

# **REPORT ON THE TRIP TO VIETNAM, CAMBODIA AND INDONESIA**

## **MAY – JUNE 2007**

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***(August 2007)***

### **OBJECTIVES**

- To launch the VS Technical Manual – Vietnamese Edition
- To review current and new vetiver projects in Vietnam
- To inspect current and new vetiver projects in Vietnam and Cambodia
- To develop new project in Indonesia
- To thank and farewell to Elise Pinners.

### **VS TECHNICAL MANUAL – VIETNAMESE EDITION**

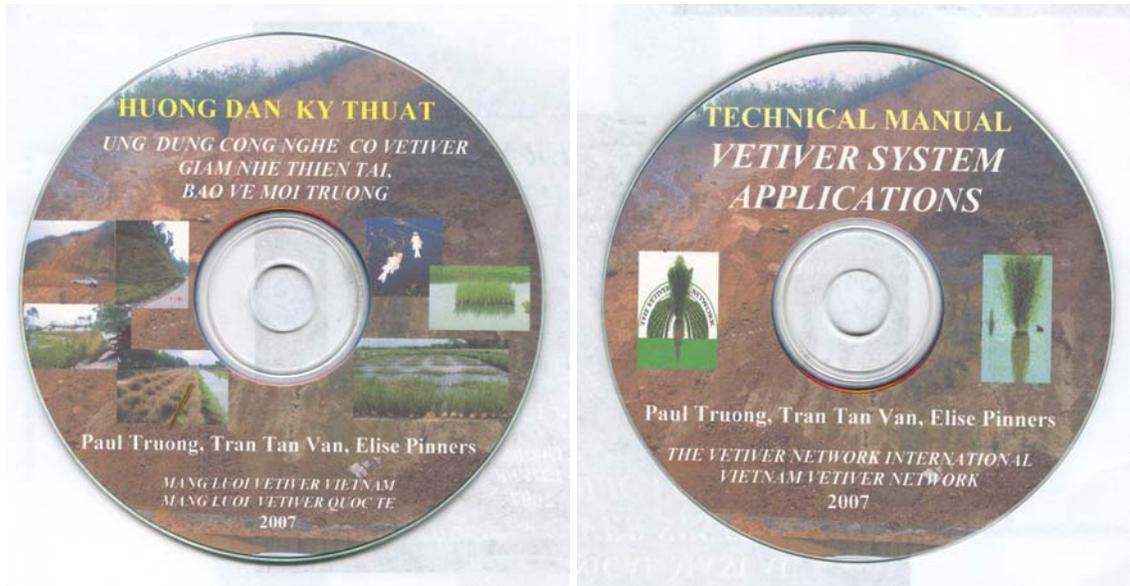
In the last 6 years The Vetiver Network International in collaboration with the Vetiver Network Viet Nam has worked with local partners in a dozen different provinces in Viet Nam, to establish demonstrations and trials of a wide range of applications of the Vetiver System. Various applications have been tested in a diversity of soil and climatic conditions that are representative for Viet Nam, and results were presented and discussed with professionals from a wide range of organizations (consultants, government officers, NGO technical assistants, etc.). However, despite the proven successes in all areas particularly in infrastructure and environmental protection it is clear that if the use of Vetiver is to be widely accepted, it is essential that a set of technically based guidelines be prepared, accepted and adopted by national regulatory agencies.

As a result this Technical Manual was prepared by Paul Truong, Tran Tan Van and Elise Pinners under the sponsorship of the Royal Netherlands Embassy in Hanoi. The primary aim of this Manual is to introduce VS to Vietnamese planners and design engineers, managers and policy makers in the fields of construction, transportation, water resources engineering, agriculture, natural disaster mitigation, environmental protection etc., as well as local communities and other potential users, who often are unaware of the effectiveness of bioengineering and phytoremediation methods.

The Manual has 5 Parts: 1- The Vetiver Plant, 2- Propagation methods of Vetiver, 3- Vetiver System for disaster mitigation and infrastructure protection, 4- Vetiver System for prevention and treatment of contaminated water and land and 5- Vetiver System for on-farm erosion control and other uses.

Although this Manual was first written in English, it was translated to Vietnamese for its first edition and it is currently being translated to Chinese, Spanish and French, and possibly Swahili and other languages in the near future.

The launch was made at two small seminars, one at the Water Resources University in Hanoi and one at Cantho University in the Mekong Delta. Due to time constrain, only digital copies of the Manual were released at these seminars. One thousand hard copies are now being printed in Hanoi and will be available shortly. The publication and launching seminars were parts of the funding supports by the Royal Netherlands Embassy and TVNI.



## REVIEW OF CURRENT PROJECTS IN VIETNAM

At the two seminars I made a brief introduction of TVNI structure and various projects supported by TVNI with grants from Donner and Wallace Genetic Foundations. I also summarised and presented some highlights of ICV4 that can be adopted for local uses. In Hanoi Tran Tan Van introduced VNVN and brief highlights and summary of the Manual and Elise Pinners on the history of the support from the Royal Netherlands Embassy in VS applications in the last 6 years.

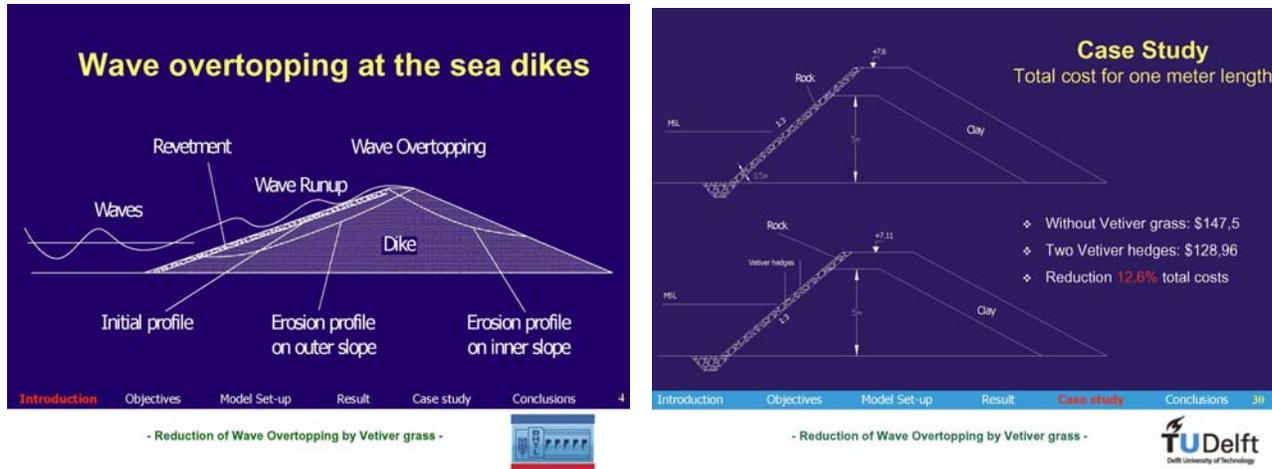
The followings are abstracts of papers and PowerPoints presented at the two seminars:

- **Reduction of wave over-topping (run-up) by vetiver grass**
  - The retardance (roughness) factor of vetiver hedges varies with stem density (number of stem per square meter) and water depth
  - Vetiver hedges is capable of banking up water to a depth of 0.4m and reducing the overtopping volume by 60%.
  - The model predicted that the dike crest height can be lowered from 7.6m (no Vetiver), to 7.38m (1 Vetiver row), 7.10m (2 Vetiver rows), 69.96m (3 Vetiver rows).
  - When 2 rows of vetiver planted on the outer wall of the dike, the dike height can be lowered by 0.5m and construction cost by 12.6% (Fig.1).

- **Treating heavy metal contaminated effluent with vetiver grass**

Heavy metal absorption and translocation rates from heavily contaminated effluent from a piggery and village ponds [Al (12.4 mg/L), Cu (278.2 mg/L), Sn (38.6 mg/l) and Zn (122.3 mg/L)] were determined in a hydroponics experiment.

- **Al:** Vetiver can absorb from 17 to 30 times more than the reference plant, but most of this was stored in the roots, with the leaf content comparable with the reference plant.
- **Cu:** Very high levels, up to 660 mg/kg in the root and 46.2 mg/kg in the leaves, much higher than other plants with values generally between 20-100 mg/kg in the roots.
- **Pb:** Lead has high translocation rate, up to 41% to the leaves
- **Sn:** Tin had a very high translocation rate 82%.
- **Zn:** Zinc had a very high translocation rate 46%.

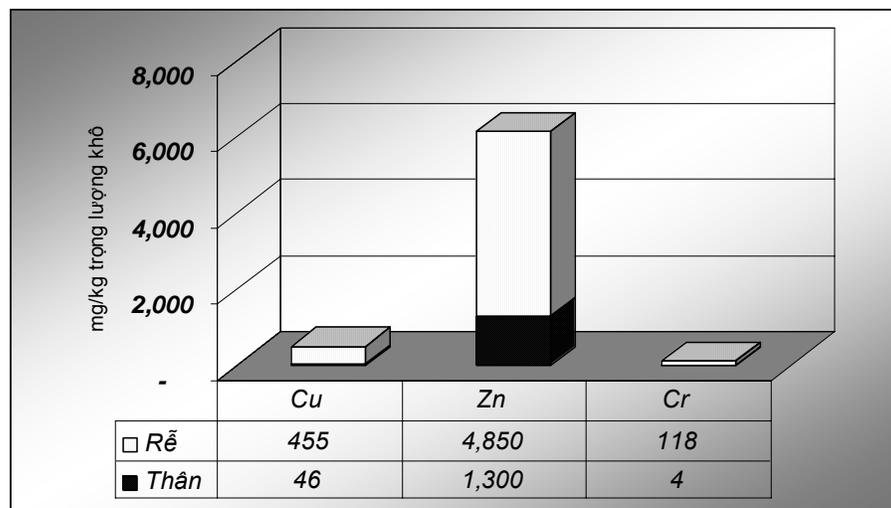


**Fig.1:** (Left) Erosion profiles of outer and inner dike batter. (Right) Reduction of crest height and construction cost when protected by 2 rows of vetiver.

- **Preliminary results of treatment of heavy metal contaminated canal sludge with vetiver grass in Ho Chi Minh City**

The canal sludge is highly contaminated with heavy metals from light industries in the city: Zn (4 026 mg/kg); Cr (2 290mg/kg), Cu (1 033mg/kg) and Cd (12 mg/kg).

- **Plant species:** Four plants were tested: *Phragmites australis*, *Typha angustifolia*, *Sesbania grandiflora* and vetiver.
- **Vetiver** was the only plant survived after 2 months trial
- Vetiver absorbed a relatively large quantity of heavy metals in the following order: Zn (6150 mg/kg), Cu (500 mg/kg) and Cr (121 mg/kg)
- Most of the Cu and Cr absorbed remain in the roots, in contrast to Zn, which has 21% translocation rate (Fig.2).



Re = Root; Than: Shoot

**Fig.2.** Absorption and distribution of heavy metals in vetiver

- **River and canal bank stabilisation with vetiver grass**
  - **Top growth**, root spread and tiller number/clump are not affected by the number of row (1-5) for plant spacing of 50cm x 30cm
  - **Root Depth** was affected by water level and soil compaction
  - **Erosion** was much reduced with vetiver planting, particularly at depth 0 – 0.8m
  - **At lower depth** the protection was not as good due to poorer root development
  - **Bank stability** increased with the number of row planted rather than planting method

**Recommendations:**

- On new site, planting should be done at 1.5 – 2m from edge so the vetiver roots can be fully developed in terms of density and depth. This will provide higher protection against erosion.
- **Application of VS to protect People Clusters at Tam Nong, Dong Thap Province.**
    - The new people clusters established for ‘flood-escaping’ purposes in the Mekong delta is highly erodible and severely damaged every year during the flood season
    - These people clusters also generate a large volume of domestic effluent, which will heavily contaminate the environment of these densely populated communities

**Objectives:**

- **First phase:** To evaluate the effectiveness of different planting design in protecting the batters against flood damage during the flood season
- **Second phase:** To evaluate the effectiveness of different methods of domestic effluent treatment

**Expected outcomes:**

- Demonstrate to the community the effectiveness of VS in erosion control and effluent treatment
- Recommend appropriate design for batter stabilisation
- Determine the optimal treatment method of effluent treatment using vetiver grass.



*Badly eroded batter and current erosion control measures*



*Reshaping batter and batter ready for vetiver planting*

- *Vetiver grass for sustainable agriculture on adverse soils and climate in south Vietnam(Update from last year results):*

**Results to date:**

- Vetiver grew very well on saline and alkaline sand under semi arid conditions
- Vetiver produce a very large biomass, providing much needed organic matter to the poor sandy soils
- The extensive and deep root system improved both physical and chemical characteristics of the soil in a relatively short time
- Composting with farm manure vetiver biomass greatly improved maize and grape yield

**Maize Yield**

<b>Treatments</b>	<b>Yield (t/ha)</b>
Common fertilizer rate N (1.25t/ha Urea) P(450kg/ha Superphosphate) K (100kg/ha KCl)	<b>5.487a*</b>
100% Manure (5t/ha)	<b>4.743b</b>
50% manure+50% Vetiver leaves	<b>5.183a</b>
25% manure+75% Vetiver leaves	4.410b
100% Vetiver leaves	<b>4.347 b</b>

\*Different alphabet indicates Significant Difference

- **Wallace Genetic Foundation Water Quality Improvement Project Update:**

- *A small paper mill at Bac Ninh, north Vietnam*

This site was established in July 8, 2006, at a small paper factory, making special paper for artistic uses. The wastewater from this factory is highly polluted, as bad as landfill leachate, and it is being discharged directly to a small river.

The treatments consist of:

1. A number of rows on the banks of the holding ponds, where the soil is highly polluted with water from the ponds.
2. Bamboo rafts put on the bank of the severely polluted pond.

- *A small Nitrogen Fertilizer Factory at Bac Giang, North Vietnam*

This site was at a small N fertilizer factory. The wastewater from this factory is being discharged directly to a small river. This wastewater is heavily polluted with acids and lime.

The treatments consist of planting on the banks of the holding ponds, where the soil is highly polluted from the ponds and on an adjacent wetland

**Results to date:**

Vetiver grew very well on these highly contaminated sites and due to the very impressive results, these factories are now in the process of expanding the planting area to increase the efficiency of the treatment.



*Vetiver is thriving on the bank of the retaining pond*



*and on the wetland outlet at the fertiliser factory*

## REVIEW OF NEW VETIVER PROJECTS IN VIETNAM

- **Steep slope stabilisation and pollution control on a cut flower farm**

A cut flower farm with an extensive collection of shade houses is located on a very steep terrain, with some sites having slope gradient exceed 45 degrees due to limited available lands. After considering several options, Mr. Dinh, the owner, decided to use VS for its effectiveness, low cost and “green” solution. He heard about VS after the Regional Conference in Cantho in January 2006 and came to this conclusion after visiting TVNI website, where he obtained all the necessary information from the well illustrated Picassa file. The following photos will demonstrate a very successful outcome using VS for steep slope stabilisation and pollution control.



*Stabilisation of fill slopes created for glasshouses and at the same time absorption of nutrients in runoff from flower beds*



- **Freshwater aquaculture**

After a highly successfully trial using VS for pond batter stabilisation cum waste water purification in 10 ponds, on the advice and cooperation with the University of Cantho, a freshwater fish farm is now extended the VS to the rest of their 100 fish ponds (1000m<sup>2</sup> each). The company is

also planning to extend the planting to up to 300 ponds at other farms belong to the company, when more planting materials are available. This was carried out with their own resources and is currently the largest privately funded VS project in Vietnam, which has attracted considerable attention not only from neighboring farms but also the whole freshwater aquaculture industry in the Mekong Delta.

On my advice the company is now planning to incorporate the VS to purify their intake water as well as treating their wastewater discharge. The company is so happy with the outcome so far that it is considering to sponsor a workshop to promote their success.

Cantho University will continue to work with the company and is seeking funds to set up new projects to monitor water quality under various treatments, water retention time, fish health and growth, and fish yield.

*Sixteen months after planting*



*Water intake canal*



*Service road between ponds*



*Batter stabilisation and treating high nutrient pond water at the same time*





*Planting in progress on new ponds*

- **Sea dike**

Concurrent to the expansion of freshwater aquaculture, Vietnam is also reclaiming large areas of tidal flat at the estuary of the Mekong River for prawn (shrimp) farming. As a result sea dikes are being built to regulate sea water movement as well as to protect these farms from both king tides and tidal surges during the rainy season. In a trial, vetiver was used for erosion control on an 11km long freshly built sea dike in Bac Lieu province.

I was very surprised to see vetiver growing very well after 18 months when it was planted on freshly dredged mangrove soil. Although establishment and growth were very poor during the dry season (even with watering), very good growth occurred during the rainy season, even half of the dike was occasionally submerged during king tide periods.

It was so successful that they will plant vetiver on a new 33km dike near by on a reclaimed mangrove swamp. The local authority was very happy with the result, as mentioned that VS is much more effective than they first thought.



*The two year old, 11km dike protected with vetiver*



*The new 33km dike to be planted this year*



**Inside batter facing prawn farms**



**Outside batter facing the sea**

- **Proceedings**

All the papers and Powerpoint presentations mentioned above will be collated into a short Proceedings for limited distribution.

## **REVIEW OF NEW VETIVER PROJECT IN CAMBODIA**

- **Mekong Riverbank Stabilisation**

Research in China has shown that vetiver can survive up to 2 months under total submergence conditions in a tank of clean water, but its survival under muddy conditions is not known. Mr Tuon Van has a property on the Mekong River bank north of Phnom Penh, which is severely eroded during the annual flood season and can be submerged under muddy water.

A 250m stretch on this property was planted with vetiver last year to test VS ability to control erosion under these extremely hostile conditions. This is a very important test for VS in riverbank stabilisation where the fertile but highly erodible alluvial soil of the bank is subjected to both wave and high velocity flow erosion, in addition to being submerged up to 6 six months under fairly muddy water. The planting is now ready to face this year flood season.



***Badly eroded bank in March 2006***



***Planting following earth shaping***



**Excellent establishment and growth in June 2007**



**Flood water coming up in August 2007**

## **REVIEW OF NEW VETIVER PROJECT IN INDONESIA**

- **Pulp and Paper Manufacturer**

PT RAPP in Riau Province, Sumatra, is a company in the APRIL ASIA group, which is one of the biggest paper and pulp producers in the world with factories and plantations in Indonesia, China, Africa and Brazil. At this factory alone PT RAPP processes Acacia plants harvested from their 120 000ha plantation, daily output worth \$US2M in pulp alone, the company also have palm oil and other forestry products.

At the Riau site PT RAPP has 500km of major road and 5 000km of secondary road, canals, riverbank etc are badly eroded in places, in addition there are problems with leachate from their pulp mills. David Booth, IDVN Coordinator and I are now working with the company on nursery establishment, construction site and road batter stabilisation.



**Left: *Beserah Road batter erosion***



**Right: *Building site at Kerenci needs Vetiver protection***



**Left: Two month old Nursery**



**Right: Three week old and 80cm tall  
on pure tropical acidic peat**

- **Regional Conference, Jakarta 27-29 November 2007.**

David Booth and I are organizing a regional conference in Jakarta in late November, which will be sponsored by the Indonesian Ministry of Public Works, with expected support from The World Bank, the Asian Development Bank and a number of construction companies.

The theme of the conference will be **Vetiver System for Natural Disaster Mitigation and Environmental Protection**, with Sub-themes: *Infrastructure Protection and Wastewater treatments*. In addition to Indonesian speakers, a number of international vetiver experts will be invited from Australia, China, Thailand and Vietnam. The three day conference will include technical papers presentation, field trip and training workshops