



# Vetiver

## A Case Study on Use of Synthetic Biology Replacements

**Farmers Affected:** 27,000 families in Haiti  
(an estimated 60,000 people)

**Market Value:** 16 million USD per annum for Haiti.  
Globally approximately 50 million USD  
(250 tonnes/annum<sup>1</sup>)

**Uses:** Scent and fixative in perfumes and fragrances

**Syn Bio Companies:** Evolva (formerly Allylix)

**Hotspots:** Haiti (100 tonnes), Java (100 tonnes)<sup>2</sup>, India  
(20-25 tonnes),<sup>3</sup> and Réunion (20-30 tonnes)

**Also Grown In:** Indonesia, Philippines, Sri Lanka,  
China, Madagascar, Paraguay, Japan,  
Brazil, Africa (South Africa and West  
Africa)

**Cultural Importance:** Vetiver Oil, or the  
“fragrance of the soil” is cited in the  
Bhagavad Gita and has been used by  
Ayurvedic and Chinese medicinal practitioners for  
thousands of years.

**Biodiversity Considerations:** Erosion prevention and  
water filtration, landslide control, tidal flood control,  
fish production. Grass used for fallow lands, land  
demarcation, housing, fuel and fodder for the animals.

**Quality Concerns:** Natural vetiver oil has several  
constituents. Evolva/Allylix has synthesized only one  
of them (Beta-vetivone) which is also not the key  
vetiver compound (khusimone). So quality and  
richness is lower.

**Patents:** WO2008116056 A3, US8642815,  
US7622614 B2

**Products:** Used in 90% of Western perfumes.<sup>4</sup>  
Also household scented products

**Method:** Fermentation

**Commercialization:** Announced for 2012; Evolva has  
since said they will not commercialize for now.

**Feedstock:** Synthetically engineered yeast

**Brand, Identifier:** Epivone™

### Overview

Vetiver (*Chrysopogon zizanioides*), or khus, is a perennial, densely tufted grass native to India. It is planted widely for its very efficient root system as a means of erosion prevention and water filtration. However, and most importantly, it is valued for the oil made from its roots that sells on the market at \$200 US/kg. It may be used in 90% of all Western perfumes, and also in lotions, air fresheners, household products, ice creams, cosmetics and as a food preservative.

### Status: Syn bio vetiver is delayed for now



R&D

Scale Up

Commercialization

In Haiti alone, vetiver oil production is the country's single most valuable agricultural export and supports an estimated 60,000 people. Java produces approximately the same amount of oil per year, and should be considered as supporting a comparable amount of farming families.

In 2012, Evolva announced Epivone™, its new, genetically engineered fragrance based on a key vetiver compound beta-vetivone which had never previously been synthesized. However, although the commercialization of this substance was slated for 2012, it has never been put on the market.



For more information on  
Synthetic Biology please visit  
the ETC Group website:  
[www.etcgroup.org/synbio](http://www.etcgroup.org/synbio)

## What is Vetiver?

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.

GQ Magazine has called it the “perfect natural raw material for a masculine scent.” Known for its musty, woody odour, 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 reported to be contained in 90% of scented products,<sup>6</sup> while forming the major ingredient in some 36% of all Western perfumes (e.g. Caleche, Chanel No. 5, Dioressence, Parure, Opium) and 20% of men’s fragrances.<sup>7</sup> In addition to perfumes, vetiver oil is used in lotions, air fresheners, household products, ice creams, cosmetics and food preservation.

## Vetiver as a Natural Product

Vetiver is closely associated with the country of Haiti. 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 also has important conservation benefits, preventing soil erosion and helping maintain water quality.

Annual world trade of vetiver is an estimated 250 tonnes. Major commercial producers include Haiti, Java, India, Réunion, China, Japan, Indonesia and Brazil. For at least two island nations, Haiti and Réunion, 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% in 2001 to over 60% in 2007. In the wake of the worldwide financial crisis however, Haiti has seen a sharp reduction in vetiver exports. Haiti produces about 50 to 100 tonnes of vetiver annually, up to half of the world’s supply.

*“The invention of cheap, synthetic alternatives to high-value agricultural exports such as vetiver could suddenly destabilize vulnerable economies by removing a source of income on which farmers rely.”*

World Economic Forum Global Risks Report 2015<sup>5</sup>

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

employing and benefiting yet more people. 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.

Indonesia had been the second largest vetiver oil-exporting country in the world after Haiti; however, following Haiti’s 2010 earthquake, Indonesia appears to be the leading exporter of this valuable oil.<sup>8</sup>



*Planting vetiver grass in Kenya 2010*

## Biodiversity and Cultural Considerations

Vetiver grass thrives in harsh environments. It can be cultivated on steep hillsides, and used for landslide control. In coastal areas vetiver is grown for tidal flood control; in marshes, it is grown to aid fish production.



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 the soil and develops into a tightly-knit net. The roots absorb soil nutrients and chemical substances, protecting water sources from chemical fertilizers and pesticides. Farmers also use vetiver to regulate soil moisture, recharge groundwater, recycle soil nutrients and control pests.<sup>9</sup> Vetiver is a wonder grass for low income farmers, who can plant it in their fallow lands, use it for land demarcation and as housing, fuel and fodder for their animals.<sup>10</sup>

Vetiver Oil, or the “fragrance of the soil” as cited in the Bhagavad Gita, has been used by Ayurvedic and Chinese medicine practitioners for thousands of years and was used for massaging brides to sanctify them before marriage in India.

### Synthetic Biology Production

A California-based synthetic biology company, Allylix, Inc. (now purchased by Evolva), has engineered a metabolic pathway in microbes to produce beta-vetivone through fermentation; beta-vetivone is one of three key fragrance compounds found in vetiver oil. In March 2012, Allylix, Inc. announced that it would begin commercial sale of its new vetiver fragrance, called “Epivone™”, in the third quarter of 2012. The company estimated that sales of similar terpene molecules used in fragrance applications would amount to between \$20 and \$200 million dollars per year.<sup>11</sup>

However, since the 2014 acquisition of Allylix, Evolva has not publicly disclosed plans for further research, development or commercialization related to beta-vetivone i.e. Epivone™. The company’s website does not mention Epivone™ or the potential market for a vetiver-related fragrance. ETC Group contacted Evolva’s CEO, Neil Goldsmith about the company’s plans to commercialize its Epivone™ product. According to Mr. Goldsmith: “No, we are not developing Epivone. Allylix decided not to commercialize it, and we have no plans to revisit that decision. Is that a ‘no, never?’ No it is not. But I think it is highly unlikely.”<sup>12</sup>



*Freshly harvested vetiver plants Photo (cc) Josuah*

### Implications and the Future

Evolva told ETC Group that the decision to halt commercialization had already been made by Allylix before it was acquired by Evolva. We suspect that the high profile support for Haitian vetiver by philanthropic organizations, plus concerns already raised by ETC Group and our allies about Epivone impacting vetiver farmers, was seen as a public relations liability. It would also detract from Evolva’s most strategically important “natural” products (especially engineered stevia, in partnership with Cargill).

Chemists have so far been unable to achieve chemical synthesis of vetiver essential oil – although key aroma compounds (such as khusimone) have been synthesized.<sup>13</sup>

There is no assurance that vetiver-related fragrance compounds will not be the target of Evolva or other synthetic biology researchers/companies in the future and at this point Evolva appears to be retaining the patents on Epivone. If Evolva or another company move ahead with commercializing vetiver compounds, this can seriously impact the market for botanically-derived vetiver, as well as the livelihoods of around tens of thousands of farming families in Haiti. This was highlighted in a recent “global risks” report by the World Economic Forum, which pointed out that, “The invention of cheap, synthetic alternatives to high-value agricultural exports such as vetiver could suddenly destabilize vulnerable economies by removing a source of income on which farmers rely.”<sup>14</sup>

## Endnotes

- 1 Scott Freeman, *Vetiver in Southwest Haiti*, prepared by for the United Nations Environment Programme (UNEP), 2011. [http://haiti.ciesin.columbia.edu/haiti\\_files/documents/Freeman\\_UNEP\\_Vetiver\\_Report\\_2011\\_0.pdf](http://haiti.ciesin.columbia.edu/haiti_files/documents/Freeman_UNEP_Vetiver_Report_2011_0.pdf)
  - 2 Massimo Maffei. *Vetiveria: The Genus Vetiveria* (2003). [https://books.google.ca/books?id=SMXVFFQlpcC&pg=PA10&lpg=PA10&dq=vetiver+production+java&source=bl&ots=vj0Xmyvh\\_C&sig=OBzw04NlId2MqPHvVV0WzQTp54&hl=en&sa=X&ved=0ahUKewjikuCk6u3LAhUGvRoKHQMgDwwQ6AEIGzAA#v=onepage&q=vetiver%20production%20java&f=false](https://books.google.ca/books?id=SMXVFFQlpcC&pg=PA10&lpg=PA10&dq=vetiver+production+java&source=bl&ots=vj0Xmyvh_C&sig=OBzw04NlId2MqPHvVV0WzQTp54&hl=en&sa=X&ved=0ahUKewjikuCk6u3LAhUGvRoKHQMgDwwQ6AEIGzAA#v=onepage&q=vetiver%20production%20java&f=false)
  - 3 [www.dmapr.org.in/Publications/Bulletine/Vetiver%2016-1-15.pdf](http://www.dmapr.org.in/Publications/Bulletine/Vetiver%2016-1-15.pdf)
  - 4 see <http://perfumeniche.com/content/note-series-8---vetiver>
  - 5 Global Risks Report 2015. *Report of the World Economic Forum* (tenth edition) <http://reports.weforum.org/globalrisks-2015/part-2-risks-in-focus/2-4-engineering-the-future-how-can-the-risks-and-rewards-of-emerging-technologiesbe-balanced/#view/fn-4>
  - 6 see <http://perfumeniche.com/content/note-series-8---vetiver>
  - 7 <http://www.fragrantica.com/notes/Vetiver-2.html>
  - 8 Kadarohman, A., S.R. Eko, G. Dwiyantri, K.L. Lailatul, E. Kadarusman, and F.A. Nur, "Quality and chemical composition of organic and non-organic vetiver oil,) *Indo. J. Chem.* 14(1) 2014: 43-50
  - 9 [www.vetiver.com/ICV4pdfs/DC29.pdf](http://www.vetiver.com/ICV4pdfs/DC29.pdf)
  - 10 Md. Fazlul Huq. VETIVER - AN ECONOMIC MIRACLE GRASS FOR SMALL-SCALE FARMERS IN BANGLADESH: THE PROSHIKA EXPERIENCE. [www.vetiver.org/TVN\\_IVC2/CP-6-1B.PDF](http://www.vetiver.org/TVN_IVC2/CP-6-1B.PDF)
  - 11 [www.allylix.com/content/company](http://www.allylix.com/content/company)
  - 12 Email communication with Neil Goldsmith, CEO, Evolva. Feb. 26, 2015.
  - 13 WIPO Patent WO 2015/001225 A1, Novel Method for the Synthesis of Khusimone, Applicant: Robertet SA. Publication date: 8 January 2015.
  - 14 Global Risks Report 2015 above.
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