History and Achievements of The Vetiver Network International

Vetiver hedgerow technology for erosion control is not a new. Vetiver was used for erosion control, bank and channel stabilization for centuries in parts of India. The British colonial agricultural services promoted Vetiver hedgerows for erosion control in the 1930s, particularly on some of the Caribbean islands and Mauritius. In the 1950s the Fiji Sugar Corporation used the hedgerows extensively to protect sugar cane fields on steep slopes - they were still there 30 years later when John Greenfield returned to review them. During this post World War II period engineered systems, following patterns developed in the USA, gained ascendency and complimented age-old terrace systems that had been used for centuries in many parts of the world. Unfortunately these systems did not always work, and they became more expensive to construct and maintain. What changed? In the early 1980s John Greenfield from New Zealand, who had worked with the Fiji Sugar Corporation in the 1950s, joined my World Bank team in India where he introduced Vetiver hedgerows to four or five large watershed development projects. He authored a small handbook for farmers "Vetiver Grass – A Hedge Against Erosion". This served as a basis to extend the technology to other tropical countries (translated and published in at least 20 languages). At the same time some Indian universities undertook research to quantify the impact of Vetiver hedgerows for soil and water conservation. In a nutshell the results showed more than 90% reduction in soil loss and up to 70% reduction in rainwater runoff. CIAT, in 1991, obtained similar results in experiments at Cali with soil loss reductions from 142 down to 1.3 tons per ha. In effect Vetiver hedgerows along with contour farming cultivation virtually provided a drought proof cultivation system that was low cost, easy to learn, and one that worked.

After leaving India in 1987 I was responsible for Agricultural technical services for the Asia region and for the next six years took the opportunity to introduce the technology to other, mainly Asian, countries. In 1988 I visited China and introduced the technology there. In 1991 the US Academy of Science set up a committee, under the chairmanship of Dr. Norman Borlaug, to review the Vetiver Grass Technology (VGT) for soil and water conservation. The outcome of this review was very positive and its findings were published in the book "Vetiver Grass – A Thin Green Line Against Erosion".

The World Bank expanded its support for VGT. It produced (Jim Smyle, now TVNI President, was the editor) a newsletter – The Vetiver Information Network. These newsletters are available on line at: http://www.vetiver.org/TVN_newsletter_index.htm. 1n 1990 Jim Smyle visited Ethiopia for a workshop and the Ethiopian initiative was started with a number of NGOs participating.

The next step was to look for opportunities in Asia. Dr. P.K.Yoon of the Rubber Research Institute of Malaysia, who I met by chance in Indonesia, undertook some seminal research on Vetiver grass and its applications. This practical work "A Look See At Vetiver Grass in Malaysia", published in 1993, is online at: http://www.vetiver.org/MAL_PK.Yoon%20Look%20see/START.HTM

Yoon was the first to see the potential of VGT for large-scale complex highway slope stabilization, and he organized in 1992 the first VGT workshop/conference held in Malaysia. At that conference a fairly young Vietnamese Australia participated, he was interested, but skeptical, in the potential of VGT, and went back to Queensland to look at the grass. He was astounded at its ability to grow under a wide range of conditions, and was smitten by the technology and went on to achieve great things in widening the applications of Vetiver to amongst others things - pollution control. He is here today – Dr. Paul Truong – now the most knowledgeable Vetiver System specialist in the world, and Technical Director of TVNI.

At about the same time the King of Thailand became interested in VGT and he set out to test it and verify its uses and benefits on his research farms. Thereafter he pressed his government and the Royal Development Projects Board to start extending the technology in Thailand. Another Thai, Diti Hengchaovanich, a highways engineer working in Malaysia, together with P.K.Yoon commissioned research into the strength of Vetiver roots and its impact on the shear strength of soil. The results were impressive. Vetiver roots had on average a tensile strength equivalent to mild steel - 65 Mpa (psi = 9427 lbs. per square inch) and improved the shear strength of soil by as much as 45%. Currently one of the leading advocates for slope stabilization using VS is Roley Noffke of Hydromulch, South Africa. Noffke has demonstrated, in a number of countries, VS over a wide range of extreme conditions; he has shown how effective it can be. In addition he showed in Madagascar how to involve poor local farmers in producing high quality Vetiver plant material, in doing so he changed their lives forever. Noffke has also invested a lot of time and money in teaching others how to apply VS for slope stabilization. A recent online photo essay "Geotropism of Vetiver" by Paul Truong nicely summarizes the progress of VS for slope stabilization.

Over the next few years' steady gains were made in broadening the technology and applying it. Paul Truong and his colleagues in Australia, China (Xia Hanping) and Thailand, and Vietnam expanded research into Vetiver's tolerance to and uptake of heavy metals. VS applications for: stabilizing landfills and dealing with leachate effluent (Australia, China, Thailand, USA); mitigating and stabilizing mining wastes and sites (Australia, China, India, Venezuela); processing waste water from homes and sewage processing plants (Australia, Indonesia, India, Vietnam), were initiated with a good deal of success. Thus VS was established as an application for treating contaminated water and land at a relatively low cost and as a "green" solution. Paul Truong will unveil at this Conference a simplified "model" that will allow easy calculation of the amount of Vetiver needed to treat small amounts (mainly domestic and community) waste water, including effluent from small coffee pulping mills in Colombia.

Bi-product use of Vetiver has become of increasing importance and interest, as research and demonstrated its potential as forage (Australia, China, India, Vietnam); mulch (China, Ethiopia, India, Vietnam); a biofuel energy feedstock (China, Dominican Republic, Haiti); and a material source for handicrafts (China, India, Thailand, Venezuela). As small farmers started to see the potential use of bi-products their interest grew in the use of Vetiver for erosion control (Ethiopia, China, Haiti, Indonesia, India,

Kenya, Malawi, Madagascar, Philippines, Tanzania, Thailand, Zambia, Zimbabwe, South Africa, Venezuela, and others). Most importantly small farmers have shown that they can produce high quality Vetiver plant material for sale for commercial applications of VS.

Over the past 25 years the Vetiver System (the generic name for all the applications) has grown and is used today in most tropical and semi tropical countries, as well as niche areas in more arid regions (Mediterranean, California, Kuwait, Iran and Turkey). Apart from the exciting new applications, the technology has been increasingly used for infrastructure stabilization (Brazil, Madagascar, Ethiopia, China, India, Malaysia, Thailand, Venezuela, Colombia, Guatemala, Costa Rica, El Salvador, sub-Sahara Africa, Vietnam amongst others), and of course a slow but expanding use of VS for on farm soil and water conservation in most developing countries. (Ethiopia is an excellent example involving tens of thousands of small farmers).

In summary by 2013 some 25 years after the World Bank/Greenfield initiative in India VGT has proven to have great potential for a number of important applications involving agriculture, infrastructure, land rehabilitation, ground water recharge, pollution control, mining, health and various other uses. It is an environmental technology that has significant cross sector implications with the potential of one application driving another.

How did we get there?

I retired early from The World Bank in 1994 with the objective of mainstreaming the VGT worldwide. At that time the World Bank was focusing on policy orientated lending and was not really that interested in technology – the latter was the borrower's responsibility. I knew that on my leaving the Bank little effort would be made by the institution to promote VGT. I decided to establish (with the generous funding help of my friend and former colleague, Paul Zuckerman), a nonprofit organization (NGO) that would solely focus on VGT. "The Vetiver Network", later renamed "The Vetiver Network International" (TVNI) was registered as a Virginia, USA, company with 501 3 c tax-free status. We established a small Board and started looking for funding sources. We were fortunate to be awarded Monsanto's US$100,000 "John Franz Award for Sustainability" (John Franz invented "Roundup" the only herbicide that will kill Vetiver!) and we received a $300,000 grant from the Royal Danish Government. Over about 7 years we raised close to a million US dollars. I was determined that these funds would not be for TVNI salaries – TVNI has always been 100% operated by unpaid volunteers. Our funds were allocated as grants to support focused Vetiver research, small catalytic pilot projects, training workshops, regional and country networks, publications and our website. For most of the last 18 years I have been Webmaster, accountant, and administrator. On the whole we have been quite successful. Of course we had failures, but success outweighed failure by far. More importantly we have achieved a situation where TVNI operates worldwide through the support and networking of Vetiver users, and as a network could probably operate indefinitely at virtually no cost.

Getting information out to the public was our first priority; we did this through the publication, twice a year, of an extensive newsletter (80 pages or more

http://www.vetiver.org/TVN_newsletter_index.htm) that documented ongoing research, feedback from field programs, and general commentary. Soon this was supplemented by a website (www.vetiver.org); eventually the newsletters, that cost a lot to print and mail, were phased out and the website became the main source of VGT info for the public. We also reproduced John Greenfields's field handbook, and produced a rather good brochure poster that has been translated and reproduced in a number of languages. In 2008 Paul Truong, Elise Pinners and Tan Van Tran authored a new Vetiver manual – "Vetiver System Applications – Technical Reference Manual", covering all aspects of VS, and translated now in nine languages and downloadable from our website at no cost. In more recent years we have established a blog http://vetivernetinternational.blogspot.com/ and a Facebook page https://www.facebook.com/groups/vetivergroup/. Vetiver Grass Facebook page has become an important place where VS users can exchange experiences and ideas. With the advent of the social networks we have encouraged country networks, individuals and entrepreneurs to create their own dedicated Vetiver Facebook pages and blogs. These are listed at: http://www.vetiver.org/g/other.htm. Most of this effort has cost nothing or very little, thanks to Google, Facebook and Alberto Rodriguez of Puerto Rico. Our manuals can be bought from Amazon.com, but all are available and downloadable electronically, at no cost, via our website.

The next step, following establishing information transfer processes, was to encourage multilateral development agencies, governments, NGOs, and the private sector to start using the technology. NGOs quickly saw the advantage of VS for soil and water conservation for small farmers as the technology did not depend on complex and costly technical support, and NGOs found it easy to introduce the technology (fortunately Vetiver grass, *Chrysopogon zizanioides,* was introduced to most tropical countries in colonial days for the oil of Vetiver, extracted from its roots). Today's successful Vetiver program in Ethiopia is due in part to TVNI grants made to two European NGO's who received $10,000 each. Likewise similar grants to NGOs in India, Indonesia, South Africa, Cameroon, Venezuela, Mexico and China led to start of long-term Vetiver initiatives (we granted US$200,000 in total to NGOs for start up projects). In Malawi the European Union funded a program that included Vetiver. In Madagascar, Senegal, Mali, Haiti and other countries Vetiver programs were funded under USAID projects. IFAD and the World Bank have included Vetiver in their projects. In latter years private sector companies have taken up VS for infrastructure stabilization, mine rehab, landfill and wastewater treatment, and land slide rehabilitation. In many instances the companies contract small farmers from nearby communities to provide the plant material thus adding significant cash flow to the farmers.

In parallel to developing actual applications in the field it was important to encourage research at national level. This was achieved: through the efforts of individuals who saw the benefit of VS and were in a position to encourage local universities and institutions to take up Vetiver research; by including Vetiver research in development project funding; by TVNI research grants; the establishment of TVNI Awards program that awarded cash prizes of up to US$5000 (totaling USA$40,000) every four or five years for various categories of research - the latter was a useful carrot; and encouraging graduate students to undertake research in Vetiver for their PhD thesis. His Majesty the King of Thailand

established “The King of Thailand Award” for outstanding proficiency in Vetiver. Worth $10,000, the award is made at the time of International Vetiver Conferences that are nearly always attended by TVNI Patron - Her Royal Highness Princess Maha Chakri Sirindhorn of Thailand representing the King.

The main centers of research have been in India (agricultural universities), China (primarily the South China Institute of Botany), Australia (University of Queensland), Vietnam (Saigon University), Thailand (universities and government research centers), Malaysia (Rubber Research Institute), and other research centers in Kenya, Kuwait, Ethiopia, Nigeria, The Netherlands, USA and Venezuela. Additionally there has been a lot of practical experimentation by users that have led to the use of modified applications and techniques. The Consultative Group for International Agricultural Research (CGIAR) carried out some limited Vetiver research under CIAT, ICRAF, ICRISAT, and IRRI, but did not take it very far. USDA did some very useful research on Vetiver for erosion control, but because of Vetiver’s lack of cold tolerance research was discontinued (except in Hawaii), however USDA/NRCS did promote cold tolerant grasses for hedgerow conservation. More recently a study and report by USDA/NRCS in Hawaii titled “Sunshine Vetiver – Plant Guide” was very positive and importantly confirmed Vetiver’s non-invasive characteristics. http://www.vetiver.org/USA-USDA-NRCS_Sunshine.pdf . Most of this research is documented on TVNI’s website.

TVNI has used the venue of Vetiver specific workshops and conferences to bring to the front and to the public the results and impact of the activities mentioned in the preceding paragraphs. The Vetiver community has been fortunate to have the deep commitment of His Majesty the King of Thailand, his family, and his foundation, The Chaipattana Foundation that has supported all the international Vetiver conferences that have been held every four or five years. The first two were held in Thailand (1966 and 2000), the third in China (2003), the fourth in Venezuela (2006), and the last in India (2011), The next conference will be in Vietnam in 2014. The proceedings for these conferences (and workshops) are at: http://www.vetiver.org/g/conferences.htm.

TVNI has also promoted and occasionally helped fund regional and country conference/workshops. The more important ones include two in China, Vietnam, India, Kuwait, Chile, Ethiopia, Kenya, Indonesia, Madagascar, and the latest here in Colombia. In most cases TVNI has provided one or more key resource persons. In every case we have found that VS applications have accelerated as a result of the workshop/conference interaction. This is demonstrated by increasing in-country/regional activities and increased Internet activity recorded on our various sites.

TVNI manages a certification program that certifies an individual’s technical capability in specific aspects of VS. The certified people are listed on our website. This certification process is a start towards professional recognition.

Lessons Learned

Some interesting facts and lessons have emerged from our various initiatives, these include amongst others:

- Published VGT characteristics and applications are scientifically well supported and verified. It is a relatively low cost technology that can be applied over a wide range of conditions - both benign and extreme. Like all technologies it performs best when applied correctly, so quality plant material and quality application are important.
- The main VS applications relate to soil and water conservation (including groundwater recharge), contaminated land and water rehabilitation (including pollution control), and slope stabilization associated with infrastructure and natural systems such as riverbanks and gullies.
- There are many interesting bi-products of Vetiver that are being used, tested and developed.
- Small farmers have been slow to use VS for erosion control for many reasons; their reluctance could be reduced through better training at community level and a better appreciation of the many applications and uses of Vetiver. Those who train farmers, whether they are government workers or NGOs need to understand the wider aspects of Vetiver, particularly the use of its bi-products.
- The adequate availability of Vetiver plant material is a prerequisite to any VS program however big or small.
- Small farmers can be easily taught to produce high quality Vetiver plant material for sale to contractors/landscapers and others responsible for stabilization of slopes, as well as to other nearby farmers or community projects.
- VS should not be a technology confined only to agricultural and soil conservation staff and engineers, but is a tool for anyone in any sector looking for a biological solution to solve problems relating to land and water.
- When VS is applied for infrastructure – slope stabilization or waste and water treatment - it is important that technically verifiable specifications are clearly established. Follow up maintenance for at least two years is important to assure long term effectiveness.
- The private sector has a major role to play in extending the technology and pressing government policy makers and agencies to use it. Large companies have an important role to involve small farmers in the production of quality plant material.
- The demand for plant material will increase substantially and it needs to be propagated near the application site.
- TVNI no longer funds research, there seems sufficient interest in the technology assuring alternative funding of research.
- Workshops and conferences are important for furthering the technology, and should be continued. Attendance by experienced VS resource persons is important.
- Greater efforts need to be made to create VS awareness at policy maker levels across various sectors.

- The Internet has been and will be critical to the success of VS in providing information fully in the public domain on the technology and for providing the means for social networking and interaction.
- The 100% volunteer culture of TVNI and its associates has helped assure a common trust amongst users that has resulted in an unprecedented sharing of information and experience that to my knowledge has not been duplicated.

What Next for the Vetiver System

At this time of: climate change and the associated extreme weather conditions; a world population expansion that can hardly feed itself and is using its land and water resources at an unprecedented rate; deteriorating quality of natural resources both in land and water; ever increasing costs of stabilizing and maintaining infrastructure; and continuing rural poverty and food insecurity, VS offers a well tested solution that can be applied over a wide range of conditions to mitigate some of these problems. VS mitigation is affordable and relatively easily applied both at industry and community levels. As mentioned above VS can impact significantly on drought proofing farms and providing flood protection and thus help assure a harvestable crop; by reducing rainfall runoff VS will reduce downstream flooding and will improve groundwater recharge; VS can mitigate storm damage as clearly demonstrated in Vietnam (preventing typhoon damage to sea dykes under other flood barriers) and Brazil and China (repairing and stabilizing slopes after landslides); VS can be used to clean up drainage and sewage effluent and thus impact significantly on improving health and prevention of diseases; and VS can stabilize infrastructure (roads, railways, bridges, canals) and help assure continued access and use even under very difficult climatic situations, all at a fraction of the cost of alternative "hard" engineering technologies that in any event of funding constraints will hardly be applied outside of the major population areas purely because of lack of affordability.

In discussions with public, institutional, private sector entities, and communities we should highlight and pursue the following:

Agriculture:

- VS should be a key on-farm component (specially in the small farm environment) in addressing food security. High yielding seeds and fertilizer are not enough, soil erosion and moisture conservation must be addressed, if the full benefits of genetic and cultural improvements are to be achieved.
- The world's net increase in irrigable land will in the future be zero or negative, and therefore any major increases in food production will have to come from rainfed farming. VS conserves improves soil moisture and recharges groundwater.
- Small farmers can benefit by using the many bi-products of VS, and could greatly enhance their incomes if VS were to be widely used for slope stabilization of infrastructure and for pollution control, with farmers and communities providing the plant material.

Infrastructure:

- VS has been tested under practically every conceivable condition for slope stabilization (roads, railways, canals, drains, building construction sites, and levees). The applications are well documented. It is generally recognized that VS is significantly less costly and often more effective than other technologies. There is no reason why it should not be applied widely. In addition its use for slope protection would impact significantly on rural communities if the latter were contracted to supply the plant material, and of course the same communities would be paid to plant it. VS should be included in all designs where it could be appropriately be used.

Contaminated land and water:

- VS should be considered in design of industrial and urban scale wastewater treatment plants, landfills, and mine reclamation.
- VS is appropriate for treating black and grey water effluent from individual and communal units. In doing so smell and disease would be reduced.

Land Rehabilitation:

- VS should be used for rehabilitating degraded lands, stabilizing gullies, and prevention of further degradation.

Vetiver bi-products:

- If used on large scale for the above applications there would be significant bi-products that could be utilized for: fuel, mulch, thatch, building materials (fiber board), paper, handicraft material source, and many other activities. All provides additional income or savings in buying alternatives. In addition large-scale use of VS will reduce destruction of forests and will increase the sequestering of atmospheric carbon.

Richard Grimshaw, October 2013