

The Future of Naturals in the Fragrance Industry

Can we really have a green, sustainable and natural fragrance industry?^a

L. Denzil Phillips

For at least 25 years the global fragrance and cosmetic industry has turned to nature to find inspiration and build its corporate image. Global retail chains like Aveda, Body Shop, Kiehl's and Yves Rocher, to name just a few, have built their multimillion-dollar empires upon this green and natural image. Baby boomers, like myself, who were their early customers, were the first green warriors—the founders of Green Peace, Friends of the Earth and the modern environmental movement.

The Origins of “Natural is Better”

Over the last quarter of a century, fostered by clever media and advertising, we were all led to believe that “natural” beauty products were better for our health and welfare, and also for our environment. All things man-made were, on the contrary, considered “synthetic,” harmful and unsustainable. This highly simplified outlook continues today partly because the fragrance industry does not want to say too much about how fragrances are really formulated, nor inform the public about how and where their aromatic ingredients are sourced, processed and refined.

There is a strong and fairly well-founded belief that if the public really knew what natural chemical isolates and nature-identical aroma chemicals were or just how small a percentage of plant-based ingredients are used in most “natural” fragrances they would probably no longer buy these products.

As Judi Beerling of Organic Monitor points out, “Natural obviously has a big emotional hook for consumers. It seems somehow to make a fragrance ‘real,’ where talking about synthetic molecules does not.”

“Maybe I’m cynical,” says Jennifer Hirsch of Beauty Botanist, “but I think marketers really love these terms that sound good, but that don’t have one fixed agreed meaning so you can make it your own. Natural is one of those.”

And how would the public react if they read Charles Sell’s excellent book “The Chemistry of Fragrances,”^b which clearly shows that the production of many natural essential oils



Only where mechanization can be cost-effectively employed, as with chamomile (pictured) and lavender, can we expect to see sustainable natural florals still on the market.

At a Glance

In this article, L. Denzil Phillips offers some insight into what more might be done to ensure the future of the natural fragrance industry and asks fundamental questions, including:

- Are the targets on sustainability set by multinational fragrance companies realistic given that they operate in such a celebrity-driven mass market industry?
- Is a return to nature really possible bearing in mind the poor state and under-investment in the present day essential oil industry?
- Is the fragrance industry correct in promoting natural products when so many good nature-identical aroma chemicals exist whose carbon footprint may actually be less than that of cultivated aromatic plants?
- Would biodiversity and the environment benefit more if the fragrance industry actually reduced its purchases of naturals, particularly those sourced from wild and endangered aromatic plants?

^aA version of this article was presented during a lecture to the U.K. Society of Cosmetic Chemists.

^bCS Sell, *The Chemistry of Fragrances: From Perfumer to Consumer*. RSC Paperbacks, Cambridge (2006)

consumes more fossil fuel, produces more carbon dioxide, more effluent and has more negative environmental impacts than many synthetic aroma chemicals.

Sue Curtis of Neal's Yard Remedies thinks the preoccupation with natural is much more obvious: "Given that there are at least 60,000 new synthetic chemicals that we are being exposed to in the last 50 or so years ... it is hardly surprising that many consumers are seeking out 'natural' ingredients in personal care products." But, as she points out, "Using only natural ingredients in fragrance can be seen to be very limiting, especially as regards creating 'lasting' fragrance profiles, so it's a challenge that different companies choose to take on in different ways."

Hirsch agrees: "If we're talking about a 100% natural fragrance, I think that is incredibly limiting for the perfumer. And, in my experience, the fragrances that result don't last on the skin in the same way as synthetic and partially synthetic fragrances do. Until that issue is resolved, I don't see how 100% plant-derived fragrances can compete."

The green imperative has of course more drivers than simply the passion and willpower of the founders of these natural beauty retail chains. There has been a growing necessity for global multinationals to play a more active corporate role in society, as well as pressure from the public and competitors who realized that going green and talking about sustainability was a way of gaining market share, customer loyalty and product differentiation.

The triple-bottom-line approach to business, which combines economic, social and environmental objectives into the economic model, is how most people in the fragrance industry see the sustainability agenda.

However, as Nidhimi Kohli, founder of *www.mybeautymatches.com*, points out, "For the general public, this word sustainability has little or no meaning in terms of buying beauty care products."

Anastasia Brozler, founder of bespoke fragrance house Creative Perfumers, adds, "And when a perfumer thinks of the words 'sustainable fragrance,' they will more likely associate this term with sustainability of price, color, longevity or other technical requirements. They are unlikely to refer to the sustainability of a natural source."

Will the Green Pioneers Remain Green?

So much of the pioneering work in the natural field was undertaken by committed visionaries like Anita Roddick, Horst Rechelbacher, Liz Earle and the like. Their drive and passion changed the whole landscape of the modern beauty care industry.

Now that most of them have moved on and their companies are in the hands of global corporations, will this commitment to nature and grassroots suppliers remain, or will the drive to rapidly grow these brands and make them mass-market global commodities change their image and their procurement policy forever? Insiders certainly report of many radical changes taking places in companies like Body Shop and Jo Malone.

Examples of corporate takeovers of founding natural brands include:

- Aveda by Estee Lauder
- Burts Bees by Clorox
- Body Shop by L'Oreal

- Liz Earle by Avon
- Kiehl's by L'Oreal
- Joe Malone by Estee Lauder
- Frederic Malle by Estee Lauder
- Aveeno by Johnson & Johnson

Perfume Lifecycles

The 1984 edition of Michael Edwards' "Fragrances of the World" listed just 38 new fragrance launches. As the author himself writes in the introduction of his latest edition, "In my wildest dreams, I could never have imagined that, 30 years later, I would track more than 1,400 new fragrances in a single year (2014)."

The question on many fragrance formulators' minds is this: "How can we possibly build a sustainable green supply chain for even a small percentage of such new launches, especially when the majority of them will be pulled from the shelf after 18 months for failing to achieve ever-more ambitious sales and profit targets?"

The sheer numbers of annual launches have radically changed the way the fragrance industry works. Speed of creation is vital, and pressure on profit margins means that, particularly for fragrance (as opposed to flavor) formulations, the driving force determining raw material selection is price and availability.

As Brozler points out, "Sadly, fragrance is no longer a luxury. It has become a commodity. Within this [large] market, driven by mass marketing and a gigantic global distribution network, 'naturals' are no longer on the priority list of compounding houses. Technical requirements, ongoing changes and demands on regulations and documentation, and statistics based on success rates and low risk are all aspects that put pressure on perfumers to replace ... natural oils with those made in a laboratory."

Unsustainable Celebrities

Getting a celebrity to help brand and promote one's perfume has become one of the most common ways that the fragrance industry has tried to woo the younger generation to buy more fragrances. However, as Kathy Phillips, international beauty director for Conde Naste, points out, "Are any of these celebrities really interested in promoting green and sustainable products, and do their increasingly Asian teenage followers really understand and support these principles?" And, anyway,



TRP agarwood nursery, Southern Vietnam.

how many of these celebrities will be around to help in the fight to produce a greener and more sustainable world?

The industry needs to mobilize green ambassadors and use celebrity adventure programs like those of Bear Grylls and Les Stroud to make millions of viewers aware of not just the thrill and adventure of the rainforest, but also the dangers of its rapid disappearance. Could Sting or Justin Timberlake be persuaded to launch a green perfume, and what will be the brief they present to the fragrance house that will make it for them?

The Logic of Organic Fragrances

For the majority of buyers, natural beauty care products are simply those that include some undefined % of natural ingredients. A growing minority of consumers feel that only organic products are truly natural and increasingly demand certified organic or biodynamic essential oils and fragrance products.

Even if one sidesteps the problem of the ever-growing number of overlapping and often confusing standards used to define the organic and natural beauty care sector, can the industry really create fragrances made with 20–30-plus different ingredients, all of which are organically certified? Aveda originally thought so, but soon found that the quantity and variety of ingredients needed far exceeded what the organic essential oil industry could cost-effectively supply.

As Virginie Daniau of Parfum Parfait, a formulation expert, points out, “To test whether all ingredients in a completed formulation are indeed organic is almost impossible, and hence no full audit trail exists. I seldom encourage my clients to go the organic route in perfume, unless it plays a central role in their marketing strategy.”

The State of the Aromatic Plant and Essential Oil Industry

While the love affair with all things natural continues on the high street, and more and more fragrances are launched each year, just what is the state of the aromatic plant and essential oil industry at the grassroots level? The answer is, by and large, bad.

Rapidly increasing costs of land and labor and lack of investment for more than 100 years in new plant and equipment means that the essential oil industry is basically much smaller and less developed today than it was when Ernest Guenther traveled the world to research his magnificent book series, “The Essential Oils,” which were published in 1948. A quick review of Guenther’s works reveals the following remarkable statistics:

- 9,500 hectares of damascene roses were planted in Bulgaria in 1912
- 2,021 tonnes of Mysore sandalwood was distilled in 1927
- 132 tonnes of Reunion geranium was exported in 1938
- 1,500 tonnes of jasmine flowers were picked in Southern France in 1927
- 95 tonnes of Guyanese rosewood was harvested in 1929
- 1,600 tonnes of Florence orris roots were picked in 1949
- 2,400 hectares of Bergamot were grown in Calabria in 1956
- 300 tonnes of Parma violets were picked in Grasse in 1900
- 8,000 hectares of geraniums were planted in Algeria in 1925



The process of distillation using water and steam is essentially an environmentally friendly one, so long as energy-efficient boilers and condenser systems are used.

Today’s essential oil industry is a pale shadow of this former glorious past. In many countries, the industry is not much more than a tourist attraction. When one visits the great former centers of global essential oil production like Provence, France, Plovdiv, Bulgaria, Florence, Italy, or even Cairo, Egypt, one will see an industry living off its past glory, selling samples and trinkets, rather than the vibrant value-added agro-industrial sector that it should be.

Fragrance and flavor houses may refer to this glorious past in their brochures and promotional material, but may not even spend 10% of their R&D budget on farm technology and agro-forestry research. Admittedly, when a supply problem arises they may make attempts to overcome bottlenecks by undertaking some ad hoc projects, but a sustained long-term program of global research, development and training in essential oil production and distillation simply does not exist.

Agricultural Challenges

As Joseph Hunwick, an expert on African natural oils points out, “If you look at the websites of the World Bank, UN Food and Agricultural Organization, the European Commission, and the Asian or African Development Bank you will find it hard to find a single project where aromatic plant breeding, cultivation, storage and processing plays an important part.” But, he adds, “Growing and processing essential oil plants is an ideal small-farmer activity where poor and inaccessible farmers can make a reasonable living from a small patch of land.”

“This cannot be said for green chemistry, however environmentally friendly it may be,” says Hirsch.

While technological developments in the field of extraction, analysis and fragrance formulation become ever-more sophisticated, the technology used to cultivate and harvest aromatic plants is not very different from what it was 100 years ago. With few exceptions, the planting and harvesting of these plants involve large amounts of labor, most of which is provided by women and children.

This labor supply is rapidly drying up, not just in Europe and North America, but also in India, Egypt, Morocco and China. Costs of production of essential oils that cannot be mechanized will continue to rise as labor becomes more and more scarce

and enforcement of restrictions on the use of child labor extend further across the world.

Sustainable Processing of Naturals

Distillation is one of the world's oldest professions. The first distillation units were found in the Indus valley 4,000 years ago. Without the discovery of distillation, the modern chemistry, pharmacy and perfume industries would not exist.

Despite the importance of these skills, there are very few training centers for distillation engineers or recognized diploma courses in the art and science of distillation of aromatic substances. While perfumers are given great respect within the fragrance industry, the distillation engineers who produce fine-quality natural fragrance raw materials get little or no recognition.

Tim Denny of Tasmania, perhaps the 20th century's leading distiller, with whom I had the privilege to work, often remarked on how little has been written about the art and science of essential oil distillation (even his own brilliant book was never formally published). Distillation engineers appear to prefer to retain their ancient image of smoke, magic and alchemy.

The process of distillation using water and steam is essentially an environmentally friendly one, so long as energy-efficient boilers and condenser systems are used. Too often, valuable timber or charcoal is being used to fire essential oil stills, or, in more urban conditions, costly gas and oil burners. Sadly, the majority of stills, particularly in developing countries, are extremely inefficient in terms of heat and use of spent waste. They also often use excessive amounts of water for the steam boilers and condenser units.

While some attempts have been made to help farmers in places like India use spent waste from the stills as fuels—either directly or in compressed bale form—by and large most distillation units are not efficient in the use of fuel or water. Making more energy- and water-efficient distillation units could greatly increase the sustainability of the natural fragrance and cosmetic industry and reduce what are often unacceptably high carbon footprints. If mobile stills are installed, the efficiency of the process is further improved, and the carbon footprint reduced even further.

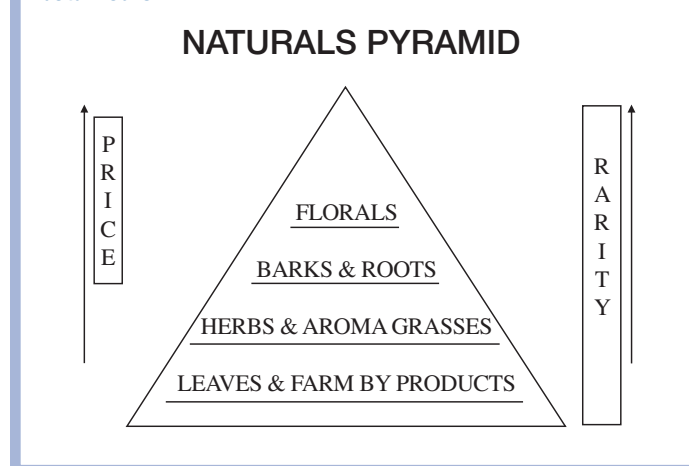
More Inventions, More Patents

The fragrance industry is investing in green chemistry and new methods of sensory evaluation when it comes to essential oil technology. However, figures published by *Perfumer & Flavorist* in 2004 clearly show that not enough research is going on in this field. In the last 23 years, the authors indicated that only 990 patents were registered in the USA concerning the use of essential oils and, of these, 41% were connected with its use in deodorants, 21% in dental products and only 6% in perfumes. Clearly something needs to change to ensure more innovation takes place in the field of essential oils.

Perfumer Education: Botanical Constraints

Perfumers need to be better informed as to the agronomic and environmental characteristics of the natural ingredients they use, especially as these characteristics largely determine the long-term price and availability of such raw materials. The simple pyramid in **F-1** helps describe why some types of aromatic materials are far more likely to have a long-term sustainable future than others.

F-1. The relationship between price and rarity for various botanicals



Florals: The much-loved florals, such as rose, tuberose and jasmine, will almost without exception become more expensive to grow and process as they as they require very large amounts of water, labor, fertilizer and other inputs. Moreover, land, water and labor used for florals can also grow food crops in an increasingly overpopulated world. Only where mechanization can be cost-effectively employed, as with chamomile and lavender, can the industry expect to see sustainable, affordable natural florals still on the market.

Bark and roots: The bark and roots of trees are equally unlikely to survive, seeing as so many of them are won from ever-endangered, slow-growing hardwood trees. Only with cost-effective agro-forestry solutions, as with sandalwood in Australia, will there be much chance that this category survives intact.

Herbs and aromatic grasses: In the case of herbs and aromatic grasses (sage, basil, mint, citronella, etc.), the future looks much brighter. For a start, herbs are usually annual crops used also as foods and medicines. They receive much higher R&D investment and have a more stable multi-sector market. Furthermore, high-technology mechanized propagation, cultivation, harvesting and processing methods, similar to those used in vegetable and oil seed production, can be relatively easily adapted for these types of crops. Best of all, the aromatic waste materials are recovered from other agro-industries, meaning the cost of production and harvesting are negligible as they are by-products or residues.

Aromatic leaves and twigs: All the aromatic leaves and twigs of trees, like eucalyptus, clove, orange and cinnamon, fall into this category, as do the expressed peels of almost all citrus. Here, there are still plenty of business opportunities. Take the easy-peel mandarin hybrid called *kinnow*, which is now harvested across the Punjab region of India. There are thousands and thousands of tonnes of this peel simply going to waste!

The Impact of Headspace Technology

The headspace technology pioneered in the late 1980s by IFF's former chief scientist, Braja Mookherjee, has done much to revolutionize our understanding of the chemistry of plants. Headspace analysis makes it possible for scents to be captured and studied without the need to kill the plant. This has enormous

advantages as fragrance bio-prospectors no longer need to go through the hugely bureaucratic process of getting permits to move plant material around the world. Suddenly, perfumers have gained access to limitless natural scents, including rare species, aromas from flowers that cannot be cultivated in large numbers and scents that had previously been impossible to reproduce artificially, such as lily of the valley.

Apart from the pioneering work by Mookherjee, several companies have now patented similar headspace technologies: Aromascope (Takasago), Jungle Essence (Mane) NaturePrint (Firmenich) and ScentTrek (Givaudan). These companies and others can now create nature-identical perfumes with far greater accuracy and precision, as well as obtain accurate aromatic fingerprints from all the world's major flowers.

The creation of nature identical aroma chemicals can certainly reduce the fragrance industry's dependence on overexploited or endangered plants. One example is IFF's Helional, an aroma chemical that mirrors the haylike aroma of the roots of the tropical sassafras tree. Natural sassafras was highly prized for products such as perfumes and soaps, so farmers in Asia and Latin America were cutting down more and more sassafras trees to harvest their roots. IFF says that more than 110,000 trees have been saved annually since the introduction of Helional.

Can Unhealthy or Dangerous Solvents Be Replaced?

The use of chemical solvents to extract aromatic principles from many flowers and plant products is an increasing concern to the industry from both a marketing and environmental point of view. Not only are the risks of fire and explosions elevated in factories using certain solvents, but health hazards exist for both the workers and the consumer when some types of solvent residues are not properly eliminated. Furthermore, the disposal of solvent waste poses growing costs as regulations increasingly prevent industries from simply dumping these in rivers and lakes.

Can these solvents be replaced? The answer is yes, especially when the principles of green chemistry are applied. Clearly, water, carbon dioxide and ethanol represent safer solvents and the use of a renewable feedstock, as well as having the widest acceptability and range of solvent polarity.

As Beerling points out, "There is increasing pressure from certifying bodies like COSMOS and Natrue to restrict or prohibit petrochemical extraction of [extracts] and absolutes, so I think the fragrance and cosmetic industry could invest a lot more in research to develop green solvents to replace materials such as hexane."

But the fragrance industry, unlike the food and pharma sector, has been slow to take up CO₂ or water extraction methods, although they are both much greener and safer than petrochemical-based solvents like hexane and toluene.

Even better are florasols, which use a refrigerant-based material (1,1,1,2-tetrafluoroethane) as the extraction solvent. This process is so gentle that some seeds are still alive after extraction and can be germinated. It is non-toxic and non-hazardous, requires very little energy, uses no water and produces no effluent. Sadly, although this technology has existed for more than 25 years, it has not been widely accepted by the fragrance industry to date.



TRP resin inoculation experiments aided the production of resin.

Is Green Chemistry a Potential Savior?

For some, like Daniau, green chemistry offers one of the most promising avenues for the fragrance industry of the 21st century: "I'm excited about green chemistry and feel it is good way to develop sustainable and environmentally friendly fragrance products."

Green chemists, like those at the Symrise catalysis laboratory, which opened in Holzminden, Germany, in 2013, aim to reduce the cost and increase the efficiency of making aroma chemicals. Using catalysts allows certain transformations or provides access to new molecular structures which are otherwise low-yielding, or even impossible by classical means.

FairWild

Rainer Bachi, founder of certification agency IMO, was one of the first people to draw special attention to the fact that a very large number of medicinal and aromatic plants used in global business were in fact wild-harvested and that special efforts were needed to foster and conserve wild flowers, herbs and tree crops and ensure that they are used in an equitable and sustainable manner. With his support, the FairWild foundation was born in Switzerland in 2008. FairWild's objective isn't to ban the harvesting of wild plants but to foster methods of forest management and enrichment which allow the safe and sustainable harvesting of these materials in a fair and equitable manner.

Curtis has successfully helped Arbor Oils in northern Kenya get FairWild certification, hence paving the way for the introduction of the world's first FairWild-certified frankincense beauty product in their shops. This is an important positive step, but is still only a rare example of how the industry can help the wild-harvested aromatic plant sector.

Can Rare and Endangered Aromatic Plants Be Saved from Extinction?

The FairWild certification system work well for the collection of aromatic starting materials such as leaves (eucalyptus) or twigs (petitgrain), but this approach seldom works for bark, heartwood or roots (sandalwood, agarwood, cedarwood, etc). Such aromatic timbers are almost without exception under threat from

over-exploitation. Either the industry will have to synthetically recreate these ingredients using headspace technology and the like or begin to seriously support agro-forestry investments such as Australian sandalwood and Chinese star anise.

The number of endangered plants is significant. The most acutely threatened sources are:

- Indian sandalwood (*Santalum album*); India
- Chinese perfume plant (*Aglaia odorata*); Southeast Asia
- Atlas cedarwood; Morocco
- Osyris (East African sandalwood); East Africa
- Costus root (*Saussurea lappa*); Nepal, Bhutan, India
- Agarwood (*Aquilaria*); Malaysia, Vietnam
- *Guaiacum officinale* (*Lignum vitae*); Venezuela, Brazil
- Buchu (*Agathosma betulina*); South Africa
- Jatamansi (*Nardostachys jatamansi*); Himalayas
- Sassafras (*Ocotea odorifera*); Brazil
- Rosewood (*Aniba rosaeodora*); Brazil
- Immortelle (*Helichrysum*); South Europe

Even small groups of committed people can have a big impact on this problem, as I found out when I went to work with TRP Rainforest Project in Vietnam some years ago. There, a private U.S. philanthropist, a Dutch forester and one of the world's

greatest plant pathologists combined their skills and energies to come up with a way of saving the agarwood (oud) tree from total destruction, while still offering the world's incense and perfumery industry sustainable supplies of this highly interesting natural aromatic material.


Firstly, TRP needed to work out how to grow the tree rapidly, cheaply and successfully so that they could start a massive 1-million-plant-plus replanting program (pictured). Once they had solved that problem with the help of the South Vietnamese Forest Service, TRP turned its attention to the much more difficult task of how the agarwood resin, an aromatic substance that only occurs when the tree is ill or wounded, is formed.

Enter the Minnesota University Plant Pathology department, which came up with a now-patented technology of inoculation that allowed wounded and unwounded trees alike to produce resin (pictured). Together, in less than five years these few dedicated people had found a way to make sustainable natural agarwood. Sadly, despite the subsequent "discovery" of oud by European perfumers and the consequent boom in demand for agarwood oil in western fragrances, TRP's work has largely been ignored by the Western fragrance industry, which has primarily relied on the development of cheaper nature-identical substitutes. The TRP agarwood project cost about \$2.5 million. Some would say this is a great deal of money, but compared with the long-term benefit or the amounts spent on advertising and fragrance launch parties, this figure is small.

As Gary Young, founder of Forever Living, boldly stated recently, "The essential oil and aromatic raw materials industry is failing to self-police itself with respect to conserving threatened plant and animal species. Green policies and any semblance of ecological awareness with respect to these commodities often seem to originate more from the attitudes of consumers than via the raw materials producer and reseller, in spite of the existent national and international laws restricting or forbidding trade in certain threatened species."

Both the late Mookherjee, who created one of the best private aromatic plant gardens at IFF, and Roman Kaiser at Givaudan, whose research work "Vanishing Flora—Lost Chemistry: The Scents of Endangered Plants around the World" is widely quoted by the fragrance industry, were well aware of the importance of such conservation work. However, until and unless the fragrance industry starts to enter into serious dialogue with the conservation agencies like CITES, IUCN and WWF, it still runs the risk of being "caught on the back foot." Such was the case when CITES decided to apply a CITES 2 listing on rosewood and guaiac wood at a time and in a manner that surprised most and outraged some in the fragrance industry. With the Nagoya Protocol supplementary agreement to the Convention on Biological Diversity now firmly in place, fragrance producers will be put more and more in the spotlight when it comes to their policy on sourcing raw materials from potentially endangered plants. Will it be ready?

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Little has been written about the art and science of essential oil distillation; engineers appear to prefer to retain their ancient image of smoke, magic and alchemy.