en peligro*. July 1997 Version. Instituto de Investigacino de Recursos Biologicas Alexander von Humboldt. (unpublished).

Cambornac M., Crepin J., Flavet L., Guellec g., Redziniak g. & Robin J.R. (1998): “*Arnica chamissonis* Less., an alte rnat ive to *Arnica montana* L., plant under threat. – *Proceedings of the 20th IFSCC Congress,* Cannes, France, September 1998.

Cambornac M. (2000) “Preservation of *Arnica montana* L.” *Medical Plant Conservation* **6** (2000) pp26-7.

Cassels A.C., Walsh C., Belin M., Cambornac M., Robin J.R. & Lubrano C. (1999):” Establishment of a lantation from micropropagated *Arnica chamissonis*, a pharmaceutical subtitute for the endangered *A. montana*.” *Plant, Cell Tissue and Organ Culture* **56**, 139-144.

Chakravarti V. (2002) “Vulnerable & threatened plants of economic value. *Hydnocarpus kurzii*.” *MFP News* **12**(2), 17-18.

Ciesla W.M. (2002) “Juniper Forests – A Special Challenge for Sustainable Forestry” *Forests, Trees and Livelihoods* **12**, 195-207.

CIMAP (1997): Central Institute of Medicinal and Aromatic Plants (CIMAP 1997). From *Indian Medicinal Plants Facing Genetic Erosion* CIMAP Lucknow 1977.

CITES (2005): see http://ec.europa.eu/environment/cites/pdf/ctwff/33rd_summary_com.pdf

Clarke M. (2007). “Sandlawood industry overview & research needs analysis”. RIRDC Project No AGL-5A – see http://rirdc.gov.au/como07/eop1.html#AGL-5A.

Claeson, P. (1990). “Pharmacognostic studies on scented myrrh with emphasis on the Biological Activities of the isolated sesquiterpene T-cadinol.” 1-46. PhD Thesis, Uppsala University, Sweden.

CoAS (2003) Commonwealth of Australia Senate – Economic Value of Native Animal Commerce see - http://www.aph.gov.au/SENATE/COMMITTEE/rrat_ctte/completed_inquiries/1996-99/wild/report/c05.htm

Collins N.F., Graven E.H., van Beek, T.A. & Lelyveld G.P. (1996) "Chemotaxonomy of commercial buchu species (*Agathosma betulina* & *A. crenulata*) *J. Essen. Oil Res.* **8**, 229-235.

da Costa H. (2003) "The evolution of agricultural policies in East Timor." Agriculture: *New Directions for a New Nation — East Timor (Timor-Leste)* eds Helder da Costa, Colin Piggin, Cesar J da Cruz & James J Fox ACIAR Proceedings No. 113 (printed version published in 2003)

Cropwatch (2005) "Ambergris Update" http://www.cropwatch.org/ambergris.htm

Del Fierro, P. & Rivera H. (2001) Bosque 2001. – 262 pp. CONAF and GTZ. Santiago de Chile.

Didal J. (2007) "Air-freighted food muss pass Fairtrade test to retain organic label in future." *Guardian* Oct 25th 2007 p 4

Dietrich K. (1920) *Analysis of Resins* p.201 'through Barry *et al.* (1926) *Natural and Synthetic Resins* p83-89.

DFID (2002) - Department for International Development, United Kingdom - through Williams (2005) q.v.

Douglas, J. A., Smallfield, B. M., Burgess, E. J., Perry, N. B., Anderson, R. E., Douglas, M. H., Glennie, V. le A. (2004) "Sesquiterpene lactones in *Arnica montana*: a rapid analytical method and the effects of flower maturity and simulated mechanical harvesting on quality and yield." *Planta Medica* **70**(2), 166-170.

Ellenberger A. (1999): Assuming responsibility for a protected plant. Weleda's endeavour to secure the firm's supply of *Arnica montana*. In: TRAFFIC Europe (Ed.): Medicinal plant trade in Europe. Proceedings of the first symposium on the conser vation of medicinal plants in trade in Europe, 22-23.6 .1998, Kew – pp. 127-130, TRAFFIC Europe, s.loc.

Farjon, A. Page C.N. & Schellevis N. (1993). "A preliminary world list of threatened conifer taxa." *Biodiversity and Conservation* **2**, 304-326.

Farjon A. (2005) "*Juniperus* L." In: Guner A. Ozhatay N., Ekin T., Baser KHC (eds.) *Flora of Turkey & East Aegean Islands* **11**, 810. Edinburgh Univ. Press.

Felgelson J. (1990) "Sandalwood - the myth & the reality." Paper presented at the *Symposium on Sandalwood in the Pacific*, April 9-11, 1990, Honolulu, Hawai'i.

Ferreira A. (2007) "Farmers see profit in S. African Herb." *Reuters UK* Mar 6th 2007

Fletcher R (1994) 5.4 Sandalwood in *The Australian New Crop Newsletter* No 2 July 1994.

Florence, J. (1996). Liste des espèces endémiques de Polynésie Française avec leur répartition géographique et leur statut IUCN, tirée de la banque de données botaniques NADEAUD (unpublished).

FRA (2005) "Threatened, Endangered and Vulnerable Tree Species : A Comparison between FRA 2005 and the IUCN Red List" FRA WP 106/E

Gachathi F. N. (1997) "Recent Advances on Classification and Status of Main Gum-Producing Species in the Family Burseraceae" available at http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/X0098e/X0098e01.htm

Garzuglia M. (2006) Global Forests Resources Assessement 2005: “Threatened, endangerd and vulnerable tree species: a comparison between FRA 2005 and the IUCN Red List.” Rome, 2006.

Gantie L., Zixiang Y., Slycken J.V. & Weidong Z. (undated) “Conservation of genetic resources of European Black Poplar (Populus nigra L.) in China.” *PGR Newsletter* **143**, pp46-50.

Gebrehiwot K *et al* (2007) "The importance of closed areas for the natural regeneration of *Boswellia papyrifera* (Del.) Hochst in Ethiopia" In: SA Ghazanfar & HJ Beentje (eds) “Taxonomy & ecology of African plants, their conservation & sustainable use.” pp147-156 Royal Botanic Gardens Kew.

Githae E.W, Mins Chuah-Petiot, John K. Mworia, David W. Odee D.W. (2007) "A botanical inventory and diversity assessment of Mt. Marsabit forest, a sub-humid montane forest in the arid lands of northern Kenya" *African Journal of Ecology* (OnlineEarly Articles) doi:10.1111/j.1365-2028.2007.00805.x

Gramosa N.V. & Silveira E.R. (2004) “Volatile constituents of *Copaifera langsdorffii* from the Brazilian Northeast.” *J. Essen. Oil Res*. **17**, 130-132.

Gramosa N.V. (2004) “Contribucao au conhecimento quimico des plantas do nordeste: Capparis flexuosa & Estudo quimico da autoxidacao do β-cariofileno em oleos essencialis.” MSc. Thesis presented at UFC, Fortaleza, Ceara, Brazil (1994).

Greenwood H. (2006) “How green is your spritz?” *Sydney Morning Herald* 12th June 2008.

Guha R. & Pramanik D. (2005) “Know yourt CITES Plnts –II: *Nepenthes khasiana* Hook F. & *Saussurea costus* (Flac.) Lipschitz. – Treasures worth saving.” *Envis Newsletter* **10**(1&2) 2005.

Gulati B.C. (1082) In *Cultivation & Utilisation of Aromatic Plants* (eds Atal C.K. & Kapur B.M. Regional Research Laboratory, CSIR, Jammu-Tawi 620-633.

Hamayan M., Khan S.A., Sohn E.Y & Lee I-J. (2006) “Folk knowledge & conservation status of some economically valued medicial plants of District Swat, Pakistan.” *Lyonia* **11**(2) 2006

Hancock L. (2005) *The Guardian Weekend*, Jan 8 2005, p43].

Hilali M., Charrouf Z., Soulhi A., Hachimi Larbi., Guillaume D (2007) "Detection of Argan Oil Adulteration Using Quantitative Campesterol GC-Analysis." *J. Am Oil Chem Soc* **84**(9), 761-764.

Holliday I. (1989) *Australian Trees* p292.

Hoegler N. (2000) “Plight of Buchu Underscores the Need for International Herb Development” *Herbalgram* **50,** 16.

Higman *et al*. (1999) *The Sustainable Forestry Handbook* Earthscan Publicns.

Hilton-Taylor, C. 2002. 2002 IUCN Red List of Threatened Species. IUCN Gland, Switzerland and Cambridge, UK.

Hsu, Hong-yen *et al.* (1986) *Oriental Materia Medica: a Concise Guide* pub. Oriental Healing Arts Instit. of the United States.

Jabeen N., Shawl A.S. & Dar G.H. (2007) “Micropropagation of *Inula racemosa* Hook.f. - A Valuable Medicinal Plant.” *International Journal of Botany* **3** (3): 296-301.

Jha A. (2007) “Endangered tigers found in Indonesian jungle allocated to agriculture.” *Guardian* Oct 31st 2007 p15.

Jha A. (2008) “Shark species face extinction amid overfishing & appetite for fins.” *Guardian* Feb 18th 2008 p11.

Jiko L.R. (2000) “Status & Current Interest in Sandalwood in Fiji” *Sandalwood Research Newslettter* No. **10**, May 2000.

Joulain D. 1994 “Success & failures in essential oils: a historical overview” 4emes *Rencontres Internationales* – Nyons 5-7th Dec 1994.

Kathe W. (2005) "Sustainable sourcing of *Arnica montana* in the Apuseni Mountains (Romania): A field project." *Medicinal Plant Conservation* Aug 2005

Kaufusi S., Harmani S/ & Thomson L. (1999). “Sandalwood work on ‘Eua, Kingdom of Tonga.” *Sandalwood Research Newsletter*. CALM, Kununnura, Western Australia.

Kepler A.K. (1985) “Sandalwood: Hawaii's precious ‘iliahi.” *Mauian.* **2**(6): 6-11.

Khalid H.S., Elkamali H.H. & Elmanan A.M. (undated) "Trade of Sudanese Natural Medicininals and their role in Human and Wildlife Health Care." Presentation to the 3rd WCAMP in Chaing Mai Thailand.

Kobus A (2004) – private correspondence to Cropwatch.

Kull C. A. (2002) *Journal of Cultural Geography* 22.03.2002.

Lawrence B.M. (1995) “Progress in Essential Oils” *Perfumer & Flavourist* Vol 20 July/August 1995 p30.

Lawrence B.M. (2007) “Progress in Essentialk Oils.” *Perfumer & Flavourist* Sept 2007 pp44-49.

Lopes J.N.C. *et al* (1991) "Chemical variability of vanillosmopsis erythropappa." *Anais da Academia Brasileira de Ciências* **63**, 21-22.

Lucas G. & Synge H. (1978) *The IUCN Red Data Book* pub IUCN Morges Switzerland 1978.

Lumain M. “SCSS - Outing to a Palm Oil Plantation” *IFSCC Magazine* **8**(3), 234-235.

Lupe F., Souza R. & Barata L. (2008) "Seeking a sustainable alternative to Brazilian rosewood." *Perf & Flav*. **33**, 40-44.

Lybbert T., Wilkes H. & Barrett C. (undated) "Commercializing Argan Oil in Southwestern Morocco: Pitfalls on the Pathway to Sustainable Development" - see http://aem.cornell.edu/faculty_sites/cbb2/Papers/LBN_commercializing.pdf

Maia B. *et al.* (2000) “Essential Oils of *Toona* and *Cedrela S*pecies (Meliaceae): Taxonomic and Ecological Implications” *J. Braz. Chem. Soc.* **11**, 6 Nov./Dec. 2000

Makeswari ML & Saxena DB (1974) *Ind J. Chem* **12**, 1221

Mardaga (1999) *Le grand livre de la Foret Morocaine* pub. P. Amardaga Spimont (Belgium) 1999.

Margolis M. (2004) “Jungle Economics; Environmentalists thought they could save the Rain Forest and make money at the same time. They were wrong.” *Newsweek Internat.* 16.02.2004

Marzan A.S. & Vidal J. “Malaria moves in behind the loggers.” *Guardian* Oct 30th 2007 p17.

Mathaba (2007) “Vietnnam promotes crassna plantation for essential oil – posted 2007/09/18 – see http://www.mathaba.net/news/?x=564413

Mathachen, G. P., Vasudeva, R., Gowda, H. C. H., Ganeshaiah, K. N., Shaanker, R.U. (2004) "Ecological amplitude and regeneration of medicinally important threatened trees in the Central Western Ghats." *Indian Forester*, **130** (11), 1330-1338.

Mbuya L.P., Msanga H.P., Ruffo C.K., Birnie A. & Tegnass B. (1994) "Useful trees and shrubs of Tanzania:" SIDA/RSCU, Nairobi, Kenya.

Mwang'ingo P. L., Teklehaimanot Z., Lulandala L. L. & Maliondo S. M. (2006) "Propagating *Osyris lanceolata* (African sandalwood) through air layering: Its potential and limitation in Tanzania." *Southern African Forestry Journal* **207**, 7-14.

May P.H. & Barata E.S. (2004) "Rosewood Exploitation in the Brazilian Amazon: Options for Sustainable Production." *Economic Botany* **58**(2) pp257-265 (2004).

Merkle J. (2008) "Face cream firms stop using shark liver oil." *Guardian* 30th Jan 2008 p10.

Meyer J-V & Florence J (1997?) "Mont Mauru (Tahiti, Society Islands) and Toovii ridges (Nuku Hiva, Marquesas Islands), two natural areas of ecological interest in French Polynesia, proposed as PABITRA sites"

Montague-Jones G. (2007) "Brazil reveals all at Beyond Beauty, Paris." *Cosmetic-Design Europe* 02.10.2007.

Montague-Jones G. (2007b) "Weleda executives explain green challenges & plans." *Cosmetics-Design Europe* 27.09.2007.

Mwai, Muthui (2005) "Call to protect the sandalwood" *The Nation (Nairobi)* Pub: 07/10/2005.

Murphy C. "Forest idealists blinkered in their thinking on wood needs" *Business Day* Oct 19th 2007

Olsen C.S. & Helles F. (1997) "Making the Poorest Poorer: Policies, Laws and Trade in Medicinal Plants in Nepal" *J. of World Forest Resources Management* **8**, 137-158

Ogbazghi W. (2001) "The distribution & regeneration of *Boswellia papifera* in Eritrea. Tropical Resources Management papers No. 35.incl. Ogbazghi W. (2001) "The distribution & Regeneration of *B. papifera* (del.) Hochst." In Eritrea. PhD thesis Dissertation, Wageningen Univ. Wageningen.

Ogbazghi W., Rijkers T. Wessel1 M. & Bongers F. (2006) "Distribution of the frankincense tree *Boswellia papyrifera* in Eritrea: the role of environment and land use." *Journal of Biogeography* **33**, 524–535.

Ohashi S.T., Rosa L dos S., Santana J.L. *et al*. (1997) "Brazilian Rosewood Oil: sustainable production and oil quality management" *Perf & Flav.* **22**(2), 1-5.

Oommen S.T., Rao M. & Raju C.V. (1999) "Effect of oil of hydnocarpus on wound healing." Int J Lepr Other Mycobact Dis. **67**(2), 154-8.

Osava M. (1998) "Brazil trade: perfume makers accused of pirating Amazon resources" *Inter Press Service English News Wire* 19.08.1998

Ozugurlu E. & Duzgun M. (2003) "Policies to promote sustainable operations and utilisation of non-wood forest products in Turkey in *Harvesting of non-wood forest products* Forestry Dept FAO 2003.

Page T. Tate H., Tungon J., Sam C., Dickinson G., Robson K., Southwell I., Russell M., Waycott M., Leakey R.R.B. (2006) "Evaluation of heartwood and oil characters in nine populations of Santalum austrocaledonicum from Vanuatu." *Sandalwood Research Newsletter* **21**, 4-6.

Parascandola J. (2003) "Chaulmoogra Oil and the Treatment of Leprosy" *Pharmacy in History* **45**(2), 47-56.

Parry-Jones, R., and Wu, J. Y. (2001). *Musk Deer Farming as a Conservation Tool in China*. TRAFFIC East Asia.

PCIERD (2007) "Prototyping of Ylang-Ylang Oil Extractor by Hydro-Steam Distillation" Philippine Council for Industry and Energy Research and Developmentsee http://www.pcierd.dost.gov.ph/publication/Brochures/ylang.pdf

Peters C. *et al*. (2003) "The Life and Times of *Bursera glabrifolia* (H.B.K.) Engl. in Mexico: A Parable for Ethnobotany" *Econ Botany* **57**(4) 432-441

Phillips T. "The Amazon burns once again." *Guardian* Tues Oct 16, 2007 p23.

Pitman S. (2005). "EU changes animal by-products guidance" *Cosmetics Design-Europe* 27th Oct 2005.

Piozzi F., Passsannanti S. & Paternostro MP (1974) "Diterpenoid resin acids of *Daemonorops draco*" *Phytochemistry* **13**, 2331-2233.

Plowden C. (2003) "Production Ecology of Copaiba (*Copaifera* spp.) Oleoresin in the E. Brazilian Amazon" *Econ Botan* **57**(4) pp 491-501.

Pordie L. (2000) "Tibetan Medicine & the modern environment in Ladakh – A threat to medicinal plants". *Med Plant Conservn.* **6** (2000) pp14-17

Prance L. (2007) "Symrise up efforts (sic) to save alpha-bisabolol production" *Cosmetics-Design Europe* 05/06/2007.

Ram V.A. (1997) *Herbal Indian Perfumes & Cosmetics* Indian Medical Science Series No 59 Sri Satguru Publications (Div of Indian Books Centre) Delhi, India p57.

Rasoanaivo P. (1997) "*Ravensara aromatica*: A Threatened Aromatic Species of Madagascar" *Med. Plant Conservn.* **4**, (Nov 1997) p9.

Reich M.S. (2008) "Sorting Through The Confusion In Personal Care Certification." *Chemical & Engineering News* **86**(19), 16.

Rice D.W. (2002) In: William F. Perrin, Bernard Würsig & J.G.M. Thewissen eds. *Encyclopaedia elemiof Marine Mammals*. Academic Press, San Diego, CA.

Rijkers T., Ogbazghi W., Wessel M. & Bongers F. (2006) " "The effect of tapping for frankincense on sexual reproduction in Boswellia papyrifera. "*Journal of Applied Ecology* **43**, 1188–1195.

Robson K. (2004) "Experiences with Sandalwood in plantations in the South Pacific & N. Queensland." In: *Prospects for high value hardwood in the "dry" tropics of N. Australia*. Proceedings of a workshop held in Mareeba, N. Queensland, Australia 19-21st Oct 2004. pub. Private Forestry North Queensland Association Inc. N. Queensland.

Rouhi A.M. (2003) "Indulging the Chemical Senses" *Chemical & Engineering News* July 14, 2003 p 60.

Ruffo C.K, Birnie A. and Tengnas B. (2002) "Edible wild plants of Tanzania. RELMA Technical Handbook Series 27. Region Land Management Unit (RELMA), Swedish International Development Cooperation Agency (SIDA), Nairobi, Kenya.

Rukangira E. (2001) “The African Herbal Industry: Constraints & Challenges.” Paper presented at the *Cosmeceutcals 2001* conference. Published in *Erboristeria Domani* Aug 2001.

Seiiedin-Nejad S.H (1991): “Report of Utilization & Trade Office in 1991.” Ministry of Agriculture, No. 163, Iran.

Selvam A.B.D. & Bandyopadhyay S. (2005). “ *Kaempferia galangal* L. – a negative listed plant with promising aromatic & medicinal values.” *Enis Newsletter* **10** (1 & 2), 2005.

SFM Tropics (2005) Status of Tropical Forest Management: Columbia p219 – see http://www.itto.or.jp/live/Live_Server/1249/Colombia.e.pdf

Shad G.A. (1995): *Autoecology of Dorema ammoniacum and study of the harvesting methods at Mohammad-Abad, Kashmar* (in Farsi). – M.S.C. Thesis, Agricultural University of Gorgan, Iran.

Shankar D. & Majundar B. (1997)”Beyond the Biodiversity Convention: the challenge facing the biocultural heritage of India’s medicinal plants” in *Medicinal Plants for Forest Conservation & Health Care* FAO Rome, 1997.

Shanley P. & Rosa N.A. (2004) “Erroding knowledge: an ethnobotanical inventory in East Amazonia’s Logging Frontier.” *Economic Botany* **58**(2), 135-160.

Sharma A, Kumar A, Tiwari R, Hasan SA (1993) *Indian Medicinal and Aromatic Plants Facing Genetic Erosion* CIMAP Lucknow, India.

Shiva M.P., Lehri A., Shiva A. (2002) *Aromatic & Medicinal Plants* pub. Intl. Book Distrib 2002, Dehra Dun, India.

Skottsberg C. (1922) “The phanerogams of the Juan Fernandez Islands” p117. In: C. Skottsberg ed. *The Natural History of Juan Fernandez & Easter Island. Uppsala, Almqvist & Wiksells Boktryckeri AB*. Vol 2.

Snowden J.M., Roberts M. & Cross S (1997) "Determining the efficacy of emu oil in wound healing and cellular regeneration." RIRDC Reseach Paper No 97, RIRDC.

Sullivan, C.A. and D.P.O. Regan (2003). “*Winners and Losers in Forest Product Commercialisation*”. Vol. I pub. Department of International Development, Oxfordshire, UK,

Swaminathan M.S. (undated) in *Recent advances in the Research & Management of Sandal* Associated Publishing Company, New Delhi, India.

Swapna T.S, Binitha M., Manjus T.S. (2004) “In vitro multiplication in *Kaempferia galangal* Linn.” *Appl. Biochem. Biotechnol*. **118**(1-3), 233-241.

Tanker M., Tanker N,, Sarer E., Atasu B., Senser S., Kuruc S & Mericli F. (1003) “Results of certain investigations into the volatile oil containing plants of Turkey.” *Proc of IFEAT meeting Antalya 1990* Edits KHC Baser & Guler N. pp16-39 Isdtanbul 1993.

TenBruggencate, J. (1988). “Private sandalwood logging has state upset.” *Hono-lulu Star-Bulletin/Advertiser*, September 27,

Tennessen J.N. & Johnsen A.O. (1982) *The History of Modern Whaling* Univ. of California Press Berkeley p322

Thompson L. (1997) “Report of Visit to SPRIG countries.” *Pacific Islands Forests & Trees Newsletter* No. 1/97 April 1997.

Toon Rijkers *et al* (2006). The effect of tapping for frankincense on sexual reproduction *in Boswellia papyrifera*. *Journal of Applied Ecology*, **43**(6), 1188-1195.

Trease G.E. & Evans W.E. (1978) *Pharmocognosy* 11th edition Bailliere Tindall, London.

Usumaki J.T. (1981) "Sandalwood survey report – Bua province, Suva, Fiji." Unpublished report of Forestry Dept.

Watson P. (2005) "Rejecting the Cultural Justification for Slaughter" – see http://www.seashepherd.org/editorials/editorial_050621_1.html

Valder C. & Neugebauer M. (2003) "Western Auistralian Sandalwood Oil - New Constituents of *Santalum spicatum* (R.Br.) A. DC. (Santalaceae). J. Essent. Oil Res. 15, 178-186.

Ved, D.K. & V. Tandon, Eds. (1998): *Conservation assessment and management plan workshop for high altitude medicinal plants of Jammu-Kashmir and Himachal Pradesh, Kullu, Hima.*

Veiga Jnr. V.F. & Pinto A.C. (2002) "O genero Copaifera L." *Quim. Nova* **25**, 273-286.

Veillon J.M. & Jaffré T. (1995) "Sandalwood (*Santautm azrstrocaledonicum* Vieillard) in New Caledonia: Taxonomy, Distribution, Ecology." – see http://horizon.documentation.ird.fr/exl-doc/pleins_textes/pleins_textes_6/divers1/010006403.pdf

Verlet, N. 1993. "Commercial aspects." In K.M. Hay & P.G. Waterman, eds. *Volatile oil crops: their biology, biochemistry and production* p. 137-174. Harlow, UK, Longman Group UK.

Vidal J. (2007) "The looming food crisis." *G2 Suppl. Guardian* 29.08.07 p6.

Vieira, R.F. 1999. "Conservation of medicinal and aromatic plants in Brazil". p. 152–159. In: J. Janick (ed.), *Perspectives on new crops and new uses*. ASHS Press, Alexandria, VA.

Vod D.K., Mudappa A., Shankar D. (undated) "Opinion; Regulating export of endangered medicinal plant species – Need for scientific rigor" – see http://www.ias.ac.in/currsci/aug/articles8.htm

Vogel H. (2004) "Bolso (*Peumus boldus* Mol.) – Exploitation from the wild & domestication studies." *MPC* Vol 9/10 p21-24.

Wagner, W. L.; Herbst, D. R.; Sohmer, S. H. 1990. *Manual of the flowering plants of Hawai'i.* Honolulu: University of Hawaii Press and Bishop Museum Press; 1218-1223.

Webb M.A. (2000) *Bush Sense - Australian essential oils and aromatic compounds* National Library of Australia p17.

Werkhoven, M.C.M. 1997. "Threatened trees of Suriname. A list compiled for the UNEP-WCMC/SSC" *Conservation and sustainable management of trees* project.

Weyerstahl P., Marschall H., Phan T.S., Phan M.G. (1999) "Constituents of Vietnamese pemou oil - a reinvestigation." *Flavour and Fragrance Journal* **14**(6), 409-410.

Wiliams S (2005) "Socio-economic aspects of the sustainable harvesting of buchu (*Agathosma betulina*) with particular emphasis on the Elandskloof community" Thesis Dept of Geography & Environmental Studies Faculty of Arts, Univ of Western Cape Nov 2005.

Woodall C.S. & Robinson C.J. (2003) "Natural diversity of *Santalum spicatum* host species in south-coast river systems and their incorporation into profitable and biodiverse revegetation." Australian *Journal of Botany* **51**(6) 741 – 753.

Wyness M. (2006) "Aussies destructive attitude to nature is just not cricket." *Guardian* Wed Dec 6th 2006.

Xinhua News Agency (2004): "Tanzania bans logging in overseen areas." 23.09.2004.

Yang Q, Meng X, Xia L, Feng Z. (2003) “Conservation status and causes of decline of musk deer (*Moschus* spp.) in China”. *Biol Conserv* **109**, 333-342.

Yeld J. & Ellis E. (2002) “Arrests soon in R50 million buchu smuggling probe.” *Cape Argus* 22 April 2002.

Yingkang C. (1991) “Captive Civet Cats” *Perfumer & Flavorist* 16, Mar/April 1991 p15.

Zhou Y., Meng X., Feng J., Yang Q., Feng Z, Xia L. & Bartos L. (2004) "Review of the distribution, status and conservation of musk deer in China." Folia Zool. 53(2), 129–140.

Zhu L., Ding D. & Lawrence B.M. (1994) “The *Cinnamomum* species in China: Resources for the present and future” *Perf & Flav*. **19**, July/Aug 1994, 17-22

GLOSSARY

IUCN RDB status codes:
EX = Extinct, EW = Extinct in the Wild
CR = Critically Endangered, EN = Endangered
VU = Vulnerable, LR = Lower Risk
cd = LR: Conservation Dependent
nt = LR: Near Threatened
lc = Least Concern, DD = Data Deficient
NE = Not Evaluated

ACRONYMS IN TEXT EXPLAINED

ABP Animal By-Products
A-SNAPP Agribusiness in Sustainable Natural African Plant Products
BPC British Pharmaceutical Codex
BSE Bovine Spongioform Encephalopathy
CAMP Conservation Assessment and Management Plan
CAS Chemical Bstracts Service
CIMAP Central Institute of Aromatic & Medicinal Plants
CITES Convention on International Trade in Endangered Species of Wild Fauna and Flora
COLIPA European Cosmetic, Toiletry and Perfumery Association
CoP Code of Practice
CSIRO Commonwealth Scientific and Industrial Research Organisation
DEP Diethyl phthalate
DFID Department for International Development
EFFA European Flavour & Fragrance Association
FAO Food & Agricultural Organisation
FRA Forest Resources Authority (or Assessment)
GATT General Agreement on Tariffs & Trade
GFA Global Forests Authority
IBAMA Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis.
IFRA (now renamed to) International Fragrance Association

INDECOPI Peruvian National Institute for the Defense of Competition & Protection of Intellectual Property
ITTO International Tropical Timber Organisation
IUCN International Union for the Conservation of Nature & Natural Resources
PCIERD Philippine Council for Industry and Energy Research and Development
RSPO Roundtable for Usutainable Palm Oil
TCM Traditional Chinese Medicine
TRAFFIC (- the wildlife trade monitoring network -) Trade Records Analysis of Flora and Fauna in Commerce
TRP Tropical Rainforest Project Foundation
UEBT Union for Ethical BioTrade
UNCTAD United Nations Conference on Trade & Development
UNEP United Nations Environment Programme
USDA United Sates Department of Agriculture
USP United States Pharmacopoea
WCMC World Conservation Monitoring Centre
WRM World Rainforest Movement
WTO World Trade Organisation
WWF World Wildlife Fund