

# VETIVERIM

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## Editorial

### Ecotype vs Variety of Vetiver

According to the Merriam-Webster Online Dictionary, ...”an ecotype is a population of a species that survives as a distinct group through environmental selection and isolation and that is comparable with a taxonomic subspecies...”.

A (botanical) variety is a group of individuals or plants having similar traits that can be reproduced "true to type" from generation to generation. For cultivated plants, a special term is used, i.e. “cultivated variety” and is abbreviated as “cultivar” that has the same meaning as “variety”, except that it designates specifically plants selected by mankind. A cultivar is an assemblage of plant that (a) has been selected for a particular character or a combination of characters; (b) is distinct, uniform and stable in these characters and (c) when propagated with appropriate means, retains those characters.

Vetiver used in soil and water conservation consists of two species, (i) *Chrysopogon zizanioides* (syn. *Vetiveria zizanioides*) or wetland vetiver and (ii) *C. neomoralis* (syn. *Vetiveria nemoralis*) or upland vetiver. The former has been used extensively while the latter is mainly used in Thailand as it is native to the country. Many varietal names have been given to wetland vetiver internationally, such as Sun Shine, Monto, Fiji, etc. In Thailand, many clones of vetiver have been introduced and the names of the country / state, ‘Sri Lanka’, ‘Indonesia’, ‘Karnataka’ have been used as the name of the varieties. A number of accessions have also been collected from various sites throughout the country by the Land Development Department and temporarily designated the names of the place where it was collected as the name of the “ecotype”, the term used temporarily until further studies have been made with respect to their performance and ultimate selection or rejection.

A total of 28 ecotypes have been collected and studied with respects to their morphological and physiological characters, together with their DNA finger printings. It was found that all 28 ecotypes have distinct DNA patterns such that their identities can now be termed as cultivars to avoid confusion. Thus from now on the term “ecotype” will be replaced by “variety” or “cultivar” to be on a par with the rest of vetiver.

## Vetiver Against Moles and Gophers

There has been an interesting dialogue going on in the Vetiver Blog on the issue of vetiver against moles and gophers. It all started when Alberto Rodriguez sent a message to the web <vetiver-system@googlegroups.com> asking for comments and opinions on vetiver ability to protect against moles and gophers.

For those who are not familiar with moles and gophers, here is a short description of these animals.

**Moles:** The mole, *Scapanus* species, is a small insect-eating mammal. Contrary to a commonly-held belief, it is not a rodent. Moles are small cylindrical mammals adapted to a subterranean life-style. They have velvety fur; very small, difficult to see ears and eyes, reduced hind limbs; and short, powerful fore limbs with large paws positioned for digging. Moles live almost entirely underground in a vast network of interconnecting tunnels. They frequently create shallow tunnels just below the surface where they capture worms, insects, and other invertebrates. They may infrequently consume roots, bulbs, and other plant material, although rodent species (e.g., pocket gophers, meadow voles, and deer mice) are almost always the cause of such chewing damage. By far the greatest damage from moles occurs through their burrowing activity, which dislodges plants and dries out their roots. In lawns, the resulting mounds and ridges are unsightly and disfiguring.

**Gophers:** Gophers, generally known as pocket gophers, are stout-bodied rodents with small ears and eyes and large clawed front paws. Their large front teeth are used to loosen soil and rocks while digging, as well as to cut and eat roots. They are well-equipped for a digging, tunnelling, with large-clawed front paws, small eyes and ears, and sensitive whiskers that assist with movement in the dark. Their pliable fur and sparsely haired tails - which also serve as a sensory mechanism - help gophers run backward almost as fast as they can run forward. Their large front teeth are used to loosen soil and rocks while digging, as well as to cut roots. They can be a problem for home owners, but they actually benefit the soil and vegetation in many areas. Unfortunately, the positive effects are not as visible as the mounds gophers create in lawns and pastures.

Unlike moles, which mostly eat insects and other invertebrates, gophers only eat vegetation. Gophers eat roots, bulbs, and other fleshy portions of plants; they encounter while digging underground. Gophers also eat the leaves and stems of plants around their tunnel entrances and can pull entire plants.

Now, back to the dialogue, chronologically presented below:

**1 - From:** Alberto Rodriguez <alrod312@gmail.com>, 1 August 2014, at 8:47

Hello everyone. A client of ours in Santa Ana, California (USA) has posed a question that I had never heard before and I would appreciate any comments from anyone that has seen a similar problem. I have been working with this client with the planting of vetiver in a very steep and delicate situation that he has handled very diligently. The question seems to relate to a separate area of his property where moles and gophers are digging tunnels underground and weakening the surface.

This is the gist of his question:

*I would like to get your opinion on using the vetiver as hedge against moles and gophers. We have a section of the property where we noticed there are three to four inch diameter tunnels about three to four feet deep down from surface. Currently this area seems to be sinking. Do you think the vetiver could be used to establish a perimeter to prevent these pests from digging these tunnels? We noticed there are no traces of the gophers in the areas already planted with vetiver.*

Has anyone used vetiver as a subterranean barrier against burrowing (digging) animals? Will the roots of a mature hedge be enough of a barrier to block these aggressive animals or would they just eat right through the roots?

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\* Compiled by Narong Chomchalow (<narongchc@au.edu>), Vetiver Expert, Office of the Royal Development Projects Board, Bangkok, Thailand.

Somebody, may be John Greenfield, made some mention of gophers in days past. Comments and opinions highly appreciated.

**2 - From:** Liaqat Hayat <liaqathayat5@gmail.com>, 1 August 2014, at 22.47

I am sure vetiver planting with deep roots do offer some resistance for the burrowing animals.

**3 - From:** W.K. (Tim) Journey <timjourney@gmail.com>, 2 August 2014, at 0.21

Moles are insectivores and burrow close to the surface. At that level they would run into the densest part of the below ground components of the vetiver plant, which probably would redirect them to a less resistant part of the soil. If it is true that vetiver root exudates repel many insects and earthworms, the soil next to vetiver roots may likewise be an unrewarding environment for hungry moles.

Gophers are entirely herbivorous. They prefer alfalfa when they can get it, but eat most anything else. The issue is whether they dislike the taste of vetiver roots and shoots, and whether the phytochemistry of vetiver tissue might cause some digestive problems. The way to find out is to feed captive gophers vetiver roots and shoots and observe their behavior and to monitor their weight until conclusions may be drawn. Of course, a starving gopher may eat vetiver if that is all that is available, so an additional experiment would be needed to determine dietary preferences among typical plants that they would normally encounter.

Gophers are accomplished burrowers. The issue is whether the vetiver root mass, even in the event that gophers are not repelled by the smell or taste of the roots, is so dense that it poses a challenge the gophers to the extent that they avoid vetiver in favor of places that don't offer so much resistance to burrowing. This can be evaluated as well in an experimental setting.

**4 - From:** Ciss Juliad <cjuliad@mtds.com>, 2 August 2014, at 1.03

Thank you for bringing up a new issue with vetiver; we thought we had the best soil protection system EVER! Now we are informed that in fact, moles and gophers are more diligent vertical hole diggers than we ever thought of (2 ¼ - 3 meters deep and 7 ½ - 10 cm in diameter) is quite an excavation. I have not been privy to such earth-moving critters before, but I wonder what the Santa Ana California client, with such patience, suspects moles and gophers do with vetiver's root system; do they consume them, do they cut them loose with their teeth and make a more comfortable bedding with them, and, are there predatory animals in the area that force moles and gophers to make deep and wide holes?

What does the client & other vetiverists think about placing a thick vetiver clump in 2 or 3 Mole/Gopher holes, along with a wide ball of vetiver leaves (7 to 10 cm in diameter), and subsequently observe what moles and gophers do with the clumps' roots and leaf system. Do they use these parts of vetiver by trying to bring them down into their habitat, or would they search for other grounds, rendering the client's sloped land even more fragile; which is NOT an objective!

As John Greenfield would say, "Just a thought."

**5 - From:** Alberto Rodriguez <alrod312@gmail.com>, 2 August 2014, at 3:14

Oops!... reading Criss' reply, I realized that my feet to meters conversion was wrong. They are not really that good at digging! The sentence should have read: We have a section of the property where we noticed there are three to four inch (7 1/2 to 10 cm) diameter tunnels about three to four feet (2 1/4 - 3 mt) [should read (.9 - 1.2 mt)] down from the surface.

It does not change the question much, but they should be finding a heavier wall at that depth.

**6 - From:** Don Miller <donmillernz@gmail.com>, 2 August 2014, at 4.36

I have no information regarding the impact of vetiver roots on gophers, but if you wish to discourage them you could try the traditional technique used in Southern Shan State, Myanmar. There they establish *Datura* plants around the perimeter of the field. The moles eat the roots and this apparently disorientates them so much that they leave the root crops undamaged.

**7 - From:** Richard Grimshaw <r.grimshaw@comcast.net>, 2 August 2014, at 7.24

The fact that gophers are not present in the vetiver planted area is of interest in itself as gophers have been reported as a nuisance to vetiver. I would suggest your client just tries out a small perimeter hedge and see what happens. A useful way of contributing to our knowledge base!!

**8 - From:** Henry Green, <hennrygreen4@gmail.com> 2 August 2014, at 8:39

Somebody, maybe John Greenfield, made some mention of gophers in days past.

**9 - From:** John Greenfield <27@xtra.co.nz>, 2 August 2014, at 8:59

You have a good memory Henry. My son planted a couple of vetiver hedges on his property in Santa Barbara – the Gophers ate it all. He watched them pull the plants in to the ground. He's a medic and didn't have time to handle the problem.

**10 - From:** Richard.Grimshaw <r.grimshaw@comcast.net>, 2 August 2014, 9.35

Sounds as though it all depends on the type of soil - digability. There is plenty of vetiver that has not been bothered by vetiver in the Santa Barbara area, e.g. the recent posting on facebook.

**11. From:** Vinod Kumar K <rigvinod@gmail.com>, 11 August 2014, 3:03

Photographs of gopher almost digging up a vetiver hedgerow. Gopher digs near vetiver roots.

(See the photographs on page 10).

### Vetiver – A Living Trap\*

Vetiver grass, with its unique morphological, physiological and ecological characteristics, has amongst others, a key role in soil and water conservation, environmental protection, bioengineering, phyto-remediation, etc. Many new applications of vetiver have been added in recent years. Many use it as a “living trap”. The following paragraphs explain the meaning of “trap”, the property of vetiver as a living trap, and the kinds of living traps

#### 1. The Meaning of “Trap”

According to Websters' New World Dictionary (Third College Edition), when used as a noun, a trap is “any device for catching animals”, or “any strategem or ambush designed to catch or trick unsuspected persons”; when used as a verb, trapped or trapping means “to catch in”, “to hold back”, “to seal off by a trap”, “to furnish with a trap or traps”, or “to set a trap”.

In normal situation, the traps are non-living, while those that are trapped are all living creatures. However, the word “trap” can be extended to be used as a living thing, which performs the function of trapping other objects, be they living or non-living. This is exactly what the author will establish – vetiver plants grown in a single line along the contour can act as a living trap that holds back or catches other objects, living or non-living. While slowing down and spreading fast incoming overland flow, vetiver hedges have proven to be very effective to filter, or “trap” of objects that are filtered through them.

#### 2. The Property of Vetiver as a Living Trap

Vetiver has special properties that make it suitable to function as a living trap. These are:

**2.1 Living Wall:** Vetiver planted across the slope of the land having thick clumps growing close together, acts as a living wall to slow down the fast running water from higher areas, collects debris, sediment and water that mostly remain in front of the vetiver line, thereby “trapping them there”.

**2.2 Living Dam:** Vetiver's deep root system penetrating vertically down to the subsoil layer, together with thick and strong clumps, act as a living dam in collecting everything dispersed along with the run-off water flowing down the slope, this debris is then deposited in front of the vetiver line. In this way, sediment, fertilizer, weed seeds are all collected in front of the vetiver line or

“hedge”. In addition, this hedge of vetiver with its strong, deeply penetrating root system helps to bind the soil particles preventing erosion by run-off and wind.

**2.3 Highly Tolerant to Pollutants:** Vetiver is highly tolerant to high concentration of pollutants (Truong, 1999; Roongtanakiat, 2009). Vetiver has been found to be highly tolerant to extreme soil conditions including heavy metal contamination (Truong and Baker, 1998).

### 3. Kinds of Vetiver Living Traps

Living traps of vetiver can be divided into two main kinds depending on the objects being trapped, namely:

**3.1 Non-Living Objects:** These are all non-living objects brought down along with the runoff water, either above- or underground. Such objects can be categorized as follow:

**3.1.1 Sediment Trap:** Vetiver grown as a contour hedge along the slope retards the run-off water and traps soil sediment, large and small, carried by the water and deposited at the front of the vetiver line. Chemical pollutants often associated with these sediments will also be trapped by vetiver hedges, thus reducing off-site pollution (Truong and Baker, 1998). These materials add to soil fertility and moisture at the front of the vetiver line.

Criss Juliard (Personal Communication) observed that none of the full-grown banana stalks have any bunches, and there is no vetiver to be seen at this side of the banana field (Fig. 1). Fig. 2 shows one person who works on the plantation; he is showing the first and only full-sized banana bunch in the orchard. Close to the banana stalk are vetiver plants in good standing, which Juliard has had previous experience adding vetiver close to fruit trees and vegetable plots. Juliard is of opinion that planting vetiver outlining vegetable plots or newly planted young fruit tree like avocados generally prevent nematode invasion. He found that nematodes do not survive well when vetiver is close to new young plants (vegetables in particular). There was no special additional watering among banana stalks in the second photo, as watering is uniform and monitored within the entire banana “orchard.” What seems evident, is vetiver’s capability to provide an amendment or supplement to the banana stalk improves banana growth and output.

Vetiver hedges planted across and along the sides of waterways and drainage lines reduce erosion and trap both coarse and fine sediments resulting in less sediment in downstream water bodies, including dams (Truong and Baker, 1998). Vetiver traps the silt and reduces the speed of the runoff. Thus more water has time to seep down to lower layers of the soil, while the rest is spread out and flows through. Over time sediment accumulates at the front of the hedgerow increases and eventually forms a natural terrace. In NE Thailand, soil of corn plantation along and across slope has different amount of soil loss ranging from 7.81 to 5.91 tons/ha, and plowing and planting corn across slope could decrease soil loss around 33.6%. Vetiver hedges further decrease loss, on average to 4.81 tons/ha. In the 2<sup>nd</sup> year, vetiver planted in double row and developed into dense strip futher reduce soil loss by 50-90%. These deposits result in the formation of natural terraces, that increase in height by about 30 cm a year (Suriyo and Vongkasem, 2002).

**3.1.2 Fertilizer Trap:** Vetiver hedges can trap/filter fertilizer residue that farmers apply to their crops resulting in increasing soil fertility in front of the vetiver hedge. This can be observed from the luxuriant growth of the plants growing in front of the vetiver hedge (Suriyo and Vongkasem, 2002).

**3.1.3 Pesticide Trap:** Vetiver hedges trap pesticide residue carried along the water run-off and deposited in front of the vetiver hedge. In addition, the concentration of insecticides, fungicides, bacteriocides, herbicides, etc. carried along with the water is much reduced when passing through vetiver hedge which acts as a filter for these pesticides. Elevated concentrations of pesticides in runoff were reduced after the runoff had filtered through the vetiver strip. Thus, the water passing through the vetiver hedge contain less concentration of these pesticides every time they pass through each hedge of vetiver. In Thailand, it was found that vetiver planted in line along with a cabbage crop on sloping highland was able to trap such pesticides as carbofuran, monocotophos and anachlor;

these pesticides were completely trapped such that none of them passed through to cause damage to the crops planted on the lowlands.

**3.1.4 Agrochemical and Nutrient Trap:** Vetiver can act as a living trap that holds back agrochemicals and nutrients carried along in the water run-off and deposited right in front of the vetiver line (Truong, 1999). This makes the soil more fertile. As vetiver can tolerate high concentration of agrochemical, thus can perform the function of phytoremediation quite well through the absorption of such chemicals into their roots. This is the most convenient and economic method of trapping agrochemical and nutrient from cultivated land. Truong, et al. (2000) were successful in using vetiver hedgerows to trap a high concentration of endosulfan and phosphorus in cotton plantations in Australia.

Vetiver can also be used to trap runoff following fertilizer applications. Elevated concentrations of nutrients in runoff were reduced after the runoff had filtered through the vetiver hedge.

**3.1.5 Heavy Metal Trap:** Mine tailings create a lot of problem as they contain heavy metals used in the ore treatment process. The presence of such heavy metals are a problem for their removal, and as a result are allowed to accumulate in the mine tailings, that when leached, are carried along with water run-off to lower areas, often resulting in the contamination of domestic water in many areas in Thailand, including as lead contamination in Kitty Village, Thong Pha Phum, Kanchanaburi Province; cadmium in Mae Sot District, Tak Province; arsenic in Ron Phibun District, Nakhon Si Thammarat, etc. Vetiver hedges can trap and remove these heavy metals as demonstrated by John (2007) who used vetiver as living trap to collect arsenic carried by the water and associated sediment from higher area prior to entering the reservoir.

Vetiver grown in a single line performs its duty as a living trap for these heavy metals, such as demonstrated by Srisatit, et al. (2003) and John and Watzke (2007) who used vetiver to trap arsenic carried along the current to the reservoir in Ron Phibun District of Nakhon Si Thammarat Province in Thailand. The water that passes through the vetiver hedges is clean and free from arsenic.

## 3.2 Living Objects:

**3.2.1 Insect Trap:** Levy (1994) observed that vetiver grown in close proximity to the sugarcane could inhibit the attack upon the sugarcane of certain insects such as the cane borer. He proposed that it could be due to the effect of insect trapping.

Javier Frances (pers.comm.) of El Salvador observed that the stem borers preferred to lay their eggs on vetiver than on the sugarcane. The latter seems to be healthy as the stem borers couldn't complete their life cycle on vetiver.

Grimshaw (2004) posted on 6 July 2004, a letter from Dereck Jakobi of Zambia (organics@zamnet.zm) who farms 200 ha of commercially produced organic horticultural crops, "We have noted the control of corn stalkborer in fields of baby corn as well as control of leaf miners in peas as well as in our coffee blocks. The maize borer control is more that the vetiver acts as a trap crops for the stalkborer moth when it lays its eggs, wherever with the leafminer it seems that the beneficial wasp population takes care of the leafminers"

Van Den Berg (2007) experimented to prove that vetiver could perform its duty as a living trap to catch corn stem borer. The vetiver hedges growing around the corn reduced the danger of stem borer infestation because it prefers to lay eggs on the vetiver leaves rather than on corn leaves. Having hairs on the underside of the leaves, the emerging young larvae could not bore a hole into the vetiver stem, thus fall down to the ground and die. Besides, the vetiver plant is the host plant of predatory insects that overwinter on it, thus are able to eradicate stem borers that come in spring. He also found a number of arthropods that act as predators on the vetiver rather than on corn plants, both in the summer and the winter. From such works, Van den Berg (2007) developed an integrated pest management system, named, "the push-pull system" for insect protection. From these studies, both in the laboratory and the greenhouse, he could demonstrate that the moth of *Chilo partellus* prefers to lay eggs on vetiver, and not on corn leaves. From continuing studies in the greenhouse and in the field, he demonstrated that the larvae of stem borer's moth has less chance of survival on vetiver leaves. Consequently, vetiver behaves as a living trap for stem borer when grown in between rows of corn plants. Such a result might be applied in sugarcane field as well as in rice field.

Vetiver --- A Living Trap (see the article on page 4)



Fig. 1. (Left) Vetiver hedge traps sediment carried down with water and deposits in front of the hedge. (Right) Vetiver hedge forms natural turrace 30 cm high per year.



Fig. 2: (Left) Vetiver hedges grown alternatively in between vegetable plots help to trap fertilizer carried along with water to the vegetable plots; (Right) collecting debris and sediment carried along with the water and deposit in front of the vetiver hedge.

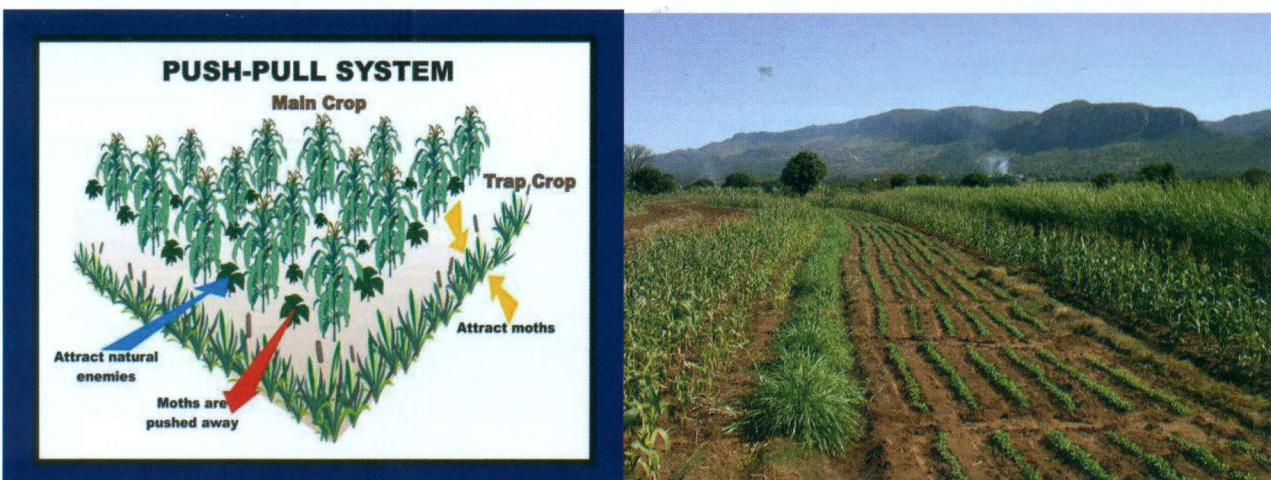


Fig. 3: (Left) Push-Pull System developed by Prof. Van Den Berg using rows of vetiver surrounding corn fields making the former a living trap of corer borers before they can damage the corn plants by pulling the insect pests to the vetiver plants and push the insects away. (Right) Vetiver planted in rows to protect the field of corn plants in South Africa.



Fig. 4: (Left) Banana field with no vetiver; none of the banana stalks have any bunched. (Right) Banana field with vetiver; with the first and only full-sized bunch.

## Vetiver System in Highway Batter and Steep Slope Stabilization in Vietnam and Hong Kong

### Ho Chi Minh Highway, Vietnam



Fig. 1: Erosion on batter during construction in 1988-99. Fig. 2: Vetiver planting in 2000



Fig. 3: Batter in 2014, completely stabilised and almost covered by indigenous vegetation





Fig. 4: Panoramic view of the slope full of vetiver  
**Hong Kong Highway Batters and Landslips**  
**Kwai Shing Site**



Fig. 5: July 2002 – 3 years after planting  
**Sin Tin Wai Site**

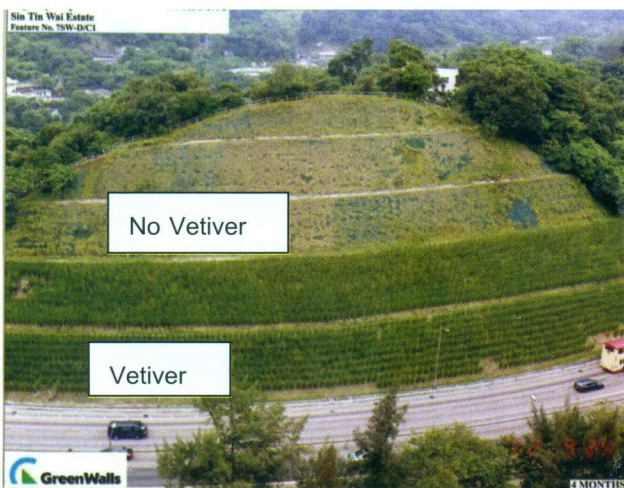


Fig. 6: July 2001 – 4 months after planting



Fig. 7: June 2014 – 13 year after planting



Fig. 8: June 2014 – 16 years later

Mole and Gopher  
(see article on page 2)



Fig. 1: Mole



Fig. 2: Gopher – a rodent

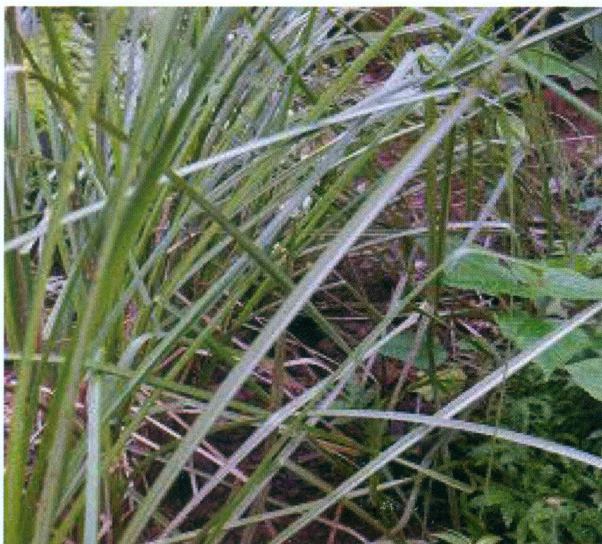


Fig. 3: Gopher almost digging up a vetiver hedge near the roots (by Vinod Kumar)

**3.2.2 Nematode Trap:** In Ethiopia, a farmer planted chilli pepper in between the rows of vetiver and found that the yield is much higher than of other growers who did not grow in such a manner (Grimshaw, personal observation and communication). Although Grimshaw did not think that this has anything to do with sediment trapping, but rather the interaction with exudants from vetiver roots and the nematode, but the effect is higher yield as the result of no nematode infestation. Although this case is an anecdotal evidence, it may be possible that rows of vetiver plant could behave as a living trap for nematodes carried by the current along with soil sediment, thus could no longer move further and be destroyed with pesticides accumulated in the vicinity of the vetiver roots. Grimshaw (2009b) recommended to look at the document related to nematodes and vetiver in the website <[http://www.vetiver.org/ETH\\_WORKSHOP\\_09/ETH\\_A3.pdf](http://www.vetiver.org/ETH_WORKSHOP_09/ETH_A3.pdf)>.

One of the observations Juliard (pers.comm.) took note is that planting vetiver outlining vegetable plots or newly planted young fruit tree like avocados generally prevent nematode invasion. He found that nematodes do not survive well when vetiver is close to new young plants (vegetables in particular).

Thus, there are two schools of thought about the role of vetiver in providing higher yield of fruit crops; one is a living trap for nematodes carried by the current along with soil sediment, the other is vetiver provides exudate that prevents nematode invasion.

**3.2.3 Weed-Seed Trap:** Grimshaw (2009) refers to the letter that Olsen and Skidmore from Queensland, Australia who wrote him the following: "The vetiver hedges delay the flow of water current and distribute soil mass that was carried along the current to deposit in front of the vetiver rows effectively. As a bonus the weed seeds carried along with the run-off and soil mass and deposited in front of the vetiver rows, thus do not disperse to cultivated areas, thus the farmers might eradicate them without the use of chemicals."

#### 4. Discussion

It has been known for a long time that vetiver has been called a miracle plant that has a major role in soil and water conservation, reclamation, rehabilitation, phytoremediation, bioengineering, etc. The use of vetiver in soil erosion control and collecting soil sediment has been practiced for a long time, but the concept of vetiver as a living trap is rather different and broadens the multipurpose application and usefulness of vetiver. This "trap concept" might further encourage the application of vetiver by farmers and others.

The objects trapped are both non-living and living. The former includes solid sediment, fertilizer, agrochemicals, nutrient and heavy metals carried along with the current. Vetiver has done a marvelous job in this respect as it acts as a "living wall", and "living dam". It is also tolerant to high toxicity concentration of the pollutants that it traps.

Trapping of living things such as insects, nematodes and weed seeds also rely on the "living wall" and "living dam" properties of vetiver. But the most important thing is the resistance to the attack by these living organisms that preventing the loss of the vetiver hedge itself. One thing that vetiver hedges have done well is pest control, whether they are insects, nematodes or weed seeds. However, as pointed out by Van Den Berg (2007), the role of vetiver in controlling plant pests should not be separated from the integrated pest management system, because by itself, vetiver is the same as other control measures that cannot reduce the expansion of plant pests fully at all time. The vetiver system should be one part of an integrated pest management approach such as in using vetiver system as a living trap for a particular pest species and the host of numerous other species. Good agricultural practices help to strengthen the plant which is the basis of plant pest control.

But Vetiver's major role in agriculture, is controlling runoff for moisture conservation. In 'rainfed agriculture' moisture conservation is absolutely essential.

The Vetiver System should also have an important role in a the much broader approach to agro-ecology, as compared to a narrower role as part of integrated pest management.

(See the photographs on page 7)

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### Long Term Effectiveness of Vetiver System in Highway Batter and Steep Slope Stabilisation In Vietnam and Hong Kong\*

(See the photographs on pages 8-10)

To assess the long term effectiveness of the Vetiver System Technology (VST) in highway batter and steep slope stabilization, I visited the Ho Chi Minh Highway in Vietnam in February 2014 and Hong Kong in June 2014

#### Ho Chi Minh Highway (HCMHW)

The aim of this visit was to assess the effectiveness of the VST in controlling erosion on the Ho Chi Minh Highway after 14 years of implementation (2000-2014). This was conducted as a part of the preparation for field trips for ICV-6 in Da Nang in May 2015. This visit covered a two day trip over a distance of about 1 000km. Starting west from the coastal National Route No.1 at Da Nang to Section 2 (Quang Nam to Quang Binh) on one of the traverse connecting roads (200km) then north to East HCMHW (364km) and to Section 1 (Quang Binh to Hanoi) (500km). Following the obvious failure of the costly conventional measure in controlling the erosion and landslips along the Highway, in 2000 the Ministry of Transport adopted VST as a preferred erosion control measure on all new sections of the Highway and on eroded slopes of the completed sections.

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### **General Observation and Some Conclusions**

- On the whole there are no serious erosion events over the length of about 1000km of Sections 1 and 2 of the HCMHW and Vetiver System has successfully stabilized these sections of the highway.
- This survey did not cover Section 3: from Quang Nam to Saigon where some shallow (small slips 1-2m deep) and more serious large (deep-seated slides 5-10m) occurred.
- Occasional eroded batters and small slips occurred, partly due to uncontrolled animal grazing and poor internal drainage.
- Vetiver has accomplished its mission as a pioneer plant, providing effective erosion control on very steep and hostile slopes, trapping sediment and runoff water, producing a micro-environment to facilitate the establishment of endemic plants.
- All these plants re-established naturally by themselves, mostly from endemic seeds from the surrounding areas. Some were blown in from further out.
- In general, the original vetiver was shaded out by the spread of the local plants. It can be found only along the edges of the original planting.
- Most importantly, in area where local species did not re-establish, vetiver persisted and continued to provide protection.
- Based on long term experience in subtropical Australia, local trees will eventually come back to provide a permanent protection.

Vetiver planting created favourable condition for local species to come back and faded away due to shading, but it persisted where local species could not come back.

### **Hong Kong Highway Batters and Landslips**

These projects were carried out by Dr. P.K. Yoon in 1998 and 2001 to stabilise highway batters and rehabilitation of a landslide site in Hong Kong.

#### **Kwai Shing Site**

This project was carried out in 1998 to rehabilitate a landslide along a major highway leading to the city centre. The site is completely stable now, vetiver has done a perfect pioneering job, stabilised the site and local shrubs and trees are coming back slowly after 16 years. Vetiver is growing well, with occasional trimming, but growth can be improved with occasional application of fertilisers.

#### **Sin Tin Wai Site**

This project was carried out in 2001 to rehabilitate very steep batter of a major highway leading to the city centre. Vetiver was only planted on the bottom two terraces to stabilise this batter to promote natural rehabilitation of on upper terraces.

### **General Observation and Some Conclusions**

- On the whole there is no erosion on these two sites, the Vetiver System in combination with some hard structures has successfully stabilized the landslide after 16 years, and the very steep sections of the highway after 13 years.
- Vetiver has accomplished its mission as a pioneer plant, providing effective erosion control on very steep and hostile slopes, trapping sediment and runoff water, producing a micro environment to facilitate the establishment of endemic plants.
- All these plants re-established naturally by themselves, mostly from endemic seeds from the surrounding areas. Some were blown in from further out.
- Based on long term experience in subtropical Australia, local trees will eventually come back to provide a permanent protection.

Similar to the HCMHW, vetiver planting created favourable condition for local species to come back and faded away due to shading, but it persisted where local species could not come back. Further details are presented in PRVN Technical Bulletin No. 2015/1.

A network is an institutional framework committed to co-operate in common thematic activities. The network approach has been particularly useful as a means of exchange of technology, expertise, and information among members. Networking helps reduce or eliminate the duplication of efforts among national institutions, providing a cost-effective instrument for information exchange and institution building, encourages collaboration for technological development, and make the most effective use of the members' limited facilities and resources.

### The Hierarchy of the Networks

When Mr. Richard Grimshaw set up the Vetiver Information Network (VIN) in the late 1980's, his idea was just to release information to research workers who were interested in vetiver. There was no plan to set up other networks. As time went by, a lot of people became interested in its publications, and Grimshaw has retired from the World Bank, thus could not draw further resources to run the VIN, yet he continued the Network under a new name, "The Vetiver Network (TVN)" (now change to The Vetiver Network International - TVNI), and ran it as an independent autonomous body with funding support from donors who were a number of government and private agencies. Through his recommendations, a number of regional and national networks were soon established. The first network was a regional one for Latin America, set up in October 1995, followed by the second one soon after the First International Conference on Vetiver (ICV-1) in January 1996, that is now the Pacific Rim Vetiver Network. Several regional and national networks were soon established under the umbrella of TVN. These can be grouped under five categories based on the levels of hierarchy as follow: (1) Global Level (2) Regional Level (3) National Level, and (4) City Level. These different levels of vetiver networks are discussed below:

**1. Global Level:** The Vetiver System (VS) is a low-cost technology to solve big problems of soil and water conservation. However, before such a system can be transferred, there is a need of funds for research and development as well as for transferring the derived technology. The Vetiver Information Network (VIN) was established in 1989 by Mr. Richard Grimshaw, as a non-profit organization to support the use of vetiver for soil and water conservation (Grimshaw 2002). The main activities of the VIN were to provide funding support to various scientists and agencies in developing countries, and to publish a newsletter under the name "Vetiver Newsletter", on an occasional basis, starting in 1990.

As a continuation of the VIN, its predecessor, The Vetiver Network (TVN) was established in 1995. It is the first and the only vetiver network that has the global responsibility in all aspects of vetiver R&D. TVN is an autonomous body receiving grants from various governmental and non-governmental agencies to run its activities. It has provided technical as well as financial support to other networks under its umbrella around the world. It has and also helped in the organization of meetings on vetiver at the international as well as national levels. Under the coordination and editorship of Mr. Richard Grimshaw, it continued to publish the "Vetiver Newsletter" (starting No.13, November 1995) while the World Bank, through its Agriculture and Natural Resources Department, continued to provide funds for the printing and mailing of the Newsletter. However, the World Bank stopped funding supports a few years back. Fortunately, through the efficient administration of Jim Smyle as the President and Joan Miller as the Coordinator, TVN has continued its operation marvelously well with funding supports from a number of donors.

**Regional Level:** At present there are five regional vetiver networks, whose details are given below in order of their establishment:

**1.2.1 Latin American Vetiver Network (LAVN):** Established in October 1995 to disseminate and assist the exchange of information in Spanish regarding the use of vetiver within the region, LAVN has been successful in its goal. The Secretariat Office is located in San Jose, Costa Rica. Major activities include the publication of a newsletter (*Boletín Vetiver*), providing material to the Vetiver Network Homepage, videos, technical information on specific topics; assembling a

directory of the most active VS users and network members; providing small grants for initiation of vetiver nurseries, etc. (Miller 2002).

**1.2.2 Pacific Rim Vetiver Network (PRVN):** Established in April 1996, with the Secretariat Office at the Office of the Royal Development Projects Board in Bangkok, Thailand. At present, there are 20 member countries, namely Australia, Brunei, Cambodia, China, Cook Islands, Fiji, Indonesia, Japan, Lao PDR, Malaysia, New Caledonia, New Zealand, Papua New Guinea, Philippines, Samoa, Taiwan, Thailand, Tonga, Vanuatu, and Vietnam. The main activities include the publication of a quarterly newsletter, *Vetiverim*, since July 1997, the publication of occasional technical bulletins (ten have been produced up to now), establishing a homepage (<http://prvn.rdpb.go.th>), production of CD ROMs on various subjects (Chomchalow 2002b).

**1.2.3 Southern Africa Vetiver Network (SAVN):** Established in November 1996 with the Secretariat Office at the Institute of Natural Resources, Scottsville, South Africa, SAVN's targets are in four specific areas: (i) provincial and regional government department/parastatals, (ii) local champions, (iii) mass circulation publications, and (iv) NGOs. Activities included the publication of newsletter and support of two research projects, one to determine if any existing cultivars perform better than others in the cooler high altitude environment, also to determine more precisely the impact vetiver has when used in landfill rehabilitation (Hay 2002).

**1.2.4 Europe and Mediterranean Vetiver Network (EMVN):** Established in November 1998, for a period EMVN operated its own Home Page that was little more than a mirror of the TVN Website. After one year this was discontinued in favor of a section within the centralized TVN Website. EMVN produced its first newsletter in April 1999. The fourth one came out in November 2000. The Secretariat Office is located in Lagos, Algarve, Portugal. The members include Portugal, Spain, Israel, Italy, Albania, and a few other countries that have potential such as Greece, Syria, Turkey, Morocco, and the Canaries (Pease 2002).

**1.2.5 West African Vetiver Network (WAVN):** The Secretariat Office is located in Accra, Ghana. However, due to poor health of the Coordinator, Mr. Linus Folly, this regional network has so far been inactive.

**1.2 National Level:** At present, there are a number of national vetiver networks in Asia, Africa, Europe and the Mediterranean, and Latin America, viz.:

**1.3.1 In Asia:** Among these are: China Vetiver Network (CNVN), Indian Vetiver Network (INVN), Indonesian Vetiver Network (IDVN), Philippine Vetiver Network (VETNETPHIL), Thailand Vetiver Network (THVN) and Vetiver Network Viet Nam (VNVN)

**1.3.2 In Africa:** Among these are: Cameroon Vetiver Network (CMVN), Amhara State (in Ethiopia) Vetiver Network (ASVN), Madagascar Vetiver Network (MGVN) and Tanzania Vetiver Network (TZVN)

**1.3.3 In Europe and the Mediterranean:** Among these are: Albania (A-VN), Israel (ILVN), Italy (ITVN), Morocco (M-VN), Portugal (PTVN) and Spain (ESVN).

**1.3.4 In Latin America:** Among these are: Brazil Vetiver Network (BRVN), Chile Vetiver Network (CLVN), Colombia Vetiver Network (C-VN), Costa Rica Vetiver Network (CRVN), Ecuador Vetiver Network (EQVN), Mexico Vetiver Network (MEXVN), Panama Vetiver Network (P-VN), Peru Vetiver Network (P-VN) and Venezuela Vetiver Network (VEVN).

**1.4 City Level:** In a large country, there may be a need to set up city vetiver network to cover construction site stabilization. One has already been established, i.e. Fuzhou Vetiver Network (FZVN), in Fujian province, southern China.

## 2. The Vetiver Network Acronyms

Acronym is a word formed from the first letters of a series of words that comprise the name of a country, an organization, institution, etc. It is very useful for people to memorize and comprehend. US, UN, FAO, WTO, IRRI, ASEAN, are examples of well-known countries/organizations/institutions.

Acronyms have been used for various networks, some with four-letters, some with fewer or more letters; thus there is inconsistency in the acronyms of the vetiver networks in the world.

The author has brought the problem of inconsistency of the acronyms to the attention of the vetiver coordinators around the world. In the Editorial of *Vetiverim* 20, the author (Chomchalow 2002a) put forward the idea that since there has been a large number of the regional and national vetiver networks established, and many more networks will soon be established once the importance of vetiver is realized, it is suggested that a four-letter acronym for all networks under the umbrella of the international one be adopted.

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