

# Vetiver & Synthetic Biology

## A Case Study



photo: Forest and Kim Starr

**Product:** Vetiver oil, a fragrance widely used in cosmetics and perfumes, is extracted from the aromatic roots of a perennial grass native to India (*Chrysopogon zizanioides*), commonly known as vetiver.

**Status:** California-based synthetic biology company, Allylix, Inc., has engineered a metabolic pathway in microbes to produce a key fragrance compound found in vetiver oil. The company had announced plans to launch commercial sale of its biosynthetic fragrance in the third quarter of 2012, but it remains unclear whether the product is currently being sold or not.

**Affected Country/Region:** Farmers in Haiti, Indonesia, China, Japan, India, Brazil and Réunion grow vetiver for export. In 2007, small farmers in Haiti accounted for an estimated 60% share of worldwide vetiver exports.

Haiti's vetiver crop is processed by 10 distillers, but it provides jobs for some 27,000 farming families in the southwest. For these farmers, the vetiver plant has important conservation benefits, preventing soil erosion, and helping maintain water quality.

**Market:** 250 tons *per annum*, worth between \$12 to \$16 million.

**Commercialization:** Announced for 2012; company has not provided updates since then.<sup>1</sup>

### What is Vetiver?

GQ Magazine has called it the “perfect natural raw material for a masculine scent.” A distant relation of lemongrass native to India, the perennial vetiver grass (*chrysopogon zizanioides*) is the source of vetiver oil. Known for its musty, woody scent, vetiver oil is also known for its fixative qualities, which means that it helps a fragrance to last longer after it is applied to the skin. Vetiver oil can be detected in the “base notes” of many perfumes or colognes. It is the basis of the Indian perfume ‘Majmua’ and is the major ingredient in some 36% of all western perfumes (e.g. Caleche, Chanel No. 5, Dioressence, Parure, Opium) and 20% of all mens’ fragrances.<sup>2</sup> According to U.C. Lavania, a scientist at India’s Central Institute of Medicinal and Aromatic Plants, vetiver is used in 90% of all Western perfumes.

“a  
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–GQ

Annual world trade of vetiver is an estimated 250 tons. Major commercial producers include Haiti, Indonesia, China, Japan, India, Brazil and Réunion. For at least two island nations – Haiti in the Caribbean and Réunion in the Indian Ocean – the essential oil obtained from the roots of vetiver is a major source of foreign exchange earnings. Haiti’s share of worldwide vetiver exports grew from 40%



# Ingredients, Flavours, Fragrances and Synthetic Biology: A New and Emerging Issue for CBD

This case study illustrates recent developments in synthetic biology that could impact the \$22 billion global flavour and fragrance market and the livelihoods of producers of natural commodities. These developments impact the sustainable use of biodiversity and fair and equitable sharing of benefits from the genetic resources that produce natural plant products. The world's largest producers of food ingredients, flavors and fragrances are all now partnering with synthetic biology companies to develop biosynthetic versions of key high-value natural commodities such as saffron, vanilla, vetiver and patchouli, replacing botanical sources. These in turn are just a few out of hundreds of economically important natural plant compounds whose production may be switched to synthetic biology production in a very short time frame.

The Convention on Biological Diversity is the first and only intergovernmental body to address the potential impacts of synthetic biology on the conservation and use of biodiversity and on the livelihoods of those who depend on agricultural export commodities (including high-value flavors, fragrances, essential oils, etc).

in 2001 to over 60% in 2007. In the wake of the worldwide financial crisis, Haiti has seen a sharp reduction in vetiver exports. Haiti produces about 50 to 60 tons of vetiver annually, about 50 percent of the world's supply.

An estimated 60,000 people in Haiti's Les Cayes region depend on vetiver as their primary income source; the crop is grown on 10,000 hectares. The region also supports up to 10 distilleries that process and extract vetiver oil for export. Before 2009, Haiti's vetiver crop was valued at approximately \$15-\$18 million per annum. In recent years, Haiti's export earnings from vetiver have declined to around \$10 million per annum.

## Current R&D

In March 2012, Allylix, Inc. announced that it would begin commercial sale of a new fragrance

that the company calls "Epivone™" – which is structurally related to beta-vetivone, one of the key components of vetiver oil – in the third quarter of 2012. Epivone™ is produced via fermentation. The company estimates that sales of similar terpene molecules used in fragrance applications amount to between \$20 and \$200 million dollars per year.<sup>3</sup>

With current data, it is not possible to predict how or if Allylix's new biosynthetic product will affect demand for botanically-derived vetiver oil and the livelihoods of small-scale farmers who depend on it.

*"Epivone is a highly valuable compound and because we own the patents claiming the fragrance and its novel production method, we expect to be the only commercial supplier."*

– CEO, Allylix

March 12, 2012

## Conservation Benefits

The vetiver plant provides vital natural protection against soil erosion and helps maintain water quality. Vetiver has a strong fibrous root system which rapidly penetrates deep into soil, and develops into a tightly-



knit net. The vetiver roots holds the soil together and serve as an underground wall which slows water flow. The roots absorb plant nutrients and chemical substances, and protect water sources from chemical fertilizers and pesticides. Farmers also use vetiver to regulate soil moisture, recharge groundwater, recycle soil nutrients and control pests.<sup>4</sup>

### For More Information

ETC Group has published several documents explaining and analyzing the impact of Synthetic Biology on biodiversity and livelihoods including *Extreme Genetic Engineering – An introduction to Synthetic Biology*, *The New Biomasters – Synthetic Biology and the Next Assault on Biodiversity and Livelihoods* and *The Principles for the Oversight of Synthetic Biology*. These publications are available on our website: [http://www.etcgroup.org/en/issues/synthetic\\_biology](http://www.etcgroup.org/en/issues/synthetic_biology)

The Potential Impacts of Synthetic Biology on the Conservation & Sustainable Use of Biodiversity: A Submission to the Convention on Biological Diversity's Subsidiary Body on Scientific, Technical & Technological Advice (A Submission from Civil Society): <http://www.etcgroup.org/en/node/5291>

### Endnotes:

1. <http://www.aocs.org/Membership/FreeCover.cfm?itemnumber=19304>  
<http://uk.reuters.com/article/2014/04/24/haiti-perfume-idUKL2N0-N903X20140424>
2. <http://www.fragrantica.com/notes/Vetiver-2.html>
3. <http://www.allylix.com/content/company>
4. <http://www.vetiver.com/ICV4pdfs/DC29.pdf>  
<http://fr.scribd.com/doc/215896984/Farmers-Perception-on-the-Role-of-Vetiver-Grass-for-Soil-Water-Conservation-the-Case-of-Tulube-PA>



photo: Victor Wong

### Intellectual Property related to Biosynthesis of Vetiver:

US Patent #: 8,124,811: Fragrance and methods for production of 5-epi- $\beta$ -vetivone, etc. Assignee: Allylix. Date published: 28 February 2012.

US Patent #: 7,622,614: Methods for production of 5-epi- $\beta$ -vetivone, etc. Assignee: Allylix. Date published: 24 November 2009.

WIPO Patent #: WO2008116056A2: NOVEL METHODS FOR PRODUCTION OF 5-EPI- $\beta$ -VETIVONE, etc. Assignee: Allylix, Inc. 25 Sept. 2008.

