

# VETIVERIM

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## Editorial

### Unique Property of Vetiver: Drought Tolerance

Vetiver's botanical name was *Vetiveria zizanioides*. The specific epithet, *zizanioides*, means growing in or near the river. Even its new botanical name, *Chrysopogon zizanioides*, still maintains the specific epithet of *zizanioides*. Natural habitat of vetiver is the swamp or flood land along the river bank. Its unique property is having the aerenchyma, the air cells that bring the air from the shoot to the root, making the latter able to survive in the water, where no air is available.

Vetiver's vernacular name in Thai is 'Faek Lum', signifying that it is a plant that grows in wetland, in contrast to the other species of vetiver, *Chrysopogon nemoralis*, whose vernacular name is 'Faek Don', signifying that it is a plant that grows in dry land.

Although both species of the vetiver are used in soil and water conservation and other purposes in Thailand, the wetland vetiver is preferred to the dry land species, even in the place where drought prevails. How can a wetland plant survive in the dry land? The answer lies in its unique property of the root system that penetrates deep down in the soil at the depth of 3-4 m in the first year. This deep root system makes wetland vetiver extremely drought tolerant, much better than its relative, the dry land vetiver, whose roots do not grow as deep.

Drought tolerance makes it possible for vetiver to tolerate extreme climatic condition such as prolonged drought, which is now more common in many places as the result of global warming.

Vetiver's ability to re-grow very quickly after being affected by drought makes it a choice species to fight against drought. With its deep root system, it is the only plant that survives in a severe drought condition. Although the top part dies down after forest fire, the root system is still viable and can perform its function by absorbing the water at great depth underneath the soil to enable the new shoot to sprout and grow, while no other plants can grow in such a harsh condition.

Whether it is grown for soil and water conservation, soil stabilization, embankment stabilization, or phytoremediation, vetiver performs extremely well when drought prevails. *Thanks to its drought tolerant property!*

## **A Changing Industry: On-site Phytoremediation of Landfill Leachate Using Trees and Grasses – Case Studies\***

The on-site utilization of landfill leachate using phytoremediation systems is transforming the way the solid waste industry handles facility-generated liquid waste. The change not only replaces the age-old ‘load, haul and dump’ process where the technology fits, but also represents a truly GREEN, carbon negative, and sustainable approach using trees and grasses. In addition, the approach saves millions of dollars at each site where it is implemented. Leggette, Brashears & Graham, Inc. (LBG) has partnered with Republic Services, Inc. on a number of phytoremediation projects with great success. This presentation will review the industry-changing process in action at full-scale sites across the U.S., as well as at additional landfills for Promotora Ambiental S.A.B. de C.V (PASA), the largest solid waste company in Mexico.

Phytoremediation is defined by McCutcheon and Schnoor (2003) as “the use of vascular plants...to either remove and control contaminants, or to spur contaminant breakdown by microorganisms in the rhizosphere.” The “removal” process described above consists of contaminants being utilized by the plants as micro and macro nutrients (note that non-essential nutrients are removed and/or degraded by the same mechanisms). Phytoremediation systems use specifically selected, fast-growing plants that have a huge demand for nutrients and moisture, making the technology a natural fit to utilize leachate on-site as a resource to the plant-based system rather than disposing as a waste. This advancement greatly reduces the financial burden and environmental problems associated with leachate disposal, which is one of the most persistent and expensive problems within the solid waste industry. The technology can be applied at both open and closed landfills.

Phytoremediation is grounded in science. It is a combination of expertise drawn from numerous specialty disciplines including, but not limited to: engineering, agronomy, soil science, chemistry, hydrology, and biology. Decades of research and activity conducted by all three arms of scientific development (academic, governmental, and private industry) have advanced the technology past laboratory experiments and field trials to successful, full-scale field applications such as those described below.

### **Case Studies:**

#### **Hybrid Poplar Site – St. Louis, MO**

The phytoremediation system installed at the Republic Jeffco landfill has been in place through four growing seasons. Approximately 2,100 hybrid poplar trees were planted over a 5.5 acre area in December of 2007. Since then, over 14 million gallons of leachate have been processed on site rather than being hauled by trucks to a wastewater treatment plant. A total cost avoidance of \$810,000 has already been realized by eliminating the transportation and disposal process. The phytoremediation system paid for itself in less than two years, and due to the reduction in annual O&M by 80%, the annual cost of long-term financial assurance policy premiums has also been significantly reduced. In addition, this first of its kind project allowed for the year-round utilization of leachate in a cold weather climate through the use of a specialty subsurface drip irrigation system. The innovative project was honored with four awards, including being named to the top 25 engineering projects in the USA in 2009 by the American Council of Engineering Companies (ACEC) Engineering Excellence Competition.

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*\* Paper presented at the Global Waste management Symposium – Promoting Technology and Scientific Innovation, September 30 – October 3, 2012, Arizona Grand Resort, Phoenix, AZ, USA, by Brad A. Granley, Leggette, Brashears & Graham Inc., Senior Associate; and Paul N. Truong, TVNI Coordinator Asia and Oceania.*

## **Hybrid Poplar Site – Chicago, IL**

Building on the success of the St. Louis project, the northern limits of the technology were further tested at another Republic landfill located in the Chicago metropolitan area. Over 4,000 hybrid poplar trees were installed over a 7.5 acre area to process an average of 1.5 million gallons of leachate per year, with an ability to increase utilization to three to four million gallons per year in the future. Expectations were exceeded when the first year goal of processing 500,000 gallons of leachate was accomplished after only five months of system operation. Since full system startup, not a single load of leachate has left the site and over 2.7 million gallons have been processed, avoiding \$350,000 in leachate disposal costs in two years and cutting annual O&M by 75%.

## **Vetiver Grass Site – Biloxi, MS**

The Republic Gulf Pines landfill became a first-of-its-kind project in the western hemisphere when vetiver grass was used for phytoremediation of leachate at this Gulf Coast location. In addition to having a huge demand for moisture and nutrients, this unique plant has amazing characteristics which make it an excellent choice for leachate utilization in applicable climates.

It is very tolerant to pests, disease, and also to high levels of numerous contaminants (metals, ammonia, VOCs, nitrogen, salts, and many other compounds). It is tolerant to drought and flooding, grows well in a variety of soils, and is USDA non-invasive. Three acres of vetiver were planted on top of this pre-subtitle D landfill to process approximately three million gallons of leachate per year. The per gallon disposal cost was cut from \$0.13 to less than \$0.015 per gallon. The project is expected to save \$8 million over a standard accrual period compared to traditional off-site disposal methods. This project was recently honored as a national Grand Prize winner in the American Academy of Environmental Engineers – National Engineering Excellence Competition.

## **Vetiver Grass Sites – Mexico: Leon, Poza Rica, and Villahermosa**

The first three projects of their kind in Latin America using vetiver grass for phytoremediation of landfill leachate are underway for the largest solid waste company in Mexico, and each pose numerous, site-specific challenges. The Leon landfill is a recently acquired facility in great need of numerous improvements that were left undone by the previous owner. One enormous problem is handling of very strong, fresh domestic / industrial leachate from this active facility. In addition to the 25,000 gallons of leachate produced daily, an additional 15 million gallons is currently stored in lagoons awaiting treatment. The owner is under great political pressure to quickly bring the landfill to acceptable standards. The use of phytoremediation to resolve these issues has already eased some pressure and has been a significant step forward towards overall site success. The Poza Rica facility includes using vetiver for three main purposes: stabilization of very steep, highly erodible slopes, the on-site utilization of fresh leachate, and control of leachate outbreaks. Villahermosa is similar to Poza Rica, but the design and operation of an effective system was further complicated due to the extreme rainfall at this facility, which is located along the southern coast of the Gulf of Mexico.

The observed results at the above facilities have shown that phytoremediation can effectively utilize landfill leachate on site as a resource rather than disposing as a waste. Because the approach is both environmentally friendly and saves millions of dollars at each site where it is implemented, it is fully expected that the innovative technology will continue to change the way the solid waste industry handles landfill leachate long into the future.

## Why Are Not More People Using the Vetiver System Technology?\*

*The Vetiver System has come a long way over the past 20 years and there are a lot of users applying the technology for different purposes. We know that most users once using it correctly are avid fans of the technology. The question is "why are not more people using the technology"? "Why is it not being used at an accelerated rate"?*

*I would very much appreciate if you could give this some thought and send me a list of the five most important reasons for slow expansion. I attach the responses they are worth reading. In reviewing the responses the following lists some of most quoted answers in order of importance:*

**1. Lack of Knowledge and Technology Dissemination:** This covers a wide range including ignorance of the technology by administrators, policy makers and planners, uninformed technical professionals and lack of profession endorsement, teaching and learning limitations in universities and schools, limited press coverage, absence of mass marketing, and lack of publications (language barriers). Not using modern marketing tools.

**2. Leadership:** New technology introduction requires far sighted leadership with vision and commitment. A committed lead organization is required. Good NGOs and private sector companies can often do this best. Rarely found in government organization.

**3. Corruption:** Not always, but generally VS is seen as a low cost technology that does not attract high budget allocations, and therefore the opportunities and attractiveness for corrupt practices are much less than for high cost alternatives.

**4. Technology:** Majority of solutions have in the past an engineering base. Most engineers have not been trained in bioengineering solutions, particularly those that are low cost. Low cost biological solutions are often seen as too simple and as such are unattractive. Again applying low cost solutions result in lower fees for designers and executing contractors. Many higher cost engineering solutions do not always last long and have to be replaced – that is good for business!

**5. Specifications:** Engineers, in particular, like clear specification. Specifications and standards should be followed. Bad application generally results in failure and detracts potential users. Site specificity is important. Often rather general standards are given and followed, and if not properly supervised and fine tuned, can lead to failure.

**6. Multipurpose Use:** Two sides to this one. For some potential user groups such as railway and highway engineers, it is best to have narrowly focused workshops and training on the application at hand. For other users such as farmers and rural planners, there is a need to look at the wider aspects and the multi-benefits that are possible from VS. In other words sometime the focus and the message is not right.

**7. Plant Propagation:** Because vetiver has to be vegetatively propagated an upfront investment and lead time is required. This can be a detraction. However there are plenty of demonstrations showing that small farmer private nurseries can be quickly established if there is a guaranteed market.

**8. Invasive Species and Native Plant Syndrome:** This is more of a problem in developed countries. Sometimes deliberate miscasting of vetiver as an invasive species (this has quietened in recent years). Many government projects in the US will only use native plants. Also, well entrenched vested interest in other more “profitable” technology works hard to keep VS out.

**9. Research:** Some research has been very adequate, in some cases government research staff have shown little interest – conflicting agendas, jealousy, scientists without vision, research lagging behind field developments.

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\* By Dick Grimshaw <r.grimshaw@comcast.net>.

**10. Silver Bullet:** Overselling technology, this can be a problem. But generally occurs when the recipient is looking for problems. VS will do many things, but is sometimes deliberately misapplied in the hope of failure – then the silver bullet. However there are cases where vetiver has been used in very marginal climatic areas (arid) with poor results. (**Note:** the terminology – magic grass – was not invented by TVNI)

**11. High Profile Demonstrations and Projects:** In some countries the lack of large-scale examples can result in lowering of potential user interest.

**12. Economic Benefits:** Economic benefits are not always obvious to the users, particularly small farmers with limited education. Larger users need to understand the benefits and value that vetiver provides them in future cost saving and environmental benefits.

### TVNI Received Certificate on GreatNonprofits 2012 Top-Rated List

Richard Grimshaw, Chairman, The Vetiver Network International (TVNI) recently received the Certificate on GreatNonprofits 2012 Top-Rated List. In his email to vetiverites attached to TVNI, he stated the following:

“Congratulations on making it into the GreatNonprofits Top-Rated List. Read more and collect your certificate.

See links to certificate. In this case we are part of the 1%! (Perhaps the right 1% this time). Well done everybody. Feel free to put the certificate on your office wall, website, etc.

I am sure that I may have left some off the list, please forward with my apologies.”

Begin forwarded message:

**From:** Perla Ni, CEO of GreatNonprofits <perlani@greatnonprofits.org>

**Date:** December 19, 2012, 10:14:11 AM PST

**To:** <r.grimshaw@comcast.net>

**Subject: Congratulations, THE VETIVER NETWORK INTERNATIONAL!**

Congratulations on qualifying for the GreatNonprofits 2012 Top-Rated List. We are especially thrilled to recognize the great work of your organization, given that less than 1% of eligible nonprofits have received this distinction.

To help you promote your Top-Rated status, we've created these new tools for you:

- [Click here](#) to get your official 2012 Top-Rated Nonprofit certificate. Print this certificate and hang it proudly in your office where your supporters and staff can see it and recognize this accomplishment!
- [Click here](#) to buy Top-Rated Nonprofit stickers. Use these stickers to seal envelopes for your donor appeals or letters to supporters.

Your online profile on GreatNonprofits.org has also been updated with a Top-Rated 2012 badge. For more ideas and information on how you can share your reviews with donors and volunteers, visit our homepage to sign up for our free newsletter.

Congratulations again for winning a spot on the 2012 Top-Rated List!

Sincerely,  
Perla Ni  
CEO, GreatNonprofits, GreatNonprofits  
330 Twin Dolphin Drive  
Redwood Shores  
CA 94065, US

## Faasai Resort Plants Vetiver in Wetland

The Faasai Resort and Spa, a family owned eco-resort in Thailand, has planted vetiver to protect White Water Lake, a conservation lake 500 m from the resort. Their guests were invited to join the planting on World Responsible Tourism Day, on June 2, 2009.



White Water Lake (Nong Nam Khao) has healing mineral spring waters which collect in streams, the small lake and a swamp. To increase the water retention the owners of Faasai Resort have increased the depth of the stream and lake. They have also planted vetiver grass, bamboo, lemongrass and about 1,000 trees around the perimeter of the lake and on adjoining land.

"Our intention is to preserve the springs as a reservoir of pure fresh water and to provide a safe shelter for birds and other wildlife including fish, frogs, bats, lizards and snakes," say the owners. So far more than a hundred varieties of birds, dozens of varieties of fresh water fish, fresh water shrimps, water monitors, pythons, rats and water snails have been recorded at the sanctuary.

On June 2, 2009 the edges of the water were planted with an additional 1,000 vetiver plants - which was considered to be a 'super grass' for water conservation. Vetiver (*'Ya Faek'* in Thai) has a strong fibrous root system, which rapidly penetrates deep into the soil and develops into a tightly knitted net. It holds the soil together and serves as an underground wall, which retards water flow but allows water to seep into the soil. The roots are also capable of absorbing mineral nutrients for plants and other chemical substances such as chemical fertilizers and pesticides before they flow into the water sources. This protects the water from pollutants and maintains water quality.

The resort is nestled beside a small forest reserve in the foothills of the world-renowned Cardamom Mountains which stretch into Cambodia 100 km away. This makes the area a magnet for wildlife, despite being only a three-hour drive from Bangkok. The sustainable practices implemented by the resort have earned them much recognition from the tourist industry. See more about this story in this Asia Travel Blackboard newsletter.

## Proceedings of the Fifth International Conference on Vetiver

The documents that were presented during the Fifth International Conference on Vetiver (ICV-5) in Lucknow, India from October 28 - 30, 2011 have been organized and published at the web site of The Vetiver Network International.

For the first time at an ICV conference some pharmaceutical papers were presented. These included a paper on the ability of an extract of vetiver oil to act as an antimycobacterial agent to combat tuberculosis.

The documents are all in English and separated into text and the graphic presentations used during the conference. They are organized by subject as follows:

- Climate Change
- Infrastructure Protection
- Environmental Protection
- Vetiver Oil
- Basic Research
- Dissemination
- Soil and Water Conservation
- Pharmaceutical
- Socio-economics
- Innovation

## Vetiver for Slope Stabilization and Riverbanks Protection in Vietnam

A group of technical officers from Thailand consisting of government officers, vetiver supervisors from the Office of the Royal Project Development Board, specialists from the Petroleum Authority of Thailand (PTT) and university lecturers paid a visit to Danang, Vietnam, during 4-9 April 2013. The main purpose is to see the achievement of vetiver employed in Vietnam for slope stabilization and riverbanks protection.

In Vietnam, vetiver has been used for soil and water conservation for over a decade and has become a successful tool at the for villager level. As a cheap technology, affordable, easy to implement and maintain looked after and its importance demonstrated achievement shown, vetiver is now becoming widely used extensively and on a in large scale and in many districts mainly for stabilisingfixing roadside cuttings and fills slope and protecting the eroding of riverbanks. One of the visiting areas visited in Danang is was a newly made cut road running routing along the bay which certainly will certainly become an attractive tourist attractive spot very soon. The newly cut slope has been protected from soil erosion and land slides as well as promoting a green scenic environment by vetiver hedges.

In this area vetiver has been simply planted with little effort small support, without beautiful no bench terrace and no fertilizer. Small planting holes were prepared in a line at a level and vetiver then were planted directly in to the gravelly soil; this also for saving the saves labor costs labor cost. Although the newly hedges has have been simply easy to maintain but vetiver has grown rapidly, starting to form hedges and fix stabilising the slope. The whole area looks nice and in order, however, if there was more plant maintenance were more support for the plant such as watering,gap-filling repairing, adding some organic fertilizer etc. it is expected that the hedges will become more vigorous fertile and able to fix and support slopes with its full capacity and more over promoting greenic green view throughout the route..

It is noticed that, the vetiver plants that were used employed in this project were all are lowland vetiver (*Chrysopogon zizanioides* (L.) Roberty)

## Letters to the Editor

### Vetiver for Coffee Industry

As background, I am the founder of the Vetiver Network International and for the past 25 years we have been promoting the use of vetiver grass for soil and water conservation - it does a great job in both areas.

We have also more recently being using vetiver for pollution control. For coffee, vetiver hedgerows will intercept any runoff containing herbicides, pesticides and fertilizers (nitrates and phosphates) removing 90% or more of the chemicals. Vetiver can also be used for the treatment of coffee pulping effluent, and if used correctly will bring effluent discharge levels to EPA requirements

We recently held a conference in India and a number of papers were presented, some of which might interest you.

- The Use of Vetiver Grass in the Cultivation of Organic Crops.
- Introduction of Vetiver for Coffee Effluent Treatment.
- Recent Advancements in Research, Development and Applications of Vetiver System Technology in Environmental Protection.

There are many more examples of the value and use of vetiver on our website. Vetiver is being used in Costa Rica on coffee fincas there. Vetiver is available in El Salvador where it has been mainly used for the stabilization of highway cut and fill.

If I read the New Yorker article correctly I think you will find the Vetiver System intriguing with great potential for the coffee industry.

Richard Grimshaw, Chairman, TVNI  
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**To**

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