

THE VETIVER SYSTEM: A GLOBAL TECHNOLOGY THAT LINKS VETIVER AND PEOPLE TO STRENGTHEN RURAL COMMUNITIES AND CONSERVE NATURAL RESOURCES

Narong Chomchalow

Chairman, Continuing Committee, International Conference on Vetiver
Coordinator, Pacific Rim Vetiver Network
Office of the Royal Development Projects Board
78 Rajdamnern Nok Avenue, Dusit, Bangkok 10300, Thailand
narongchc@au.edu

Abstract

The Vetiver System (VS) is a technology employing vetiver grass for soil and water conservation, bioengineering, environmental protection, disaster mitigation and phytoremediation purposes. It is inexpensive, simple, and effective. VS has been used to link vetiver and people to strengthen rural communities and conserve natural resources.

Results of selected VS studies are described in this paper. VS's positive impact on communities is evidenced by: (i) handicraft making in Venezuela, (ii) railway rehabilitation in Madagascar, (iii) poverty eradication in Indonesia, (iv) rural community strengthening through people participation in Thailand, and (v) riverbank and dike protection in Vietnam.

VS's contribution to natural resource conservation is evidenced by: (i) effective watershed management in the Dabie Mountains of China, (ii) wetlands protection in Toogoolawah, Australia, (iii) mudslide disaster mitigation in Thailand, (iv) environmental safeguarding of an open-cut bauxite mine in Venezuela, and (v) the reduction of watershed sediment in Guam.

Keywords: Handicraft making, railway rehabilitation, dike and riverbank protection, poverty eradication, socio-economic impacts, sustainable watershed management, vetiver wetland system, mudslide disaster.

1. Introduction

1.1 Vetiver System

The Vetiver System (VS) is a simple, low-cost technology that employs vetiver grass for soil and water conservation, bioengineering, environmental protection, disaster mitigation and phytoremediation of deteriorated or contaminated land and water. This technology, previously known as Vetiver Grass Technology, was first developed for the agricultural sector by the World Bank for soil and water conservation, in the 1980s. It was later expanded to cover non-agricultural sectors through bioengineering and phytoremediation for environmental protection such as slope and embankment stabilizations, reclamation of wasteland, rehabilitation of

contaminated land, water purification, pollution control, prevention or mitigation of natural disaster, etc. VS is a very practical, inexpensive, low maintenance, and effective means of soil erosion and sediment control, as well as water conservation, land stabilization, and land rehabilitation. Because Vetiver grass does not normally produce seeds, it stays where it was planted. It is not affected to any significant extent by pests and diseases, nor does it act as a host for pests or diseases that might attack crop plants. Being vegetative, it is also environmentally friendly.

1.2 The Advantages of VS

In relation to strengthening rural communities and conserving natural resources, VS has the following advantages:

- 1.1.1 Low cost and simple technology:** It is a natural, green, simple, practicable and cost effective solution, and its biomass by-product can be utilized to make handicrafts, animal feeds, thatches, mulch, mushroom medium, compost, fuel, etc.
- 1.1.2 Effective method for soil and water conservation:** With its profuse deep root systems, vetiver grown as a hedgerow can do marvelous job in conserving soil and water.
- 1.1.3 Effective method for bioengineering:** VS can be used to protect the environment (soil, water and air) before deterioration occurs, such as control of erosion of stream and reservoir bank, flood control, etc.
- 1.1.4 Effective method for phytoremediation:** VS can be used to cure environmental problems that have already occurred through reclamation of wasteland, deserts, etc. or to rehabilitate contaminated soil and water, water quality treatment, habitat restoration, etc.
- 1.1.5 Effective method for disaster mitigation:** VS can be used to mitigate disasters such as to stabilize landslides, mudslides, shifting sand dunes, flash flood, etc.

1.3 Linking Vetiver and People

VS is a global technology that has been used worldwide as a means to link vetiver and people. The two major issues in this link will be discussed, namely: (i) strengthening rural communities and (ii) conserving natural resources. These goals are not mutually exclusive. In many cases, they can both be accomplished in one operation. However, for the sake of easy understanding, each will be discussed separately in the following two sections:

2. The Role of VS in Strengthening Rural Communities

VS has been used extensively for various purposes in many countries around the world. The following showcases are cited to exemplify its role in strengthening rural communities.

2.1 Handicraft Making in Venezuela

The most impressive activity associated with vetiver in Venezuela is that of community development supported by the Polar Foundation Vetiver Project (PFVP). This was evident

from the visits to many sites where local people gathered to welcome the author to eagerly show him their valued products, and even to sing songs they composed in praise of vetiver. This get-together is an excellent means of bringing people close together, and to unite them. The visit to see vetiver handicraft exhibits strengthened my great admiration of the concept of using vetiver as a means of helping the poor people to earn extra income - most often the only income - which has tremendously improved their quality of life.

According to Luque (2004), some 6,000 poor people were involved in the PFPV in 2004. They were located in eight states of Venezuela. The principle involved in the Project was to generate an economic interest through the development of the handicrafts and markets. This was done through the delivery of harvested vetiver leaves to the villagers who were trained to make, in the beginning, simple handicraft articles such as furniture, wallets, handbags, etc. Later on, more complicated ones were produced. These items were sold in the cooperative stores and during exhibitions. As the demand for vetiver leaves was increased, the villagers started to plant vetiver in other areas near the communities where erosion and/or polluted water occurred. By that time, the villagers were trained to properly harvest the leafy materials for handicraft making. Every small plot of vegetables or field crops was soon bordered with vetiver hedgerows. The social activities that were incorporated were singing songs, short readings on the topics related the self-esteem and motivation for community integration

It can be stated that by utilizing vetiver as a source of raw material for handicraft making, the poor people in the community not only earn extra income, but are united in their mutual activity in the community. This has culminated in more and more vetiver is being planted for soil and water conservation in the farmlands and elsewhere. This is in contrast with the conventional approach in which the farmers are encouraged to grow vetiver to protect their soil, which often ends up with little or no planting at all, as the farmers earn no income from such planting. Judging from the look at the smiling faces with starry eyes of the poor villagers as they sang vetiver songs or while they made handicrafts, I could say that they were quite happy with their involvement in the Vetiver Project.

2.2 Railway Rehabilitation in Madagascar

In 2000, two cyclones hit the island nation of Madagascar, located on the east coast of the African continent. They created a severe damage with more than 280 landslides to the East Coast Railway (FCER) which is crucial to the livelihood of the native people. The cause of landslide was mainly slash-and-burn farming practice on both sides of the railway track. Upon the request of the Land Development Intervention of Madagascar (LDI), two Thai vetiver specialists were recruited by Thailand's Office of the Royal Development Projects Board to investigate possible approaches to using vetiver to rehabilitate this railway. Following the advice of the specialists, the LDI and the FCER disseminated the VS along the railway track, and provided technical supports in removing the soil and restoring the drainage infrastructures. Based on the success of the Doi Tung Development Project in Thailand, LDI used a community-based intervention in helping the community to fight against poverty, and at the same time, stop erosion and landslides. The planting of vetiver provided sustainable agriculture alternative to slash-and-burn farming while at the same time enhanced soil fertility and increased farmers' income. The poor people living along the railway can now produce crops protected by vetiver hedgerows, and can transport the produces by train for sale in the nearby city (Charanasri, 2006).

2.3 Poverty Eradication in Indonesia

The East Bali Poverty Project (EBPP) was launched by David Booth in 1998 with the main purpose of helping the people in impoverished community of 2,500 families in 15 villages in East Bali, Indonesia. The first community school was established in 1999 on donated wasteland with volcanic sand. Vetiver was planted to rehabilitate 20km dirt roads to facilitate vehicular usage for 1,500 families who grow alternative crops such as cassava and corn on steep lands. Over 500 children in five EBPP schools have learnt how to stabilize terraces on steep mountain slopes for organic vegetable gardens. Vetiver was also used in creative art classes, painting, handicrafts and roof thatching competitions. Vetiver information was disseminated throughout the whole village, influencing hundreds of cassava farmers to improve massive tracts of almost barren farmland, starting by planting vetiver to stabilize terraces. Vetiver's ability to stabilize dirt roads has encouraged hundreds of steep-hillside farmers to protect their homes with vetiver, with the added advantage of beautifying their dry environments. Recently, VS has also been used to help thousands of Indonesian farmers in other regions to conserve soil and water (Booth and Adinata, 2006).

2.4 Community Strengthening through People Participation in Thailand

Huai Khayeng is a sub-district of Kanchanaburi province in western Thailand to which many inhabitants moved from a lower area during the construction of a reservoir in 1972. It is located on a highland with poor soil fertility. The PTT Public Company Limited, which successfully rehabilitated the Yadana gas pipeline with vetiver in 1997, started to introduce VS in Huai Khayeng with strong emphasis on people participation, motivation, encouragement and outward orientation (Tansamrit and Salinla-umpai, 2006). A stepwise operation plan was implemented in four phases, namely:

First Phase: A controlled vetiver experiment within the community where the benefits of growing vetiver would gradually become apparent to the people.

Second Phase: Vetiver planting on the land of volunteer farmers.

Third Phase: Successful implementation of these earlier two phases initiated a third phase by which a quarter of all the households planted vetiver on their own lands.

Fourth Phase: Vetiver was planted in about half of the areas in the community, and in appropriate public lands.

Besides preventing surface soil erosion, several benefits have resulted from the operation:

1. Vetiver was found to improve the soil fertility to be more suitable for agricultural production.
2. The community members learned to make use of vetiver as compost, animal feed, and mulch to cover vegetable beds. Together with other activities such as regularly saving the money and abstaining from drinking on religious days, such activities have helped the farmers to save their money substantially.
3. Growing vetiver has resulted in improved cultivating area as the soil contains more moisture and is more fertile.
4. Vetiver helps the farmers to decrease their cost of production through: (a) saving on fertilizer cost through the use of vetiver compost, (b) less watering because the soil contains more moisture, (c) saving on animal feed by feeding the animals with vetiver leaves, and (d) an overall increase in crop yield resulting from vetiver being planted along with the crops.

The implementation of VS in Huai Khayeng community originated from people participation in considering and making a decision. At present, the environmental condition of Huai Khayeng is sustainable and most of the villagers have a better life.

2.5 Riverbank and Dike Protection in Vietnam

In the lowland of the Mekong Delta of Vietnam, riverbanks and dikes have continuously been damaged by wave erosion caused by motorized boats. Local people have used traditional approaches such as wooden, cement, or rock walls; by planting wetland species along the shore or keeping water hyacinth as a cushion to absorb wave action to prevent further loss of valuable land and damages to the dikes, all of which proved to be ineffective or too costly to implement. Dung, et al (2006) reported that when VS was employed, it provided effective erosion control in fresh water, brackish water rivers and canals, on alluvial soil as well as highly acid sulfate soil. After exposing to a very effective extension program, the farmers and local communities realized the value of vetiver as they can also use it for animal feed. Many other uses have also been discovered such as string to bind rice seedlings and rice straw. It can be stated that the application of VS has great socio-economic impacts on the rural people and economy of the local community. As a consequence, in An Giang province alone, VS is planned to be used for flood erosion control on 20 dikes, with a total length of 61km, using 1.8 million slips of vetiver.

3. The Role of VS in Conserving Natural Resources

By definition, “natural resources” means “those actual and potential forms of wealth supplied by nature, as coal, oil, water power, arable land, etc.” However, most people, including those who work on vetiver, relate it to the environment; thus, conserving natural resources is the same as conserving the environment, be it soil (or land), water, and air. The major role of VS in conserving natural resources is mainly through environmental protection.

There are a lot of works going on at present on the issue of environmental protection, and it is almost impossible to cite them all in this presentation. Thus, only a few selected ones are cited to exemplify the role of vetiver in conserving natural resources.

3.1 Watershed Management of the Dabie Mountains in China

According to Liyu Xu (2005), the China Vetiver Network (CVN) first introduced VS to the Dabie Mountains in 1998. In May 2004, CVN launched the “Vetiver for Sustainable Watershed Management in the Dabie Mountains” project. The project’s objective was to introduce and extend VS for water and soil conservation in the Dabie Mountains. Caused by various factors, the area of the Dabie Mountains remained under-developed, and was ranked one of the poorest regions of China. Soil erosion caused by water force was one of the main factors influencing agricultural development. Since soil in the Dabie Mountains was mainly derived from coarse granite rocks, soil erosion was serious. Field trials in Anhui Province’s Yuexi County and Hubei Province’s Huanggang Prefecture showed that vetiver grew very well and played an important role in soil conservation and slope stabilization as it was able to control erosion caused by flash flood during the rainy season, and at the same time protect natural resources.

3.2 Toogoolawah Vetiver Wetland System in Australia

Using an innovative technology developed by the Queensland Department of Natural Resources, Mines and Energy, the Esk Shire Council, a local government in Queensland, Australia, installed the Toogalawah sewage treatment plant employing the vetiver wetland systems to treat sewage effluent. The treatment process allows the passage of effluent through a vetiver wetland, following contours of the land which allows good contact between vetiver and the effluent. In this way, vetiver maximally absorbs the water and filters it. The Project has successfully restored the ecosystem of the local creek that feeds into Wivenhoe Dam. The Esk Shire Council claimed to be a local government enterprise which demonstrated that “the high-tech and costly operation may not be the best solution for wastewater treatment” (Anon. 2004b).

3.3 Mudslide Disaster Mitigation in Thailand

In 2004, several steep-slope villages in the Khao Kho area, notably Nam Ko and Nam Chun of Phetchabun Province’s Lom Sak District in northern Thailand, suffered severe damage from mudslides due to devastating heavy rainfall as the result of a very strong typhoon that hit the region. Previously, the areas amounted to 16,000 ha were deforested (Anon. 2004a). It was estimated that in such steep sloping land, from 0.8-3.2 tons per ha of soil have been washed away annually. The forest in the area was completely cleared by the villagers to plant cabbages.

The Thai Land Development Department (TLDD) has implemented a project in the areas affected with such disaster (Anon. 2004a). The first attempt made by the TLDD was to rehabilitate an area of over 320 ha by planting vetiver hedgerows along the newly constructed contours in order to conserve the soil. The land areas in between the hedgerows have been planted with upland rice as a cash crop in order for the villagers to earn their income. Subsequently, land consolidation was made with the assistance of the TLDD, which also provided instruction and budget to produce compost. It was reported that the farmers who planted vetiver along the contours of the sloping land have attained a good status in their livelihood, with sustainable development of their land and a good income from the selling the harvested produces. The area is now well protected from further landslides as the result of heavy rains.

3.4 Environmental Protection of Open-Cut Bauxite Mine in Venezuela

VS has been used to stabilize various slope gradients on soil-concrete interface to protect infrastructures on the site of an open-cut bauxite mine in Los Pijiguaos, Venezuela (Luque et al., 2006). In addition, stabilization of gullies and border drains, and reinforcement of lagoon dikes were also accomplished. Sandy bags, stone rows or wooden stacks were installed as perennial vetiver barriers. The company has issued a policy to mitigate the impact of mining activities on the local community through the use of VS. The aim of this policy was to provide assistance to the community and to develop the region as a whole. It was found that VS has played a significant role in stabilizing slopes, gullies and border drains, protecting infrastructures of soil-concrete interface, reinforcing lagoon dikes, and filtering of water drained into the lagoons. During the past three years, the company was successful in developing VS for land rehabilitation and environmental protection which culminates in restoring the open-cut bauxite mining site to a desirable level which is environmental friendly.

3.5 Reduction of Watershed Sediment in Guam

On the Pacific Island of Guam, forest burning is the major cause of land degradation, having the end result of sediment loss due to erosion. As the result of runoff from eroded soil, sedimentation is the major cause of water pollution which threatens the coral reef that is the major attraction for the tourist. Sedimentation also reduces the water storage capacity of reservoirs and canals and increases flooding. In order to obtain better health of the reef ecosystem, Golabi et al (2006) used VS as a watershed management technique to mitigate sedimentation and improve the water quality. They found that VS was quite effective in erosion control. Moreover, the quality of runoff water downstream was greatly improved. This resulted in a reduction of sediment in near-shore waters, the end result of which was that coral reef was protected from the detrimental effects of storm runoff.

4. Discussion

The Vetiver System has been applied in tropical and subtropical regions in more than 70 countries on five continents around the world. Originally, it was applied to soil and water conservation problems in agricultural areas, but it has since been extended to various other applications in non-agricultural fields such as environmental protection, phytoremediation, wastewater treatment, and disaster mitigation. VS has a unique role in strengthening rural communities while at the same time conserving natural resources. Both of these activities are intimately linked to the people who are living in the communities as well as to the environment. VS has been shown to improve the living conditions and earning capacities of communities and to provide a better environment through environmental protection, phytoremediation and disaster mitigation. In short, the Vetiver System is a global technology whose time has come.

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Author Data

Dr. Narong Chomchalow holds a B.S. in Agriculture (with honors) from Kasetsart University, an M.S. in Genetics from the University of Hawaii, and a Ph.D. in Botany from the University of Chicago. He previously served as Assistant Professor in Biology at Northern Illinois University, Deputy Governor of the Thailand Institute of Scientific and Technological Research, and Regional Plant Production Officer in FAO Regional Office for Asia and the Pacific.

Related to vetiver activities, he prepared the Constitution of the International Vetiver Conference (ICV), and was a key person in the organization of ICVs 1 to 3. He is presently the Chairman of the ICV Continuing Committee, Coordinator of the Pacific Rim Vetiver Network (PRVN), and Editor of the *Vetiverim* Newsletter and all technical bulletins of PRVN. He is also the Vetiver Expert of the Office of the Royal Development Projects Board and a member of its Vetiver Committee.