A NETWORK AND NEWSLETTER PROMOTING THE VETIVER SYSTEM

THE VETIVER NETWORK

VETIVER NEWSLETTER NUMBER 21
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The Second International Conference on Vetiver. Vetiver and the Environment.

To Commemorate the Sixth Cycle Birthday Anniversary of His Majesty the King of Thailand 18 - 22 January 2000, Phetchaburi Province Thailand

Some 340 engineers, researchers, practitioners, development experts, donors and businesses from 5 continents and 31 countries attended the conference which was organized by the Office of the Royal Development Projects Board with support of the Chaipattana Foundation.

The Executive Chairperson of the Foundation, Her Royal Highness Princess Maha Chakri Sirindhoorn attended the Conference which was Chaired by Dr. Sumet Tantivejkul, the Foundation's Secretary General.

The conference must be regarded as a great success bringing together vetiver users and researchers from all over the World. Over the past four years since the first conference in Thailand the Vetiver Grass system has moved from just being an agricultural technology to one that can be applied over a wide range of environmental needs. The technology has taken hold in more than 100 countries and it attracts new users daily.

At this conference the quality of presentations were good, as were the wide range of R&D topics. There were excellent demonstrations set up at the Conference and in nearby areas. Additionally the Conference was enriched by the feedback from regional and national networks, and by the presentations from users around the world.

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The conference organizers produced some excellent documents that are available from the PRVN Secretariat, (Attn. Suwanna Pasiri), Office of the Royal Projects Development Board, 78 Rajdamnern Nok Avenue, Dusit, Bangkok 10300, Thailand. Fax: 662 280 6202. Email: pasiri@mail.rdpb.go.th. A list of publications is available, the latest include:

- **Vetiver Handicrafts in Thailand** by the Department of Industrial Promotion.
- **The Use of Vetiver Grass System for Erosion Control and Slope Stabilization along the Yadana Gas Pipeline Right-of-Way by The Yadana Gas Pipeline** Project - Petroleum Authority of Thailand.
- **Vetiver Grass Technology for Mine Rehabilitation** by Paul Truong.
- **Techniques of Vetiver Propagation in Thailand** by Narong Chomchalow.
- **Factual Tips About Vetiver Grass** (A Manual with photos). Office of the Royal Projects Development Board.

Also the Royal Projects Development Board stands good on its offer to train bonefide vetiver users in various applications of

The King of Thailand Vetiver Award winners received their awards at the Chitralada Palace from Her Royal Highness Princess Maha Chakri Sirindhoorn. The winners were:

Paul Truong - Australia
W.S. Shu et al. - China
Department of Land Development - Thailand
Oscar S. Rodiquez - Venezuela
Liyu Xu - China
Yadana Gas Pipe Line Project - Thailand

vetiver. Training in handicraft and propagation would be of special value. Trainees have to get to Thai at their own cost.

For a more detailed account of the Conference read Criss Juliard's article found on page 12 of this newsletter.
Dick Grimshaw

VETIVER AND WATER AN ENHANCED PERSPECTIVE

At the start of this new millennium many of the world's governments and institutions are focussing on the pending water crisis that will effect most parts of the world during this century. Fittingly the Conference endorsed the proposal that the 3rd International Conference on Vetiver, to be held in China in 2004, should focus on Vetiver and Water. The Vetiver Network endorses this proposal and asks its members and affiliates to give special focus to the water related aspects of vetiver. This should not be difficult because each time vetiver is used it interacts with some aspect of water; thus for many vetiver users and researchers it will be mainly a matter of highlighting the water related aspects of vetiver. However we need to give special emphasis to those vetiver application that will have a direct water focus.

The World is faced with fast growing problems of reduced availability of water and declining water quality. With regard to quantity there is a need to improve ground water recharge to offset the lack surface water storage and increasing losses through violent rainfall occurrences. With respect to quality water is increasingly polluted by chemicals and by sediments from the increasing areas of eroded lands. These polluted waters not only effect humans but also effect fisheries, coastal coral reefs etc.

Vetiver grass should be an essential tool in mitigating this pending water crisis. The following areas are of special interest:

Quantity:

- Vetiver should be used to protect the fountain of rivers i.e. the spring heads.
- Vetiver hedgerows play a vital role in watershed protection. Hedgerows slow down flood runoff, spreads the water out, and recharges groundwater (it does this better than most plants because of its deep penetrating roots). Later in this newsletter you can read about substantial recharge of aquifers in Orissa, India. Vetiver increases soil moisture thus reducing the need for supplementary irrigation.
- Vetiver hedgerows can be used to stabilize dam walls, canal banks, and drains thus reducing maintenance costs and assuring the integrity of the systems.

Quality:

- Vetiver hedgerows when used for watershed protection will significantly reduce soil loss and sediment flows into the drainage systems.
- Vetiver rehabilitated degraded lands and those lands effected by landslides (mass sediment flow sources) will have significantly reduced sediment out flows, and hence improved water quality.
- Highways and other engineered structures when stabilized with vetiver will result in less polluted runoff from highway sites.
- Vetiver used for the stabilization of mines, landfills, and other polluted sites will cause a reduction in leachates and better quality water.
- Vetiver used across out flows from high intensity agricultural enterprises that use large amounts of fertilizers and pesticides can reduce the discharge of chemicals significantly, thus improving water quality.
- Vetiver can be used to block animal and human waste effluents.
- Vetiver can be used to stabilize river banks, levees and canal banks reducing the risk of breaching and the resultant water loss, and devastation to human life and property.

These are just some of the many benefits that vetiver can bring to the water sector. We know that vetiver will be effective, but in many cases we need more quantitative data and application architecture to present to potential clients. These needs should provide an in-

Third International Conference on Vetiver CHINA --- 2004

The Continuing Committee of the Second International Conference on Vetiver recommended that the **Third International Conference on Vetiver**should be in China in 2004. The focus of the Conference would be **Vetiver and Water.**

For further information please contact Liyu Xu at China Vetiver Network. Email: vetiver

teresting challenge to researchers and developers.
Dick Grimshaw

WHERE DO WE GO NEXT?

At the start of the Second International Vetiver Conference I presented a paper, part of which is in this newsletter, that set out the following agenda for accelerating the dissemination of the technology:

- The spontaneous establishment of new national and local vetiver networks and the expansion of existing networks without financial assistance of TVN. Hopefully governments and donor agencies, including international agencies and trade organizations such as Rotary and Lions' Clubs or such local equivalents, will provide assistance.
- As government and other agencies, become more appreciative of the value of VGT, they will include it in their technical strategies, and be more active in its promotion application. Agencies need to better appreciate the cross sector linkages that VGT impacts on;
- The expanding involvement of private sector enterprises that are realizing the importance of the technology and the fact that it can be applied profitably. The private sector will actively market the technology, and thus will impact a whole string of enterprises from small plant material producers to landscapers and construction companies.

By the time the conference completed I considered that views were generally supported by the description of current activities reported by conference attendees.

There are no lack of ideas as to how the technology can be applied now and in the future -- there are plenty of innovative users and researchers around the world who will create new vetiver architecture and its quantification. However our ideas are far in advance of improvements in dissemination of the technology. Over the next few years we must find better ways of getting more vetiver out to more users.

The single biggest constraint is the availability of plant material. Most users or planners just do not appreciate the hundreds of hectares of vetiver nurseries that are required. At its best 1 ha of nursery will supply enough plant material for 100 - 150 linear kilometers of hedgerow. On very steep slopes one needs 1 km of vetiver hedgerow per protected hectare of farm land. Adoption rates will be slow, and opportunities for large applications will be lost unless large multiplication programs are established. Therefore we must find ways of increasing supply significantly. This can be best done by small farmer nurseries and or by large commercial nurseries.

Market development can either be as now -- slow -- or can be accelerated by better marketing in user countries. The experience of the private sector in Madagascar, Philippines, and El Salvador is interesting because all the companies involved were able to convince government policy makers and planners of the effectiveness of the technology, to the extent that in Madagascar and the Philippines the technology is now formally incorporated as government policy. As a result markets will grow and nurseries, whether large or small, can develop and produce larger quantities of plant material that have a good chance of being sold.

Many countries are dependent on bilateral and multilateral agencies for financing of development projects. We must get these agencies to pay greater attention to vetiver. Some such as USAID, DANIDA, and GTZ know about the technology and are increasingly using it. Most vetiver developers and users are part of the agricultural sector -- we are not good at marketing to the non agricultural sectors, and yet it is in many of these sectors where a large potential market exists. As this non agricultural market develops the supply of plant material will increase to the benefit of the agricultural sector

With few exceptions governments have a bad record in promoting vetiver grass for erosion control amongst farming communities. The reasons are complex -- split departmental responsibilities, alternative agendas, poor extension approaches, failure to communicate, and a host of other reasons. Without exception we find that when NGOs introduce the technology to farmers by and large the adoption rate is high. A review of an NGO vetiver project in India, described later in this newsletter, gives a good example of the problems and successes of a vetiver initiative with some of the poorest rural people in the world -- the tribals of Orissa. Interestingly we also find that where government vetiver initiatives have worked it is nearly always because the lower level government workers are committed to the technology, even though their superiors may not be. Most government extension services look to research services for guidance and support, many of these services seem disinterested in vetiver grass -- maybe a "not invented here" syndrome. Some others have researched with the object of proving that the technology is not what it is advocated to be, but have ended up finding the contrary, often leading to strong support for the technology! Vetiver initiatives from Malawi, Mexico and Papua New Guinea suggest that community programs that link NGOs, researchers, government extension services, and the private sector may be the best way to go. The NGO can play an important part in leadership and working with and building the trust of the communities; research services support the program in resolv-

ing technical problems as they occur (and they do!); the extension services can supplement the work of NGOs by providing special farmer training services, and providing other technologies that are needed to complete the technical package in its broadest sense, and the private sector acts as a bridge to sophisticated engineering projects that need to use the technology.

The vetiver networks established at regional and national levels have on the whole been very successful. The best have not only networked information but have been very active in promotion and development of vetiver initiatives. They have done this with minimal funds. Some have been supported by TVN, some have established themselves independently. Some developed from local vetiver initiatives as did the Amhara (Ethiopia) and Cameroon Vetiver Networks, other started before field vetiver initiatives were developed. It doesn't matter which way, the key is committed persons who want to do something for erosion control and their people, and who are convinced that vetiver is an effective and low cost technology. Over the next four years we need to establish many more national networks in all the regions of the tropics and semi tropics. Even within countries local networks can be usefully developed. Networking with or without the Internet is very effective -- with the Internet it is even more effective. People who want to start networks in their countries need to find local funding sources -- preferably from the private sector or by bilateral donors such as DANIDA, NEDA, DIFID, USAID and GTZ. All these agencies know about vetiver and use it on their projects.

What of The Vetiver Network? It is not going to last forever. TVN continues to have a "knowledge transfer" role, something that we have been successful at in the past and can continue to do in the future. We can link users together, we can help put funders and networks in touch, and we can help find specialized consultants to help get special programs initiated or problems solved. It looks as though we will NOT be able to fund networks or field vetiver programs directly. We will do our best, we will be flexible in our approach and we willingly hand over responsibilities to others as and when the time arises. TVN's own staff resources are less than minimal, so we need help from others to do some of the work. Recently we found the funds for Paul Truong to put out a new CD-ROM, and Suwanna Pasiri of PRVN was able to get them "printed" at a much lower cost than elsewhere. This is just one example of how we can share the work load. If there are any volunteers who would like to involve themselves with our work please get in touch with me at vetiver@vetiver.org.

Dick Grimshaw

A TECHNICAL DESCRIPTION OF VETIVER GRASS TECHNOLOGY (VGT)

At TVN's Board meeting held during the Conference we discussed the need for establishing standards for VGT in order to try and assure that application quality was maintained, particularly in the commercial sector. Our Board will give this some thought and we hope to come up with something that should be helpful for the maintenance of standards. In relation to standards we discussed "Trade Marking" the technology as a means of preventing the technology from being corrupted and used in inappropriate ways i.e. outside the conformity of standards and general description of the technology. We decided to leave "Trademarking" for further discussion. Again in relation to Trade Marking we discussed the name "Vetiver Grass Technology" and "Bio-engineering". There was a consensus that both names were not fully appropriate. The word "technology" makes vetiver sound too complicated and high tech which it isn't. Bio-engineering gives some people the feeling that we are marketing "terminator genes", "modified crops", and other activities that some see as distinctly "non green".

We agreed that we would use the phrase "VETIVER SYSTEM". It is simple and descriptive. All VETIVER SYSTEMS (VS) use vetiver grass. VS is a system of conservation and stabilization of natural resources using vetiver grass, generally in the form of a narrow hedge on the contour or across the slope of the land. Within this there are variations, e.g. Vetiver System for soil and water conservation - VSSW - (i.e. on farm conservation); Vetiver System for embankment stabilization - VSES - (i.e. for construction site stabilization); Vetiver System for polluted site stabilization - VSPS - (i.e. mine reclamation, land fill stabilization); and so on.

We would like to try this nomenclature over the next year and see how it works out. We would appreciate that you cooperate (you don't have too!). If it works and it helps clarify the use of the technology we might then go ahead and Trade Mark "VETIVER SYSTEM".

If anyone has any thoughts on this topic please get in touch with me.

Dick Grimshaw

THE GLOBAL IMPACT OF VETIVER SYSTEMS

How does one measure the global impact of Vetiver Systems (VS)? International donor agencies go to great lengths and cost to evaluate the impact of their development programs. TVN does not have this luxury; thus it is difficult for TVN to monitor its impact. However we are able to make an assessment of progress since 1986, the starting year for the revival of the technology:

- In 1986 the technology was introduced to India, in the year 2000 some 138 countries know about the technology and more than 100 are using it in one form or other;
- In 1986 there were no vetiver networks, in 2000 there are at least 14 known networks;
- Since 1989 TVN has produced 17 formal newsletters with an issue of about 3,000 per newsletters;
- The first newsletter had about five pages; the last one, # 20, had 70 pages -– mostly technical information coming from the field. Other networks have produced newsletters on a biannual basis – LAVN, MVN, SAVN, PRVN, WAVN, VETINETPHIL and CVN have all produced newsletters regularly;
- Over 100,000 vetiver handbooks have been distributed since 1987;
- TVN's homepage that was established in 1996 has received about 17,000 hits;
- Over 800 NGO's are using the technology;
- Some 800 government agents are using the technology;
- About 1000 research stations/ agencies receive the vetiver newsletter, many of them carry out vetiver research;
- In Ethiopia we are told that half a million farmers know about the technology;
- In Malawi it is government policy to promote VS;
- In 1986 VS was solely applied as an erosion control measure, in 2000 it was used for highway stabilization, mine land rehabilitation, river, canal and drainage bank stabilization, sea shore stabilization, wind breaks, pollution control mitigation associated with municipal trash dumps, and for housing construction site stabilization;
- In 1986 few engineers knew anything about vetiver grass, today many do, and for example in 1999 the Madagascar Society of Engineers formally recognized VS as an important technology for road stabilization purposes;
- In 1986 VS was associated only with government projects today more than 800 commercial and private individuals receive the Vetiver Newsletter. There is an increasing involvement of the private sector in the establishment of VS enterprises that serve the engineering sector, good examples of this can be found in Malaysia, Thailand, El Salvador, South Africa, Philippines, and China;
- VS has become a frequent component in bilateral funded projects in Ethiopia, Ghana, Madagascar, Malawi, Tanzania, Zimbabwe, China, India, Sri Lanka, Papua New Guinea Philippines, Indonesia, Honduras, Panama, Costa Rica to name but a few;
- Apart from numerous site oriented workshops there have been a number of international conferences devoted to VS, and most other conferences that to soil erosion control and biological engineering include papers on VS.

The Vetiver network is continually receiving letters and other communications from persons in most countries in the tropics and semi tropics requesting information about the technology. We receive feedback from unlikely places which suggests that the technology is now becoming quite well known and that there is a lot more going on with VS than we really know. When the vetiver initiative was started most scientists had either had never heard of the technology or thought that it could only be confined to the low altitude wet tropics — the technology has indeed come a long way.

NETWORKING – A MEANS FOR THE DISSEMINATION OF TECHNOLOGY

The Vetiver Network (TVN) was one of the early organizations to network a single technology. Subsequently other vetiver networks were formed in association with TVN. Together the networking process has been successful, and it is worthwhile setting out some of the reasons for this success:

- the networks focus on VS and not on other comparable technologies (although it acknowledges that other technologies may be effectively used in conjunction with VS or as stand alone technologies). One of the failures of many technology initiatives and development programs is that sometimes too many options are introduced that often prove over complicated both as a message and for the messenger. Lower level extension workers often feel that the delivery of one or two good messages will produce better results than multiple messages. Further more VS is an exceptionally good technology that is superior to most other comparable ones – feedback from users confirm this fact. Some bilateral donors feel that beneficiaries

need to have many options to choose from. This view is only acceptable if the intended beneficiary knows what the options are. Fifteen years ago hardly any one knew about VS, thus there was a need for a single technology approach in order to disseminate the VS technical message.

- The message is technically simple, low cost and effective, when applied correctly. VS is really a very simple technology to apply and good demonstrations quickly convince potential users. "Seeing is believing" is an important aspect of passing the message on to new users. One user wrote to TVN "we read, we did, and it worked" — what better accolade than this!-
- The technology requires a much lower labor input than traditionally engineered systems, and once established needs little maintenance. On average a person can construct 15 meters of traditional terrace a day, compared to 200 m of VS hedgerows. This means that a ha of land can be protected in two or three days, compared to 40 days for terracing, and therefore it is an attractive technology to resource poor farmers;
- VS is gender positive. For example, Ethiopian women like the technology as it is not as hard work as terracing, and they see plenty of useful social bi-products from the grass including thatch, weaving materials, medicinal supplies, mattress stuffing material, snake excluder, privacy hedges, and a host of other uses. Women in the Philippines like the technology as they can develop mini nurseries to produce containerized vetiver plants to sell to the commercial sector for highway stabilization purposes. They call it "cash grass".
- VS is unique in that vetiver grass can be applied over a wide range of ecological conditions (hence a basis for wide adoption), and many environmental and economic uses — the two often combined. It is difficult for most people to believe that the grass will grow over a wide range of extreme conditions. Thus one species will do the job of many. Once planners and users are convinced of this, and promote it as such, the technology adoption accelerates rapidly;
- The end user comes first. This is a basic principle of TVN. Users are more important than government officials and scientists. TVN recognizes that the latter are useful, but we do not forget that it was, in the first place, the users who developed the technology; and it is the user who comes up with many of its refinements;
- The majority of information received is immediately fed back to users, and is published in the newsletter and on TVN's website. There are no delays;
- There are no formal peer reviewers — the end user is the peer reviewer — he/she either uses the information or rejects it. . So long as material received by TVN is readable and relevant we will publish it. There are no peer reviewers to reject the material as unworthy of publication, or to reject the material because it conflicts with their own agendas. There are no supervisors who want authorship in return for publication;
- Incentives (awards) are provided to encourage active participation. The awards program has been very successful, not only does it encourage research but it also acknowledges many "small" persons in the vetiver system that work hard with little recognition. A vetiver award is often a coveted prize, even if it is just a certificate (in the future if TVN has limited funds, certificates may be the only way we can recognize worthy contributions to the furthering VS.);
- Most vetiver researchers and users have been generous in sharing their information; because of the open approach taken by TVN, those involved with vetiver have been keen to provide feedback. This doesn't mean that we get all the feedback that we would like, we would like a lot more from those that receive but do not give!
- In most countries there are committed individuals who make great efforts to disseminate information on VS, organize training etc. There are perhaps three dozen individuals around the world who have really made a difference to "moving the technology". Amongst them and foremost is His Majesty the King of Thailand. Others include: Ed Balbarino and Noah Manarang of the Philippines, Liyu Xu and Xia Hanping of China, Govind Bharad of India, P.K.Yoon of Malaysia, Tony Tantum and Duncan Hay of South Africa, Paul Truong of Australia, Diti Hengchanovich and Narong Chomchalow of Thailand, Joan Miller and Jim Smyle of Costa Rica, Linus Folly of Ghana, John Greenfield and Don Miller of New Zealand, Criss Juliard, Mark Dafforn, Ken Crismier and Noel Vietmeyer of the US, Alemu Mekonnen of Ethiopia, Ngwainmbi Simon of Cameroon, Glenn Allison and Paul Zuckerman of UK, Mike Pease of Portugal, Cornelis des Bouvries of the Netherlands, Stephen Carr of

Malawi, and Jano Labat of Zimbabwe. These are but a few of the many active participants of TVN – they and others have all created change.

- 99% of the information that is networked is delivered at no cost to the recipient; and is delivered fast. Early in its operations TVN found that people either don't like paying for new information, or don't have the money, or can't get the foreign exchange even if they have the money. So we have a policy that it is better to get the information out at our cost rather than not at all, or in limited amounts. Occasionally we ask people to pay or make a donation. But I am convinced that our success is partly because we have delivered good information quickly and at no cost.
- TVN has deliberately set a policy that encourages affiliated networks to take the lead at regional and national levels. Although TVN led in the beginning we have made great efforts to devolve responsibility and fund raising to local networks. We have provided up to US$ 30,000 – US$ 50,000 per network to assist networks get off to a reasonable start. Mostly the response has been good and the networks have done far more than we originally anticipated. TVN remains in the back ground as a feeder of information, and a linker of information and persons;
- Networking vetiver technology appears to be self-sustaining. If TVN closed down we can be assured that VS's adoption would continue at an increased rate, particularly in those areas that are using it widely. This says much for the technology and for the way the technology has been disseminated. However there are still many countries and sectors that do not know much about vetiver. Thus we think it is important to keep TVN operating in some form or other.
- The Internet homepage, CD-ROMs etc. are powerful tools in the dissemination effort. A picture can tell a thousand words. TVN has made a point of sending out videos and slides relating to the technology and its uses. Now that CD-ROMs are so cheap (US$ 1,500 per thousand CDs) it is possible to send out all we know about vetiver at a very low cost. The current CD that we give away includes all 20 newsletters, important vetiver papers and articles, the vetiver data base, five pictorial presentations, and the "Green" books in English, French and Spanish. The Internet also provides a very good information source about VS. TVN's home page, http://www.vetiver.org, with links to other vetiver network sites, contains all we know about VS (some 15 megabytes). More people are using it, and if only 20% actually do something with what they have learned then the return to the annual cost (about US$ 1000 per year) of running the homepage and the associated ftp site will indeed be high. As other web sites with similar interests are established and inter links are made between sites we can expect an acceleration of hits on our site;
- Hard copy newsletters are an essential component in disseminating information to the majority of recipients. Unfortunately we cannot do without hard copy newsletters. Most of our participants do not have computers, and if they do, accessing the Internet can be expensive. TVN and local network newsletters are therefore essential. We find vetiver newsletters for sale, often in tattered condition, in remote book fairs in the heart of India! We find one newsletter is often circulated to 50 other readers – so hard copy is still a powerful tool;
- Internet dissemination is a powerful information tool for NGOs and other agencies that are plugged in to the World Wide Web. Once these agencies have access to the information they disseminate to a wide audience of users. TVN's homepage has played a vital role in information dissemination, and will in the future become even more important as more users and potential users come "online". Other NGO's that, like TVN, have limited financial resources should find the Internet hugely useful for information transfer. Along with our homepage the use of email has greatly enhanced communications between the networks and between users. Network coordinators can become real communication facilitators if the system is used to its full capability; and
- TVN itself is unencumbered by bureaucratic processes. TVN was fortunate to raise over half a million dollars, most of which was quickly disbursed, under simple agreements, to recipients (other vetiver networks and NGO's). Most grants were processed from start to delivery within six weeks. Much was done on trust, and most times the trust paid off in successful programs, the few times when it failed was so small that it made little difference to the overall outcome. The really successful grant support was to those organizations whose leader(s) were already fully committed to the technology and who had a real sense of

commitment to their own people and to the environment. All were volunteers in the sense that they already had personal incomes (a salaried job, pension etc.). They took on VS because they believed in it.

CONCLUSIONS

What of the future? I see the future expansion of the technology coming from three directions:

- The spontaneous establishment of new national and local vetiver networks and the expansion of existing networks without financial assistance of TVN. Hopefully governments and donor agencies, that might include international agencies and trade organizations such as Rotary and Lions' Clubs or such local equivalents, will provide assistance.
- As government and other agencies, become more appreciative of the value of VS, they will include it in their technical strategies, and be more active in its promotion application. Agencies need to better appreciate the cross sector linkages that VS impacts on;
- The expansion of private sector enterprises that are realizing the importance of the technology and the fact that it can be applied profitably. The private sector will actively market the technology, and thus will impact a whole string of enterprises from small plant material producers to landscapers and construction companies.

The dissemination of VS has undoubtedly been a successful initiative, and the original objectives have been exceeded by far. Rather than just being a carrier of words, the initiative has been a creator of actions. This process will continue, probably not with TVN in the prime spot, but rather through the actions of users and scientists working in better communications and harmony in the field. TVN's own future is, and has always been, rather fluid, we change course depending on the availability of funds and the need of users. If TVN does not receive any significant funding in the near future it will downsize its work to an information exchange based on the Internet. The latter is almost a costless exercise.

VS has proven a very successful technology because it is simple, low cost, and effective. It is also a very exciting technology because its use seems to be boundless, and it is therefore an exciting technology to use and experiment with. It is also a technology that is available to everybody without being tied up in bureaucratic practices. It is not a technology that is controlled by large consulting engineering firms, in fact it is quite the opposite -- we can mainly be free of costly consultants, protracted studies, and complex procurement and financing programs. In fact today its use would be more widely applied if other technologies, particularly "hard" engineering technologies, were less financially attractive to corrupt officials and profit optimizing entrepreneurs.

Richard Grimshaw

NEW BOARD DIRECTORS APPOINTED TO VETIVER NETWORK

At a Board meeting held at Phetchaburi, Thailand on 22 January 2000, four new Board members were elected:

Cornelis des Bouvrie (Netherlands)
Mark Dafforn (USA)
Criss Juliard (USA)
Paul Truong (Australia)
Shawki Barghouti (Jordan)

These directors are in addition to:

Richard Grimshaw (USA)
John Greenfield (New Zealand)
Noel Vietmeyer (USA)
James Smyle (USA)
P.K.Yoon (Malaysia)
Monty Yudelman (USA)
Paul Zuckerman (UK)

MISCELLANEOUS NEWS

Don Heumann of Louisiana tells me that in collaboration with Louisiana State University a compound in vetiver oil has been identified, synthesized, and patented that will kill termites. Termites cause colossal economic damage in the southern parts of the United States.

Also published at this time are new papers that confirm VS application for mine stabilization, wetlands, infrastructure, and the removal of surplus pesticides from cotton and sugar cane fields in Australia. (available at our web site: www.vetiver.org)

Paul Truong is compiling some new CD-ROMS about VS, including P.K.Yoon's reports "Look See at Vetiver I and II". P.K's research work in the early 1990's remains some of the best explorative research on vetiver agronomics and application. His reports are well documented and are full of excellent photographs.

We hope that the Proceedings of the Second International Conference on Vetiver will be published on CD-ROM and made readily available.

New vetiver networks have been established for the Amhara Region of Ethiopia and Cameroon. We understand that new networks are under consideration in California, Bangladesh, Brazil and Nepal. If this is the case we would invite the network coordinators to bet in touch with TVN at vetiver@vetiver.org

DEVELOPMENT MARKETPLACE A WORLD BANK INITIATIVE

In early February I attended Development MarketPlace at the World Bank's Headquarters in Washington DC. This was a really good and useful initiative by the Bank. The end product was $3 million awarded to 44 innovators (amounts from $30,000 to $360,000) who put together innovative start up proposals that would impact positively on poverty. I won't go into the details of the award winners' innovations, but of 1200 entries, 300 were selected as finalists (including a proposal by TVN and CVN) and these 300 were given a booth at the MarketPlace to market their "project." More information and the details of all the 1200 projects can be found on the Internet at: http://www.DevelopmentMarketplace.org.

This event will be held again next year and I am sure that it will be even more competitive. So if you want to enter I suggest that you start thinking about it now. For those of you who want to start up new vetiver networks, or special projects here is an opportunity of getting some funds. There are a few rules. Keep it simple and too the point. Emphasize the end objective -- that objective should be poverty/community/sustainably/ orientated. For example: AIDS prevention, land (asset) protection, rural water quality improvement, handicraft improvement, disaster aftermath clean up and so on. Of course vetiver systems will be used in all of these programs -- however the focus should be on the result and not the means!!

I will publish the rules and the forms for the next MarketPlace later on this year when they are available.

Apart from meeting a lot of good people and introducing them to the Vetiver Grass System I learned some very useful lessons.

First: Policy makers, planners and others (the judges) are basically not that interested in the means of achieving an objective but rather on the objective itself. Thus when we are trying to raise funds for our vetiver networks and projects, take a hard look at what the major issues are in your area and then see if the Vetiver System will provide the means of solving all or part of the problem. Our new theme of Vetiver and Water provides plenty of opportunity for innovative vetiver orientated programs. For example in most developing countries ground water levels are reducing significantly so that rural people have far less water in their wells. The Vetiver System for Ground Water (VSGW) improvement would require reducing rain water runoff on farm land and wastelands -- we all know how good vetiver grass hedges are for reducing runoff. We thus put a different focus on the objective - in this case groundwater improvement, but at the same time we achieve a whole bunch of other secondary benefits that we are interested in such as erosion control, better water quality, improved soil moisture, etc. The point is don't talk to rural water supplies people about vetiver grass for soil conservation, but talk about what they want to fix -- improved quantities of rural water in village wells!!

Secondly: We tend to get too bogged down in detail. As agriculturists and engineers we need details (and we are trained to produce details, but the people who make decisions don't have time for them, and often don't understand them -- they rely us on us for quality and effectiveness guarantees. So when looking for funds keep your proposal short and to the point, illustrate it with a few key pictures or diagrams and focus on RESULTS and IMPACT. For example if we want funds to reduce "slash and burn" practices in the Philippines a few farmer quotes on how "mora" grass (vetiver) has resulted in continuous and profitable farming practices will say a lot more than detailed technical explanations and cost estimates.

Thirdly: Development planners and funding agencies love innovations that give good results and are LOW COST, SIMPLE, AND WORK. Vetiver Systems meet all these criteria.

STABILIZING HOMES ON STEEP HILLSIDES IN SOUTHERN CALIFORNIA

In January I was the guest of Wolfram Alderson and Leslie Baer, and their son Oscar, at Panoma, southern California. All great people. Wolfram until recently was the head of Casa Colina's horticultural operations, he has now set up an NGO called Global Gardens. He has been growing vetiver for the past eight years and has proven quite conclusively that once established the Vetiver System does well in this dry Mediterranean type climate. He has found that during the establishment year drip irrigation using RainBird's "T" tape has been a simple and cost effective method. He has been collaborating with some landscapers in the area. Two in particular should be mentioned -- Doug Richardson (tel: 805 565 9453 and John Greenlee (tel: 909 629 9045) -- These landscapers using Vetiver System for Steep Slope Stabilization (VSSS) have successfully stabilized high value residential land on steep fragile hillsides that are subject to slippage and mud slides. These sites have even more valuable houses built on them, so the cost is fully justified. Both containerized and bare rooted plants have been used successfully , obviously bare rooted plants are preferable if irrigation is available. I think what has been done thus far has attracted a lot of attention. I also gave a presentation to the local Clairmont Water District - it is interested in low cost solutions for watershed stabili-

zation particularly around their reservoirs -- a good fit for Vetiver Systems for Watershed Protection and Vetiver Systems for Water Quality (VSWQ).

I was surprised at the tremendous waste of water in this part of California. CALTRANS -- California's highway authority -- uses millions of gallons annually to irrigate and keep alive various plants and weeds on highway cut and fills. Water use could be greatly reduced if Vetiver System for Highway Stabilization (VSHS) was introduced. The same applies to some enormous landfills that are being stabilized. These landfills are hundreds of feet high and cover many acres of land. Vetiver System for Landfill Stabilization (VSLS) would stabilize these artificial mountains, would reduce or even eliminate leachate outflows, and would save tens of thousands of dollars every year of irrigation and maintenance costs.

Wolfram is now thinking of establishing a Vetiver Network for California. People interested in supporting his effort should contact him at: <wolframald@earthlink.net>
Dick Grimshaw

PROMOTION OF VETIVER GRASS SYSTEMS

You will notice that I have written a lot about Vetiver Systems dissemination in this newsletter. This is because I believe we must give much more attention to promotion, than we have thus far. Many, many people -- potential users, planners, policy makers, and funding agencies know nothing about the Vetiver Systems. We have to change this rapidly, and it is mainly up to the members of The Vetiver Network to do this promotion. In other words **YOU!!**

Promotion will be a lot easier if we focus on the end of objective. Most of us are connected to the agricultural sector and have tended to confine the technology to the agricultural sector. We need to get out and sell VS to other sectors. As I mentioned earlier consider all the problems in your area and then list them out and see if VS will be part of the solution. If it is go and find the people who are concerned -- politicians, administrators, community groups and tell them how VS can solve the problem. Find local journalists to write articles in the local papers or for broadcasting on radio or television. Search out traders and companies who are selling and advertising products in your area -- it might be soap, special foods, condoms (anti AIDS), and see if it would be beneficial for them to link their advertizing with VS. For instance it would be easy for local soap manufacturers to perfume their soap with vetiver oil. That "vetiver soap" would make a nice link with Vetiver Systems and Improved Water Yield in Village wells. Another might be "Use Condoms - - A Barrier Against AIDS - - Use Vetiver A Barrier Against Erosion". I am sure you can all think of slogans (potential advertisements) like these or better.

Improvement in Vetiver Systems technology dissemination is very important, and you will find most of the articles in this newsletter deliberately focuses on dissemination and networking. It is quite evident that the establishment of vetiver networks in countries and regions have done much to promote and activate the use of vetiver grass in many countries. We need to see many more networks established. Regretfully TVN can't help fund new networks as we did with those first established, but we can give you technical and professional support. I am sure you will get good funding support if you can clearly articulate the end objectives of the your new network. Funding agencies are looking for sustainable objectives, poverty alleviation, gender, natural resources improvement, better water, less pollution and better quality of life for all. The Vetiver System has a role in all of these objectives if properly crafted.

VETIVER SYSTEM FOR ENGINEERING

Two years ago Liyu Xu, the Coordinator of the China Vetiver Network (CVN) organized a conference in Fujian Province to introduce VGT to a wide audience of users in south China. In October 1999 he did the same again in Jiangxi Province, but with a focus on engineering for highways.

I attended the conference. It was a great experience working with him, Paul Truong (Australia) and Diti Hengchanovich (Thailand). More than half the time was spent visiting sites in Jiangxi, Fujian and Guangdong Provinces that had been stabilized with VGT.

During the past few years China has added over 30,000 km of major roads to her inventory. Many of these are in the south of the country. It is estimated that over 80% of the point source erosion comes from these and other infrastructure developments in China's south eastern provinces. Apart from their great length these highways often pass through rugged terrain involving massive fill and cut engineering. As a result there are huge stabilization and re-greening problems to deal with. The normal Chinese approach is to stabilize with local grasses (that are not deep rooted) and or use stone masonary to face the cut and fill. Linked to this construction are large and unrehabilitated stone quarries that add to sediments flows and remain environmental eyesores.

Over the past three years the highway departments of the provinces have been testing VS and the results are convincing and impressive.

In Guangdong a cut and fill slope on a highway near Guangzhou planted by Xia Hanping in 1996 is now fully stable. Vetiver was interplanted with *Acacia mangium* seedlings. These trees

are now over 6 m high and the area has been turned into a dense woodland. It is an excellent example of how vetiver can be used to stabilize nearly impossible sites with slopes over 100% and extreme "soils"

Most of the vetiver has been shaded out. But it did its job in providing initial stabilization and a better environment for the trees to grow.

It appears that there are a lot of opportunities to expand the use of VS to highways throughout south China, and to use it for the reclamation and re-greening of the many quarries that have been opened to supply materials for the huge construction program that has taken place in China since the market reforms were initiated.

A major limitation to the expansion of VS is the lack of trained and experienced landscapers. This can be rectified through technical training workshops for existing and new landscaping companies. We see a big increase in demand for VS, which means that small farmers will get involved as suppliers of quality plant material (training needed here too).

What we are seeing in south China is an emerging pattern of increased use of VS for engineering purposes. Companies have been established in Central America, Philippines, Malaysia, Australia, and South Africa to produce large quantities of plant material and to apply the technology to construction sites. The rate of demand is likely to go up as more companies are established and they market the technology to highway designers and owners. A new paper shows that in Australia (a high priced labor market) financial savings are estimated at over 60% when VS is used over conventional methods. In China the savings are 90%+!!

Other areas of potential for VS in China and other tropical countries is VS's ability to stabilize acid sulphate soils in coastal areas, rehabilitation of mines, and stabilizing of river banks, dikes and levees. In China, Bangladesh, and Vietnamfor example, millions of dollars are spent annually on maintaining the levees and banks of major rivers. VS could be used to reduce these costs.

VS is on the move; and those of you whose main focus is to use VS for on farm soil and water conservation should look at some of these other engineering related applications, because as the demand for them grow, so will the demand for vetiver planting stock, the majority of which will be produced by small farmers.

Some New Homepage Papers http://www.vetiver.org

Application of Vetiver Grass Technology in Off-Site Pollution Control. I. Trapping Agrochemicals and Nutrients in Agricultural Lands.

Tolerance to herbicides under selected wetland conditions inAustralia.

Soil Temperature and Insect Damage Impacts on Vetiver Grass New Zealand.

Vegetative Barriers - A New Upland Buffer Tool - USA.

Water Bioengineering Conference, Manila, Philippines April 1999.

Southern California Vetiver Grass Tales: "Moondust & Shale".

Growth of Vetiveria zizanioides and other three grasses on Lechang (China) lead/zinc mine tailings: A field experiment.

THE VETIVER NETWORK HOMEPAGE.

http://www.vetiver.org

The home page continues to expand. We are receiving as many as 400 hits a week -- so there must be something useful on it!! On page 71 of this newsletter there is a complete list of all the files currently on the home page. Some are duplicaates and cross referenced, but most are not. There is so much information coming in now from various sources that it is no longer possible to publish them in the Newslette. However what ever we receive normally goes on our web site or our FTP site at ftp://www.vetiver.org. To make it easier to follow what is newI have dated the files. Those of you who have access to the internet should go to "What's New" on our site and then navigate to "Recent Developments". These two sites have everything that has been put on the homepage during the past three months.

The Vetiver Network is a registered on profit organization under IRS code 509(a) (1). Donations to the Network are welcome and are tax deductible.

The Network produces a biannual newsletter edited and published by Dick Grimshaw. We encourage those interested in vetiver technology to participate by contributing articles to the network.

The Network also manages a homepage on the Internet at http://www.vetiver.org. Most articles are published on the homepage and the associated ftp site at ftp://www,vetiver.org. The small green handbook, including diagrams, "Vetiver a Hedge against Erosion" can be downloaded from the ftp site

The Second International Vetiver Conference --Thailand Summary 18 - 22, 2000.

Report by Criss Juliard

WHAT: The Vetiver Grass Network's 2nd International Conference on Vetiver was held January 18–22. The King of Thailand through his development foundation sponsored and helped organize the conference, held in a coastal region of Thailand with the theme "Vetiver and the Environment."

WHO: We were some 340 engineers, researchers, practitioners, development experts, donors and businesses from 5 continents and 31 countries. Vetiver Grass Technology, first introduced in India in 1986 under a World Bank agricultural/environment project, is now used in over 100 countries for soil/water conservation, erosion control, and environmental protection.

THE SUBJECT: Vetiver Grass Technology uses vegetation (bioengineering) to mitigate environmental degradation, improve soil fertility and crop production, reduce water contaminants and ameliorate reforestation and wetland practices. The plant's numerous and strong root system holds soil when planted in hedgerows. Its deep roots grow to 2-3 meters in a year, and because of their depth, bring nutrients back up to the surface like a biological pump. The King of Thailand is a fervent promoter of Vetiver Grass Engineering, and has personally seen that it is integrated into Thailand's rural development strategy. The King is a respected engineer committed since the 1960s to improve Thailand's land, forestry and water resources. He has some 20 patents to his name, most related to soil and water conservation processes. Through Royal Demonstration Centers, universities, research institutions, ministries and NGOs, vetiver grass engineering has been promoted on a national level with impressive success. The King requested that Thailand host the second conference to show the significant results obtained through broad promotion and research of vetiver technology.

THE CONFERENCE: Upon arrival at Phetchaburi, the conference site we were given some 15 publications covering recent research and application of vetiver; one was a 480 - page bound document containing all the papers to be presented over the succeeding 3 days. The documents allowed us to follow each presentation since most presenters where not native English speakers. In addition, CD-ROMs were distributed of all slides and pictures presented at the conference. Two prizes valued each at $5,000 were offered by the King of Thailand for the best papers on the conference subjects.

DAY ONE: The conference opened with an impressive reception, dinner and cultural show organized by the Palace (dances, songs, fireworks, light shows). Next morning key papers were presented discussing basic improvements in the technology since the last international conference 4 years ago.

Key among these was a paper on the impact of The Vetiver Network, a well-managed information dissemination and exchange system linking some 15 national, regional vetiver networks, and Internet sites, newsletters, and institutions. The Network's web site www.vetiver.org receives about 1,000 hits per month. Over 800 NGOs, 800 government agencies, 1,000 research stations and about 800 private individuals and commercial entities are part of and access The Vetiver Network.

The Vetiver Grass Network records research and field experience in the area of:

- soil and water conservation (recorded reduced soil loses between 70% and 90%)
- crop yields (increased by up to 20%)
- forestry development (soil stabilization to reestablish eco-systems)
- stabilizing engineering structure (extends life of roads, bridges, embankments)
- pollution control (reduces dangers of pollution and waste site thru absorption of heavy metals and toxins)
- improving groundwater (improves ground water recharge due to long roots)
- flood control (dynamic reduction of damages to croplands, river banks, hillsides)
- land rehabilitation (used for extremely degraded soils)
- disaster mitigation (after Hurricane Mitch, where vetiver had been planted in Honduras, very little damage observed on hillsides)
- other application (handicraft industry using the leaf and root and thatching stimulating rural income)

Field experiences in El Salvador, Tanzania, and the Philippines show that when provided several options to different conservation practices, over 80% of farmers applied and preferred vetiver. The technology is simple, inexpensive, gender positive and it works.

Other papers included the results of DNA studies on vetiver varieties, and its adaptive resistance to diseases. This was delivered by Dr. Robert Adams of Baylor University's Plant Biotechnical Center.

A paper by Dr. Paul Truong, provided the result of his research in the heavy metal tolerance of the plant, and the global impact it is hav-

ing on reducing landfill pollution and purifying polluted waters. A paper presented by Chinese researchers from the School of Life Science in Guangzhou Province and the Chinese Academy of Science gave results of experiments with four different types of grasses to reduce pollution levels of a lake damaged through chemical run-offs and improve surrounding infertile lands. Vetiver was found to have significantly improved the re-vegetating of abandoned area. Other papers the first day covered experiences in establishing countrywide dissemination programs which included our paper from Madagascar. Other countries included Venezuela (winners of the King's Vetiver prize), Ethiopia, Cameroon, Malawi, Thailand (the State Oil company adopted a complete vetiver remediation program to protect a gas pipeline recently established to supply the country's gas imports), Philippines.

DAY TWO: Day Two was the opening of a large exhibition fair set up on the resort grounds which included some 20 pavilions, all demonstrating a ministry, agency, university or NGO's work and research in vetiver. The extent and detail of this exhibition was daunting. Pavilions included the Ministry of Public work in protecting roads and structures using vetiver, the Ministry of Land Management work in rehabilitating desolate lands, models of the State's Oil company's use of vetiver, the Ministry of Industry and Commerce's work in developing marketed handicraft products including charcoal briquets from compacted vetiver leaves; insulation panels, construction bricks of mixed cement/clay/vetiver leaves, tiles, nursery pots, household products of all types including mats, lamps, picture frames, hats, paper, screens all made from the vetiver leaf or root. Various universities displayed research results of work conducted over the past several years, the Ministry of Education showed the books it had developed to teach school children the value of vetiver. The exhibition took about two hours to visit.

Papers continued to be presented the entire day. They focused on field-testing techniques and field experience where vetiver provided sustainable farming and agro-forestry practices. Three panel discussion groups and four concurrent presentations in which some 40 papers were presented and discussed highlighted the day. Topics of interest included the positive effect of vetiver on crop yield and soil moisture (studies conducted by Kaen University and the Thai Bureau of Land Management), the ability of sloping land farmers in Fiji and Vietnam to obtain sustainable farming and controlling cash crop through use of vetiver hedges, improving efficiency of vetiver propagation, rehabilitating degraded watershed in Ethiopia using vetiver, disseminating technology at the village level worker in India and at the decision level in South Africa.

It was clear from day two that Thailand, which had initiated vetiver research and application since 1991 was far ahead of other countries in knowledge and widespread usage of vetiver. Thailand was propagating biomass using tissue culture, and went from producing about 6.5 million plants in 1993 to a production and utilization level of about 99 million plants per year (1999 figures). Agricultural development difficulties in Thailand had been exacerbated by land degradation, especially in ecologically fragile areas, and rainfalls had carried away precious topsoil and plant nutrients. It was estimated that Thailand was losing between 12.5 to 62.5 tons per hectare per year. Applying vetiver in hedgerows was able to reduce that loss by about approximately 85%. The Thais were proud of this achievement, and reserved Day 3 to "show and tell" what they had accomplished.

DAY THREE: Technical tour. Participants to the conference spent Day 3 visiting four project sites where vetiver had been planted either for public demonstration purposes or by individual farmers for their own use. The visual impact of these visits was impressive. The first site was the Huai Sai Royal Development Study Center, one of 14 throughout the country. This one had been chosen because vetiver was used to rehabilitate the harsh environment and specific ecosystem. The site had been selected in 1993. It was an inhospitable, rock-covered region with little or no vegetation. Dr. Paul Truong from Australia had visited the site at the time of selection, and had advised the Center to chose another area since the sub-strata was basically hard rock. However, upon the insistence of the King, the site was maintained. Holes 15 cm in diameter were chiseled in the rock landscape to permit young vetiver to be planted with potting soil. Dr. Truong informed us that over the 7 years since he had seen the site the transformation was impressive. Vetiver was planted in both large circles and semi circles; slow growing trees and fruit trees (mangos, citrus, tamarind) had been planted in various arrangements for demonstration purposes. We were shown how the long vetiver roots helped maintain humidity and brought nutrients up to the surface. The fruit trees were growing well, the hardpan soil and rock had turned into productive land.

The second site demonstrated vetiver usage in an integrated farming system. The grass was planted in hedgerows, and in a semicircle and circle around the base of fruit trees that had been planted in poor sandy and dry land conditions. Vetiver leaves were cut periodically and used for mulch, as the leaves become a good source of organic matter helping improve the soil's potential in retaining water and plant nutrients. This was done next to trees where no mulch had been used. We were able to witness the difference in fruit size and taste, as well as see the difference in vegetation between areas where vetiver was planted and

where it was not. Vetiver was planted around pond edges to prevent soil erosion. The diversity of plants serve as supplement to the paddy as well as poultry and fish farming practiced in the area.

The third site was 770 ha area that had been an uninterrupted pineapple growing plantation for 20 years, and without proper soil and water conservation measures, the land was no longer suitable for cultivation by individual farmers. The Department of Land Development decided in 1994 to use the land as a study area and incorporate the use of vetiver to restore soil, water and forest or forest ecological system. Vetiver was planted along the contours across the slopes, and along check dams along gullies. By 1999, the vetiver system had helped maintain topsoil and moisture, which led to an improved ecological system. Natural vegetation grew to cover the soil and fostered growth of the trees. Again, Dr. Paul Truong had been at the site at the outset of the project and indicated now that the reforestation and revegetation were "unbelievable."

The last site included the farm of Mr. Songsak a small citrus grower. He first planted vetiver as a nursery in a field adjacent to lime trees. He saw that the lime trees that rimed the vetiver nursery did not have yellow leaves like the others further away, and in fact produced larger quantities of limes. He consulted with vetiver extension agents who suggested he rim all his trees with vetiver as the grass, through its long root system maintains ground humidity during the flowering season, extending the time flowers remain on the tree, and thus increase the pollination period. The farmer has become a "Dr. farmer" who provides farmer-to-farmer extension services to neighbors. We were able to see where he had stabilized the bank of a river that runs along part of his farm, which had eroded during recent floods, using vetiver.

In the evening, we had another outstanding dinner and Thai show, complete with singers, dancers, marionettes and demonstration. We also had a business meeting to help discuss the venue and topic of the next vetiver conference planned for 2004. It was agreed that the Chinese will host the next vetiver conference, and the topic would be "Vetiver and Water." This was chosen to help stimulate research on vetiver usage to improve water quality, prevent coral degradation in coastal regions, mitigate flood damage and to reduce water wastage in agriculture.

DAY FOUR: This was a half day with some 15 concurrent presentations on such topics as soil and water attributes of vetiver, research and general studies in China, Bangladesh, Zimbabwe, the US Army and India, and evaluation of vetiver application in road construction, in perfume, and cotton yields. Most interesting were the closing sessions that included summary comments from organizers of the conference and Richard Grimshaw, Founder of the Vetiver Network, on the future outlook for vetiver.

There was an additional field visit to a model farmer as we drove back to Bangkok. The farmer had applied vetiver on hillsides, but had not seen spectacular result, this in part because he had been among early users, and had used a variety of vetiver that is no longer recommended.

SUMMARY

Vetiver has made significant inroads in the minds of professionals who several years back scoffed at the idea that a grass indigenous to India could be used to replace mechanical engineering works, could have multiple environmental applications, and could offer inexpensive and reliable solutions to soil degradation and loss of soil fertility.

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EROSION CONTROL IN AGRICULTURAL AREAS: AN ETHIOPIAN PERSPECTIVE

by Alemu Mekonnen, Ethiopia presented at the Second International Vetiver Conference, Thailand, January 2000

Introduction

Ethiopia, with an estimated area 1.12 million km^2 and close to 60 million inhabitants, is one of the largest and most populous countries in Africa. Agriculture is the mainstay of the economy as it contributes 57% of the GDP and 85% of the employment (UNCTAD 1997). With GDP $150 per capita in 1995, Ethiopia is among the poorest country in the world (World Bank 1997). Most of the agricultural land is located in the highlands and is operated by Peasant Households. Smallholders cultivating fragmented micro holding (0.075 -1 ha) produce more than 90% of the annual agricultural output. Despite its pivotal role, the performance of the sector has remained largely unsatisfactory. Food self-sufficiency remains an unattained objectives, and per capital food, production has been falling over the decades. In 1993/94 production grew by 0.05% per year while population grew by 3% implying a per capita food production declined by 2.5%.

This is constrained by the country's deteriorating natural resource base and environment. Degradation of the resource base mainly due to soil erosion and nutrient depletion has continued at alarming rate. The national soil erosion hazard assessment which is based on soil erosivity and erodibility and land cover land use data of 1994 indicates that over the whole country, up to 3.5 billion tons of top soil is eroded every year mainly from farm lands through the process of sheet erosion. Because of this,

annually it is estimated that 20,000 - 30,000 ha of cropland is abandoned because the land could no longer assist cropping. Consequently, by the year 2010 it is expected that about 2.8 million highlanders would be affected.

Soil erosion is greatest on arable land where the average annual loss is estimated to be 42 t/ha, but may even reach to 300 t/ha/year on some fields. This is six times the rate of soil formation and probably causes an average annual reduction in soil depth of 4 mm. FAO (1986) estimated 50% of the highlands are significantly eroded, of which are seriously eroded and have reached a point of no return.

Various approaches, mainly based on mandatory policies, have been unsuccessfully tried in the past to encourage adoption of erosion control practices by the peasant sector. Soil and water conservation (SWC) program, mainly engineering based, was implemented with large investment input from the government, generous international organizations and the local people. Around $ 20 million was disbursed annually during 1980s and 1990s in the form of FFW. Farmers' labor involvement amounted 30 million person days per year. With available resources 25% of the targeted areas were rehabilitated and most of the physical measures constructed. Recent study in Food For Work (FFW) areas indicate that structures were dismantled from 53% of the plots and partly removed from 31% once the coercion to keep them is lifted. Faster than the degraded land recover, more land became exhausted. The success of the effort, as witness in recent years, has however been limited. One wonders what prompts peasants to destroy vital resource - improving investments of high value to the society. Several factors may be mentioned for failure of the past conservation program. The most significant are:

- Lack of participation / top down approaches.
- In appropriate technology / blanket recommendation: No attempt was made to involve the end users in adoption the technologies to the local conditions. Soil or stone bunds are not equally effective in high and low-rainfall areas. The productivity impacts of the structural measures were not considered, as the focus was only to curb the loss of soil.
- Takes scarce productive lands out of production thus yield falls at least in the short-term.
- Structures also created a breeding ground for noxious weeds and rodents.
- Focus on quantity rather than quality: Apart from failure to involve land users in the design, implementation and management of conservation works, the FFW approach of remunerating the workers according to the quantity of work accomplished led workers constrained to meet their subsistence needs, to emphasis quantity rather than quality.

Today, many development based organizations have brought the new approach into the main steam of thinking, and have highlighted particularly the potential use of biological soil conservation in general, and the use of vetiver grass in particular, and a need to move away from pure engineering approaches for SWC.

Introduction of Vetiver Grass

In 1970, for the first time, the grass was introduced to the country by the State Coffee sector. It was imported from India. The purpose of its introduction was mainly to demarcate the different coffee estates and to control the expansion of noxious grass called *Cynodon dactylon. A* few years later, some NGOs also reputedly introduced the grass to the peasant sector. It is probably after the commencement of the Vetiver Newsletter in 1989, and the First National Workshop in 1991, most people become aware of the wonder grass as the cheapest means of erosion control in croplands.

Barriers to the Technology

Like any other introduced technology, the vetiver grass faced a considerable resistance from the professionals and farmers side. The major reasons were:

- Farmers were reluctant to use because they considered the grass as a noxious, invasive grass that occupies and abandons their croplands.
- Farmers also doubted about its different uses advocated by the extension agents.
- Professional, starting from the top policy makers down to the development worker, who were geared to physical SWC measures and used to work under FFW program were not convinced at all and did not even allowed the introduction of the grass to FFW areas. They said "It is the grass of the World Bank and the Bank may have its own hidden mission".
- Another reason they raised was that the grass has not been researched under our condition in any of the SWC research centers. That at least needs 6 -10 years before the research result officially comes out.

Because of the above stated obstacles and until end 1989, the usage of grass was limited and localized only in the State Coffee sector and in non-FFW areas. It was in 1991 that an Ethiopian based NGO called Menschen fur Menschen (MfM) for the first time broke the barrier and introduced the grass to the peasant sector particularly to its project areas.

This NGO promoted the grass mainly for its SWC using the following approaches:

- *Creating Awareness.* The first and the most important entry point was creating awareness for its own development agents.
- *Establish Vetiver Nursery.* Establish the first vetiver nursery in the country for SWC purposes. In addition, very strictly follow the management at nursery level.
- *Demonstrate the Application.* In the same year, demonstrate the application of the grass for farmland SWC. For the first time in the country, 1991, the grass was planted on ten-ha cropland owned by five farmers. One of them won the 1993 Farmers Award arranged by The Vetiver Network in Washington
- *Organize Training.* After two years of progress, the Project organized training. This training was the first of its kind in the region that brought together all organizations (NGOs, GOs) working in the SWC projects to discuss the potential of the grass for SWC and its promotion in the region.
- *Handing Over the Award.* Invite local level officials and influential farmers during the handing over the award to the farmer, Mr. Walelege, the winner of Farmers Award. This was the occasion for most people to become enthusiastic about the grass.
- *Environmental Clubs:* The majority of the schoolboys and girls in Ethiopia come from rural areas. They spent their time after school hours and school vacations assisting their families in their day today farming activities. Taking this as an advantage, the NGO has assisted the establishment of environmental clubs at five school grounds in order to disseminate the technology at faster rate through students to parents. Vetiver was one of major components included for SWC purposes. This principle played an essential role in the expansion of the technology to the majority of the beneficiaries with out any additional cost and labor (extension staff).
- *Media and Press:* Since the introduction of the grass to the area, there were five press releases about the grass in the major news letters and more than ten radio interviews made by the staff of project and government and the beneficiaries. On top of this, the progress of the project was on air in Ethiopian Television every year during the main rainy season. This approach contributed much to introduce the technology through out the country.
- *Training Supports:* Translation the Green Book into local languages and making available to extension workers and farmers was one means of technology transfer used by the NGO. Beside, video and slide show contributed a lot to programme. Flyers on the technology is prepared and distributed during Subject Matter Specialist and farmers training.
- *Farmers Self-Help Groups:* In 1995, when all concerned bodies accepted and started applying the grass for their SWC program, the project handed over partially the production centers to interested farmers groups. This created confidence among the groups about the technology because it helps to generate income to the owners of the nurseries.
- *Assisting the Establishment of Nurseries:* Besides assisting farmers groups in establishing their nurseries, the Project also technically and materially assisted almost all GOs and NGOs in the region during the initial establishment of nurseries.
- *Farmers to Farmers Networks:* Farmers groups are the main targets for the enabling roles of the development support services. A principle of ennoblement is minimum input for maximum out put. This implies that the support services have to promote self-help, local level initiative, and farmer to farmer interaction. The network, though not officially established helps farmers to share resources and skills. It helps in marketing the grass to needy organizations.
- *Paper Presentation:* Whenever there is possibility of participating in workshops, conferences and seminars, papers on vetiver were presented in particular for officials and policy makers at federal or national level This has contributed very much in changing the attitude to officially accept the grass as one of potential plants for on going SWC programs in the country.
- *Awards:* Every year in the month of December, the project organizes an award ceremony for outstanding farmers and field workers. On the occasion, invited people from GOs, NGOs and influential people such as farmers, religious organization and youth groups.

Vetiver Today

Beneficiaries and Organizations Involved

Unlike those initial years, the vetiver grass is being used by a majority of the farmers, rural road experts, urban dwellers, small-scale cottage industries and Wet Lands Development Project. There are 250 NGOs in the country working in different program. Of these, 110 are working in the field of natural conservation. 80% of them are now

using the grass for their SWC program. This has brought the number of NGOs involved from one in 1991 to 88 in 1999.

The country is administratively divided into 12 regions. According to the latest survey made by the Ministry of Agriculture in 1998, the majority of the, regions now are using vetiver grass for their different program.

Other than these, the bilateral organizations like GTZ, SIDA, CIDA; and multilateral organizations such as FAO, UNCDF, IJNDP, World Bank, etc. have fully accepted and willing to finance projects that are interested to promote the technology. Consequently, today one the biggest vetiver promotion projects has been launched by financial assistance of two bilateral organizations, GTZ and SIDA, in the northern part of the country.

Number of Nurseries, Production, Total Area Treated

As stated above, the first nursery was established in 1991 by MfM in southwest part of the country. In the same year, more than 50,000 clumps were produced and about 10 ha of farmland was planted for SWC purpose. Since 1991, great progress has been observed in the development of nurseries in the country. Table 1 shows the nurseries established by government agencies and non-government organization until end of 1999.

Table 1.Vetiver nurseries established by government agencies and non-government organizations until end of 1999

[Table excluded]

Application

Agro-Ecology:

Slope: The grass is practiced on different slope classes. The upper slope limit ranges between 40-45%. Still at this slope class, it effectively holds the sediments. The planting procedures should strictly be applied otherwise, the cause of the damage will be enormous. For very steep slope, containerized plants are used for better and quick effect.

Vertical Intervals (VI): The applied VI in the country varies from one slope class to other. The VI recommended in the country for slopes classes between 3-15%, 16-25%, and 25% is 1, 1.5 and 2 m, respectively. For very steep slopes, it is advisable to plant splits closer and just after the first shower. In our case, we also use containerized plant for better survival and effect.

Altitude: Most of the high lands in Ethiopia are situated above 1800 m a.s.l. These are highly populated and experiencing sever land degradation. The upper altitudinal limit where the grass is tested is 3100 m. a.s.l. Even when it freezes the plant has survived with out big shock. However, the optimal and effective limit is below 2,800 m. a.s.l.

Area of Application: Apart from farmland conservation the grass is used for the following areas:

Plantation. The main use of the grass is to replace stone-made micro basins by vetiver made micro basin. This is now becoming a famous undertaking in coffee growing areas.

Gully. Together with physical measures the grass is widely applied to control the gully sides and heads.

Waterways: Mainly used to stabilize the sides of the channels from sliding and falling. It is used mainly to protect the drains along the roadside.

Irrigation canals and riverbank control: The walls of irrigation canals that have low angle of repose are better protected by planting vetiver along both sides of the canals. In the same way riverbanks that have undercut / scouring effect were protected by planting bigger size plants without splitting into smaller tillers.

Dam catchment protection: It is the only grass family that has proven to be effective in controlling the sediment from silting the dam. Today, domestic water supply and hydroelectric authority involved in dam construction area are convinced to use the grass to treat the catchment before any dam is built. Good examples and experiences are the dam built by one NGO called the Amahara Relief and Development Organization in the northern part of the country and the Fincha Hydro electric power plant in the south that used vetiver to treat the whole catchment.

Benefits other than the above: Beside the different uses stated above, the grass has other economic and social advantages that are as follows:

- *Thatching.* 83% of the population in the country lives in the rural areas, of this 2-4% can only afford to roof their hut with iron sheets while the majority use grass for roof making. Those farmers who established the vetiver grass hedgerows not only use it for their own hut building, but also sell it to neighboring farmers.
- *Feed value:* Though international literature declares Vetiver as unpalatable for livestock - probably on the account of its feed value - it is readily eaten by livestock here. Occasional cutting is practiced that stimulate the growth and as livestock fodder by-product. The year 1999 can be remembered for its long dry season (Oct-July). This has caused considerable damages to human and animal life. The presence of this drought resistance grass has saved the lives of many heads of cattle in the project area.
- *Rodent.* Field rodents reduce crop yield by 10 -12%. They damage standing crop while they are in the field. Their main nesting areas are structures built for soil and water conservation and road purposes. Thanks to the introduc-

tion of vetiver for SWC, the damage caused by rodents has considerably reduced by 85%.

- *Obstacle for farming:* One of the complaints of farmers about physical SWC measures is the obstacle to freely move farm implements and farm animals. The continued length and of course the height of the structures limit the movement of animals from one terrace to other. In many cases, this problem has been overcome by replacing vetiver for structures.
- *Mulch:* Nowadays vetiver is the main source of mulching material to cover pre-germination seedbeds and as mulch to conserve moisture for young seedlings.
- *Mattress.* Mattress made from vetiver grass is most liked by rural people. Farmers say it is completely free of any bed bugs and fleas. Good information and findings.
- *Income:* Schools who have well-established hedgerows are getting income from the sale of the grass mainly during Ethiopian holy days and weeding ceremonies. On top of this, additional income is also obtained by selling the grass for multiplication purposes. They sell tillers by dividing the hedgerows into two leaving major portions to remain on the ground. The income is mainly used to assist students who quit their education because of financial problems.
- *Wetlands rehabilitation:* Wet lands are our main source of ground water. They are natural reservoir of streams and rivers. If disturbed they cause considerable damages to habitat and bio-diversity. One major cause of this particular ecosystem is the unlimited exploitation of the grass that grows only in this habitat. Farmers in the area usually live in the hut where the roof is made from grass. The main source of the grass comes from the wet lands. Every year in the month of November and December it is a common practice to replace the old roof with new once. Farmers have to walk a distance to cut and carry the grass. This continuous exploitation of the grass has resulted to drying of wet lands there by affecting the continuous flow of stream and rivers that have their water source from this ecosystem. After expansion of the vetiver grass into the region, mainly for SWC, farmers now use vetiver grass for thatching. First, it is available near their villages and secondly it lasts long compared to the grass from wetlands. More over, the downstream people can confidently develop their irrigated agriculture and animal husbandry without any danger.
- *Cost of the system:* The over all labor cost of establishing a nursery and planting in the field is far less than that of using structural measures for SWC. A hectare of nursery can produce about 2.5 - 3 million splits in five months. Labor requirement to mange this nursery until planting out is five PD/day. The daily wage of a laborer in the area is $0.55. Plants produced in one hectare of nursery can treat 166.5 ha cropland on 3% slope or 40 ha on 20% slope. Total establishment cost of vetiver hedgerows/ha on 3% slope including production is estimated to be $ 3.02 and $ 13 for 20% slope. With structural measures the same slope and area may cost $ 119 for 3% and $ 186 for 20% slope.
- *Spacing:* Farmland occupied by hedgerows is about 1/10th of the equivalent physical structures.
- *Gender sensitive:* In the country, 25 - 30% of the farming households are women. The typical households that exercise poor SWC are these disadvantage group. The main reason for this condition is all SWC measures in practice were mainly engineering by nature and they usually require more labor and time that can not be afforded by women. With vetiver introduction in the country, we see more and more women participating in SWC. On top of their appreciation for its easiness of application and time saving job, they use it for spreading on the floor during coffee ceremony. Traditionally, the coffee ceremony with out green grass spread on the floor is not attractive.
- *Organic fertilizer:* In several villages, particularly in the south, it is a common practice to use the grass as bedding for their animals in order to collect manure.
- *Local based development:* To day, where MfM is active, farmers' overall level of continuing innovation is remarkable. Dividing and selling tillers from existing hedges can be cited as the best innovation for sustainability of the technology.
- *Leadership capacity:* Seventy-six well-trained farmer extensionists are presently active for vetiver grass promotion in the whole MfM program areas. Farmer to farmer extensions trips and inter village visits are organized and arranged by these extensionists. They also participate during the selection the best farmers for annual award this created healthy competition and trust among farmers.

Replication to Non-Program Ar-

eas

Replication by other organizations within and outside Ethiopia has been significant. The program methodologies, as well as technologies, have now spread to all part of the country. In 1996, the presenter of this report has been selected as a resource person by The Vetiver Network, Washington, to share his experiences for Cameroon people. Today the federal government has accepted the grass to be included in its conservation policy and forest action plan. This by itself will assist the wide spread of the technology mainly in the peasant sector.

Discussion

Sustainability of the Technology It is quite clear that a very close inverse correlation exists between the sustainability of SWC technologies and the amount of labor they require. In Ethiopian context, the most long lasting technology is one that:

- requires the least amount of labor.
- leads to significant increase in the villagers' well-being, economic as well as social, and
- can be carried out by villagers themselves. Besides, it should contribute to decrease cost and risk.

Vetiver Grass Technology meets these criteria.

How to Achieve Sustainability

These days governments of developing countries are constrained by financial problems. The chance of financing projects with big inputs no longer exists. Beneficiaries should be responsible for the continuation of projects that have been earlier assisted by the governments or others. One of these programs includes the promotion of vetiver grass technology. Experiences from similar projects reveal that by encouraging farmers to produce and sell the grass on their own can also support farmer's own multiplication schemes, and buy from them to distribute to other needy farmers. It can be foreseen that such an approach may increase the participation of farmers even more and more in addition generating income.

Training and visits at all level should be one tool to sustaining the technology in the future. Moreover, proper care during propagation will also contribute to the better success of the program.

Selecting the proper time for planting will increase survival and easily convince and attract the beneficiaries. Always the expert in charge should practically demonstrate how to plant in the farmers' fields. He/ she should invite all stakeholders like the development agents, the contact farmers and the owners of the farm.

Giving lectures in the agricultural and forestry colleges will be of an advantage to the programme as they are the factories producing young and energetic people that go directly to the field after graduation.

Beside the technical feasibility, which ideally should be further tested for another 2 or 3 seasons, the social dimension should not be overlooked. This is mainly true for countries experiencing free livestock grazing. If farmers are unable or unwilling to curb uncontrolled grazing, the technology most probably may not be as attractive and effective. This will automatically affect the sustainability of the technology. This has been very clear to the farmers and has to be repeated at every possible opportunity.

Recommendations and Policy Implications

- Combine vetiver grass with other compatible leguminous fodder crops. Parallel to planting the grass for SWC purposes, compatible and supplementary fodder crops should be sown or planted along the hedgerows to increase the feed value of the grass. This is advantageous particularly in places where trimmed vetiver is usually wasted during maintenance of the hedgerows. However, this approach has also been found effective for better growth of vetiver in northern high lands. Good grass growth has been observed in places where leguminous fodder crops are grown along with the vetiver hedgerows. This is because leguminous fodder crop can fix nitrogen, which is required by the grass deficient in the area.
- Use simple and cheap means of propagation the grass. It is important not to loose momentum. Soil erosion in most part of the world is so rampant that very little time only is left to halt this trend of degradation. The present need of getting the grass from limited nurseries may not be sufficient to tackle the problem. Another very effective way of propagation the grass should be researched and made available to people at large. The available technique like that of tissue culture should be further promoted.
- Maintain flexibility in application of the technology: Giving exact and scientific specifications and making only one recommendation as to how to solve each problem reduces the space the farmers own trials and make the technology theirs. When we recommend, for instance, we should give the farmer a range option for spacing, plant population to experiment with and should encourage him or her to try other grasses for comparison he or she may have seen elsewhere.
- Develop closer relationship between the governmental and non-governmental organizations: The mutual learning and sharing resources and experiences between govern-

ment and non-government organizations, as well as among the non-government agencies, has definitely helped the promotion do more effective and spread quickly in the country.

- Watershed Approach: Another important fact is to apply the Watershed Management Approach. Only if a whole watershed area is treated simultaneously the required impact and effect of the technology can be effected.
- Better support to The Vetiver Networks at all level: International organizations and donor agencies should better support both financially and materially the Vetiver Network. It is because of these networks and the initiatives of few devoted individuals that helped us to be here at this gathering.
- Even poor countries like Ethiopia should direct some of their funds to assist the international networks in their own countries.
- Push now and get our respective governments to include the grass in their conservation policy frame works. Never give up until they do so!

Conclusion

It can be seen from the report that vetiver grass has the potential to improve in the medium and long term the natural resource base in fragile and heavily abused environment such as the Ethiopian highlands. In this case, it may well pay off to have trodden the path of the last two decades where priority had been given to physical SWC measures. The Vetiver approach is six to eight years old in some places and in others is just at its initial stage. Future problems and setbacks should not be excluded or minimized. Yet, there can not be progress without taking (calculated) risk. Therefore, we should not give up if we are confronted with technical and social problems. We have to try repeatedly. Hopefully, we will be successful.

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THE PILOT PROGRAMME FOR PROMOTING VETIVER GRASS IMPLEMENTED BY THE PEOPLES RURAL EDUCATION MOVEMENT (PREM), ORISSA, INDIA.

A Review By Rajan Ghandi.
(Editors comments on this review are at end notes on page 27)

P.R.E.M (Peoples Rural Education Movement) in mid 1998 implemented a Pilot Project to promote the planting of Vetiver in 10 villages in 10 Community Development Blocks in Orissa, India.

The objective of that Pilot Programme was: "*To promote the cause of vetiver as widely as possible in the tribal areas under the influence of PREM".*

The underlying reason for promoting vetiver in these areas was to mitigate the problems due to depletion of forest cover and the related decline in traditional forest products. Dependency on shifting cultivation had increased. Optimum intervals between shifting cultivation cycles were no longer possible. "Slash and burn" techniques had resulted in serious problems of soil erosion and it was felt that there was an "*urgent need to begin the process of restoration ….*"

THE REVIEW

The review was initiated by Mr. James Campbell in early October '99. The objective was to learn from PREM's experience so as to assess whether and how similar programmes could be replicated elsewhere, for instance in Gujarat.

A secondary objective was to evaluate the need for and the type of a central training and coordination organisation that might function as an arm of a future India Vetiver Network. Such an organisation would act as a repository of the expertise and experience of Vetiver existing in different parts of India and the world, provide training in the technology to any persons interested in Vetiver and promote Vetiver throughout the country.

The review involved visiting as many sites/villages as possible where PREM had planted Vetiver, to interview those involved in the Pilot Programme (whether beneficiaries, village leaders or trainers) and to assess the degree of success.

The review was held from January 3 - 12, 2000. Since this author was not familiar with Vetiver, it was suggested that the very first visit be to the World Bank-financed Integrated Watershed Development Programme (IWDP) at Phulbani. The IWDP had extensive plantings of Vetiver as a major component of its Soil Conservation efforts and the Programme had resulted in widespread use of Vetiver for this purpose as well as for reinforcement of the banks of canals and waterways.

Berhampur-Phulbani

There were no officials of the IWDP available. Fortunately, an employee of Fr. Paul Raj's orphanage, had been working with Vetiver at the IWDP was able to take us to a few

sites, including the dirt airstrip where Vetiver had been planted to stabilize embankments. It was very clear that Vetiver had done an excellent job in preventing landslips on the embankments all along the runway. Photograph 1 illustrates the Vetiver row along the dirt strip.

A fruit plantation behind the airstrip had been planted with Vetiver amidst the rows of trees, but the entire plantation had been abandoned and there were huge gaps in the hedgerows. It was learned that villagers had cut down the barbed wire fencing, allowed free grazing and generally ravaged the plantation. Photograph 2 illustrates the present condition of the Vetiver originally planted. There were wide gaps between the Vetiver clumps and indications vetiver had been subject to grazing. The plantation was on relatively flat land which facilitated grazing, whereas the runway embankments would have made it difficult for animals to graze.

En route to and from Phulbani, there were some instances of Vetiver being used along the banks of waterways; the neat rows were evidence of human intervention and it was learned that the IWDP had extensively used the technology for soil conservation. It was, however, disappointing that the technology had not spread to individual farmers in the area. Only isolated instances were seen of farmland with Vetiver planted on earth bunds. We were advised that it was a local practice to demarcate plots belonging to the same family using Vetiver[1]. This practice was considered more socially acceptable, for instance amongst brothers, than building a wall or a fence. It is thus possible that the isolated instances noticed were thus for purposes of demarcation than soil conservation.

We were able to meet Mr. R C Panda, District Soil Conservation Officer, who was part of the IWDP team. He stated that the IWDP had reclaimed 7000-8000 hectares of land in Daspalla, Saranpur, Nayagadh, Bhanjanagar, Jagganath Prasad, Belaguntha etc. Success in reclaiming gulleys and ravines had been outstanding. The water level in open wells had risen by 5 m over a 4 year period.

Mr. Panda felt that Vetiver is best used as a part of a "total" and integrated approach[2]. Water harvesting was an equally important factor and he went out of his way to illustrate the methodologies adopted.

Berhampur – Daringabadi

Photographs 3 and 4 illustrate the countryside and the terraced farmland around Daringabadi. PREM had sponsored the plantation of approx. 6000 running metres of Vetiver in mid-'98. 6000 running meters of Vetiver had been planted by about 10 workers at the commencement of the Monsoons; they covered between 400-500 metres per day or around 50 metres per worker per day.

The community had been paid @ Rs.1.00 per running metre for the labour, which translates to Rs.50.00 (about US$ 1.50) per capita per day. In contrast, the Government-approved rates for manual farm labour are said to be Rs.40 per day for males and Rs.35 per day for females. It must be noted that tribals rarely, if ever, receive the full Government approved rates.

Two truck (actually LCVs or Light Commercial Vehicle) loads of Vetiver had been sent by PREM but these arrived just at the commencement of the rains when farmers were anxious to begin sowing of their own crops. Thus there had been a delay of 3-4 days between arrival of the Vetiver slips and planting.

Vetiver slips had been planted with a spacing of 15 cm (about the span of 1 hand) and a horizontal interval of approx 20 feet between rows, with the vertical interval largely ignored (this was relatively flat land). No chemical fertilisers had been used and no-one seemed sure about whether FYM had been used at the time of plantation. By and large, the farmer had ploughed and cultivated along the contour.

The farmer had allowed cattle and goats to graze on the land immediately after harvest. Vetiver shoots would have been tender and palatable to grazing animals at that stage and according to him, the gaps occurred due to this reason rather than the delay in planting.[4]

The farmer himself did not appear particularly concerned at the ravaging of the Vetiver rows. In fact he had himself ploughed the land right across a Vetiver row and appeared mildly surprised at all the fuss. Photographs 5 and 6 illustrate the present condition of the Vetiver plantation rows[5]. An estimated 15% of the Vetiver originally planted survives to this day and were visible, the leaves were just 3-4'' above the ground.

A Vetiver "nursery" covering 1 hectare on Government land was in even worse shape, as was a field in a nearby village. It is doubtful whether this could ever be used as a nursery, but considering the apparent lack of interest, it will not be greatly missed.

Berhampur – Gunpur – Koraput: Deepti, an associate of PREM was the agency which promoted the plantation of Vetiver in Gunpur on a hillside (Photograph 7) where there was a mixed plantation of fruit-bearing trees, yams etc. They had planted approx. 6000 running metres across the slope of the hill and had in fact sought more slips which were not available.[6] The slips had arrived (1 truck load) a bit late in the Monsoons, but nevertheless had "taken" well with more than 70% survival rate evident.

Although the prescribed spacing between Vetiver slips had been followed, there were a number of gaps and one could not really see a hedgerow, as such. Unfortunately, there did not seem to be any attempt to plug the gaps during the '99 Monsoon season. The villagers interviewed at Gunpur stated that they practiced a controlled form of grazing and did not allow animals

on the hillside, which probably accounted for the high survival rate.

The fact that animal grazing was prevented was also evidenced by the tall grass (Photograph 8)

The hedgerows had been planted about 10 feet apart and followed the contour of the hillside. The reason for the 10-foot interval could not be explained by anyone, but all those interviewed seemed convinced that even after one Monsoon, the benefit – prevention of soil erosion – was already apparent. In fact Mr. Maheshwar Rao of Deepti had set up a separate Society solely for promoting Vetiver grass.

There is ample scope for this in the terraced fields in the area where the traditional crops of bajra and dal would benefit. A village approx 20 km away where Vetiver grows in the wild and is being harvested and sold by locals could provide the necessary planting stock. The sheer enthusiasm displayed by Deepti and the local villagers is commendable, as is the tremendous effort it must have taken to undertake the planting of Vetiver in what is a remote and steep hillside.

Koraput: The agency responsible for the Vetiver Pilot Programme in this area was SOVA (South Orissa Voluntary Action), an associate of PREM.

The area comprises largely denuded hills and gently undulating rocky land. Photograph 8 shows the general environment. Gullies and ravines can be noticed in the background. On the path leading to the village of Lankaput, where the Vetiver Pilot Programme had been implemented, clumps of Vetiver could be seen growing wild. SOVA representatives stated that these had possibly been planted by villagers 10 years ago but for some unknown reason, the practice had been abandoned.

Using locally available planting stock, they had planted 13 rows of 400 running metres length along the contour of a hillside (community land), with rigorous observance of a vertical interval of between 1 – 1.50 metres. The gap between hedgerows was observed to be between 15-20 feet. Slips had been planted with a spacing of 6". However, the gap between clumps of Vetiver was somewhat high, about 9"-12" and these gaps had not been "plugged" during the most recent Monsoons.

SOVA representatives stated that it took 25 farm workers approx 20 days to plant the Vetiver, i.e. approx 500 mandays for 5200 running metres or 5.2 running metres per manday[7]. This contrasts with the speed of plantation of 50 metres per man per day in Daringabadi, which was on relatively flat land. Planting of Vetiver had been undertaken in June '98 at the commencement of the Monsoons.

Excellent "take" of the Vetiver had been observed, unsurpassed by anything seen elsewhere. The Vetiver had grown high enough for it to be pruned to about 6" height, the cut leaves being harvested for use as roof thatching, for making ropes, handicrafts etc. (Photograph 11). Villagers were asked specifically about whether Vetiver seeds spread onto their crops and proliferated as a weed. They said that by and large, this did not happen but if it did, they ploughed right over it. Certainly they did not see it as a potentially hazardous weed[8].

The red soil was pretty rocky but villagers were planting hill paddy and dal and all those present, including the head of the village panchayat and the block leader, commented that the run off of soil had been significantly less in '99 than in the previous years. There was unbounded enthusiasm for the Vetiver Programme amongst the villagers who appeared proud of their effort and glad of its appreciation. Villagers from surrounding areas had made special trips to see the benefits themselves, and it was reported that several local farmers had started planting Vetiver on their own land and of their own accord during the Monsoons of '99.[9]

In contrast to other sites, the hill with the Vetiver plantation had been fenced off (Photograph 9). SOVA had financed the fencing, paying for it over and above the Re.1.00 per running meter paid to the community chest for the Vetiver plantation. This possibly accounted for the high degree of success achieved at Lankaput although the villagers stated that grazing animals found the sharp, serrated leaves of Vetiver unpalatable. They said that in some areas, there was no fencing but animals still stayed away from Vetiver.[10]

Photographs 11 – 13 all illustrate the Vetiver plantation at Lankaput. Truly, this was an example of outstanding communal effort and success. The enthusiasm and confidence was plain to see; in contrast to other areas, villagers were keen to volunteer information and proudly posed for a group photograph with this author. Whether enthusiasm breeds success or whether it is the other way around, the example of Lankaput should be recorded on the Vetiver map.

The local Soil Conservation Officer, Mr. Patro, paid a visit to SOVA and discussions were held with him about Vetiver. He was unstinting in its praise, particularly in arresting the menace of gully and ravine formation. In contrast to the villagers here and elsewhere, he said however that Vetiver attracted snakes, particularly cobras, and that one had to be very careful to avoid them in Vetiver nurseries[11].

He also suggested growing Sisal in wastelands. It did not require more than one Monsoon to take roots and the fibres yielded an income when the leaves were harvested in approx 5 years from planting. The waste after the fibres were

extracted was excellent green manure and the fibres themselves fetched a market price of Rs.20 per kg.

We paid a visit to the Orissa University of Agricultural. Although they recognised the importance of Vetiver in soil conservation and stated that it would help in water harvesting, they had not planted Vetiver themselves nor was it their responsibility to promote the planting of Vetiver[12] !! They had, however, developed some very interesting techniques, particularly of growing bamboo.

Koraput – Kharikua – Chandragiri – Berhampur: The local coordinator at Kharikua (Mohana) village was away at a meeting and thus detailed information was not available. Nevertheless, a local villager served as an escort to the hillside where Vetiver had been planted during the Pilot Programme in mid-'98 on a mixed plantation, similar to the one at Gunpur.

The results were nowhere near as impressive as observed in Gunpur. There was a fair degree of tree cover and only sparse and occasional clumps of Vetiver grass could be observed. Possibly due to excessive shade, the plants seemed stunted and weak (Photograph 14) and it appeared doubtful whether the surviving Vetiver would be able to play any significant role in soil conservation.

Our escort was directly asked what he saw as the chief benefit of Vetiver. He was unable to provide a satisfactory answer without much prodding. Possibly he was not involved too deeply with that particular plot of land, which was community property.[13]

PREM's excellent establishment at Chandragiri was the next halt. This was where PREM had, amongst other projects, set up a Vetiver nursery with feedstock from Konarak. Four beds were seen, each with thick and high Vetiver growth (Photograph 15) which had not been harvested or trimmed.

Vetiver planting is one of the vital components of PREM's new Social Forestry plan, aided by the DFID, and PREM could draw stocks from the nursery at Chandragiri if needs be. At the moment, the nursery is not being used.

En route, we observed Vetiver growing wild on the banks of the Bansadhara River at Gumuda. The legendary (in this area) James Campbell[14] is reported to have repaired to a bus shelter and proffered drinks all around when he saw the expanse of wild Vetiver growing in abundance, free for the taking ! (See Photograph 16)

Berhampur – Baraikudi – Berhampur: Visited the Secretary of PREM, Father Chacko, in the morning. He very kindly showed us the illustrations prepared for training villagers and trainers when the Vetiver Pilot Programme was launched. Also discussed community-size Solar Cookers for possible installation at Chandragiri, for which this author has promised some help, and the offer by Wilfried Riehle to finance a tribal house which he had designed.

In the afternoon, visited Baraikudi, a short distance from Berhampur. There are entire fields of Vetiver growing wild here and PREM had drawn their stocks from this source for the Pilot Programme, it being much closer than Konarak. A flat rate of Rs.850 per LCV-load was paid to the villagers for the Vetiver slips. One LCV load took approximately 10 man-days and was sufficient for approx 3000 running metres of planting.

Discussions with the local farmers yielded the following additional information:

Local farmers stated that Vetiver did not necessarily attract snakes. However, rats definitely burrowed under thick clumps of Vetiver They endorsed the view that cattle and goats grazed on Vetiver only when the shoots were young and tender. Mature leaves were left alone, since the sharp serrations would cut the tongues of grazing animals.

It was interesting to observe that although the paddy fields all around were destroyed by the recent cyclone, Vetiver was still flourishing[15] . Locals stated that the fields had been inundated for 10 days continuously with water levels as much as 20 feet high on occasion, but Vetiver was unharmed.

Berhampur – Konarak – Bhubaneshwar: The purpose of visiting Konarak was to see the type and enormous quantity of Vetiver growing wild en route, as well as to meet Mr Lakshman Naik of CPDA, a PREM associate. CPDA that day were completely pre-occupied in Cyclone Relief measures owing to the unexpected arrival of 2 truckloads of relief supplies which needed urgent distribution. They had themselves not much experience of Vetiver planting, but were glad to point out the several areas where Vetiver was growing and could be harvested as needed.

Konarak had been savagely mauled by the Cyclone. Damage to the standing crops, said to have been the best in the last 30 years, can be assessed from the condition of the trees (Photographs 17 and 18) and even electricity poles (Photograph 19). Wild Vetiver grass had, however, successfully withstood the storm and subsequent inundation even by saline water from the sea[16] . (Photograph 20).

A canal along the road had been planted with a single row of Vetiver along the embankment, probably by the IWDP (Plains Division). The canals had overflowed for days and yet at the time of the visit, Vetiver had regenerated and was thriving (Photograph 20).

Dept. of Silviculture, Govt. of Orissa, Bhubaneshwar: Although the Dept. of Silviculture has nothing to do with Vetiver, the purpose of the visit was to meet Mr H S Kumar who had been the Project Director of the IWDP Project at Phulbani. Several people met during this visit, including the President of PREM, had suggested that this author meet him since he was considered the "guru"

of Vetiver in Orissa.

Mr. Kumar kindly granted an appointment and the question of possible replication of his results in different States/areas was discussed, with particular reference to Gujarat. He felt that if the topsoil was clay, chances of survival by the 3rd year were poor.[17] If, however, the clay layer/black cotton soil was found beneath a 1 metre layer of good soil, Vetiver would thrive and its roots could penetrate the clay layer, permitting recharging of ground water resources. His experience was that open wells which had dried up showed 2-3 feet of water within the first year of starting with Vetiver along with other methods of water harvesting. In Phulbani, they had found that roots went down to 4.2 metres.

He said that the seeds were, by and large, sterile – especially the stock drawn from Konarak which had been used for the nursery in Phulbani.[18] A spreading variety did exist and whilst this was inadvisable where crops were being planted, he had found it useful in preventing splash erosion on hillsides.

To establish a nursery, he suggested planting in a continuous shallow ditch with Vetiver slips having 10 cm of leaves and an equal length of roots, with 5g per plant of Di-Ammonium Phosphate (DAP). In the event of mortality, the next clump could be used to fill in the gaps. Termites were a definite problem and he strongly advised dusting with any anti-termite powder if they were in evidence (Daringabadi had plenty of termite hills in evidence – could this have been a reason for the high mortality rate ?) [19]

Mr Kumar also suggested the following rules of thumb:

> Agriculture: plant Vetiver at horizontal intervals of 40 metres, at bunds
> Horticulture: plant Vetiver hedgerows at every 5 rows of trees
> Forestry: plant Vetiver hedgerows at every second row of trees.

His experience had been that in Horticulture, Vetiver had not worked too well since farmers rarely bothered to look after the hedgerows.

He was asked whether there was a need for a Central resource-base on Vetiver, such as a branch or offshoot of The Vetiver Network. He felt that it was a good idea because the huge benefits of Vetiver technology were indisputable; all it needed was a push in the right direction. Mr Kumar offered to assist in any way he could if such a central resource-base was set up.

Discussions with the PREM were a critical component of this visit since only they could provide necessary guidance and advice on replication of their experience elsewhere. Discussions with PREM personnel were held before and during the field visits, but regrettably, a "wrap-up" session was not possible.

PREM had trained some 100 people from the 10 selected blocks both in "classroom" type situations and by organising field visits to the IWDP project at Phulbani. The trainees were the farmers themselves and Mr James Campbell had played a crucial role in the training process. Ten hand-painted posters had been produced to assist in the training and the 2000 copies of the "Green Book" in Oriya had been printed (specimen collected). Although the farmers were mostly illiterate, these copies were distributed to NGOs, Government officials, PWD (Public Works Dept) officials etc. They had also held 2 Workshops for NGOs and Govt officials.

PREM had established 2 Vetiver nurseries of their own but did not consider the establishment of nurseries too good an idea. For a start, wild Vetiver was plentifully available and secondly, the roots of Vetiver plants in nurseries went down so deep that gathering of slips became a problem.[20]

The methodology adopted was that PREM would arrange for the Vetiver slips to be delivered to the selected sites, at its own cost. Villagers contributed by way of labour and the village community – never an individual – was paid a sum of Rp.1.00 per running metre for planting of Vetiver. There was only partial financial support for fencing off. Since a farmer from that particular village had been trained in Vetiver technology, the care and maintenance of the slips to maturity was the responsibility of the trained farmer and the community.

One problem faced by PREM and its associate organizations was that the planting of Vetiver corresponded with the onset of the Monsoons, when the farmers were understandably preoccupied with sowing of their own crops. This had on occasion caused a delay between the physical arrival of the slips at site and the actual planting.[21]

Informal discussions with PREM personnel also revealed a concern about the levels of motivation of the villagers. They felt that farmers would more readily care for the Vetiver hedgerows if the technology was introduced as part and parcel of an income-generating project, e.g. the plantation of cash crops such as fruit trees which could yield an immediate/near-term income.[22]

Notwithstanding the problems which PREM and its associates had faced, and further not withstanding the erratic results obtained, PREM is sufficiently convinced to make Vetiver a key component of its DFID-aided Social Forestry Project in Gajapthy District[23].

PREM's Pilot Programme provides a unique learning experience. The lessons learnt are invaluable not only for PREM's Social Forestry Project, but for others interested in replicating PREM's experience elsewhere[24].

Whilst the foregoing parts of this Report merely record the observations, the following section attempts an analysis. The observa-

tions, and therefore the analysis, are based on the villages actually visited and to that extent are limited. However, the visit schedule had been carefully planned by PREM to be as representative of the whole Programme as possible and thus (subject to PREM's concurrence), this analysis should be valid.

OBSERVATIONS AND ISSUES

TRAINING: Great effort had been made in training the associated NGOs, village/community leaders and project co-ordinators and it was clear that the training had paid off in most respects. Vetiver slips had been planted along the contour and at the prescribed intervals. However, the vertical interval seemed to have been ignored (or at least, the significance had been forgotten). Also, in several instances, "success" seems to have been measured by the height that the Vetiver achieved rather than by the density of the hedgerows.[25]

MOTIVATION: This strikes one as being a key element of any similar Programme. It must be acknowledged that the true benefits of Vetiver to farmers will arise in the medium to long term. In contrast, the population in the areas surveyed had more immediate needs, those of survival. This factor is compounded by the fact that the tribals do not own the land they are cultivating, and quite naturally are not particularly concerned about the long term.[26]

The statements of Mr Mitrabhanu Panigrahi and Mr Ratan Mishra of PREM therefore assume great significance: that when encouraging Vetiver technology in an area as poor as this and when the land is not owned by the cultivator, it is best to promote the technology as part and parcel of something which will yield an income in the near future[27] .

But even fruit trees take time to yield income. In the interim, the farmer must care for the Vetiver hedgerows as much as he cares for his crop. In Daringabadi, there was a marked absence of enthusiasm on the part of all concerned and the pitiful condition of the Vetiver hedgerows was plain to see. Conversely, in Lankaput, there was abounding enthusiasm and tremendous success. The enthusiasm could not have been caused solely by the direct benefits of Vetiver, since only one Monsoon had passed and it would have been somewhat premature to assess the full impact.

What led to this enthusiasm? The answer is not clear, but perhaps the keen interest shown by SOVA played an important role.

What is abundantly clear from the Lankaput experience is that success breeds enthusiasm, and the fact that villagers of their own accord have started to plant Vetiver hedgerows is an indication of true success. In the absence of committed organisations such as SOVA, perhaps a Video recording showing "before and after" scenes would serve to motivate villagers and to keep them motivated.[28]

MANAGEMENT: This has several facets:

1. Planting: It was learnt from the visit to Baraikudi that it took 10 man-days to put together an LCV-load of Vetiver slips, and that an LCV load covered approx 3000 running metres.

If the objective is to plant Vetiver as soon as possible after the slips are gathered, and if the slips are to be transported over a distance, this obviously means that a work-force of 10 persons has to be engaged each day for every 3000 running metres of Vetiver hedgerow. However, the rate of planting ranges from 50 metres per person per day (Daringabadi) to a low of 5 metres per person per day (Lankaput).

Admittedly, the terrain in Daringabadi and Lankaput was different, and factors such as supervision, levels of skill etc. may have varied. However the 10-fold difference needs to be investigated further and some kind of norm evolved, so that the rate of harvesting of slips is matched as closely as possible with the rate of planting. Otherwise delays can occur which lead to a loss of continuity in work. Such delays, experience shows, can be further compounded by other factors such as farmers' preoccupation with sowing their own crops and the net result could be an unacceptable mortality rate. This could in turn result in formation of noncontinuous hedgerows which could actually *accelerate* the formation of rills and gullies unless corrective action is taken.

Since Vetiver planting in unirrigated areas is done only at the onset of the Monsoons, the time lag for corrective action is by definition 1 year, during which a fair amount of soil erosion can take place. Equally importantly, farmers could easily be discouraged by the apparent lack of "results" with disastrous consequences.

Site selection is also of critical importance. For example, the Kharikua plantation had a high amount of tree overgrowth and the Vetiver hedges looked relatively weak and fragile. Evidently, they need a reasonably high amount of sunlight to thrive.[29]

2. Follow-up: PREM's Pilot Programme was scheduled to last 6 months. Mortality of Vetiver slips can occur because of faulty planting, poor quality slips, grazing, trampling etc. In none of the areas visited was there evidence of corrective action taken to replant in spots where the Vetiver slips had not survived. As mentioned above, large gaps in the hedgerows can actually accelerate the formation of rills and gullies and it is essential to include a formal mechanism to follow-up the initial planting and to replant as necessary.

This effectively means that a 6-month programme is inadequate. It would seem logical to have a programme that last about 15 months, i.e. from the commencement of a Monsoon to the end of the next Monsoon. Whatever be the format or duration, repeat visits to inspect the hedgerow formation and

to take corrective action must be built into the design of future programmes of this nature.[30]

3. Fencing Off: No separate budgetary provision had been made for fencing off and PREM were only able to partially finance fences to keep away grazing animals. As long as there was a standing crop, villagers kept animals away but in Daringabadi, for example, animals were freely allowed to graze soon after harvest.

In Gunpur, villagers practiced a strictly controlled grazing regime and survival rates were at least 5 times higher than in Daringabadi. In Lankaput, the hill had been fenced off and the results were even more impressive.

Unless it can be assured that grazing animals will be kept away, some form of fencing with naturally available material (e.g. cacti or thorny plants) seems to be essential. In the initial stages, when farmers cannot see the benefits from Vetiver, they cannot be expected to be as scrupulous as necessary and if fodder is scarce, animals will surely graze on Vetiver. The ravage seen at the IWDP fruit plantation at Phulbani, where the Vetiver was at least 4 years old, is adequate proof that animals will graze on even mature Vetiver when other feed is scarce.[31]

4. Conflict with Crop Sowing: In at least 2 cases, the Vetiver slips were not planted immediately on arrival since the concerned farmers were preoccupied with sowing operations. There was a time lag of about 4 days which could have contributed to the mortality rates.[32]

This situation arose because the onset of the Monsoons is the best time for planting Vetiver as well as the best time for sowing operations, resulting in a conflict of priorities where sowing will invariably win out. Such a conflict is inevitable in areas without year-round irrigation.

There is no immediate solution that can be thought of. Perhaps poly-potting, which appears to raise the "shelf-life" of Vetiver slips, provides an answer but this is practical only where there is a Vetiver nursery, unless a mechanism can be devised where poly-pots are transported to the area from which wild Vetiver is to be harvested.[33]

5. Nurseries: PREM did not find the establishment of nurseries a very practical proposition. Wild Vetiver was frequently found growing near the target area and it was simpler and more economical to harvest slips from there. Also, PREM had found that the roots of Vetiver form such a deep and complex structure that they were difficult to remove. Unless Vetiver was regularly harvested from the nursery beds (before the roots went too deep), the land became difficult to cultivate. This fact must be borne in mind whenever a nursery is contemplated.

There is much to be said in favour of Vetiver nurseries but the numbers planted and the time of planting must be carefully coordinated with the potential usage pattern.[34]

6. Spreading the Message: If Vetiver technology is to be spread far and wide, demonstration units are not enough. There should in addition be meticulous recording of yields, fertiliser usage, soil moisture content etc. before and after Vetiver was adopted. This data, along with a video recording before and after, (possibly with actual video shots of water flow being retarded down a hillside) as well as video/stills of reclamation of land in gullies and ravines, would be excellent material for showing to villagers.

Such efforts would be time-consuming and expensive, but would be a sure way of motivating farmers to try out Vetiver technology on their own. Sceptics could be directed to the closest demonstration plot: this also means that the audiovisuals should at the first instance be screened in villages proximate to the demonstration unit.

Finally there is the question of commitment. Deepti and SOVA, both NGO associates of PREM, were deeply committed to Vetiver and were able to pass on their commitment and enthusiasm to the beneficiaries. Both these organisations have done such a good job that they deserve recognition and further financial aid in spreading the message and technology.

Deepti and SOVA, in turn were fortunate in having PREM to back them. Indeed their own commitment originated from PREM without whose drive, management and support they would not have been able to achieve any results[35].

THE NEED FOR A CENTRAL CO-ORDINATING ORGANISATION

It had been hoped that after the successful implementation of the Vetiver Pilot Programme, PREM would take on the role of a Central Coordinator for India, imparting training and motivating other NGOs throughout the country to adopt Vetiver technology. Certainly PREM, with its vast organisation and managerial skills, was very well placed to do so. However, PREM is heavily committed to several other Projects and appears reluctant to take on this burden.

Perhaps this is just as well. Any such endeavour requires an organization dedicated to Vetiver and to very little else; the magnitude of the task is too great otherwise. Is there a need for a central organisation in the first place ? Available evidence seems to indicate that there is not just a need but a crying, desperate need.

Within a short span of time, this author was referred numerous people who had done "excellent work" on Vetiver. Inevitably, such people were found to be academicians or Government officials. Pockets of expertise indisputably exist but there is no central repository of data, experience and skills.

Secondly, the "lab to land" experience seems to have been abysmal. Indeed at Phulbani itself, the site of the massive and now-abandoned IWDP Project, there is

very little evidence of farmers nearby adopting Vetiver technology for their own benefit. Whether this due to absence of information or lack of motivation is not clear, but certainly academics and Government officials have not done very much to spread the message. Perhaps they do not see it as their role, even though all of them without exception stressed the enormous impact that Vetiver could make.

Other organisations which should in theory be involved seem blissfully unaware of Vetiver. Surprisingly, even the Centre for Environment Planning in Ahmedabad (contacted well before the start of the Orissa visits) knew only vaguely about Vetiver. The Gujarat Ecology Commission – which has an entire cell devoted to wasteland reclamation – was equally ignorant.

NGOs have been identified as the vehicle through which the technology could spread. However, as with PREM, NGOs often have a number of diverse Projects many of which are of a more immediate nature. NGOs, too, operate in a restricted geographical area. Constraints of funds, management skills, communications, location and numerous other factors prevent them from playing a countrywide role.

NGOs can at best be expected to implement Vetiver projects and to assist in the education and motivation role. It is unrealistic to expect them to take on Vetiver technology as their sole raison d'etre. Optimally, a coordinating body should be formed whose initial role would be to gather and store in easily accessible format all relevant material relating to the technology. It would then set about disseminating this information not passively, but by actively seeking out individuals and organisations working in the area of soil conservation and convincing them of the advantages of Vetiver technology, encouraging the application of the technology, providing technical, training and promotional inputs for the application of the technology, monitoring recording and analysing the effects of such application, according recognition to good work in an effort to promote emulation, publicising the benefits and facilitating exchange of data and opinion.

Despite the fact that Vetiver grass is native to India, that Vetiver hedgerows have been used in parts of India for 200 years or more, that it provides a simple, inexpensive and durable method of soil conservation, India continues to lose megatons of topsoil every year to erosion. Surely this situation needs urgent correction by whatever means. The suggested central Coordinating body, properly manned and financed, could make an enormous contribution in this direction[36]

COMMENTS BY YOUR EDITOR!

[1] This is a good idea , on very small plots at least two of the boundary hedges will be across the slope and therefore will be effective.

[2] Agreed.

[3] Agreed.

[4] Grazing of vetiver in first year can be a big problem, not because the plant is eaten , but rather because it is pulled right out of the ground during the act of eating. Sheep and goats are a particular nuisance.

[5] This together with subsequent comments would seem to indicate that farmers have not been adequately trained. This is a real problem in India.

[6] A good sign.

[7] I think that this is a mistake it should be 10 meters. Even this figure is ridiculously low. In Karnataka farmers are said to plant 200 meters/manday. I suspect because these farmers are being paid there is little incentive to work very hard.

[8] Note the vetiver being used in Orissa is probably a north Indian seedy cultivar. It is not the best, but it will do.

[9] Good sign.

[10] This probably reflected an alternative forage supply, if there had been none the goats and sheep woulf have had a crack at the vetiver.

[11] Who do we believe Mr. Patro or the villagers, I would go with the latter. Nearly always it's the officials who find fault, and not the users. I wonder why?

[12] Typical "not invented here" syndrome

[13] sounds as though this was a bad site with minimum farmer and communal participation.

[14] Jamie did a great job — I salute him!

[15] Was this vetiver used to stabilize paddy field bunds, if yes, did it protect the bund from destruction.

[16] Same in China after a cyclone on Pintang Island.

[17] Questionable.

[18] Konrak stock is OK.

[19] Agreed.

[20] generally it is better to have nurseries as over time you can select better quality plant material. I suspect that a lot of the "wild" vetiver slips may have been poor quality and would have died at planting. Vetiver from nurseries is not difficult to dig up. You only need a few inches of root It might be better not to devide into slips at the nursery but rather transport large clumps. These if left lying about have much greater survival time prior to planting.

[21] More reason to transport clumps.

[22] Agreed. I believe the approach should be to get the whole community involved with the plan and an overall explanation of the many benefits of vetiver — not just soil conservation. After that some individuals in the community - the innovators need special training in the technology so that it is correctly applied. In addition fruit trees and other long term crops need to be introduced.

[23] You have to expect erratic results in the beginning. Greater conformity can be obtained by following note 22. Incidentally if a community is not interested and committed, don't include them in the initial stages.

[24] Also for other countries.

[25] I sometimes feel that for most

farmers horizontal interval is the important factor. They just don't want the hedges too close together. Its probably better that way. Once the farmer sees the effect of vetiver he is more likely to add additional hedgerows if he thinks it is necessary.

[26]Correct.

[27] Correct.

[28] Sounds plausible and most likely. A video would be a good idea

[29] All the observations in this section are valid. I suspect the incentive factor is the most important factor that determines the rate of output. In my view the digging up and preparation of plant material should be done "commercially" - i.e. pay for the job. As for on farm planting, once the community is convinced of the value of vetiver there should be no need to pay the farmers for protecting there own land, so long as the plant material is provided at no cost.

[30] Agreed. It was six months because that was all the funds that were available - hopefully DIFID or some other agency might fund the next phase.

[31] Fencing is an expensive option. Back to initial community involvement training etc.

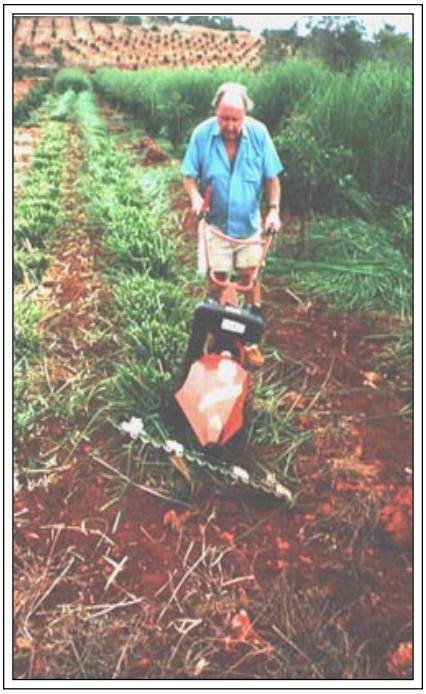
[32] Consider the option of delivering clumps rather than slips of vetiver. Clumps will survive a long time, and thus delays in field planting should not result in high mortality.

[33] No - too expensive and non sustainable

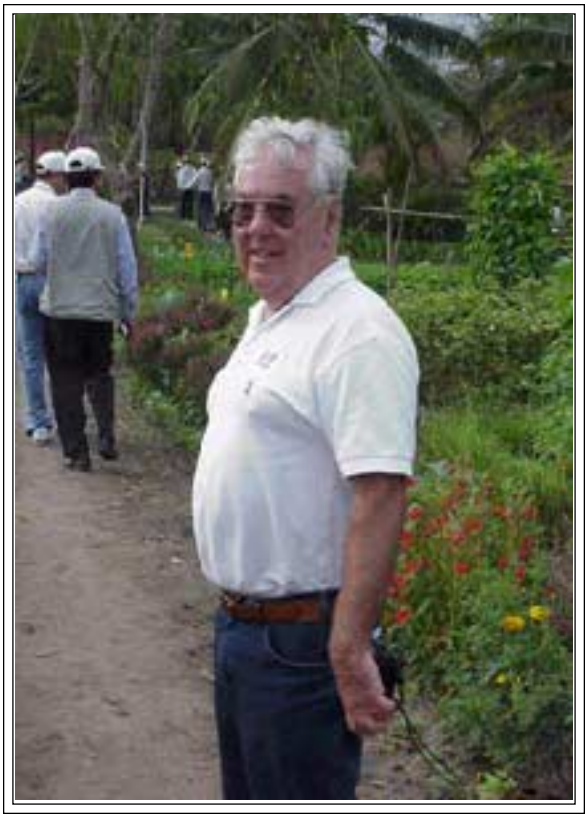
[34] Vetiver nurseries are better - they produce better planting material. Harvesting from nurseries need not be any more difficult than harvesting from the wild. One only needs about 10 cm of root. In Malaysia the best tool for digging vetiver clumps is an oil palm harvesting tool. This comprises of a long single handle (1.5m long) with a chisel like knife attached at the end.

[35] I agree with this section

[36] Good and valid observations. I have always wanted an Indian Vetiver Network, but have been discouraged from establishing one because it has been nearly impossible to identify individuals and or agencies who are committed enough to do a good job. I believe it is impossible to do this within currently operating research, academic or government agencies. There are too many conflicting agendas. Some people just don't want to know about vetiver. Others say that there are 40 other grasses that are just as good (*incorrect*) thus no need to promote a single species. There is the "not invented here" syndrome. and so on. Probably the best way is for an independent such as Rajan Ghandi to set up a network with financial backing from a some big corporations like Tata. There are also some people at high level in Government who are interested and who know the value of vetiver. I know one thing that the Network should not be in the hands of government, academia or research. They can all help, but they seem unable to lead and motivate.



Sandy Robertson of Portugal pruning his very well grown vetiver with his mechanical scythe on his avocado farm located in the Algave. Sandy is also a source of planting material. Photo credit: Mike Pease.



John Greenfield, the "Father" of the renaissance of Vetiver Systems and author of "Vetiver Grass - A Hedge against Erosion". Photographed during the Conference in Thailand in January 2000. Photo Credit: Dick Grimshaw

Best Practices -- Establishing a National Vetiver Diffusion Program: Example of Madagascar, A Country Eroding into the Sea.

Criss L. Juliard, Ph.D., CHEMONICS INTERNATIONAL, presented at the Second International Vetiver Conference,Thailand, January 2000

OVERVIEW OF THE MADAGASCAR PROGRAM

The author headed a USAID-funded technical assistance project to stimulate the agribusiness sector and to rehabilitate rural infrastructure in two of Madagascar's six regions. The infrastructure component improved farm-to-market transport. It spent $13 million over five years to rehabilitate rural roads and partially rehabilitate a railroad. Rehabilitating the roads proved to be an easier task than assuring their maintenance at reasonable cost. The hypothesis was that maintenance could best succeed by using a participative approach with the local population, who had a vested interest in protecting the investment. Management of the roads was formally turned over to road user associations comprised of villages living alongside the roads and agricultural enterprises with an interest in the area. (see Picture Gallery, #* ARABIC 1A and #1B). The associations and project staff witnessed serious problems when some of the new and costly engineered works washed out during a cyclone, and erosion and massive landslides threatened other areas under rehabilitation. (see Picture Gallery, # 2). We searched for solutions together, which led us to vetiver. We initially contacted the Vetiver Grass Network through the Internet. They subsequently provided the project with information, guidance, experience and visuals aids to tackle the problems that had already occurred and develop a capacity to avoid new ones. This led to a sensitivity and awareness campaign in the two regions where roadwork and agricultural intensification were being implemented. Subsequently, we expanded the initiative on a national level. This was done both in response to requests for assistance in setting up vetiver in other regions of the country and as a way to ensure long-term support from businesses, donors, professional associations, and government at the national level.

The overall cost for diffusing vetiver, first in the project area and later on a national scale, was roughly $750,000 over three years. This amount included about $464,000 for the purchase, transportation, and planting of the plants, $40,000 for the communications campaign, and $196,000 for project-based technical assistance. We also benefited from about $50,000 of in-kind contributions from other organizations. The result was the planting and caring of approximately 160 linear kilometers of vetiver hedges (1.6 million plants), which protected over 400 km. of roads and associated masonry works and 20 km. of vetiver hedges along a railroad line, watershed basins and agricultural lands. Approximately 200,000 of the 1.6 million plants were used in agricultural plots to improve soil quality. Cost per planted meter averaged about $2.90. The cost of protecting rural roads and masonry works with vetiver varied from 1.2% to 4.6% of the rehabilitation investment. On average vetiver cost was 3.1% of rural road cost. We estimate that vetiver will extend the life of the road by 30 to 100%, thus greatly increasing the rate of return on the rehabilitation investment.

Over the course of the project, the vetiver activity assumed greater importance than what was anticipated at the outset. Through our participation with new partners who operated on a national scale (the National Environment Office, Ministry of Public Works, World Bank, UNDP, Peace Corps, Worldwide Fund for Nature, and CARE), the technology became better known, and demand for assistance outpaced our ability to respond. After three years of intensive vetiver outreach activity, vetiver dissemination in Madagascar reached a significant scale. We had established a core of people skilled in the technology and a critical mass committed to its use. The adoption rate is high and the demand remains strong.

How did the country get to this point? What specific actions led to achieving this critical mass state? Looking back we concluded that the dissemination strategy developed as much by chance as by design. However, we believe that a good part of our success can be traced to the manner in which three questions were addressed: who will do the dissemination, with what material, and by what means?

Two or three previous attempts at vetiver dissemination in Madagascar did not succeed. We believe our efforts have been rewarded because they:

- Got the right people involved and committed.
- supply of the plant material
- Provided technical support to assure the technology was applied correctly.

This paper discusses the manner by which these three concepts were addressed and given priority.

1. GET THE RIGHT PEOPLE INVOLVED

At the heart of a vetiver dissemination program is getting the

right people and organizations involved and committed to promoting the technology. A program needs a locomotive, and it is preferable that this engine be an independent body that has:

- A mandate to achieve results in a field such as agriculture, environment or infrastructure;
- Recognized leadership skills;
- Access to financial resources;
- The drive to establish partnership relations with other organizations; and
- Create a catalyzing event.

To get people and organizations to address a common problem, organize an event such as a disaster preparedness seminar, a soil conservation workshop or engineers' conference on road maintenance. In Madagascar, an early catalyst to get people thinking about solutions to the massive erosion problem was the organization of a conference called: "Effective technologies used to preserve agricultural soil and to reduce erosion." Vetiver was one of the field-tested technologies presented by practitioners to a diverse audience of agronomists, engineers, NGOs, researchers, ministries and donors.

Such an event becomes the catalyst to help conceptualize the scope and breadth of a vetiver program. It allows individuals and implementing bodies with the drive, ideas and nurturing skills to emerge as actors who will take the idea from conception to reality. It is useful to have an eye-catching presentation by a vetiver practitioner who has slides, reports, and scientific evidence and background information on vetiver in other regions or countries. Richard Grimshaw was the main advocate of vetiver technology at the conference, and he helped to establish vetiver's credibility. The conference also discovered that other organizations that had used vetiver in the past had applied inappropriate technology. The Vetiver Grass Network and its WEB site (www.vetiver.org) provide excellent material and contacts to ensure good application of the technology.

The event can also serve as a preliminary planning platform to discuss target beneficiaries, resource requirements, sources of planting material, participating organizations, short and medium term goals, and a schedule of follow-on planning exercises.

Involve both big picture people and the details folks. In the early stages of program development, involve professionals representing the engineering, agricultural, environmental, financial, forestry, business and NGO sectors. Look for those who have a sense of the big picture and policy issues. People who are busy, who already carry many responsibilities, who have a wide network of contacts, and who work under a private umbrella are the most likely to help the initiative succeed. These people will have know-how to access key documents, pictures, reports, slides and videos on vetiver usage.

When considering partnership organizations, look for ones that have the best records working closely with village associations, farmer cooperatives and producer groups. These are the resources that deal best with the smaller details such as how best to get the message to targeted beneficiaries, problems of local logistics and ground-truthing proposed practices. They are critical to a national campaign as they complement the vision, big picture folks and help resolve practical problems at the village and local level. Remember that it is often the details that ruin a well-planned national vetiver program.

Create an information network among key people and lead organizations. Critical to a national vetiver program is networking information about the plant, its uses and virtues to the beneficiaries, including those who plant, finance, become stakeholders, researchers, businesses and those who hold local and national offices. These groups must understand the plant, the technology, and what vetiver has done elsewhere under similar conditions.

Basic information about vetiver exists in abundant supply. In addition to the vetiver web site, important documents that help get started are the World Bank Technical Paper #273; the National Research Council's 1993 *Vetiver Grass, A Thin Green Line Against Erosion,* P.K. Yoon's 1991 *A Look-See at Vetiver Grass in Malaysia;* and VGT newsletters. In addition, see the reference section of Richard Grimshaw's V*etiver Grass Technology Network and Its Impact on the Environment*, presented at this conference

To create the information network, the lead organization must establish a communications plan and a strategy to transmit information about the plant and the technology to target groups. Regardless of the target group, the program requires large quantities of visual-aids and written documents, organizing workshops, participating in seminars, involving schools in "vetiver planting days," assuring press reporting, and using resource and experienced personnel, even if at the outset they must be brought in from the outside. Estimate an active communications budget to be about $6,000 to $12,000 per year. Elicit help from journalists and the media only after there are success stories to report, and have them visit demonstration sites and put them on a mailing list to receive all the documents you generate on vetiver and its use in the country.

The communications plan or awareness campaign should be adapted to each type of beneficiary group. The challenge is to conduct your communications plan simultaneously with each. Aim at four segments of the active population discussed below:

- Vetiver users and direct beneficiaries
- Private businesses
- Local officials
- Ministries, donors and profes-

sional associations.

Vetiver users and direct beneficiaries. The first group, by far the largest and the most important, is the rural farmer and village associations. These are the most strategic groups to reach along with adjacent schools, extension agents and model farmers. (see Picture Gallery, #3). To reach them, use a community-based, participatory approach. Hold meetings. Find out their major environmental, agricultural, and disaster mitigation issues, and how they seek to resolve them. Be prepared to introduce several techniques, including vetiver. Use individuals who are good at village level mobilization to conduct these early meetings.

It is best to have a catalyst to introduce vetiver at this level such as a village level project, a major event such as "earth day," or a road rehabilitation activity. The village has to have a felt need for a vetiver project. Be prepared to show pictures, give a slide or portable computer presentation of how vetiver is used, and provide simple handouts in the local language of how vetiver has benefited others in the same situation.

Private businesses. The awareness campaign for the second group centers on private businesses, nurseries, seed producers, essential oil processors, transporters, people with land looking for an investment idea, and business associations. It focuses on ways to develop and help create the market for vetiver. Use illustrative costs estimates and reports on testing experiences. Provide on-site training visits, conferences and technical presentations.

Local officials. The third group includes local officials in the regions where vetiver has the best chances of assisting soil erosion campaigns or addressing other particular problems. Visits, discussions, slide shows, demonstration sites, and presentations on how vetiver can give their locality a competitive edge are very useful. Local officials have to see the political advantage to their region before they commit to supporting a vetiver program. This legitimate concern is to be addressed in the communications strategy.

Ministries, donors, professional associations. Technicians and decision makers at the level of ministries (agriculture, forestry, environment, land planning, public works, transport), professional associations (order of engineers, agronomist associations), and donors are the fourth target audience of a communications strategy. This is the hardest group to reach; many have set ideas, are not risk takers, and are comfortable with what their group has done before. One way to reach this group is by participation in technology seminars, conferences, and workshops. You can issue press releases, set up demonstration booths, and distribute books and brochures. Repeated visits to ministries and donor offices are a must.

Partnerships. Get partnerships established with NGOs (i.e. Peace Corps, UN Volunteers), extension services, environment projects, students and teachers at local schools, professional associations of engineers, agronomists, and rural development specialists. Most important is the support and understanding of people in the private sector. It has been the experience in several countries that giving the lead to government ministries or research institutions have not produced the best results.

Newsletters/mailing lists. Establish a network among all partner organizations, individuals, and ministries. Use electronic newsletters as a way to maintain communications among all these interested parties. Appoint one person to gather and to edit a newsletter that is Internet-based. Keep the text short and crisp, and send it regularly. For those who cannot be reached by email, fax the newsletters and as a last resort, mail them through the post. The newsletter mailing list should be expanded continuously.

Reporting. Finally, to expand the information network, it is good practice to prepare a report of the year's activity, lessons learned, and above all to record the program with cameras for the first couple of years. The vetiver network would like to receive reports and pictures. The reports can be used for further extension and sensitizing groups in other areas. Using a digital camera facilitates transmitting progress and success pictures to people in the network. Put a digital camera into your planning budget.

ASSURE A READILY AVAILABLE SUPPLY OF PLANT MATERIAL

A sound vetiver strategy requires planning for a surplus of plant material. The need for plants during every planting cycle almost always exceeds supply. We recommend promoting at least three types of plant material sources:

Private nursery and growing fields of vetiver to supply the plant in clumps or plastic bags;
Roving nurseries to supply on-the-spot replanting material;

Small plots in the gardens of people committed to the technology – for multiplication, gifts, starters, experimenting, practice, and testing.

Nurseries are established in well-watered, sandy soils, and run by professionals. Where the cultivation of vetiver for essential oil exists, the producers can be enticed to provide cut clumps as starting material. Nurseries are encouraged to prepare plants in three forms: clumps, bags, or individual tillers. As a basic multiplication technique, the nursery multiplies from its primary source by in-ground planting, not potted planting. Original tillers are to be planted 30 cm on a square in rich loose soil. A warm, wet climate generally allows a multiplication rate of about 30-60 tillers per clump over a six-month period. The nursery will use part of the multiplication stock to put

plants in poly bags and part to be sold as tillers (2-3 shoots per tiller) for direct planting. Generally, the aim is to have several hectares in continual production so that every month as plants are taken from the nurseries, five to six times the amount can be replanted for multiplication and expansion.

"Roving" nurseries, or temporary multiplication centers, are recommended for rural roads, hard-to-get watersheds and other isolated spots, where established nurseries are far away, and the cost of transport is high. Transporting plant material is one of the costliest links in the vetiver technology chain, which is why the on-site nursery is so important. The roving nursery was an extremely useful implementation tool in Madagascar. It allowed for rapid deployment of resources to isolated areas for short periods of time, and reduced overall cost of material by about 20%. A "roving" nursery is one that is established close to the planting area by a professional nursery person near for a particular planting season. It is a temporary multiplication center that has easy access to soil, water, labor and land. The plants multiplied in this nursery will equal the approximate number of plants needed for the site. Tillers or clumps are brought to the sites, and then a speedy production cycle is used. We recommend that all soil erosion applications of vetiver be planted from poly-bagged plants rather than newly separated tillers. While this may increase overall costs, it ensures immediate protection of hillsides and roads for each forthcoming rainy season since the plant no longer goes through its dormancy phase.

The following steps are recommended for the roving nurseries:

Soaking. To accelerate rooting, place tillers that have just been separated from clumps into a cow-tea bath for a period of 7-10 days (*pralinage* in French). The cow manure juice should cover the root and crown section of the plant. New white roots will emerge. Transplant these directly into poly bags, or plant directly in hedgerow. Cow manure bathing eliminates the browning phase that vetiver goes through when multiplied. (see Picture Gallery, #4)

Use cow rather than bull manure. Female manure has a greater concentrate of the hormone needed to stimulate new root growth. Don't let plants soak more than 10 days unless you add soil or dirt to the bath.

Quick rooting. Dig a trench approximately 40 cm wide and 30 cm deep, insert a plastic sheet the length and up the sides to form a water tight reservoir. Fill the trench with 10 cm of the cow tea and soak the tillers upright. Make several of these so there is a continuous amount of available tillers for transplanting. (see Picture Gallery, #5)
Transport. For access to hard-to-reach mountainous planting areas, transport the tillers (which have already rooted from the soaking cycle) in baskets lined with plastic, allowing the roots to remain soaking in small amounts of cow tea. The baskets are head carried to sites, and can remain unplanted for up to two weeks while in the basket. (see Picture Gallery #6)

Garden plots. People responsible and involved in the vetiver diffusion program need to be users, practitioners and experimenters. The best way to do this is to have small production plots right at home that can become the source of gifts of vetiver to anyone who comes by for questions, information or hints. Prepare vetiver plants in nice pots to give away at every occasion, dinner parties, Christmas, birthdays. With every give-away, encourage the recipient to multiply the plant and the technology. Provide them with little written documents explaining its uses and benefits.

T**ransporting and unloading vetiver.** Plants are transported either as clumps, tillers or in bags. Easiest to transport are clumps. Clumps and poly-bagged plants last the longest in transport. Clumps should be uprooted and transported so they can be watered daily. In a loaded truck, transporter must agree to water clumps so the bottom plants get soaked during transport. We suggest clumps be packed in jute bags. Leaves and roots should be trimmed (leaves 25 cm; roots 5 cm.) (see Picture Gallery, #7)

Poly-bagged plants should be packed in crates if possible or laid horizontally. This method is OK if the packing and transport time does not exceed 2 days.

Tillers should be bunched together in clumps of 10 or 12, and should be trimmed the same as clumps. They can be transported bare (which makes them easier to water), and stacked neatly. Cover with wet burlap to protect from sun and evaporation.

Timing. Minimize the time between transport and replanting. Clumps can last up to two weeks, but every day left unplanted decreases the survival rate. Don't store the bagged plants in a shaded area. They need sun and water.

Moisture. Don't transport bagged plants when the soil in the bag is wet. Bagged plants transport best when dry for three days. If possible don't water the nursery for three days prior to loading and transporting.

Unloading. Unload plants in clumps or bunches as near to planting site as possible. Handle plants as little as possible. Arrange for watering plants if they sit more than one day.

APPLY THE TECHNOLOGY CORRECTLY

For a vetiver diffusion program to succeed, the technology has to be applied correctly, and for this to happen, the program needs a core of five or six well-trained professionals (engineers, agronomists, foresters, nurserymen), and a larger group of on-the-ground extension agents. The first group provides training, field support and network-

ing at the implementing organization level, the second works directly with groups who grow, plant, and care for vetiver at the base. The second group is best recruited from a pool of recent graduates of agronomy, engineering or forestry schools, NGOs and rural development projects. The younger, more dynamic and eager-to-learn individuals tend to be the best kinds. As individuals or members of an organization, they must be ready to live on-site, particularly during planting season and immediately after it. In Madagascar we used an apprentice (*expert junior*) program that placed recent graduates in villages to work on agribusiness efforts. Some were assigned to work promoting vetiver full-time, others filled in when needed.

The majority of implementing organizations should be companies that do road construction, associated agro-forestry contracting services or NGOs. The most effective way to assure that these organizations will implement the technology correctly is by providing them with detailed instructions of what is expected at every step of growing, planting and caring for vetiver. This is done through detailed, and carefully written contracts. Attached to this document are sample pages from the three types of construction company contracts that were developed in Madagascar. (Annex) These guidelines have been adopted by the central government (Ministry of Public Works) and have become required construction clauses for civil engineering work financed by many donors and the government. Regular supervision is important to be sure planters understand and apply the technology correctly.

Selecting plant sites. Experience in Madagascar proved that furrows or trenches should be dug 25 cm deep and about 20 wide in all areas where the vetiver is to be planted in hedgerows. Add approximately 1 kg of animal fertilizer or compost per linear meter. Mix the soil well. Have watering cans handy. The best time to plant is during the wet season. Prepare the soil and trenches for each day's planting.

When planting along masonry works (along culvert exits, bridges, causeways, gabions), cut the furrows 4-5 cm from the masonry and along where the fill dirt meets the concrete. In this way, the vetiver can bond the two mediums as it grows. (see Picture Gallery, #8) Where an embankment, hillside, or cut is very steep, dig individual holes rather than furrows for each plant 10 cm apart, horizontally at about a 45-degree angle. This way the vetiver (preferably from a potted source) can fit in as a plug. The roots growing downward will protect the cut from erosion. On river embankments where flood waters moves at high speeds and there is a curve, dig cross furrows in a quadrant pattern, so that the vertical hedge can slow the flow and reduce the currents. Vetiver can survive for several months underwater as long as leaves protrude.

Plant vetiver perpendicular to the flow of water. Hedges should be planted on the up-stream and down-stream side of a cement crossing or bridge pillars to stabilize the footings and gabions. This prevents water swirls that loosen the soil under the cement structures. Space the lines one to two meters apart, depending on the slope.

Always start from the low end of a hillside, and move upwards as plant material and time permit. Avoid putting plants under bridges or shady areas since vetiver likes sun.

Along masonry drains, plant a row of vetiver just uphill from the lip of the drain to prevent silting. (see Picture Gallery, #9)

Where large erosion gullies have been formed, dig the furrow at the base of the gully, and work your way up with successive rows several meters apart. To stabilize the plant during rainy season, drive a wooden stake through the "crown" of the plant.

On downhill curves, dig short furrows to plant vetiver in a herringbone style so that the water is directed from the road surface to the inside drain ditch, and so as to reduce the speed of rushing water. The hedge can grow slightly into the road surface so as to increase the catchments of the herringbone pattern.

On sites where fill dirt has been excavated, begin long rows of vetiver hedges from the base of the excavation site, upwards to prevent further erosion. Ensure that the contour is respected. Place double or triple rows of vetiver along the lowest drainage points of the zone. Constantly check the selection and digging of the furrows as they are being dug. Have a supervisor outline the exact path the planting furrows are to follow along the slope's contour to facilitate the work of those who dig the furrows.

It is important to remember that vetiver technology allows one to experiment. You might not get it right the first time, but at least you can modify and change the application points as the water run-off changes course.

Estimating number of plants required. For the first season, make broad estimates of plant needs. Use the rough number of 10 to 12 plants per linear meter (plants can be either as tillers or in poly bags) or approximately 11,000 plants for every km of hedgerow planted.

After the first year, estimates have to be more precise. For each site where vetiver contour hedging is proposed, establish an on-site planting matrix or *schema d'itineraire.* For a road site, the planning/planting matrix table will include for each kilometer (on the column side of the matrix) a breakdown of the road by 50-meter lots, and (down the row side of the matrix), a list of all road-side items (e.g.: road bed L & R, bridge, access ramp to bridge, culvert, embankment L & R, ridge, gully, drain ditch, retaining wall, gabion, masonry ditch, cement crossing, downward curve, raised road-bed etc.). For each section of

the road that needs to be protected, the engineer, vetiver specialist, or program manager estimates the number of linear meters of vetiver hedge needed to protect the engineered work, embankment or fill site. Once recorded and reviewed by the potential planting entity, the planting matrix is finalized and inserted as part of a planting agreement or contract. The matrix is used to plan the budget, estimate the number of plants, people and time required to complete the planting cycle. But most importantly, it helps people review the work to be completed and establishes the base for agreement on the priority zones and areas where efforts will be concentrated. When working on the planting matrix, don't forget to look far uphill beyond the road site to check if run-off from heavy rains might not eventually come from areas far from the road, and which may need to be deflected using vetiver hedges. Count on planting time, transporting plants and watering to be greater in these areas than those adjacent to the road.

Replacement requirements over the course of a year vary from 10% to 30% due to the loss of plants that dry out, are eaten, or washed away. Calculate this requirement in the plant estimates.

An adapted matrix is used to plan a watershed protection activity, an agricultural terracing project or reforestation. Estimating the number of vetiver plants needed is derived from the number of walked-through linear meters identified for each project.

Planting and supervising planting. After losing a high percentage of plants due to drying conditions, we recommend planting vetiver from rooted stock in poly bags over planting directly from tillers. There are exceptions, but generally the survival rate of rooted plants is higher (98% versus 75% for tillers). They add good soil to the planting area, require less water, and are more easily fixed (by putting a stake through the root system), thus reducing the chances of wash-outs during periods of heavy rain. Based on recent experiences in Madagascar, we recommend:

- Spacing between plants should not exceed 10 cm (the space of a closed fist).
- Animal or organic compost should be mixed at the bottom of the planting trench.
- The crown of plant should be covered with soil, but not to plant too deeply.
- The earth around each plant must be compacted ("healed" with feet) and slightly lower than the ground level so as to create a small depression or gully that will retain water. It is compacted hard to reduce erosion caused when heavy rains fall before the vetiver hedge has had time to develop. Avoid mounting of earth around plant leaves. (see Picture Gallery, #10)
- Plants should be watered daily for three to four weeks if there is no rain.
- Mulch, cut vetiver leaves or cut grass should be put along planted trenches to reduce evaporation, maintain moisture and begin trapping eroding soils.
- On very steep embankments, putting a stake through the root system will stabilize plants. If the area is riddled with run-offs, plant vetiver with the poly bag, but cut out the bottom to allow roots to spread. Push a wooden pole or bamboo stake through the bag after it has been planted in the trenches.

Contractors must have large bags on hand at construction site to collect and dispose used poly bags. The controlling engineer could count used nursery poly bags as a way to control number of plants planted, and ensure no used poly bags are left to the wind.

Site or supervisory engineer must establish the planting schedule with the contractor. Planting vetiver should not begin until road construction and engineered works are completed.

Five days after contract award, the planting contractor needs submit to the supervisory engineer the plan of where, how, with whom, equipment and tools to be used for the work.

Once the schedule and plan are set, and work commences, the controlling engineer keeps a daily log of all activities of the day (the number of plants planted, number of meters dug, number of meters planted, number of people on site, and observations). The contractor and controller must agree on plant and meter counts to ensure proper payment papers are processed.
The controller assures that 100% of planted material is alive, free of disease, watered and in good vigorous shape.

The controller assures respect of the detailed operational plan indicating the number of location of plants to be planted. Jointly with the contractor, he determines deletions or additions to the original planning.

Motivating workers. We recommend talking to workers about vetiver and giving each worker a handout to keep on the virtues of the plant and how to plant it correctly. This effort increases their interest, quality of work and commitment to the program.

Follow-up work: watering, replacing plants, weeding and trimming. While this important phase is straightforward, it must be included in the contract of the implementing entity. Payments under the contract for planting vetiver should be spaced out over several phases (i.e., first payment when establishing the work site, second payment when completing of 40% of work, then 80% of work, then 90%). Don't make the final payment (10% of total contract) until 3 weeks after all planting is completed and the engineer or controlling entity has conducted a follow-up visit. The contractor must replace all plants that have

not re-sprouted and those that washed away. Replacing dead or damaged plants is a must in order for the vetiver hedge to be effective and for the technology to have credibility. Implementing groups must aim and insist on a 100% success rate as well. The contractor or village groups or another entity must be contacted to assure that watering is provided to the vetiver hedge for three weeks after planting if there has been no rain.

Avoid making the mistake of not planning or providing for weeding, trimming and watering after the planting cycle. Weeding should be planned for about 1 or 2 months after planting, and preferably six months thereafter. When weeds grow near or along the crown of the plant, vetiver growth is seriously delayed. Shade prevents vetiver from growing. Weeds (if the furrows have been well fertilized) will grow more quickly than the vetiver.

Vetiver hedges should be trimmed to about 50 cm (knee high) within 8 to 10 months of planting if the plant has reached more than a meter in height. After that, hedges should be trimmed once or twice a year. The leaves can be used as mulch, thatch and in handicrafts.

CONCLUSION

While Madagascar's vetiver program began within a small project that addressed a specific problem in two regions of the country, it expanded nationally because demands for its services came from other parts of the country and a network was established to meet that demand. The dynamics that ensued, in which demand for the plant and accompanying support services challenged the suppliers of plant material, technical support and researchers, have produced a process to expand the use of vetiver throughout the country. There is an inertia that keeps the process going where organizations, NGOs, and implementing agencies respond to demands expressed by end users. The experienced learned is that we cannot go into an area or a country and initiate a vetiver program because it is good and works elsewhere. The starting point is the demand rather than the supply. In Madagascar, we believe the critical mass point has been attained because demand and supply are now both growing and reinforcing each other.

On the demand side, the Ministry of Public Works has indicated that all road contracts will require a vetiver clause, and that the plant is to be used to protect engineered works and roadbeds throughout the country. The Order of Engineers has included vetiver in its norms to protect roads, dikes, and watercourses. According to the Order of Engineers, use of vetiver will be required in all terms of references where soil erosion is an issue. The European Union and the Japanese Development Agency require that road and irrigation projects funded by them must use vetiver where soil is threatened. Two World Bank projects (the livestock project and a rural infrastructure project) are using vetiver. CARE, Catholic Relief Services, and the Worldwide Fund for Nature are using vetiver in the infrastructure projects they finance.

On the supply side, seven private nurseries are now producing vetiver, some in large quantities (capacity up to a million plants a month). Eleven construction companies have experience in planting vetiver and using the technology successfully. Approximately a dozen NGOs produce vetiver for their members and for sale in the agricultural sector, and approximately 30 village level associations have small nurseries to produce plant material for road maintenance and agricultural intensification. Training in vetiver technology has been provided to engineer associations, officials from the forestry ministry, and staff of the extension service at the Ministry of Agriculture. Development organizations such the Peace Corps have been provided vetiver training and they now incorporate vetiver in the training of all volunteers.

The keys to reaching the point of critical mass are getting the right people involved, assuring a reliable source of supply, and applying the technology correctly.

Wolfram Alderson of Pamona, southern California, with vetiver growing without irrigation on "moon dust" at the CALPOLY campus. Wolfram hopes to set up a Vetiver Network for California. Photo Credit: Dick Grimshaw.

EXPERIENCES OF THE LATIN AMERICAN VETIVER NETWORK - DISSEMINATION AND PROMOTION

Joan H. Miller(Coordinator - Latin American Vetiver Network,San José - Costa Rica), presented at the Second International Vetiver Conference,Thailand, January 2000

BACKGROUND

The Latin American Vetiver Network (LAVN) was started in October 1995 to serve the Spanish speaking countries in order to expand the dissemination of Vetiver Grass Technology (VGT). Previously the only document available in Spanish about VGT was the green book (*Vetiver, The Hedge Against Erosion*).

The LAVN has no institutional or organizational affiliation. There are a coordinator and a director who work on a volunteer basis out of a home office. The director, Jim Smyle, seconded from The World Bank to The Regional Unit for Technical Assistance (RUTA) has been able to devote some of his professional time to the LAVN within the realm of his job identifying and preparing natural resources projects for funding by the World Bank. Most funding has come directly from The Vetiver Network (TVN) which covers costs for office supplies, copying, mailing of correspondence, information packages and newsletters, and printing of newsletters and other materials.

To kick off the LAVN, the first newsletter in Spanish, *Boletín Vetiver*, was published in May 1996 and sent out to all members of TVN in Latin America. This first mailing reached approximately 400 members in 20 countries of North, Central and South America (Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Bolivia, Ecuador, Peru, Brazil, Chile, Argentina, Uruguay, Paraguay, Cuba, Dominican Republic and Puerto Rico). The most recent *Boletín Vetiver* (#7 - September 1999) was distributed to approximately 723 members. The majority of our members are affiliated with NGOs and the second largest group is formed from university researchers and students and individuals who are interested in VGT. The smallest group of network members are private companies and government and research organization.

GOALS OF THE LAVN

The stated objective of the LAVN is dissemination of information in Spanish about VGT, its applications and potential uses. The aim is to provide members access to the existing knowledge about VGT for soil and water conservation, bioengineering and bio-remediation, its application, potential uses and assist in the exchange of information. The *Boletín Vetiver* permits users and researchers to share their knowledge and experiences with not only Latin America, but also the world through our link with The Vetiver Network. Additionally we have worked to increase network membership. The Vetiver Homepage and word of mouth have been the most effective means of increasing membership.

Activities to date have included the following:

- seven newsletters published in Spanish (the *Boletín Vetiver*);
- Volume I of *Boletín Vetiver* published which contains newsletters Nos. 1-5 and a reference index;
- distributed vetiver videos (*Vetiver, la barrera contra la erosión*) in Spanish;
- sent out additional technical information on specific topics such as use of vetiver in coffee, mining rehabilitation, and bioengineering;
- sent out questionnaire regarding use and experience with VGT, in order to better understand members' needs;
- assembled a directory of the most active VGT users and network members;
- assembled a growing list of vetiver grass suppliers which is printed in each *Boletín* and posted on the LAVN web page;
- provided networking assistance in the interaction of network members;
- started electronic discussion group via Internet;
- provided materials to the Vetiver Network Homepage;
- maintained contact and information exchange with other regional vetiver networks;
- obtained financing and provided technical assistance for development of a CD-ROM and video on the use of vetiver in bioengineering;
- visited the state of Oaxaca, Mexico twice to participate in training and information workshops and provide technical assistance;
- toured through southern Costa Rica to locate planting materials for a project in western Panama;
- co-sponsored and participated in a workshop on use of vetiver for bioengineering;
- provided small grant for initiation of vetiver nursery at an organic coffee farm;
- supported a local university student to research and author articles on VGT in Costa Rica;
- answered hundreds of letter and queries.

FINANCIAL SUPPORT OF NETWORK

To date we have receive $8,000 from The Vetiver Network for network activities. Additional funds

were collected which include the 1998 Vetiver Prize for Soil Conservation ($1083) and a small donation of a lottery prize (approximately $663). A Knowledge Management grant of $42,000 from the World Bank was made to RUTA and the LAVN for a regional workshop in El Salvador in May 1999 (see below for further details). There is no NGO status for the LAVN due to the bureaucracy involved in the process. Knowledge that the LAVN office would not likely remain in Costa Rica after our return to the United States (there exists no obvious candidates in Costa Rica to take over the network) have contributed to this decision.

Effectiveness of the LAVN

The LAVN has been very effective in the dissemination of the VGT throughout the Latin American region. Our membership has grown by no less than 81% from original 400 members to more than 720 members currently (the growth is actually closer to 90% due to removal of members from the network who have moved and left no forwarding addresses). All new members receive at least each of the newsletters published to date in addition to a Spanish copy of the "green book" (*Vetiver, The Hedge Against Erosion*). Requests for information and membership currently comes primarily via the Internet and often current members request membership for colleagues, associates, and organizations.

Recently more specific requests have come in for information on the use of vetiver for land reclamation, infrastructure stabilization and rehabilitation, etc. In such areas we have been able to utilize the expertise of other TVN members outside the region (for example, Paul Truong for land reclamation and use of vetiver in highly saline environments and Criss Juliard for details of their program for road rehabilitation in Madagascar).

Furthermore the development of the electronic discussion group, although not as active as we might have hoped, gives an opportunity for individuals to ask questions and receive answers (usually from the LAVN coordinator and director) that are shared with the group of subscribers. Archives of the discussion group are available on the TVN Homepage and also are printed in the newsletter. The discussion group was initiated at the El Salvador workshop amongst the participants having e-mail accounts and then opened up to the remaining LAVN membership with e-mail accounts who responded to a subscription form.

Generally the effectiveness of the LAVN has been positive, based on the growing membership and the obvious increase in sources of vetiver grass available to potential users. This means that there is more grass being grown and more people are interested in obtaining it. This is a priority function of the LAVN.

Where the LAVN lacks effectiveness is possibly in getting information to users on specifically requested topics. The reason for this is the inability to translate large volumes of information into Spanish on short notice. Correspondence is normally answered within a day and information packages sent out within days of request (on average), but providing information on specific and technical issues generally takes a great effort that is sometimes difficult to reply to in a rapid manner.

Also we feel that our effectiveness in getting feedback from our members and in "locating" vetiver activities of non-members has been limited. We know that there is a lot going on of which we have no knowledge. We constantly "stumble" on references (written, oral, second-hand) to activities, projects, people, etc. But we cannot seem to effectively inspire people to generally keep us informed. Only about 15 members provide information/feedback on any type of regular basis (more than once or twice a year). For those "active" members and champions of vetiver we are grateful. For the rest, we are frustrated.

Promotion of VGT

Promotional activities are defined as organization and participation in workshops, providing demonstrations and technical assistence, establishing nurseries, etc. During the past 4 years we have traveled to Oaxaca, Mexico twice to participate in vetiver promotion at workshops at the request of an active NGO network there which was also able to convince a financing agency to pay our way. In May 1999 the LAVN co-sponsored a 2 1/2 day workshop in El Salvador on use of VGT in bioengineering. The workshop in El Salvador (*Bioengineering Workshop for Post- [Hurricane] Mitch Reconstruction - Experiences with Utilization of Vetiver Grass for Infrastructure Protection and Stabilization*) was financed through the Knowledge Management Fund of The World Bank and co-sponsored by RUTA, NOBS Antierosion, and the LAVN. Forty-two people from 9 countries attended the 2-day workshop, which included panel discussions, technical presentations, and a full-day field trip to observe vetiver used in both bioengineering and watershed rehabilitation projects.

Knowledge Management Funds from the workshop were also used to develop an 8-minute video (*Vetiver: The Hedge for Bioengineering in Protection and Stabilization of Infrastructure*) as a tool to promote the use of vetiver for infrastructure protection and bioengineering. This and a CD-ROM focussing on bioengineering are distributed to those who request it for the cost of mailing. We then request that they make at least 2 copies of the video and give those copies to others for further dissemination. The Spanish version of the video "Vetiver, the hedge against erosion"

is sent, free of charge, to LAVN members who specifically ask for it.

In spite of the above activities the LAVN feels that it has not been extremely active or successful in this area. Our lack of promotional activities is the result of several factors.

- Our area of coverage is very large - a total of 20 countries spread between approximately 30º N and 55ºS latitude and 35º and 117ºW longitudes, thus it is difficult to organize or attened to promotional activities with a small staff and lack of institutional association or support.
- Financially all travel is paid for personally. Where VGT is in use in watershed management and natural resources projects, the LAVN can only provide information, whreas direct technical assistance or training would be much more effective. With only two people involved with the administration of the network, personnel resources are spread quite thin for any further activities. There are currently no other Spanish-speaking "vetiver consultants" within region aside from NOBS in El Salvador, but technical assistance is not their core business; though some are developing in Mexico, Venezuela, Costa Rica, Honduras, Chile and Ecuador.
- Finally language has been a barrier. The coordinator spoke no Spanish prior to living in Costa Rica and although currently fluent, the ability to make presentations and making all information of interest available in Spanish has been difficult. Volunteers within the LAVN have been used for translation and editing services, but there are limitations to the efficiency of this.

The LAVN's one large promotional activity, the workshop in El Salvador, has shown its effectiveness through the resulting activities carried out by many conference attendees and the references which have come about since then. Following are some of the activities of conference attendees since May:

- Workshop organized by CARE Honduras on vetiver for watershed management and roads construction;
- Development of mother nurseries and micro-nurseries and planting of hedges by CARE - Honduras;
- Coordination between CARE Honduras and Chiquita Brands/Tela Railroad Company for locating and planting vetiver for joint nurseries;
- Protection of drainage canals with vetiver in banana plantations in Honduras;
- Development of additional nurseries and plantings in Costa Rica by Chiquita Brands;
- Week-long workshop on organic agriculture in Costa Rica given by a workshop participant which included a vetiver component;
- Development of a proposal for the "Establishment of a Vetiver Nursery as a Source of Planting Material for Environmental Conservation and Stabilization of Infrastructure Projects" in Honduras;
- In Panama the "Rural Poverty and Natural Resources" Project have been giving talks and practical seminars about VGT and disseminating copies of the video and plan on establishing 8 nurseries.
- The US Army Corps of Engineers, the World Bank and the Interamerican Development Bank are both calling for use of VGT in landslide and road stabilization;
- A small, but tangibly growing interest is being felt in VGT for infrastructure and roads in Costa Rica, Nicaragua, and the Honduran Minstries of Transport.

Also as a result of the workshop we have seen increased correspondence between many of the workshop participants and the LAVN. A follow-up assessment of workshop participants' vetiver-related activities and promotion is planned for May - one year after the event.

We have seen success in the promotion of VGT in the region through a number of dedicated individuals and groups. Included here were the three projects that received grants from TVN Support to NGOs Program. These projects were PCERS (Oaxaca, Mexico), Fundación Golondrinas (Ecuador) and Sociedad Conservación Aragua (Venezuela). Promotional activities in these projects included workshops, technical demonstrations, and nursery establishment, etc.

Aside from the effectiveness of their promotional activities another benefit which came out of these projects was that we were able to confidently refer other interested vetiver grass users to these groups for technical advice and potentially as a source of planting material. And even more importantly to us now, is that these groups will likely be tapped to officially take over networking responsibilities for either their region or country.

DECENTRALIZATION OF THE LAVN

Because of our departure from Costa Rica scheduled for July 2000 we intend not only to transfer the LAVN to another coordinator, but also request the participation of individuals in other countries to act as local coordinators to disseminate technical information, improve promotional activities and further gather information on the use of vetiver in their regions/countries.

Ideally the LAVN will be transferred to an organization or individual which has both the interest in running the network and, equally as important, an association with an organization which would support their activities both on the time re-

quired and some of the basic overhead costs. Such an organization might include a university, technical school, NGO, or a private company. Responsibilities would include at least maintaining a database of members and user profiles, publication of LAVN newsletter, and directing inquiries to the appropriate regional coordinators.

Smaller regional coordinators would be identified based on their participation, interest, motivation and desire to carry out the responsibilities of the coordination for their region. Optimally there would be coordinators for each of the 20 countries in the region. If a country at that time doesn't have the in-country expertise or interest then a coordinator from an adjacent country could take on the responsibilities. The responsibilities foreseen for these local coordinators would include dissemination of vetiver information packages (newsletters, green book, etc.), maintaining and expanding a database of vetiver users, nurseries and other sources for planting material, providing country/regional updates and articles to the LAVN for inclusion in the *Boletín Vetiver*, etc.

Actual promotional activities would be determined by the individual regional coordinators based on their abilities (i.e. financial and personnel) and commitment to carry this out. This would include organization and participation in workshops and demonstrations when possible. Many of individuals being considered for coordination positions already are promoting VGT within their own organizations, regions and projects. There is great need in all countries for the participation of knowledgeable and experienced vetiver users for giving presentations and demonstrations of VGT. It is hoped that these more local coordinators will be able to help fill this need and also help train others to do the same.

What Have We Learned ?

The LAVN uses a single office to network, gather and disseminate information to its members in the Latin American Region. The years of experience have revealed the following:

- work and should be encouraged as much as possible… they would also be the easily identifiable prime candidates for funding should such an opportunity ever become available.
- Efforts to increase membership such as mass mailings are generally not worth it. On several occasions we sent either letters of invitation to join the network (with a green book enclosed) with little or no response. A worthwhile task would be to follow-up on activities and progress of existing members who have written for information or updated the network in the past and invite them to contribute to the newsletter in the form of articles.
- No matter what is written in newsletters, people will write and ask for the same information. This may be an indication that much of the same information, variously presented should be recycled and summarized in future newsletters!
- We would recommend further translating into Spanish as much technical information as is possible and made available to members. Although there are is a significant number of members who speak and are able to correspond in English, the LAVN needs to be able to provide all existing information and data in Spanish. This can be done by having the LAVN reside with a native Spanish-speaking coordinator and also by increasing the pool of technical assistance experts to both help answer inquiries and provide personal technical assistance.

Conclusions

The role of the LAVN is simply stated as the gathering of information for further dissemination. This is currently accomplished through a single LAVN office which carries out correspondence with a growing membership, provides contacts and technical information when requested, and publishes of a newsletter. As the LAVN is transferred to another office and coordinator, it is anticipated that the role of the LAVN might be expanded to increase effectiveness and influence of networking in the region through further promotion and increased participation. This can hopefully be accomplished though the expansion of the LAVN through the development of locally situated network respresentatives and offices. Such a change will likely require additional financing through fund-raising activities, project support, corporate/industrial sponsorship or the selling of technical assistance services. This is a challenge that we hope to overcome as we transfer the network in the year 2000.

Vetiver -- the sediment trapper!! 1 meter of trapped sediment in a South African drainageway after 300 mm storm

PACIFIC RIM VETIVER NETWORK OPERATIONAL OVERVIEW

Narong Chomchalow, Acting Regional Coordinator, Pacific Rim Vetiver Network , Office of the Royal Development Projects Board Bangkok, Thailand

Introduction

The creation of the Pacific Rim Vetiver Network (PRVN) was the result of a proposal made by Mr. Richard G. Grimshaw, Coordinator, TVN at the First International Conference on Vetiver (ICV-1) held in Chiang Rai, Thailand, 4-8 February 1966. Mr. Grimshaw suggested that Thailand acts as the core of the PRVN since Thailand is considered most suitable because it is the site of the world's largest vetiver project known as the Doi Tung Development Project implemented under the supervision of the Office of the Royal Development Projects Board (RDPB), the Organizer of ICV-1.

Subsequently, RDPB submitted the proposal to His Majesty the King, a keen supporter of the use of vetiver grass, in order to obtain his comments and approval. His Majesty agreed with the proposal and commissioned the setting up of the PRVN under the supervision of the Committee on the Development and Promotion for the Utilization of Vetiver Grass (CODPUV) according to His Majesty's Initiative, to be administered by RDPB.

In order to facilitate the effective implementation of the network with a common view and flexibility, CODPUV established a Task Force to take care of the PRVN on 6 May 1997. The Task Force consists of Mr. Manoon Mookpradit, then Deputy Secretary-General of RDPB, as the Chairman of the Team, together with a number of experienced officials from concerned agencies and renowned institutions. RDPB itself functions as the Secretariat of the Task Force.

Objectives

The main objective of PRVN is to serve the countries of the Pacific Rim as the center to collect, compile and disseminate information on vetiver grass technology (VGT) in the forms of newsletter, occasional publications and homepage of the internet. A secondary objective is to assist the member countries in training, study tours, and obtaining plant materials, as requested and when necessary.

Members

Country Members

The following 22 countries, geographically situated in the Pacific Rim, are automatically entitled to become members of the PRVN. These are, in alphabetical order, Australia, Brunei, Cambodia, Cook Islands, China, Fiji, Indonesia, Japan, Korea (Republic of), Lao PDR, Malaysia, New Zealand, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Taiwan, Thailand, Tonga, Vanuatu, and Vietnam. They are grouped under the following three categories:

Countries (4) with National Network and National Coordinator:

- *China:* China Vetiver Network (CVN), with Prof. Liyu Xu as National Coordinator (NC)
- *Philippines:* Vetiver Network Philippines (VENETPHIL), Mr. Edwin Balbarino as NC
- *Thailand:* Thailand Vetiver Network (THVN), Dr. Apichai Theerathorn as NC
- *V ietnam:* Vetiver Network Vietnam (VNV), Mr. Ken Crismier as acting NC

Countries (9) with no National Network but with Country Representative in PRVN:

- ***Australia:*** **Dr. Paul N.V. Truong as Country Representative (CR)**
- *Brunei:* Mr. Jonathan Davies as CR
- *Fiji:* Mr. Jai Gawander as CR
- *Indonesia:* Mr. Kucahyo B. Prayogo as CR
- *Lao PDR:* Mr. Boonkong Sengthavon as CR
- *Malaysia:* Dr. P.K. Yoon as CR
- *New Zealand:* Mr. Don Miller as CR
- *Papua New Guinea:* Mr. Rob Shelton as CR
- *Taiwan:* Mr. Yue-Wen Wang as CR
- *Vanuatu:* Mr. Henry Kathecau as CR
- * ***Cambodia:*** **Contact person: Mr. Numa Shams (1998)**

Countries (9) with no National Network nor Country Representative in PRVN:

Cook Islands:
Japan:
Korea (Republic of):
Samoa:
Singapore:
Solomon Islands:
Tonga:

Scientist Members

Scientists of the member countries of PRVN who had made prior contact with the Secretariat of PRVN are automatically registered as Scientist Members, which at present amount to about 1000. Others who want to join PRVN can apply directly to the Secretariat (by giving name, current position, place of work, mailing address, e-mail address, and other information which deem necessary.

Activities

The following activities have been carried out under PRVN since it was established in early 1997:

Newsletter An English language quarterly newsletter (8-pages A-4 size), VETIVERIM, has been issued since July 1997. Its circulation is 2,000 copies per each number. It has been sent in bulk to National Coordinators or Country

Representatives of the member countries for further distribution to scientists and institutes within each country in order to save postage and other difficulties in international mailing. A bound volume of 11 numbers, with subject index as well as other relevant information, is presented to every participant as a gift from the Secretariat of PRVN. A four-page index has been attached to VETIVERIM-11 for use in binding by those who do not attend ICV-2 and wish to bind those 11 numbers.

The author, who has been the Editor of VETIVERIM from the beginning, has tried his best to include news and articles from as many countries of the Pacific Rim Region as possible. However, due to the lack of responses, not many news/articles from these countries have been published. It is hoped that with better communication, more news and articles from member countries should be published in future issues of VETIVERIM. Comments and suggestions for the improvement of VETIVERIM are most welcome. Other regional vetiver networks wishing to receive VETIVERIM should contact the Secretariat.

Homepage From the very beginning, an Internet homepage for PRVN has been prepared by the Secretariat through the website: http://www.prvn.rdpb.go.th. Information has been revised from time to time, especially when worthwhile events are happening, e.g. conferences, study tours, visits, exchange of planting material, announcement of awards, research results, etc. It also includes eight pages of the present issue of the VETIVERIM.

Scientists of the member countries are invited to submit information on research and technologies on vetiver, especially those that are appropriate to the Pacific Rim countries. Information and photographs are most welcome. These can be sent to the Secretariat by mail, fax, or e-mail.

Publications The following technical bulletins (1000 copies each), have been prepared and distributed:

1. Technical Bulletin No. 1998/1 – "Vetiver Grass Technology for Environmental Protection" by Paul Truong and Dennis Baker, August 1998. (Second printing of 1000 copies had been made to distribute to scientists of Vetiver Networks of other regions.)
2. Technical Bulletin No. 1998/2 – "Vetiver Grass for Slope Stabilization and Erosion Control" by Diti Hengchaovanich, November 1998. (Second printing of 1000 copies had been made.)
3. Technical Bulletin No.1999/1 – "Vetiver Handicrafts in Thailand" by the (Thai) Department of Industrial Promotion, October 1999.
4. Technical Bulletin No. 1999/2 – "Vetiver Grass Technology for Mine Rehabilitation" by Paul Truong, November 1999.
5. Technical Bulletin No. 1999/3 – "The Use of Vetiver Grass System for Erosion Control and Slope Stabilization Along the Yadana Gas Pipeline Right-of-Way" by the Petroleum Authority of Thailand, December 1999.

National Activities Since the system of operation of each national program is independent of the PRVN, no formal reports of such activities have been received by the Secretariat of PRVN. In order to make this report complete, the author has searched for such activities from the VETIVERIM. They are presented in the Annex.

The Secretariat

The Office PRVN Secretariat Office is located at the Office of the Royal Development Projects Board, 78 Rajdamnern Nok Avenue, Bangkok 10300, Thailand; Tel. (662) 280 6193 to 280 6200; Fax: (662) 280 6206, 280 6209, 280 8915; E-mail address: pasiri@mail.rdpb.go.th; Homepage: <http://prvn.rdpb.go.th>

The Staff There is no full time staff working for PRVN. Responsible person is Mrs. Suwanna Pasiri, Head of Information Section of RDPB. Other staff of RDPB, especially in the Divisions of Compilation and Foreign Relations, also assist in the operation of PRVN. The author himself is working voluntarily as the Acting Coordinator of PRVN, the Editor of VETIVERIM as well as of PRVN Technical Bulletins.

Budget There is no regular budget for PRVN. All expenses incurred under PRVN are obtained either from RDPB or from the Chaipattana Foundation, His Majesty's own development foundation.

Problems and Prospects

Problems It is understandable that with no budget and staff of its own, PRVN has not been fully functioning. However, since the objectives of PRVN are mainly to disseminate information through publication and homepage, there seems to be no problem of both the budget and staff. The only problem is to obtain information and feedback from the scientists of the member countries.

Prospects In spite of certain existing problems, PRVN is probably one of the most active regional vetiver networks, thanks to the support of RDPB, TVN, member countries, and a few dedicated persons. With more useful information being accumulated from the member countries, it is anticipated that PRVN will be more active in the future in the dissemination of information to the member countries.

Brief Activities on Vetiver of Member Countries under PRVN

Australia: Although no official network has been set up, activities on vetiver in Australia has been one of the most active in the region. Dr. Pual Truong of the

Queensland Department of Natural Resources who voluntarily acts as the Country Representative, together with his colleagues and a group of researchers at the Central Queensland University, have conducted various researches on vetiver (e.g. Ashwath 1998; Tomar 1998). Dr. Truong has been a regular supplier for news and articles in the VETIVERIM (e.g. Troung 1998b, 1999a, c) as well as the Technical Bulletin (Nos.1998/1, 1999/2). His group has done a lot of work on the role of VGT on environmental protection such as mine rehabilitation, treatment of toxic wastes, heavy metals, etc. (Truong 1998b). He also produced CD ROMs on various topics related to the application of VGT (viz. R&D and Applications of VGT (Truong 1998a) and VGT for Infrastructure Protection (Truong 1999b)).

Brunei: Country Representative has been nominated, but no activity on vetiver has been released from Brunei.

Cambodia: Mr. Numa Shams, Manager of "Sustainable Agriculture and Integrating Farming' project, is testing the feasibility of planting vetiver hedgerow to control erosion and as a source of animal feed during the dry season. He is requesting for planting material and information from PRVN (Shams 1998).

China: A very active national network (China Vetiver Network-CVN) has been set up, with the head office in Nanjing under the leadership of Prof. Liyu Xu. He has been a regular supplier for news and articles in the VETIVERIM (e.g. Xu 1999a, and b). CVN organized two international meetings on vetiver. One held in Fuzhou, Fujian Province on 20-26 Oct 97, the other in Nanchang, Jiangxi Province on 19-21 Oct. 99. A few national meetings were also held. Other activities include large-scale demonstration of growing vetiver for soil stabilization on barren land, riverbed, embankment, as well as on the farmlands. A quarterly newsletter (in Chinese) and other occasional publications have been produced. Small grants for scientists have been provided with support from TVN. See details in Liyu Xu's paper (PD-4/2).

Fiji: Country Representative has been nominated, but no activity on vetiver has been released from Fiji.

Indonesia: Country Representative has been nominated, but no activity on vetiver has been received from Indonesia.

Lao PDR: Country Representative has been nominated, but no activity on vetiver has been released from Lao PDR. However, an EU-funded provincial irrigation project is now working on introducing vetiver into Luang Prabang Province. Two nurseries have been established, one at a local agricultural college and the other at a farmer's field. The main objective is to use vetiver for road erosion control or irrigation scheme erosion control, but no effort of using vetiver on the farmland at this early stage. The aim is to have the farmers learn of the benefits to be gained from VGS without first using on their farmland. Meanwhile, there is now a greater awareness of VGS among Lao Government officials and donor representatives (Gillespie 1998).

Malaysia: Country Representative has been nominated, but no activity on vetiver has been received from Malaysia, a country that used to be very active in R&D of vetiver. This is probably because Dr. P.K.Yoon has already retired from office.

New Zealand: Country Representative has been nominated, but no activity on vetiver has been received from New Zealand in spite of the fact that Mr. John Greenfield, one of the founders of VGT is still residing in the country. Perhaps, he is quite busy in traveling, and the name of Don Miller of the Land Use Consultant in Gisborne, New Zealand, is suggested to replace John Greenfield.

Papua New Guinea: Vetiver was introduced in 1997 in Simbu province and farmers quickly realized the potential of VGT. Only few months after planting, vetiver survived the severe drought in 1997. A booklet on VGT in Melanesian Pidgin was prepared and widely distributed, even to community schools (Shelton 1998).

Philippines: A national network, called Vetiver Network Philippines - VENETPHIL, has been established in December 1996, with Dr. Edwin Balbarino of the Farm Resource Management Institute, ViSCA, Baybay, Leyte as the National Coordinator. VENETPHIL publishes a quarterly English language newsletter (*Vetiveria)*, organized a few national workshops, and hosted an international meeting on "Ground and Water Bioengineering" in Manila, 19-21 Apr. 99. During this meeting, a short course on "VGT for Erosion and Sediment Control, Slop Stabilization and Environmental Protection" was offered to the participants. A field trip to observe VGT along the Famy-Infanta road, and to visit Vetiver Farm Inc, the main supplier of plant material to the Department of Highways and Public Works for this project. This is probably the world's first commercial farm for supplying vetiver planting material (see article "Commercial Propagation of Vetiver" in VETIVERIM 3:5-6, Jan. 98). See details in Dr. Balbarino's paper (PD-4/3).

Taiwan: Study on the application and research of vetiver grass has been made in Taiwan by Mr. Mr. Yue-Wen Wang, Department of Agronomy, National University of Taiwan who volunteers to act as the Country Representative for Taiwan. Presently he is working on germplasm collection and obtained 15 accessions from the US Germplasm Bank (Wang 1998).

Thailand: With full support from the Office of the Royal Development Projects Board (RDPB), Thailand is one of the most active national programs on vetiver. His

Majesty King Bhumibol Adulyadej has realized the urgency of the problem of land degradation caused by erosion. After careful consideration of the potential of vetiver grass, His Majesty adopted the idea of using vetiver for soil and water conservation and introduced a simple technology, first for the hilltribes on the highland of Northern Thailand, and later on all others who suffer from the same problem of soil erosion. His Majesty started to implement his concept in June 1991. The RDPB has been assigned to coordinate the R&D activities on vetiver in Thailand. Forty government and non-government agencies which are involved in vetiver activities are partially supported by budgets from the RDPB. A committee (named the Committee on the Development and Promotion for the Utilization of Vetiver – CODPUV) has been established under the administration of RDPB to coordinate all R&D activities of all agencies in Thailand working on vetiver in order to follow the policy set forth in the master plan and to evaluate the results obtained. Among the activities include organizing three national workshops and two international conferences, publishing a quarterly newsletter "Bhumivarin Anurak" (Soil/Water Conservation) and a number of documents, providing training and plant materials to scientists of neighboring countries (including Vietnam, Lao PDR, Myanmar, Philippines, etc.) (Chomchalow 1998). See details in Dr. Apichai Thirathorn's paper (PD-4/1).

Vanuatu: Jonathan Tomately (1999) is interested in using vetiver to deal with a broad and ever increasing range of environmental problems in a small island in Vanuatu. He has built a nursery to propagate vetiver and about to plant them in the field. He is asking for information and other helps from PRVN. Of late, Mr. Don Miller of the Land Use Consultant in New Zealand has suggested the name of Mr. Henry Kathecau, who is knowledgeable about vetiver in Vanuatu, to be the Country Representative of Vanuatu.

Vietnam: With a back up from an American, Ken Crismier, who volunteers to be the acting Country Representative, an active farmers' group has been set up to take care of the vetiver activities in Vietnam. Among these activities are: (i) Formal seminars organized in Hanoi, Vinh, and Saigon in January 1999, under the aegis of the Ministry of Agriculture (with Paul Truong and Diti Hengchaovanich as invited experts); (ii) Informal presentations wherever and whenever an opportunity has presented itself during Ken Crismier's three trips and four months in Vietnam in the past two years; (iii) Production of the documents: the "Green Book" in Vietnamese (5000 copies in first printing), and distributed to all seminar participants, along with a nice poster based on the green book cover, but localized for Viet Nam; 2000 copies of the "Green Book" and poster also distributed in Nghe An province; blue book (100 copies), TVN and PRVN newsletters, and PRVN research reports (all in English) distributed in small quantities to "likely prospects" (iv) A team of two persons from Nghe An province (province town is Vinh) visited Thailand for a week in late May and early June 1999 to see what is going on there (hosted by Thai vetiver people); they returned with a truckload of 12 varieties of vetiver, which have been planted at Vinh and are developing; recent brief report indicates most varieties are developing well; goal of these efforts at this location is for it to become a focal point for vetiver interest throughout Vietnam (Crismier 1999a and b). See details in Mr. Nguyen

Pacific Islands - Vanuatu - are exposed to intensified erosion due to increasing populations, over worked land and tourism. As a result major problems are emerging that effect land, water quantity and quality and the coral reefs. Low cost erosion control systems are needed for most of the South Pacific Islands. In this photo Don Miller from New Zealand has successfully established vetiver in a completely eroded gully. Resulting improved moisture conditions will enable local plants to establish. Phot credit: Don Miller.

EUROPEAN AND MEDITERRANEAN VETIVER NETWORK UNDER A MEDITERRANEAN CLIMATE

By Michael Pease. EMVN Coordinator, presented at the Second International Vetiver Conference, Thailand, January 2000

Coordination Background

The first introduction of a field application of Vetiver Grass Technology (VGT) to Europe probably occurred in 1994 through an EC-funded project that sought to determine its applicability under Mediterranean conditions. The project's managing agency was an Italian firm, Tecnagrind, and the General Manager, Ing. Marco Troglia, was appointed as The Vetiver Network's (TVN) Regional Coordinator. However, focus was limited to that area covered by the EC-funded project in Southern Spain and, with the close of the project, vetiver coordination diminished.

I am resident in Southern Portugal and have followed closely the development of VGT from its first introduction in India, some 15-20 years ago, through my close personal relationships with Dick Grimshaw. I am also a retiree agriculturalist from the World Bank and took over the role of Regional Coordinator in May 1997.

Regional Background

EMVN is one of the most recently formed regions within TVN. All the countries in the region lie to the north of the tropics and subtropics where VGT is most assured of successful application. The introduction of the technology to the region remains therefore somewhat exploratory for the time being. Those European countries within the region where VGT may have application range from Portugal's Açores in the Atlantic Ocean to Albania in the East and include, for instance, Cyprus and the Greek Islands. Potential for the use of VGT may lie in West Asia and the Middle East, particularly Turkey, Iran and Iraq. Along the Southern Mediterranean VGT may well have application in the countries of the Magreb, particularly Morocco and Tunisia. Vetiver has been grown for some time in Israel and Egypt but for its production of aromatic oil, not for soil stabilization.

Registration of EMVN

EMVN was established as a non-profit making Association, registered in Portugal, in November 1998. This was done with the intention of making EMVN more eligible for external financing as a European entity. However, to date, no financing other than that provided by TVN has been obtained though a financing proposal in EC funding format has been prepared.

Technology Dissemination and Communications

For a period in 1998 EMVN operated its own HomePage which was, in fact, little more than a mirror of the TVN WebSite. After one year this was discontinued in favour of a section within the centralised TVN WebSite. This is more cost-effective.

EMVN produced its first Newsletter in April 1999 and will produce a second in November. Newsletters are expected to be produced on a biannual basis thereafter.

National Coordinators within EMVN have been appointed for: Spain (Dr. Maria José Sanchez); Italy (Ing. Claudio Zarotti); Albania (Dr. Vangjo Kovaci) and; Morocco (Dr. Dale Rachmeler). It is hoped that National Coordinators will be able to disseminate the technology more effectively in the national language.

Strong e-mail communication links have been established in most countries within the region with much interest being expressed in the technology. Mainly this comes from private individuals rather than public bodies.

Country-by-Country Activity

Portugal a)Vetiver was first introduced into Portugal by Dr. Antonio Vasco de Mello in 1996 onto his property in north-central Portugal at a latitude of 39º 14' North. Dr. de Mello obtained his plants from Tony Tantum in South Africa and they are thriving despite the fact that his property experiences many days of frost during the winter and, probably, maximum cold of about -8º C. Dr. de Mello is using his vetiver to protect dam walls and to stabilise the banks of a heavily eroded water course that flows down a cultivated valley.

b)The Coordinator arranged additional importations, firstly a small demonstrational consignment donated by EcoGroup, Florida in November 1997 and then approximately 2,500 slips in March 1998 from Jano Labat of Vetiver Grass Stabilization, Chiredzi, Zimbabwe. Demand for plants was stimulated during seminars arranged by the Coordinator during Dr. Paul Truong's visit to Portugal and Spain in September 1998. As a result a further importation of some 3,500 slips was made, also from Jano Labat, in March 1999. Plants from these three importations went to: private individuals, commercial bodies, NGOs, government bodies such as the Department of Agriculture, Departments of the Environment in Municipal bodies and the University of the Açores.

c) In 1997 the Coordinator established a Multiplication Nursery on his property in Southern Portugal, 37º 7' N where, under intensive management the plants have performed well. Maximum low temperatures are about -5º C and mild frosts may occur on some 5-20 days in the year. Total precipitation is about 450 mm per annum with

some 5 months dry. With adequate water plants behave normally, reaching a height of some 2 meters and with active root growth. Multiplication rates are about 30:1 per annum.

Spain In 1994 an EC-funded project sought to determine the application of vetiver under Mediterranean conditions. The selected site was a steep slope of some 60% on an access road leading to a reservoir near Lorca (37º 42' N) in Murcia Region of Spain. The area has a harsh climate with precipitation of only some 300 mm per annum, 5-6 months dry and poor soils. Vetiver hedgerows were established at distances of approximately 1 meter vertical interval in two blocks of land with control blocks either side. Drip irrigation was provided for all plants during the first two years of establishment. Thereafter, within each block, three sections were defined receiving a) continued irrigation; b) reduced irrigation; and c) no irrigation. Since 1998, i.e. for the past two years, no maintenance or irrigation has been provided whatsoever. Nevertheless, the plants have survived well and the hedges are proving effective not only in controlling erosion but in providing a micro climate under which native species of plants have become established. Control blocks on either side show severe erosion with deep gullying and rilling.

Italy In Italy research work has been conducted on biomass production and salt tolerance by Dr. Vito Sardo at Catania University, Sicily. In 1998 a privately owned nursery located near Milano (45º, 25'N) established a holding of vetiver plants originating from the EC-funded project in Spain. Some plants have been distributed to a number of growers elsewhere in the country. Long-term performance under conditions of prolonged cold as experienced in more northerly regions has yet to be determined but initial results are not unexpectedly negative. The nursery is now being moved to near Pisa where climatic conditions will be much more favourable to vetiver production. Generally, within Italy, considerable interest has been expressed in VGT. The technology is likely to have considerable application particularly in the South.

Albania In 1997 the internationally financed Albanian Private Forestry Development Project imported plants produced by tissue culture from EcoGroup, Florida. The Coordinator visited the project in July 1999 and inspected all plantings. There is no doubt that vetiver has a role in certain localities where climatic conditions are suitable. However, in many locations winters are severe and vetiver would either not survive at all or, at best, would perform unsatisfactorily. The prime focus is to address problems of erosion on smallholdings. However, much could also be done within the bio-engineering context of stabilising steep slopes of roads, dams etc.

Other Countries VGT undoubtedly has potential application in such countries as Greece, Syria, Turkey, Morocco and the Spanish off-shore islands such as the Canaries. Expressions of interest have been received from the above mentioned but, to date, interest has not yet been translated into the introduction of plants.

Overview

General There is adequate indication from results of field applications, some of which were established nearly five years ago, that VGT has potential in many countries within EMVN, particularly in Southern Europe, Western Asia and countries bordering the Southern Mediterranean. This is reinforced by the climatic and pedologic parameters for effective vetiver hedgerow establishment under tropical and sub-tropical conditions which indicate that VGT would also be appropriate in many locations within EMVN. In Southern Europe it is probable that the most important immediate applications will be within a bio-engineering context, stabilising road and rail cuttings and embankments, protecting dams and reservoirs, controlling leachate on industrial and municipal landfills and protecting against erosion the landward side of erodable cliff-tops.

Climatic Factors Because of the less favourable growing conditions (cold winters and long hot summers) in many parts of EMVN, relative to tropical and sub-tropical regions, much emphasis needs to be placed on the known techniques for promoting early establishment. Also there is need for a better awareness that vetiver is no different from most other plants in that it requires management attention in the early years of its establishment following planting. For instance, regular watering, some fertiliser application and gap filling is important to early establishment of an effective vegetative barrier. Since it has been shown in Australia and China for example, that vetiver grass hedgerow barriers can be established on engineered slopes at about one tenth the cost of engineered means, e.g. gabions, gunite etc. it is still economic to provide water for the vetiver in its first two years of establishment even if this has to be transported.

Achnatherum splendens (jiji sao) Many countries or regions within EMVN have geographic and climatic limitations to the potential for establishment of vetiver grass due to prolonged and intense cold in winter. Jiji sao may well have application in some of these localities since, in China, it has been shown to have a much a higher tolerance to cold than vetiver. It would, therefore, be desirable to test Jiji sao in a number of locations within EMVN to determine its application where vetiver would be unsuitable.

Limitations on Expansion Availability of plants was a limitation on expansion but supplies are now available from within the region in Portugal, Spain and Italy. The

major problem to overcome is expansion of an understanding of the technology and potential of VGT. This requires finance which is currently limited to that provided by TVN. Some opposition, mainly from within academia, has arisen to the concept of introducing a 'new plant' that is seen as having potential risks of invasiveness and disease-spread. If the financial limitation was removed expansion of VGT usage within the region could be expected to result from the impact of seminars, demonstrations and personal visits.

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THE VETIVER NETWORK PHILIPPINES

Network Development December 1996 - 1999

By Dr. Edwin A. Balbarino
National Coordinator-VETINETPHIL, presented at the Second International Vetiver Conference, Thailand, January 2000

Introduction

The Vetiver Network-Philippines was officially established in the third quarter of 1997. I accepted the task to lead the network because I was confident that the movement could move forward based on the positive feedback of the Vetiver Grass Technology from VGT users. I had little doubts of the acceptability of the technology because I myself had personally used and evaluated the technology and is convince about its effectiveness in controlling erosion with minimal cost.

The idea of establishing a vetiver network for the Philippines was commendable. The network spearheaded an undertaking that successfully created awareness among individuals and organizations about a simple and cost-effective solution to soil resource problems. It assembled people with common interest of protecting the environment, saved the government millions of pesos in infrastructure projects, provided income sources of the people, and mobilized various sectors in combating a common foe—soil erosion. Today, the network has more than 500 members composed of farmers, researchers, extension workers, students, engineers, teachers, etc. and a number of agency collaborators who helped spread the technology nationwide.

This report covers the three years (December 1996 to December 1999) operation of the network. The funding was actually programmed for two years but the actual operation that generated substantial results lasted for 3 years.

The Network's Background

My first encounter with Vetiver grass was in early 1991 when I was assigned as Field Coordinator of an International Development Research Center (IDRC)-funded project entitled Upland Agriculture-Philippines. The main objective of the project, which started in 1990, was to test, adapt and promote technologies that would address the problem of soil erosion and soil nutrient depletion in the uplands which is the most extensive and most threatened ecosystem in the Philippines.

The Farm and Resource Management Institute (FARMI) — the implementing agency selected a pilot research site covering five upland villages in the municipality of Matalom, province of Leyte, Philippines. A study of the farming systems in these villages conducted by Tung Ly and Fatima Baliña (1990), revealed that farmers have developed their own technique to fight soil erosion called "kahon-kahon" or natural grass strips. However, the dominant grass species in the strips are not strong enough to hold the soil especially during heavy rains. The project in collaboration with farmers tried to improve the indigenous technology by searching for alternative grass species that is potentially superior than cogon (Imperata cylindrica) and other dominant native species in the grass strips.

Few months earlier, the project staff observed a grass species in another town planted by lowland rice farmers to stabilize the dikes. The farmers called the grass Mora which was confirmed later as vetiver. Farmers thought that Mora was not adaptable to the uplands. In January 1990, the first trial planting of Mora was done in Matalom to test its adaptability to acid infertile soil. A dry spell struck the area from February through May of the same year. When Mora survived this drought, its adaptability to the uplands and its drought-tolerance were confirmed.

The project invited 12 farmers from 3 villages to view a slide show on the vetiver grass technology. The slide set was obtained by FARMI from the vetiver network (TVN). The farmers were also brought to the testing field to observe the grass. The farmers signified their interest to try Mora as hedgerow species in their farms. The project provided some planting materials to interested farmers in one village. In the other two villages, the farmers secured the planting materials by themselves from nearby lowland areas. In June 1991 the farmers who have tried planting Mora numbered to 17. The farmers were requested by the project to monitor and give their evaluation of the grass.

Farmers' first VGT evaluation:

1. As hedgerows in the upland,

Mora seems to be stronger than cogon because it is deep-rooted.
2. Mora does not grow tall compared to legumenous shrubs and trees such as Glericidia, thus pruning may not be needed.
3. Less water can pass through the Mura hedgerows during heavy rains once they are already established.
4. Mora is better than cogon because its root growth is vertical while cogon has lateral roots which produce new shoots, hence more maintenance for cogon is needed.
5. Crops such as corn and upland rice planted near Mora hedgerow show better performance.
6. Mora has an expanded/dense crown which can serve as a physical barrier preventing soil and water to pass through.
7. Mora is favored over Gliricidia because the latter has laterally growing roots which interfere land preparation.
8. Mora contributes much to the control of topsoil erosion. The transported soil is accumulated along Mora hedges where it is trapped.
9. Mora can tolerate partial shading caused by ipil-ipil.

Farmers' evaluation after five years:

1. Mora is easy to plant with minimal maintenance.
2. Herbage deposited along the upper portion of the hedgerows help in trapping the soil during the rainy season. The herbage is also a good mulch for sweet potato.
3. Contour plots have leveled 3 years after planting Mora.
4. Mora grows in any type of soil. Mora planted in Anapogon (calcareous soil) and s grows very well.
5. Once established, it is not easily killed by cogon grass unlike other contour hedgerow species.
6. It does not grow anywhere except in the contour line where it is planted.
7. Mora is not effective unless A-frame is used in locating the contour line.
8. After 4 years of planting lines of Mora, the gullies are no visible.
9. Mora is a good windbreak of my upland rice and also serve as a nest for my hens.
10. In just few cropping seasons the effect of Mora in controlling soil erosion was already evident. I measured about 2 feet thick of soil trapped at the upper base of the hedges. Gullies were observed in the portion without Mora.
10. Mora survives long droughts. It regrows or produces roots at the nodes making it effective as contour riser stabilizer.
11. Corn planted near the Mora produced bigger ears than those near the Napier.

The Philippine Vetiver Network

The farmers positive feedback on Vetiver grass inspired the project staff to make VGT a major component of PARMI's Sustainable Upland Farming Program. With TVN's financial support, an easy to follow technology guide on VGT based on farmers experiences was published in English and in two local dialects. The technoguide was used as the basic GT instructional material for the institute's Soil and Water Conservation and Agroforestry projects. Perhaps TVN recognized this effort for few months later, Dick Grimshaw invited the coordinator to lead in the establishment of a vetiver network for the Philippines.

The Vetiver Network-Philippines (VETINETPHIL) was officially established on August 5, 1997 during the First Vetiver Conference-Workshop held at ViSCA, Baybay, Leyte. The network has more than 500 members at present and continues to attract students, researchers, farmers, extension workers, private and government organizations and other people who have interest in the Vetiver Grass Technology.

The VETINETPHIL Vision:

Soil erosion controlled, lands rehabilitated, and embankments stabilized in the Philippines through the Vetiver Grass Technology.

The VETINETPHIL Goal:

To promote the adoption of Vetiver Grass Technology (VGT) in the Philippines.

The VETINETPHIL Objectives:

1. To lead in the promotion of VGT in the Philippines.
2. To coordinate the VGT research, promotion and application projects of network members.
3. To assist in the establishment of members' vetiver production farms and nurseries and in marketing planting materials.
4. To support the implementation of environmental programs of the government and non-government organizations.

Strategy and Accomplishment

<u>The Vetiver Network Membership</u>. The Vetiver Network (TVN) provided the list of its members in the Philippines. Using the list, people were invited to attend the first Vetiver National Conference. Aside from the list, people who have known to have already engaged in vetiver works were also invited to the VETINETPHIL launching conference. The network now has more than 500 members who are directly or indirectly engaged in vetiver-related activities.

<u>Area Coordinators</u> To facilitate implementation and monitoring of VETINETPHIL activities, area

coordinators for the country's three main groups of islands were designated. The network has designated Ms. Noah Manarang of the Vetiver Farms Inc. to coordinate network activities for Luzon, Mr. Andy Obusa of FARMI for the Visayas and Mr. Jun Talpis of CARE-Philippines for Mindanao. Recently, Mr. Tanny Mobe was designated coordinator for Central Visayas due to the increased vetiver activities in the area. The area coordinators serve as the direct contact person in the area and will assist the national coordinator in carrying out activities and projects of the network.

Technology Demonstration As part of VETINETPHIL's extension strategy, it has set up 3 VGT technodemo and training centers. For agriculture, they are located in Inopacan, ViSCA campus and Matalom. The centers catered to farmer-to-farmer training on soil and water conservation and agroforestry. The Department of Agriculture also managed a technodemo farms in Kananga and Tacloban, both in Leyte Province.

A dozen farms in Western Leyte also served as demonstration farms and are usual destinations of cross site visits of farmers, extension workers and researchers from other areas. For infrastructure, he Department of Public Works and Highways has a demonstration project in Aklan province (in collaboration with the Vetiver Farms, Inc.), Infanta, Quezon and Baybay, Leyte. The Cebu Uniting for Sustainable Water (an NGO) also has vetiver-coco erosion net demonstration in Cebu, Central Visayas.

Training and Cross-site Visits In collaboration with the Farm and Re-source Management Insti-tute (FARMI) and other organizations, VETINET-PHIL offered farmer-to-farmer training on Soil and Water Conser-vation and Agroforestry. The network conducted a total of 7 trainings (72 technicians and farmer leaders) and cross-site visits of 6 groups of farmers and agricultural technicians from Visayas and Mindanao. Planting materials were distributed in both activities.

Extension Promotion Materials The network produced and distributed nationwide the Vetiver Technoguide in English and local dialects, the Vetiveria Newsletter, inserts to PRVN Vetiverim, Newsletter, the "Save our Soil: Use Vetiver" poster, and the Vetiver Grass Technology in the Philippines colored booklet. It also produced posters for presentation in conferences and symposia, stickers and some advertisement and articles in different print media in the Philippines. It also modified the Vetiver slide story now with audio tape. VETINETPHIL members also produced video on "Vetiver Nursery Establishment" by Noah Manarang of Vetiver Farms Inc. and vetiver brochures/leaflets by the Environmental Research and Development Bureau of the Cordillera Autonomous Region, Baguio City. The network has also produced and aired VGT technology tips at DYAC radio at ViSCA. About 20 members communicated using E-mails/internet.

Conferences, Workshops and Technical Assistance The network has sponsored 3 national conference-workshops and con-ducted a dozen of local meetings. It also presented papers and posters in international, national and local symposia. As part of VGT promotional strategy, the network offered free technical assistance to various government and non-government projects (agriculture, agroforestry, infrastructure, etc.) in different parts of the country. As a result, VGT has been integrated in various government programs like the Hillyland Research and Development Program of the Agriculture and Fishery Modernization Act (AFMA) and in various NGOs' upland development projects. The network also took part in the offering of vetiver short course during the Bioengineering Conference in Manila in April 1999.

Production Farms and Nurseries The network's VGT promotional effort has resulted to the increased in demand of planting materials either bagged or fresh tillers. VETINETPHIL encourages members to produce vetiver planting materials for big time users. Now it has more than 30 farmers engaged in the production of planting materials for the market. Most of these farmers maintained farms with vetiver hedgerows. The Provincial of Agriculture Office in Leyte has also ordered all its municipal agriculturists to establish vetiver propagation plots.

The network has maintained its own production farm and nursery to supply free planting materials to farmers, friends, NGOs, people's organizations, government projects, and members who want to use VGT or start a production project. The network's nursery also serves as the farmer-members collection area of tillers for the market.

There are member - NGOs who have commercialized the production and marketing of vetiver planting materials. Example of these are the Green Gold in Ozamiz, Mindanao; PEOPLE in Ormoc, MAFUD in Leyte, CUSW in Cebu and many more. But the biggest suppliers of planting materials are the private farms/firms which are capable of producing millions of planting materials in one production cycle. The number one producer of vetiver planting materials in the Philippines today is the Vetiver Farm Inc., which was set up entirely on a commercial basis to supply planting materials and promote VGT throughout the country. Another future big supplier is the FF Cruz Corporation in Central Luzon who set up a 10-hectare production farm in Nueva Ecija. The firm propagates vetiver for its Ambuklao Dam and coastal road projects and for other users.

Collaboration and Linkages The following are the agency/organization collaborators of

VETINETPHIL in the Philippines. Collaborators' projects include planting material production and marketing, pro-motion, demonstration, publication, research and application of VGT:

Department of Public Works and Highways (DPWH) - VGT application and demonstration.

Department of Agriculture (DA) - Vetiver production and training.

Philippine Coconut Authority (PCA) - VGT application in special projects.

Local Government Units (LGU) - VGT application in pilot sites and farmer-to-farmer SWC training.

Department of Environment and Natural Resources (DENR) - Vetiver research and application.

Central Luzon State University (CLSU) - Vetiver research, application and demonstration.

Visayas State College of Agriculture (ViSCA)-Vetiver research, training and extension.

Department of Tourism (DOT) - VGT application in hilly ecoparks.

Department of Agrarian Reform (DAR) - VGT application in ARC SWC projects.

National Irrigation Administration (NIA) - VGT Application and demonstration.

Government Special/Bilateral Projects.

Presidential Commission for Tagaytay-Taal- Promotion of VGT.

National Integrated Protected Areas Programme (NIPAP) - VGT application and promotion.

Western Samar Agricultural Resources Development Programme (WESAMAR) - VGT application in upland development projects.

Small Islands Agricultural Support Services Programme (SMISLE)-VGT application in upland farms and irrigation projects.

International Institute for Rural Reconstruction (IIRR) - Training and publication.

Forage for Small Holders Project (CIAT-FSP) - VGT application in hilly forage production farms.

ICRAF-Mindanao - Vetiver research.

SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA) - Vetiver research and application in project sites in Mindanao.

Fallow Management-Philippines (FMP) - Soil management research.

Conservation Farming in the Tropical Uplands (CFTU) - Research and extension.

CARE-Philippines - VGT application.

DOLE-Philippines - VGT application in banana and pineapple plantation.

First Worldwide Marketing Corporation - VGT application in Golf Course.

FF Cruz Corporation Inc. - Vetiver production and application.

Juboken Enterprises - VGT demonstration, research and production.

Woodland Development Corporation - VGT application.

ST Hidalgo Construction - VGT highway application.

MRC ALLIED Industries Inc. - VGT application in EPZA sites and publication.

Mag-uugmad Foundation Incorporated (MFI) - VGT application, promotion and planting material production.

Ramon Aboitiz Foundation, Inc. (RAFI) - VGT application and publication.

PEOPLE Foundation Inc. - VGT planting materials production.

PHILDRAA-Philippines - VGT application and collaborator of SWC-Vetiver training.

WELFARE-Leyte - VGT application and promotion in upland development projects

AWESOME-Mindanao - VGT application, promotion and publication.

Soil and Water Conservation Foundation - VGT application, promotion and publication.

Cebu Uniting for Sustainable Water (CUSW - VGT demonstration/promotion, publication and planting materials production.

Vetiver Research

Besides studies conducted by the network members, VETINETPHIL also supported some studies conducted by university students. The following are the completed studies:

1. Communication Environment and Information Gaps On Vetiver Grass Technology Among Upland Farmers in Bilar, Bohol
2. The Physico-Chemical Properties of the Rhizosphere Soil of Vetiver Grass Growing in Degraded Uplands
3. Effects of Nitrogen Fertilizer Application on the Growth of Vetiver Grass planted in 3 Soil Types

Problems Met

The most important problem met was the failure of the coordinator to visit more members' projects/activities due to time constraints and the location of members. Only very few members have access to the internet so communication is still done the conventional means. Majority of the members are not replying letters and network requests.

Summary and Conclusion

The following could be considered important elements that contributed to the successful promotion of VGT in the Philippines:

1. Multimedia promotion and extension system. The network used various extension methods from conventional training and visit method to high technology using the internet, videos and CD.
2. Active area coordinators. The coordinators contributed much in running the network

particularly in promoting the vetiver grass technology.

3. Commercialization of Vetiver grass. The commercialization of vetiver grass has helped create awareness and interest among the big time VGT users.
4. Participation of the private sector. The private sector played an important role in the promotion and marketing of VGT and in the production of planting materials.
5. Financial support. The availability of funds was very crucial in running the network particularly at the earlier stage of the project. Member organizations have recently started supporting some of the activities of the network.
6. Communication facilities. The communication facilities and computer system provided by TVN were indispensable in the day to day operation of the network.

The conservation and protection of our soil and water resources are very crucial towards sustainable agricultural production and the enhancement of environmental quality The unmitigated soil erosion brought about by agricultural activities, road construction, mining and water resources development among others necessitates immediate remedial action. Carrying out this urgent task requires adoption of the Vetiver Grass Technology in a national scale. The birth of the Vetiver Network-Philippines was very significant in the promotion of the technology in the Philippines.

The spread of the VGT in the Philippines in the past 3 years has been considered remarkable by TVN leaders. There are various factors that contributed to this success, one of which is the participation of the private sector. The VETINETPHIL and its partner organizations will continue its aggressive promotion of the VGT and will exerts all efforts to assure massive adoption of the technology in the early years of the new millennium.

PROMOTION OF VETIVER GRASS TECHNOLOGY IN THE PHILIPPINES: VETFARMS INC. Experience

Mary Noah S.J. Manarang
Vetiver Farms, Inc. Quezon City, Philippines, presented at the SecondInternationalVetiver Conference,Thailand, January 2000

Introduction

In December 1994, the author was among the three Philippine delegates chosen to be part of an observation tour on vetiver grass in Thailand. As Project Development Officer of the Department of Environment and Natural Resources (DENR), the author was sponsored by the Royal Development Projects Board of Thailand to a two-week study tour and training on the grass. She was able to visit sites where vetiver was widely used and propagated. The sites included Huai Hong Khrai Royal Development Study Center in Chiang Mai Province; the Doi Tung Development Project in Chiang Rai Province; Huai Sai Royal Development Study Center in Petchaburi Province; the Chaipattana-Mae Fah Luang Reforestation Project at Nong Phlap, Hua Hin District in Prachuap Khiri Khan Province; the Khao Cha-ngum Rehabilitation Project in Ratchaburi Province; and the vetiver nursery of the Land Development Regional Office 10, Ratchaburi Province. The lessons learned from these project sites were the basis of the author's effort in promoting vetiver.

Initial Research and Trials

Back in the Philippines, the author started researching and sourcing vetiver in the Philippines. Some samples from Rizal and Bulacan province were taken and propagated in the nursery of DENR and the author's experimental nursery in Pampanga. Vetiver was planted in various media in polybags to test its growth properties. From this small stock of mother plants, the author started propagation in 4 x 6" polybags as being done with tree seedlings. Aside from this, tissue cultured vetiver plants were sent to the author. The tissue culture samples came from the laboratory in Chiang Mai Province.

Promotion Through Extension Work

As there was no vetiver program at that time, the author together with her DENR colleague (Ms. Ernestina F. Jose) promoted the grass and did extension work with various sectors on their own.

Dove Foundation

One of the extension work done was a presentation with the Dove Foundation. The foundation is involved with providing livelihood program to the victims of the Mount Pinatubo eruption. Sample seedlings were given out to the communities for planting in their resettlement area.

Palawan Foundation

Vetiver seedlings were given at cost to the Bagong Pag-Asa Foundation for use in their Sloping Agricultural Land Technology (SALT) farming.

Vetiver Network - Philippines

One of the most important extension work done was the author's linkage with Vetiver Network — Philippines (VETINETPHIL). The author was invited to join the network to share her experiences and methodology in propagation of the vetiver seedlings. A propagation guide was included in the different publications of the network. The author was also

appointed as the coordinator for Luzon of the network. The author presented in the First Vetiver Workshop held in Ormoc, Leyte.

Academe

Vetiver Farms, Inc. believes that environmental education should be done at all levels in school. In line with this, the company did extension work with academic institutions and students.

Ateneo De Manila University

In the second quarter of 1998, Vetiver Farms, Inc. initiated talks with Ateneo de Manila University regarding research work to be done on vetiver by students and faculty. Vetiver Farms, Inc introduced the plant and its applications to the faculty of the department. These talks resulted in Vetiver Farms, Inc donating vetiver slips to be planted around the newly constructed Science Education Complex which has slope surrounding the whole building.

The Science Education Center, **Ateneo de Manila University*:*** The slopes around the SEC Building protected by vetiver hedgerows. Vetiver blended well with the carabao grass and the building's landscape. Several students initiated mini-projects studying the biology of vetiver.

Student Projects*:* Some of the student projects included:

- Effects of *Vetiveria zizanoiodes* leaf extracts on the red blood cell counts of *Mus musculus.*
- Assessment of anti-inflanunatory activity of *Vetiveria zizanoiodes* extracts on the paw of Sprague-Dawley rats.
- Effects Comparative effects of *Vetiveria zizanoiodes* extract, adrenalin and nitroglycerin on the diameter of rabbit ear meta-arterioles.
- Insect populations leaving near and around *Vetiveria zizanoiodes* hedges.

Some graduate student, also, did a thesis on the morpho-anatomy of vetiver (histological studies on the root anatomy of *Vetiveria zizanoides)*

Live and Learn Study Center

The Prep 1 class of Live and Learn Study center was brought to the nursery on a field trip. The students were shown the different stages of the vetivers growth in the nursery. They were taught the importance of the vetiver grass to our environment. The students took part in the propagation of the grass with VetFarms farmers.

Vetiver Farms

With the little publicity from its extension work, the experimental nursery soon became a commercial operation. In the course of promoting vetiver, the author saw the major flaw of making the technology accepted and successful and this is the lack of supply. As people are beginning to take notice of what this grass can do, replicating its success in Thailand was difficult simply because there were no available quality seedlings to be used in big projects. It was at this point that the author realized that a key to the technology's success is to make the seedlings available. This can only be achieved through its commercialization.

It was difficult to convince farmers also to plant the grass in their farms because do not see any economical benefits from it. There is also this misconception that vetiver is actually a weed and it would compete with the crops that they are planting. After a period of research and trials, the author's nursery then called L and N Farms was able to come up with an easy and practical propagation method which is ideal for volume production of uniform sized, quality seedlings. The lessons learned in the Thailand study tour was valuable in this propagation trials. With vetiver seeds being sterile, commercial propagation of the grass became a challenging task. After four years of Vetiver Farms, Inc. now boasts six nurseries with the capacity of producing five million seedlings a month. The satellite nurseries are located in different provinces all over the Philippines such as Pampanga, Iloilo, Laguna, and Cavite, and Antipolo.

Promotions and Marketing Strategy

The VGT has a niche market so to speak, thus there is not much need for conventional advertisement. Instead, VetFarms believes in bringing the technology directly to the sector that needs it. Identifying the potential users of this technology, VetFarms provided these groups with information material regarding the use of vetiver to their specific application. This saves the company a lot, which makes our seedlings very affordable. Visual presentation through video and power point were done to show the characteristics of the grass and our successful projects. So, to further the interest of the people, Vetfarms launched its own information campaign, starting with the construction of its own webpage. Designed to make, not only the company but also the technology, known to as many as it can reach, VetFarms' webpage is the first step to its worldwide information campaign (www.vetiver.com.ph). Vetiver Farms, Inc. was also featured in leading newspapers (Annex A). The Business Friday section of the Philippine Daily Inquirer on 16 July and 17 September chronicled the beginnings of the company and its marketing strategies to promote VGT. The accounts presented were testimonies of the author's efforts to promote VGT in the Philippines. In the last issue of the Manila Times on 23 July1999, VetFarms became part of history. In this report, vetiver was given recognition for its applications in preventing soil erosion.

The company has also

been featured in international television broadcast. ABS-CBN featured VetFarms in its program "The Global Filipino" which features successful Filipinos in the field of business. The program was beamed in different countries such as the USA, Australia, Hong Kong and the Middle East (Annex B).

Effects of Promotion

Private Sector: The response to the promotion efforts by the author and VetFarms Inc. are very encouraging. In the last five years, VetFarms has done more than 30 major vetiver application projects all over the country. Most of these projects are for private industries and corporations who risked using the vetiver technology for their different environmental applications. It has elicited response even from remote places (Annex C). Tagaytay Highlands/Midlands Project before (left) and after (right) Government Agencies.

The Department of Environment and Natural Resources: A presentation about the VGT to former Secretary Victor 0. Ramos got very good feedback and results. The DENR has been recommending the use of vetiver grass for soil erosion control and slope stabilization in their Environmental Compliance Certificates (Annex D). Being a regulatory tool, major development projects, which involves earth moving/clearing activities are required to use vetiver in "revegetating" the affected areas. The Secretary was also planning to put up a nationwide vetiver nursery through its provincial offices during his term.

The author and Vetfarms representatives during a presentation with (DENR) Secretary Victor 0. Ramos, the Department of Public Works (DPWH). VetFarms is one of the biggest suppliers of vetiver seedlings to the DPWH. The Department has used vetiver successfully protecting slopes in their road projects mostly in the southern part of the Philippines. Although there was skepticism about the technology in the beginning, the officials and field engineers of the DPWH are now convinced of its effectiveness as compared to the conventional riprap and stone walls. The most notable project is the Kalibo-Caticlan road project in Panay Island. This project being situated on a national highway leading to the world-famous Boracay beach, has attracted a lot of attention from both the locals and foreigners. This actually served as a model of vetivers success in protecting slopes ~ people who got in touch with as after seeing the project. Aside from its effectiveness, vetiver hedgerows are about 60% cheaper than the conventional engineering methods being used before. Kalibo-Caticlan Road (L-Before and RAfter)

Handicrafts Industries: Local exporters of handicrafts have signified their interest to utilize the leaves and the roots for their products. Although most of them know that vetiver leaves and roots make beautiful baskets, mats and ornaments, it did not really prosper as they do not know where to get the raw materials. Through our promotion, they are now willing to experiment and manufacture more products out of vetiver, knowing that the raw materials are available. VetFarms is now linking with manufacturers for possible collaboration on production of different export products, which will create new job opportunities.

Export Products Made from Vetiver Roots Featured at CITEM Fair

Peoples Organization and Cooperatives Inquiries regarding the subcontracting scheme of the company are far too many. The idea of the buyback scheme for our propagation is very attractive to groups and communities. This is because it provides them livelihood without leaving their home and their children behind. This scheme has served as a model to other project undertakings specially those which are agricultural in nature.

Future Plans

VetFarms is currently doing a lot of research, in the use of various parts of the grass for livelihood projects. The company would like to see more farmers benefiting from the grass and its myriad of uses. Further promotions through information, education, and communication campaign to farmers and policy makers is a major thrust of the company. VetFarms plans to publish a book of its experiences, the lessons learned from promoting and using vetiver grass in different projects.

Conclusion

The Philippines is an agricultural country, and the potential for vetiver to be a major agricultural product is very promising. With the frequent typhoons and flooding, its use for soil erosion control and slope protection are the ones being popularly utilized at the moment. But the other application of the grass and its by-products are many and are yet to be explored. Because of its resiliency to different weather and soil conditions, vetiver can be a tool for poverty alleviation for people in the countryside where crops are often destroyed by pest and typhoon. VetFarms nurseries alone provide livelihood to no less than 100 families. During the difficult period of El Nino, vetiver propagation was the only activity in the fields of Pampanga for there were no irrigation for the rice fields. The women are now cutting off the leaves of mature plants for drying for roofing materials and for handicraft manufacturers. Thus, the promotion of the grass and its numerous uses should be done both at the grassroots level and at the policy-making level. The potential is there, and it just needs to be tapped. Information about its use is essential and both the government and private sector should pursue promoting it together.

His Majesty King Bhumibol Adulyadej's project through the Royal Development Projects Board, sponsoring people from other coun-

tries to the vetiver study tour program is an effective tool of promoting the grass to the different parts of the world. If every participant to the study tour embarks on a vetiver promotion program in his/her country, the VGT will benefit a lot of people. The author's and Vetfarms modest accomplishments in promoting vetiver in the Philippines, is the product of this study tour, which is truly educational and inspiring. This benevolent project should be continued, and if possible replicated.

DISASTER MITIGATION AND VULNERABILITY REDUCTION: PERSPECTIVES ON THE PROSPECTS OF VETIVER GRASS TECHNOLOGY

James Smyle, Natural Resources Specialist, Regional Unit For Technical Assistance, World Bank, San José, Costa Rica .
Paper presented at the Second International Vetiver Conference Thailand, January 2000

I. INTRODUCTION

The region of Central America occupies an area comparable in size to Thailand. Its 32 million inhabitants live within the 7 nations of which the region is comprised: Guatemala, Belize, El Salvador, Honduras, Nicaragua, Costa Rica and Panama. In general, the countries have mountainous interiors surrounded by coastal plains. On the path to urbanization, the population is still predominantly rural and poor. Agriculture remains the main source of livelihood, employment and, generally, the dominant economic sector.

In the last days of October 1998 Hurricane Mitch, the most intense storm in the Atlantic Basin in the past 200 years and the most destructive hurricane in the history of the western hemisphere (1), battered the Caribbean coast and parts of Honduras, Nicaragua, El Salvador, and Guatemala. From October 27, 1998, to November 1, 1998, it dumped from 300 to 1900 mm of rain on large areas of the four countries. The storm produced sustained wind speeds of 290+ kilometers hr^{-1} and rainfall intensities of more than 100 mm hr^{-1}. The main destruction resulted from the intense rainfall.

The storm's arrival at the end of the rainy season guaranteed maximum damage. In the weeks prior to its arrival, there had been significant rainfall. Soils tended to be at or near their water-holding capacity. The spring/summer crops were at the point of harvest and the summer/fall cropping cycle was beginning.

Summary Of Hurricane Damage

Severe flooding and landslides were widespread throughout the region More than 9,000 people were killed. Over 2,000,000 people were left homeless. Much of the transportation and communications infrastructure of Honduras and Nicaragua was devastated. Towers and bridges were destroyed and roads were lost to landsliding or washed away by floods. In Nicaragua, the rain-saturated southern slopes of the Volcano Casitas gave way and mudslides reached the town of Posoltega, almost 10 miles away. In nearby communities some 1,900 people were killed due to mudslides. In Tegucigalpa, the mountainous capital city of Honduras, a landslide blocked the main channel of the principle river. When the dammed river finally broke through, the flood peak washed away entire neighborhoods; raging currents undercut city hillsides, bringing other neighborhoods crashing into the flood waters.

The dimension of damage to the region was (and is) huge. The

Thailand. Vetiver and water. A river levee stabilzed with vetiver grass. The stabilization was fully effective, and when over topped by flooding was completely stable. Photo Credit: Dick Grimshaw.

Central American commercial corridor, about 90 percent dependant on road transport, was blocked; intra-regional commerce came almost to a halt. The indirect economic losses ran into the hundreds of millions of US dollars. Of the estimated US$6 billion in direct and indirect losses, about 50 percent were from the agricultural sector. Flooding, landsliding and sediment inundation primarily affected banana, melon, pineapple, coffee, basic grain and other subsistence crops, and sugar cane; shrimp farms in Honduras were particularly hard hit. Literally tens of thousands of hectares of the region's best agricultural lands were damaged or destroyed; washed away, carried away by landslides, or inundated under deep layers of rock or coarse or sandy sediments.

The deposition of massive amounts of sediments within river courses has caused radical changes in fluvial morphology and hydrology of many catchments. The hydraulic capacity of the river systems have been drastically reduced. In a substantial number of areas, it is unclear where the current (and future) channels of major rivers are located. In the steep upper watersheds, slope instabilities were activated due to soil saturation. Risks of future flooding and landsliding have greatly increased. This year's rainy season, wetter than normal, resulted in widespread flooding in the cities of the Caribbean coastal plains and landsliding has continued.

Viewpoint of Disaster Specialists

As the true picture of the impacts began to emerge, an explanation was sought to explain what happened and why the impacts were so severe. In addition to the understanding that the disaster was the result of a natural phenomena of extreme magnitude, much attention was focused on the potential role that deforestation and hillslope farming in upper watersheds had played in "causing" or worsening the impacts of the devastating floods. In a real sense, this became the most high profile issue in the months following. The media focused on how "…*it seems that Hurricane Mitch has been far more deadly than it need to have been, just because the forests were no longer there"* (2). Government and foreign donor agencies publicly agreed that "*the effects of Hurricane Mitch have been increased…in particular [by] the deforestation of forests and wetlands that act as "buffer" systems diminishing the surface run-off in the case of such intense rains as those experienced during Mitch*" and that *"flooding was aggravated by a lack of adequate watershed management"* (3).

In parallel to this more public analysis, international experts in disaster mitigation and vulnerability reduction were assisting to diagnose what had happened and what needed to be done. Radar imagery of flooded areas, overlain on geologic maps, showed that Mitch flooded those areas which are underlain by Quaternary sediments, i.e., those soils formed in areas naturally subject to flooding. Damage assessments increasingly tended to place less emphasis on upper watersheds and deforestation *per* se and more on the broader issues of:

- Human mismanagement - *"The risks posed by natural hazards in Central America are exacerbated by social and environmental trends such as rapid urbanization and unplanned human settlements, poorly engineered construction, lack of adequate infrastructure, poverty, and inadequate environmental practices such as deforestation and land degradation"* (4).
- Human encroachment into vulnerable areas - "*People die, are injured or lose their homes in natural disasters because they continue to build and live in unsafe structures and in vulnerable locations…*" (5).
- Social vulnerability and poverty - "*Those in poverty typically do not have access to arable and safe land. Instead, they live and farm on marginalized areas, such as floodplains and steep slopes, maximizing their exposure to the next disaster, fueling the vicious cycle*" (5).

The conclusions were inescapable, the disaster that occurred was not a 'natural phenomena'. Or, as put by two anonymous disaster professionals: "*Disasters are unresolved problems of development"* and *"Disasters are indications that we have not yet learned to live where we are living".* Final estimates placed between 50% and 75% of the economic losses from Hurricane Mitch as having resulted from inadequate design and siting of housing, roads, bridges, and industry (4).

What Was Potentially Avoidable?

Following these conclusions, flowed a long series of recommendations of how to avoid, mitigate, and reduce impacts from future disasters. To those working in areas related to natural resource management, civil engineering or rural development, not surprisingly, the majority of their recommendations consisted of things which have been recommended on an almost daily basis as being "good practice". Indeed, most were basic elements of watershed management and have been a part of the development agenda for decades. Unfortunately, they are also basic elements that tend to be ignored.

We know that good watershed management requires consideration of the many issues that fundamentally influence how humans use natural resources: political, socio-economic, institutional, scientific, technical, community, legislative, regulatory framework, economic incentives, etc., – and as such, is extremely complex. However, despite the complexity, in each

of these areas one eventually has to come down to: (i) getting the objectives right and, (ii) ensuring that you have appropriate and affordable tools in order to achieve those objectives.

In the specific case of Hurricane Mitch, the lessons learned seemed to point out four main "objectives" that should have been pursued prior to the hurricane in order to have reduced or avoided the much of the human tragedy and economic losses. At the risk of oversimplifying, these were:

® *Minimize encroachment into flood plains and other elements of the natural drainage patterns, and areas subject to mass movements of earth* – Urban, commercial and industrial encroachment into these areas resulted in the greatest losses of human life and of high value infrastructure and environmental contamination (toxic and hazardous substances washed into rivers).

® *Ensure proper design and construction of transport network* – In Honduras, access and transport were returned to pre-1900 conditions. The majority of road and bridge damage and losses were ascribed to poor design, shoddy construction, and inattention to stabilization during the construction phase.

® *Ensure the adequate protection and proper maintenance of key roads and access points* – Lifeline roads and critical access link points were destroyed, leaving large populations isolated and endangered and the country's and affected region's economic activities were brought almost to a halt.

® *Assist rural households to adequately protect their production systems and housing sites* – The main economic losses took place in valley agriculture and were a direct result of massive flooding. In the uplands, the main economic impacts were in coffee; thousands of hectares of coffee plantations were lost to landsliding. Large indirect losses occurred due to loss of market access roads, forcing producers to leave crops in the field. Smallholder subsistence agriculturalists (the majority of farmers) were extremely hard hit by landsliding, flood torrents carrying away their best streamside lands, extreme soil losses from torrential rains, and loss of crops in the field. These latter's losses barely enter into the official loss figures. Even with tens of thousands of poor households losing almost everything (house, land, crops), having very little to lose, their losses figured very little in the macro calculations.

The Aftermath. What Needs To Be Done ?

According to the disaster specialists the issue now is not "*reconstruction*", rather it is "*development in the new context created by the last disaster*". From a watershed management perspective, the main challenges in this *"new context"* seem to involve:

® *Mass wasting* – especially within and near urban or other populated zones where large scale landsliding has left behind slide zones subject to further landsliding (at head of slide zones), shearing and collapse (along sides of slide zones) and unconsolidated and unstable debris slopes.

® *Shallow slips* - similar to, but much more numerous than, the deeper and larger landslides. Their occurrence is highly correlated with roads and deforested hillslopes. In the most vulnerable upper watersheds of Honduras, where the United States Geologic Survey found occurrences of up to 100 landslides per km^2, preliminary estimates associated some 50% or more of landsliding with the road system and roadcuts.

® *Sediment storage in stream system* – massive quantities of sediments were mobilized by Mitch, and in some cases river beds were raised as much as 10 meters. Vast quantities of sediments are now stored within and near stream channels. Over the coming years, these sediments will be "flushed" through the watershed, and eventually, out to sea. This virtually guarantees continued channel aggradation (raising of stream bottoms due to sediment deposition) with associated localized flooding, and resilting of dredged irrigation canals and river sections for many more years.

® "*Where's the stream channel?*" – river channels are now many times wider than previous to Mitch. In some of the principle rivers, where channels were less than 50 meters wide, they are now over a kilometer wide. No one knows where the new river channel might eventually be located. This certainly complicates the siting and construction of bridges, rebuilding of affected urban areas, reestablishment of agriculture, development of water supply systems, and numerous other activities.

® *Sediment inundation* - while some benefitted, as evidenced by the record melon crops in southern Honduras this year, this was not true for all. Substantial areas of the best lowland agricultural lands have been buried under a meter or more of coarse and sandy sediments whose productive potential is extremely low.

® *Not all future risk can be avoided in new construction* - Roads will still have to go

through the mountains, within slide prone and unstable areas. Homes will be built in unsuitable areas because the owner has no other option. Eventually the bridges must cross the rivers and building extra kilometers of road cannot always be justified in order to cross at the best possible bridge sites.

® Danger zones and encroachment - extraordinary efforts are under way to identify areas which are vulnerable and at risk. Land use planning and development of new restrictions and zoning ordinances are underway. At the same time the poor are moving back into the same zones from which they were expelled by flooding and landslides.

II. Where does vetiver grass technology fit in ?

If the challenge is to bring about development in the new context left after Hurricane Mitch while ensuring that the hundreds of millions of dollars of official aid transfers coming into the region are used to best advantage, then certainly VGT has a role to play. This fact is underscored by VGT having been specifically identified as a key technology for post-Mitch construction by the World Bank, the US Army Corps of Engineers, the Interamerican Development Bank, the United States Agency For International Development, CARE International, Chiquita Brands and Tela Railroad Company among others. Also, Mitch finally began to create interest in VGT among the Costa Rican, Nicaraguan, and the Honduran Ministries of Transport. In El Salvador, the work by NOBS Anti-erosion had already ensured that their country's transport and infrastructure ministry was aware of VGT and seeing it applied. In addition, to promote the use of VGT in post-Mitch construction, the World Bank provided the Regional Unit for Technical Assistance and the Latin American Vetiver Network a "knowledge management grant". The grant's purpose was to educate key actors and decision makers in the post-Mitch construction (government, donors, and private sector) as to the potential, the benefits and the means to go about incorporating vetiver grass technology as a low cost, proven, bioengineering approach for infrastructure and watershed stabilization.

All that is good. But there is also very limited experience in Central America with the use of VGT, relative to the size of the job ahead. Also, misuse or overselling of VGT can not only result in discrediting the approach, it can also put at risk human lives and high dollar investments. Recently, in a workshop on watershed management in Honduras, an experienced field man spoke up, saying: "*We need to systematize our approaches…I am tired of being told 'use vetiver grass' when my problem is something like an actively cutting gully which is 5 meter deep and 30 meter wide gully"*. From this perspective, a brief review of for what VGT might be good, and possibly not so good is in order.

For What Might VGT Be Good?

What are the uses and limits for VGT ? A number of aspects are worth noting:

® *Stabilizing soil and slopes* – We know from the work of Diti Hengchaovanich (6) and others (7,8,9) that vetiver's root system is excellent for stabilizing soils. The tensile strength of its roots are high ($^1/_6$ the strength of mild steel) and its massive root system greatly increases soil shear strength. Its roots penetrate deeply, even through restricting layers. Its light weight and low wind profile avoid problems associated with greater stress loading on the slope. In terms of limits, while the roots may penetrate 3 to 5 meters, in fact the greatest mass of the root system tends to occur within the top one meter or so. As a result, if shear faces or potential failure zones are at a depth below the 'effective' depth of the root system, VGT will be ineffective in soil and slope stabilization. If you are going to bet your life or investment on VGT's ability to stabilize a slope, it would probably be best not to bet on it if the potential failures are likely to occur more than one meter below the surface.

® *Trapping sediments* - Quite a bit of work has been done (11) on these aspects, including recent (12) studies in Honduras which showed that traditional slash-and-burn sites average 92 tons/ha/year of soil loss compared to 43 tons/ha/yr with crop residues and a "green mulch" cover crop compared to 0.9 tons/ha/year on sites with vetiver grass barriers and the crop residue/mulch. We know it is efficient. We know less about how well or rapidly vetiver can recover from sediment inundation. In Louisiana in the southern US, for example, vetiver barriers were able to trap more than 50cm of sandy sediments in less than one year and continue to grow up through them and maintain a reasonably dense barrier. But, we also know (personal communication, J. Hellin) that in Honduras "*landslides destroyed a number of control plots AND [vetiver] barrier plots [i.e the barriers were washed away]. However, deep-seated landslides only originated on the steep slopes [65-75%]. On the shallow slopes [35-45%] the damage arose from debris from landslides which originated on steeper slopes above and outside the re-*

search site. In the case of the damage on the shallow slopes, much maize was lost but the vetiver grass, although covered by several inches of debris, survived". On this particular aspect, we have no useful rules of thumb, and any rules would vary based on the growth rate of the plants (a function of climate, substrate fertility, available sunlight, weed competition, etc.). To be safe, under conditions where vetiver could be characterized as "growing well", you probably would not want to rely on hedges to trap more than an average between 40 and 60cm a year or that they would recover from a complete burial of more than a few centimeters (10? 20? 30?). For extreme events (e.g., shallow landslides), the expected role of the hedges would probably not be one of trapping sediments *per se*, rather of stabilizing the slope and reducing the occurrence of shallow slips and hydrostatic blowouts.

® *Reducing runoff velocities* – Flume studies in the USA (13) and flume and field studies in Australia (14) have shown vetiver hedges to be very effective at reducing total head (flow depth and velocity) of water flows. The hedge's effectiveness at doing so increases with hedge thickness (maturity). Little information is available to tell us about vetiver's effect on total head across a range of slope conditions and flow conditions, especially with turbulent flows. However, it appears that mature hedges can be quite effective at reducing runoff velocities of flows less than 20cm in depth, moderately effective with flows up to 35 or 40 cm, and have some impact on flows up to possibly 60 to 80cm. The important points here are, if the objective is to reduce runoff velocities, that: (i) first it is required that a reasonably dense hedge be established in order to be effective, (ii) that the design flows for which effectiveness might be expected are more likely to be on the order of 5 to 20 year events (versus 100 or 500 year events, as in the case of Hurricane Mitch) or where flows are turbulent, perhaps you might want to expect effectiveness up to around 20cm in depth; and where flows are laminar up to around 40 cm; and (iii) given the uncertainty at the moment, it would probably be best to restrict this particular application to non-critical areas (e.g., where failure is not "fatal").

® *Diverting flow* – Neither does there seem to be much information in this aspect, however, one might suspect that a vetiver hedge's effectiveness for redirecting flows would probably show similar impact and limitations as they would for reducing runoff velocities.

® *Enhancing infiltration* – Contour vetiver barriers increase infiltration and decrease runoff. This is a very useful characteristic in agronomic situations, but potentially something of a double-edged sword where slope stabilization is concerned. In the latter case, the objective is generally to reduce the amount of soil water, not increase it. In looking at this particular aspect, Diti Hengchaovanich (5) concluded more research was required. However, his preliminary results lead to the anticipation that vetiver would be able to deplete moisture in the soil thus lowering pore water pressure - a positive outcome for stabilization; i.e., though more runoff would infiltrate, extractive use by the hedges would more than offset the incremental infiltration. He based this preliminary conclusion on the fact that, in civil engineering use: (i) slopes will generally be from 30-60º, ii) thus the distance between vetiver hedges would be very small; and (iii) therefore moisture depletion by the hedges on such a slope would be greater. In terms of expecting VGT to enhance infiltration and thus reduce runoff on a scale to reduce downstream flooding: this would simply not be a reasonable expectation, except possibly on extremely small scales (e.g., a 2 ha micro-catchment).

® *Protecting hard structure/soil interface interfaces* - Experience has shown that vetiver hedges are excellent at protecting the interface between soil and hard structures. This is generally a very vulnerable area. It is here where often runoff is concentrated, causing soil to be scoured away. Oftentimes, this is how structures begin to be undermined, leading to the eventual failure of the structure (e.g., gabions along stream channels, bridge footings and 'wings' of approaches, concrete drainage channels along roads, etc.). This is a truly underexploited use. What the limitations might be are not entirely clear, but as this is a problem for which there are very few alternative solutions, it is worth a try wherever conditions would permit you to establish a mature hedge.

® *Demarcating areas* – Vetiver is a long-lived and, once established, resistant to most things (including being underwater for months at a time) except herbicides, shading, severe weed competition, inundation by sediment, and

being dug out of the ground. It is an ideal plant for demarcating areas; nor does it need to be established as a hedge for this purpose.

For What Might VGT Not Be So Good?

Within the uses and limits described above, for what might VGT not be so good? Three particular aspects appear to merit mention:

- ® You absolutely cannot save or protect a bad design with VGT. This is basic. If the site is unsuitable, if the road is poorly designed, if the fill slopes are not compacted to design standards, etc. VGT will not rescue the situation. Indeed, it could make it worse by providing a false sense of security.
- ® You cannot guarantee bad work. VGT has to be applied correctly or it will not work. Others shall be presenting experiences and papers in this conference on this aspect. But if there are any doubts as to what "correctly" means, the Vetiver Networks are there to assist you to get the details.
- ® You should not expect VGT to extend the feasible range of where an activity can be carried out; i.e, the purpose of incorporating VGT into activities is not to allow increasingly more risky or vulnerable areas to be utilized for roads, buildings, houses, etc., but to protect and support well located infrastructure projects.

Pre-Mitch: Where Might VGT Have Reduced Damage ?

As mentioned above, there appear to have been four main "objectives", which had they been more effectively pursued prior to the hurricane, might have reduced or avoided human tragedy and economic losses. What role might VGT play such that future disasters are less disastrous?

Minimizing encroachment into vulnerable areas. Under Central American conditions it is clear that these areas will continue to be encroached upon for a significant span of time yet to come. The main impacts (loss of human life and economic losses) occur in urban and peri-urban areas. The use of zoning does not seem to be a very effective option as neither enforcement of laws and statutes nor insurance (which most businesses and individuals lack) discourages building in vulnerable areas. Indeed, many of the areas hit hardest by Mitch were identified as "vulnerable" and "high risk" in land use plans and zoning ordinances one or more times, since the 1950s. Such areas need to be put under some economically or socially useful activity which, if wiped out in a flood or landslide, does not cause undue economic loss or human suffering.

In urban areas, these risk zones can be converted by the city or turned over to neighborhood associations for recreation areas, city parks, sports fields, community gardens, etc. The utility of VGT in these areas would be to protect these areas from the "normal" hazards and maintain their useful life between the more extreme events, through: stabilizing river banks and natural drainages, protecting roads and footpaths, redirecting runoff from upper slopes, stabilizing hillslopes and fill areas, etc. In addition, the concept of 'social fencing' acts as a deterrent in most Central American societies, i.e., if one can demarcate land (and maintain the demarcation), thus establishing usufruct, this becomes a mild to moderate deterrent to encroachment. Vetiver barriers make excellent boundary markers and are much less expensive to put up and maintain than real fences. "Regular" maintenance, such as twice yearly pruning, would serve to demonstrate continued interest and "will".

Proper design and construction of transport network and adequate protection and proper maintenance of key roads and access points. These two points are substantially the same, the main difference being one of strategy and intensity. In general, proper design and construction require that stabilization of roadsides, roadcuts, fill banks, drainage, etc. etc. be taken into account. Without going into details (as there is a whole section in the conference on these aspects), we know that vetiver works well and is low cost. The experience in El Salvador shows this – over 300 km of vetiver hedges were established before Mitch hit to protect roads and other high value infrastructure, the only failure was in one location where it was discovered that the building contractor had not compacted a fill slope to design specifications. As did the experience in Puerto Rico with Hurricane George, where, Mr. Eduardo Mas of the US Natural Resource Conservation Service was reported to have remarked: "*The storms were terrible. [Afterward there were] Landslides, roads destroyed, agricultural lands washed away; but, where there were vetiver barriers, everything seemed normal".*

Road maintenance is always a problem as there is generally little or no budget provided for this activity. Under such circumstances, vetiver is a good alternative. As Mr. William Ibarra, a division chief in El Salvador's Ministry of Public Works, explained to the attendees at the World Bank-sponsored Vetiver Bioengineering Workshop: *"We never have budget for road maintenence"* therefore his strategy is *"to lose fingers, not the hand"* by building into the construction phase protection measures which are going to give him long term, very low maintenance protection in critical areas. He counts vetiver as one of those approaches.

In terms of ensuring adequate protection of lifeline roads and critical access link points, this involves expecting disasters to oc-

cur and identifying and taking incremental measures to protect key roads and access points. Simply stated, these would be the points where the greatest attention and intensity should be given to see that VGT is used for stabilization and protection. However, given the criticality of these points, VGT would need to be part of an overall package which included hard as well as soft approaches.

Adequately protecting production systems and housing sites. With the main economic losses having occurred in valley agriculture as a direct result of massive flooding, there is little that VGT could be expected to have done to lessen impacts. In the uplands, where thousands of hectares of coffee plantation were lost to landsliding, VGT might have reduced some small percentage of losses. Many of the landslides were deep, tens of hectares shearing off and dropping into the valleys or plantations being wiped out by fast moving debris and mud flows from upslope.

Smallholder subsistence agriculturalists would be the greatest beneficiary of VGT. Damage surveys noted that virtually all the farms using recommended soil and water conservation techniques (especially, vetiver grass contour barriers, rock terraces, "green mulch"[1] and crop residue management, and an indigenous agroforestry system[2]) survived Mitch with little damage, while neighboring farms using conventional practices suffered devastating landslides that destroyed homes and degraded fields.

Simeon Gomez, a hillside farmer in Los Espabeles, Honduras who went through Hurricane Mitch said it best: *"On my field with vetiver grass contours the hillside remained perfectly in place. The fields without grass contours have had their crops and soil washed away".*

Vetiver hedges could also have be somewhat useful in protecting home sites on sloping lands and near minor drainages, especially from undercutting of walls by runoff, and perhaps diverting flows away from the house and reducing sediment damage to interiors.

Post-Mitch: Where Might VGT Be Applied In The Aftermath?

The incorporation of VGT in development efforts might reasonably be expected to assist in dealing with the conditions left behind in many of the watersheds severely impacted by Hurricane Mitch. At the same time, it would also be reducing future vulnerability and risk. Application of VGT can be utilized for treating the following situations:

Mass wasting. Many of these are deep slides whose continued instabilities derive from zones below the depth at which vetiver's root system could affect stabilization, or from huge masses of material still in movement from gravity, or from unstable materials of texture classes (large stones, boulders, etc.) for which VGT is unsuited. On the other hand, VGT could play an important, low cost role in reducing the risk that these instabilities would trigger. Among the particular applications for VGT here are in: (i) reducing erosion and undercutting of the toe slopes, which generate upslope sliding – establish contour vetiver barriers along the bases of the debris slopes, especially where they contact river channels; (ii) halting and diverting run-on from upslope which would increase soil moisture and increase risk that slides or shears would be triggered due to increased pore water pressures – establish cross-slope and herringbone pattern vetiver hedges upslope; (iii) stabilizing the shallow unconsolidated and unstable shallow debris slopes; and (iv) stabilizing the soil surface of both the newly exposed areas as well as the debris slopes such that revegetation (natural regeneration or planting) might occur.

Shallow slips. VGT could play a larger role in achieving complete stabilization of shallow slips in: (i) stopping further landsliding and shearing by stabilizing the heads and sides of slide zones; (ii) stabilizing unconsolidated and unstable shallow debris slopes; (iii) stabilizing the soil surface of both the newly exposed areas as well as the debris slopes such that revegetation (natural regeneration or planting) might occur; and (iv) halting and diverting run-on from upslope to avoid further cutting, shearing, or soil saturation.

Sediment storage in stream system. The sheer volume of the sediments involved are such that VGT might only play a very localized role in such things as: (i) trapping sediments to reduce siltation of lowland irrigation and drainage canal systems (e.g., in banana plantations); (ii) stabilizing and trapping sediments desposited primarily in ephemeral drainages and first-order streams, and (iii) stabilizing sediments in streamside zones for reclamation as agricultural lands.

"Where's the stream channel?" VGT could play a modest role in attempting to influence where the future channel might eventually develop. River training works with gabions and concrete walls are extremely expensive and often a complete waste of money. Vetiver diversion hedges at key points would be much lower cost and in the smaller stream systems (first and second order streams) could be at least as effective as hard structure in 'suggesting' where the channel might develop. Where hard structures are required, it would be recommendable to protect them from undercutting by establishing vetiver hedges along all of points of contact between the structure and the soil.

Sediment inundation. In these areas the challenge is to stabilize the soil surface so that the sites can either be reclaimed for agricultural use (e.g., through overseeding with leguminous cover crops or pasture grasses) or reveg-

etated. VGT is an ideal system for this use.

Not all future risk can be avoided in new construction. As previously mentioned, bridges must cross the rivers, roads have to go through the mountains, and some homes will be built in unsuitable areas. In these endeavors, VGT should not be perceived as allowing these to be carried out in newer, even riskier or more vulnerable areas. The appropriate role of VGT here is to extend the design life and safety margin where risk is unavoidable.

Danger zones and encroachment. See *Minimizing encroachment into vulnerable areas*, above.

Post-Mitch: Where Is VGT Being Applied In The Aftermath ?

Clearly Hurricane Mitch's impacts have stirred a great deal of interest in VGT. As previously mentioned, a number of multilateral and bilateral donors, NGOs, private companies, and government agencies are recommending and promoting its use in their Central American post-Mitch construction. Among them:

- ® World Bank – in its ongoing projects in forestry and agriculture, in its new investment programs for road construction and rehabilitation, riverbank stabilization, rehabilitation of hydraulic works and irrigation systems, and in projects under preparation for watershed stabilization.
- ® Interamerican Development Bank – in its ongoing projects for watershed protection for hydroelectric dams, and in its new investment programs for road construction and rehabilitation.
- ® The US Army Corps of Engineers – in landslide, gully and riverbank stabilization.
- ® The United States Agency For International Development – in watershed stabilization and upland agriculture.
- ® CARE International – in rural road protection and stabilization and upland agriculture.
- ® Chiquita Brands and Tela Railroad Company – in construction and rehabilitation of drainage canals in banana plantations.
- ® Costa Rican, Salvadoran, Honduran and Nicaraguan Minstries of Transport – in road construction and rehabilitation.
- ® Panama's National Authority For Reverted Areas – in the Panama Canal watershed for roads, forestry and agriculture.

Will these "recommendations and promotions" result in concrete actions on the ground ? Will VGT be applied as a key technology in the aftermath of Mitch ? It remains to be seen. At this point there is simply not enough material in the region to meet the potential demand. The region will have to see a tremendous effort in propagating planting material over the next couple of years if the potential is to be realized. It is now a year later and only CARE and Chiquita Brands have made any significant investments in vetiver propagation.

III. Conclusions

VGT can play a key role in disaster mitigation and vulnerability reduction. However, we should not get too carried away on defining the potential for its impact. The purpose and role of VGT in disaster mitigation and vulnerability reduction is to protect and conserve, not nature, but our interventions within nature and our attempts to manage nature for our own ends. Extreme events like Hurricane Mitch create conditions which simply overwhelm our works and our fabricated systems. As such, VGT is not and cannot be a substitute for appropriate siting of infrastructure, for avoiding encroachment into flood plains and other vulnerable areas, for halting watershed and soil degradation, in short, for overall good natural resource management and land stewardship, for common sense, and for quality designs and construction.

Having said that, VGT can be integrated into our systems in order to make them 'more resistant' to disaster and 'more efficient' at surviving them. It can extend their useful lives between extreme events and increase their margins of safety. The success of VGT in protecting roads and infrastructure in El Salvador and in saving farmer's fields in Honduras during Hurricane Mitch proves this to be true. And, we know it can do so at such a reduced cost that should allow for its much broader application.

Finally, too often we forget, until a disaster comes along to remind us, that it is not enough that we build or design for average conditions. Engineers remember this instinctively. Natural resource professionals often do not, especially those working with the rural poor. We accept soil and crop management systems and unprotected feeder roads because we understand the farmer's and poor community's logic and time horizon; an economic calculus that does not necessarily pay attention to the medium and long terms. But what happens when the 5-year event overwhelms the pineapple, sugar cane and fallowed strip hedgerows? and the 10-year event the tree hedgerow? and the 25 year event closes the only access road for a year or more ? Or, as in the case of Mitch, an even more extreme event forces tens of thousands of rural households off the land and into urban areas whose economies cannot absorb them? . While we may not know with precision the limits of VGT, we do know that for many applications no other hedgerow or soil stabilization plant has proven more effective. As appropriate, VGT should always be included as an option in farming systems and bioengineering applications where hedgerows or soil and

slope stabilizing plantings are called for.

Certainly, for the next few years in Central America we are assured that all natural resource management, civil engineering, rural and urban development professionals will be reevaluating what constitutes "good practice" and comparing it against what they saw happen with their own eyes when Mitch hit. If we can get enough planting material produced and distributed and enough good technicans trained, maybe the next time around VGT success stories will be too numerous to tell.

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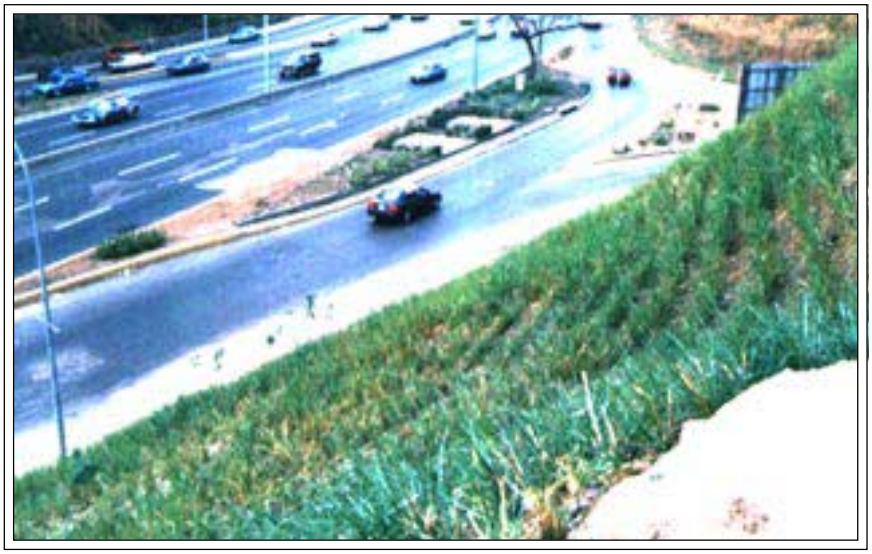
End Notes

1 A cover cropping technique: leguminous cover crop is not incorporated into the soil, rather it is : (i) slashed and the main crop is planted with a minimum till approach either before or after the cover crop is slashed, or (ii) the agricultural crop is planted (usually maize, in this case) and the cover crop planted into the field some weeks after the main crop comes up.

2 The "Quesungual" system is indigenous to the sloping lands in the humid subtropics of southern Honduras: small holder system (<2 ha); natural regeneration (150 to 500 trees/ha); pruning of trees at 1.5 to 2 m; residues and weeds slashed and left as mulch; associated with bean, corn, sorghum; use of 65kg urea/ha with grain crops beans climb or are hung on pruned trees; fields are not burned to promote regeneration of trees for next year. From farmer's perspective: reduced labor and costs; conserves soil moisture; fuelwood and mulch from tree prunings; trees provide support to bean crop and for harvested corn.



VENEZUELA: Stabilization of steep highway cut in Caracas using VS. VS should be used to rehab Caracas Flood Dammage.

VETIVER TECHNOLOGY DISSEMINATION IN CHINA FROM AGRICULTURE TO ENGINEERING

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Paper presented at the Second International Vetiver Conference, Thailand, January 2000

Soil erosion resulted in soil fertility decline and ecological environmental deterioration and formed one of the most critical issues facing our global society. Following increasing population this problem became more serious. For example, the total erosion area in China increased from 150 million hectares in 1950's to 170 million hectares at present, which accounts for 1/6 of the country land, of which soil erosion takes place in the cultivated lands for 45.4 million hectares, almost 1/3 of the total cultivated land (Zitong Gong and Guobao Luo, 1998).

Although there are a lot of soil conservation measures, the most outstanding of these is the use of vegetative soil and moisture conservation measures that are cheap, replicable, sustainable, and fully effective in stopping erosive degradation and increasing crop yield. Many examples from all of the world showed that vetiver as a boundary hedge to be the ideal plant to conserve soil and rehabilitate eroded land.

Background of vetiver technology development in China

The valuable grass vetiver (*Vetiveria zizanioides*) was disseminated to China in late 1980s as a plant for soil erosion control hedges, although it had been introduced into the county as early as in 1950's as a plant for extracting oil from its roots. Since 1980's, the Vetiver Grass has been experimented or tested in most provinces in southern China, as in Jiangxi, Fujian, Sichuan, Hunan, Guizhou, Hainan, Guangdong, Gansu, Henan, Shandong, and Zhejiang Provinces. The dissemination of the technology was promoted through World Bank supported Red Soil Project (Hu Jianye and Xue Huixian, 1998) , while some of the activities were also involved by Asian Development Bank (B. Haagsma et al, 1998). The followings are some results:

Some nurseries have been established and experiments were carried out or proposed on the biological characteristics; hedge establishment and maintenance; hedgerow impacts on soil fertility, moisture, crop yield, and soil losses;
Vetiver hedgerows were established in tea, tea oil (*camellia*), or citrus plantations in many provinces;

- The green Vetiver Handbooks was translated and distributed countrywide;
- Vetiver was used to feed fish, livestock, and to mulch ground surface of orchards;
- Vetiver hedgerows were established to protect river banks and fish ponds;
- Vetiver was planted on saline soil to ameliorate the soil properties as did in Fujian Province of southern China;
- Vetiver pruning were used to cultivate edible fungi and to make small items.

To speed up the extension of the technology in southern part of China, where 70% of the land is mountainous and soil erosion proved to be a critical problem, the China Vetiver Network (CVN) was established at the end of 1996. The main task of CVN is countrywide vetiver technology extension, i.e., to extend vetiver technology to new area or to use the grass to new applications.

Multiple measures for vetiver technology dissemination

National information service through CVN publications. The China Vetiver Network was developed based on and in cooperation with the existing national agroforestry network which has been developed for more than seven years with over 1,000 members. The national information service focus its attention on the southern part of China where tropical and subtropical climate dominate. The vetiver publications were distributed to many national universities, research institutions, governmental offices, provincial institutions, and also many county level and some township level extension stations. Many disciplines were involved, including soil and water conservation, agriculture, forestry, ecology, environmental protection, botany, and soil science, etc. The publications include:

- Vetiver Newsletter in Chinese, 4 issues with total 4000 copies each year were disseminated. The newsletter introduces new development, new technology and activities in China and foreign countries.
- Vetiver Fact Sheets (Vetiver & Soil Conservation), 4 issues totaling 8000 copies each year which introduce substantial technology to extension stations were mostly distributed to county extension stations.
- Agroforestry Today, a quarterly journal in Chinese published for 7 years, in which the vetiver grass being one of the major subjects were distributed with an averaged circulation around 1,200 copies each issue.
- Vetiver Research and Development, a proceedings of International Vetiver Workshop held in Fuzhou of China 1997, totaling 1000 copies distributed (Liyu Xu, 1998).

Different publications were produced and distributed to different

readers with different cultural background from scientists to master farmers. It bridged the gap between research and extension and accelerated the dissemination of the technology.

Technology dissemination through public mediums. Although many thousands of copies of vetiver publications were released countrywide in the past few years, there was still a strong demand for vetiver information dissemination. As a large agricultural country, there are thousands of research institutions at from national to provincial to prefecture level. Besides, there are many thousands of extension stations at county and township level involving agriculture, forestry, soil and fertilizer, soil and water conservation, livestock etc. Besides, there are also thousands of institutions involving in engineering subjects and also ecology and environment. To accelerate the technology extension, multiple papers introducing vetiver were prepared and published in national or regional journals, newspapers, and television stations. The followings is just a few of examples:

- Chinese Journal of Ecology,
- Soil and Water Conservation,
- Soil Science,
- Soil and Water Conservation in Fujian,
- Science of Jiangxi Province,
- Resources and Environment in the Yangtze Valley,
- Reference Information (a daily newspaper),
- Journal of Ecology.

Conferences and training courses. To promote vetiver technology dissemination, various conferences were organized by CVN in cooperation with different regional, national, or international institutions. These conferences provided opportunity for scientists and technicians to exchange ideas, learn new technologies, establish cooperation and linkages, and seek for new projects with joint efforts. Besides, many small training courses were held for master farmers and technicians to disseminate substantial technology.

For example, supported by The World Bank, The Vetiver Network, Natural Science Foundation of China, an international vetiver workshop was organized in Fuzhou of China in October 1997 and 100 participants attended the workshop. The main topics include:

- Results and achievement of vetiver research, experiments, application, and extension in the past decade.
- New vetiver applications and its management of extreme soil rehabilitation (seriously eroded red soil, mobile sandy dunes, toxic soils, etc.), watershed management, waterway stabilization, earth works reinforcing, pollution control, disaster prevention, etc.
- The needs of vetiver application to satisfy farmers' basic needs (fuel production for example).
- Application and management of vetiver in different agroforestry systems and different area.
- Economic and policy consideration on vetiver application and extension.
- Considerations and proposals for new vetiver projects.

Through the workshop many old users learnt new vetiver applications, while new users obtained basic information and started their tests after the conference. And many vetiver users established cooperation with their neighbors.

Just two years later, another international conference titled "Conference on Vetiver Bio-Engineering Technology for Erosion and Sediment Control and Civil Construction Stabilisation" was organized in Nanchang October 1999. In addition, some other meetings with vetiver as the only one or one of the major topics were held by CVN or its cooperative institutions in the recent few years, such as:

- South China Soil and Water Conservation Meeting (Xiamen),
- Soil Erosion and Conservation Workshop (Jiangxi),
- Vetiver Network Meeting of Fujian Province (Fuzhou)
- Yangtze River Flooding and Soil Conservation (Wuhan),
- Sustainable Agriculture in Yangtze River Basin (Nanjing),
- Vetiver for Edible Fungi Cultivation (Fuzhou),
- One-day Training Courses in Fujian and Anhui Provinces, etc.
- International Conference on Vetiver Bio-Engineering Technology for Erosion and Sediment Control and CivilConstruction Stabilisation (Nanchang).

All of these conferences plus many small training courses played an important role in disseminating vetiver technology and establishing follow up cooperation. Because the different meetings put emphasis on different subjects and different groups of people, the vetiver technology was disseminated to from universities, national research institutions to extension stations at county level or township level.

Joint field surveys and investigations. Aiming at disseminating vetiver technology and exploring new users and new vetiver applications, field surveys and investigations were carried out in Fujian, Jiangxi, Guangdong, Hubei, Hunan, and Anhui provinces in the recent few years. These investigations were organized by the China Vetiver Network and cooperated by numerous multi-disciplinary institutions at national, provincial, prefecture, county, and township levels. Through these investigations, team members learnt experiences from established vetiver application models and proposed new applications. In addition, by distributing vetiver publications and discussing with local technicians and master farm-

ers, team members encouraged more and more people to test and use the grass.

Demonstrations and visits. Watching is better than hearing. To encourage people to use vetiver technology various demonstrations were established by CVN in cooperation with numerous institutions. The demonstrations showed people with different applications, such as:

- vetiver for tea and orange tree garden terrace protection,
- vetiver for red soil amelioration,
- vetiver as a component of agroforestry systems,
- vetiver for newly built terrace stabilization,
- vetiver for edible fungi cultivation,
- vetiver for river and coastal bank and fish pond stabilization,
- vetiver for sand dune fixing,
- vetiver nursery management.

Accompanied by the organization of conference tour, these different models were extended more quickly and smoothly. Most of the demonstrations were established at sites with transportation facilities and by local technicians acting as interpreters, which was good for visitor to accept and duplicate new technology. Different demonstrations were established for different group of people. For example, in AgriWorld of Suzhou city the grass was planted along river banks, field borders, ditches as a 'environmental grass' introducing to college and middle school students.

Distribution of planting materials and mini-grants. In order to encourage new users to start vetiver program mini-grants was established and disseminated to the institutions with different disciplines. For example, in 1998, altogether US$ 10 375 was sent to 17 recipients from 7 Provinces. The mini-grants were approved based on:

- the applicants' responsibility, i.e. it is hoped that the grant recipients can do work well and very possibly to send feedback to CVN;
- the regional distribution and subject balance;
- if the recipients can seek money from other sources.

In addition, CVN organized millions of planting materials and transported to hundreds of institutions free of charge. All of these encouraged more scientists and technicians to test and use the grass. So far most of the recipients sent us feedback and used the mini-grants and/or planting materials very effectively and successfully. As most of the recipients were those who did not know or did not see the grass before, the first thing they did when they had received planting materials was to establish nursery for reproduction. And then they distributed both planting materials and technology to their neighbors.

Vetivertechnology introductiontoengineering institutions. General speaking, in the past decade since 1980's the vetiver grass has been used mostly for agricultural purpose. That is millions of hectares of range land was protected by vetiver grass. However, in the recent 20 years following national economic reform the rapid development of various constructions led to dramatic disturbance of earth materials and resulted in large amount of new soil erosion, that influenced agricultural production and caused the destruction of ditches, dams, and reservoirs and caused frequent flooding which threatened people's life. Taking Guangdong Province as an example, in the period of 1986-1992, the agricultural practices caused 811.30 km2 soil erosion with a amount of soil losses for 21 716 100 m^3, accounting for only 28.0% and 10.6% of the total erosion area and soil loss respectively (Li Guangzhi and Guo Suoyan, 1998), i.e. the nonagricultural practice caused 72.0% and 89.4% of the total erosion area and soil loss respectively. Most of the eroded area and most eroded materials was caused by mining, construction of highway, railway, power construction, quarry, etc. (table 1). These nonagricultural practices caused huge sediments in ditches, rivers, and reservoirs, and dramatically influence agricultural production and threatened people's life. Of nonagricultural factors, the construction of highway consisted of an important component. In China for example, since the national economic reform the construction of highway forms the major component of economic development and was deemed as an important channel for poverty alleviation. The total length of highway increased from 1,118 000 km in 1994 to 1,186 000 km in 1996. The annual increase reached 34 000 km. However, caused by financial limitation many highway embankments were not properly protected and caused serious new erosions.

Consequently, we decided to do our best to introduce vetiver technology to highway and other engineering institutions:

(1) CVN translated the article on vetiver grass in engineering application written by Diti Hengchaovanich into Chinese and distributed to 1 200 highway institutions via our Vetiver Newsletters.

(2) In cooperation with experts and engineers from Highway Bureau of Jiangsu Province, and Survey and Design Academy of Communications of Jiangsu Province, we prepared articles to introduce vetiver and its application in highway aspects. These articles were published in several highway journals as:

- Highway Journal of China,
- East China Highway Journal,
- Guangdong Highway Journal,
- Newsletter of Highway Society of Jiangsu Province,
- Science and Technology of Communications of Zhejiang Province,
- Proceeding of National Super Way Conference, Kunming, November 1998,
- Highway Survey and Design

of Fujian Province,
- Science and Technology of Communications of Yunnan Province.

(3) The CVN introduced vetiver at several regional and national highway conferences, such as East China Highway Conference in Xiamen in June 1998, National Superway Conference in Kunming in November 1998.

(4) In addition to the International Vetiver Workshop organized in Fuzhou October 1997, we organized the International Conference on Vetiver Bio-Engineering Technology for Erosion and Sediment Control and Civil Construction Stabilisation in Nanchang in 1999.

(5) CVN invited senior engineers and directors to go abroad to visit demonstrations. When they came back they acted as active technology disseminators. It was proved that they played a very important role in technology dissemination.

Now, almost all of the highway institutions from national to provincial to county level knew vetiver and start or wish to use the grass. Besides, some of the institutions from railway, mining, power stations etc. also knew the grass more or less.

Experiences in national networking

From above description we can see that CVN has played an important role in vetiver grass technology dissemination and extension through out the country. General speaking, what CVN has done is to encourage people as many as possible to test vetiver and to transfer the technology to others. Methodologically, the networking is to find factors which might influence VGT dissemination and solve problems on time so that VGT can be disseminated and developed more healthily and smoothly. Following is some examples.

Application models
Although VGT is easy to grasp, it may be failure if the technology can not be properly used. The technology was introduced into China for years. However caused by language problem much experience obtained from foreign countries was not fully transferred into China. Once the technology was not properly used it would act as a negative sample showing people that VGT was not so successful as expected. To solve this problem CVN established some demonstrations in different province to show people how to use the grass under different conditions and for different uses. For example, during the very hot and dry season we demonstrated farmers to use vetiver pruning as mulch to reduce evaporation and protect crops.

Keeping VGT out off secret A opposite example is that when people used VGT successfully and got profit from selling planting materials, contracting projects with highway bureaus, cultivating mushrooms etc., they may want to keep it in secret, in order to make more profit without competition. As a result, the dissemination of technology was again influenced. To solve this problem CVN disseminated the basic knowledge and successful experiences via its publications with large circulation in order to break through possible blockades.

Quality control Following increasing enthusiasm in using vetiver for highway stabilization, CVN established bridge between highway institutions and farmers who produce planting materials so that the highway institutions got plenty of planting materials to start their protection job while farmers got considerable profit from selling seedlings. Unfortunately, another problem occurred. Some farmers sold their low quality planting materials planted many years ago and accompanied by cooked account of the amount of tiller numbers to earn money, which caused the damage of highway application. To solve this problem CVN prepared a paper on the quality of planting materials and widely distributed to highway institutions telling them how to select high quality planting materials.

International exchange
VGT is a technology without borders. In the recent two years CVN invited international experts from various countries to visit China introducing their experience. For example, many China's highway institutions got interests in vetiver application because vetiver can save them 90% costs compared with traditional concrete protection. They established demonstrations themselves, or they contracted the projects with agronomists. However each of them could not arrange demonstration successfully as done by Mr Diti from Thailand. Therefore we organized an international conference to invited Diti and other international experts to give lectures and to give in situ comments to both engineers and agronomists. We encouraged our scientists and engineers to study foreign experiences and to learn from each other and to co-establish demonstrations. Besides, we organized Chinese engineers to visit foreign countries such as Thailand and Philippines.

Inviting partners from multiple disciplines Since many disciplines involved in VGT while each discipline acted as an independent kingdom, we must invite people from different disciplines to study and disseminate VGT. For example during the workshop in Fuzhou 1997 which was co-organized by Fujian Provincial Soil and Water Conservation Office there were no engineers to attend because engineers might consider it to be non of their business. To solve this problem we invited chief engineers from highway constructions to visit foreign countries and then invite them to coorganize the "Conference on Vetiver Bio-Engineering Technology for Erosion and Sediment Control and Civil Construction Stabilisation" in Nanchang 1999. Most of the conference participants were engi-

neers. The method was proved to be very successful. For the same reason we invited engineers to co-prepare articles for various engineering publication.

To sum up, VGT has developed and disseminated very quickly in the recent few years through national networking. There will be a great jump in the 21st century.

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MISCELLANEOUS MEANDERINGS OF A MILLENNIUM MAN IN SOUTHERN AFRICA

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Introduction

In November 1996 I was largely unaware of the existence of the "miracle grass", and soil and moisture conservation and land rehabilitation were only peripheral interests. Then three men; Dick Grimshaw, Tony Tantum and Paul Truong descended on me and turned my professional life upside down. In the first article of the first ever SAVN Newsletter I described Vetiver as the "conservationists' Cannabis." Unlike Bill Clinton I inhaled deeply and, just over three years on, I am firmly hooked. Still wet behind the ears, here I am attending my first World Vetiver Conference and looking forward to meeting similar junkies who have become e-mail and Vetiver soul mates. How far have I progressed into addiction? Even my prospective mother-in-law has been recruited into SAVN. How much further can one go?

What follows is largely from a personal and rather parochial view of coordinating the Southern Africa Vetiver Network for the past three years. The bias is African, particularly South African, and the focus is developing countries and the challenges we face as we enter the new millennium.

Coordinators of networks promoting Vetiver grass technologies operate at numerous levels and scales, and in contrasting physical and socio-economic environments. The roles of David Jobson in White River covering Mpumalanga (a province in South Africa), myself in Pietermaritzburg covering Southern Africa, and Dick Grimshaw in Leesburg, Virginia covering the world are fundamentally different. Yet we all face similar challenges:

- How do we secure funds to sustain our networks?
- Who do we target with support and promotion for maximum leverage?
- Where and how do we source relevant expertise and information for particular applications?
- What research should the network be promoting?
- Where do we find other champions to spread the load?
- How do we counter resistance to the technology?
- What is the most effective way of disseminating information on Vetiver?
- To what extent do we involve ourselves in works projects and propagation?

Numerous other questions also pass through all our minds. Obviously, in many cases, we will have different answers depending on where we find ourselves. Different circumstances demand different solutions. This paper does not attempt to dictate what the various solutions to particular challenges might be. Instead, it simply puts forward a number of ideas on how some key challenges might be approached.

Sustaining a network – where do we find the money?

The perennial problem – how do we pay the bills? In the past numerous networks, including SAVN, have been reliant on donations and grants from international funding agents and large private corporations. The fortunes of the networks were dictated by corporate sector and international agency policy shifts – this year soil conservation might be a priority so money for Vetiver roles in; next year poverty alleviation is the priority so the money supply dries up. Clearly, the lack of consistency and control rendered this funding source unsustainable. The challenge here for networks is to move away from donation based funding to investment based funding – investment by those who will see either direct or indirect financial returns, or some other form of return for what they are investing. This is going to demand a fundamental change in the way we conceptualise and operate our networks. For individuals and organisations to invest they are

going to want to see a service based network – if Anglo American Corporation is paying a membership subscription its mine-based environmental managers should have the latest Vetiver rehabilitation technology or advice at their finger tips. Information dissemination, as an example, will no longer be based only on what we as coordinators think is important but also on what the market regards as important. A lot of good can come out of such a shift. Network members are likely to be drawn closer. The network will no longer be some distant 'nice-to-have' free service. Instead it will be close at hand and the vested interest in its survival will be strengthened. Also, if a service is paid for its perceived value will increase. This is all very well for the Anglo's and other corporate giants who can splash out a tiny fraction of a percent of their turnover on a Vetiver network subscription. But what about Siphiwe Zondi of Biyela, central Zululand who is unemployed, who obtains occasional income from sales of Cannabis, and who uses Vetiver hedging for contouring and to hide his illicit crop from prying eyes. How is he supposed to pay – the odd parcel of 'pot' to the coordinator? Clearly, we have to look to other mechanisms and some form of cross-subsidisation has to come into play. A solution we are developing is to approach ten to twenty large mining and civil construction firms, commercial rehabilitation companies, government departments and parastatals who have a direct interest in Vetiver to become core corporate investors in the network. Conventional network members will pay a nominal fee and those who can't pay, predominantly the rural poor, will receive subsidised (free) membership. This form of investment will be linked implicitly to the level of service - through their operational divisions, core corporate investors are likely to demand greater services, normal members generally only want to be kept informed, and the rural poor only have access to certain network services.

Another way of sustaining a network financially is by developing a commercial division that effectively subsidises the network. There are definite opportunities in this direction but there are also problems. Let's use the Institute and SAVN as a particular example. We field numerous requests from contractors requiring Vetiver stock or technical services. One option is to levy a commission on the sales we facilitate. This has potential but is likely be an administrative nightmare. It also increases the price of stock; something we would prefer to avoid. Another option is to supply stock or services directly ourselves. With our agricultural training farm that contains a Vetiver nursery and with the expertise that exists within the Institute we have the capacity to do this. In this way we would certainly maximise the amount that could be ploughed back into the network. However, as operators of the network this places us at an immediate competitive advantage and I foresee conventional commercial operators crying 'foul'

Targets

Who do we target our promotion and support at to obtain maximum leverage? Again, it depends on what level the network is operating at. However, here are few ideas. When operating a national or regional network there are four specific areas where promotion and support could be directed:

Provincial and regional government departments/ parastatals: In most developing countries the agent of service delivery is regularly a government department or a parastatal. In South Africa much of agricultural extension is within national and provincial agricultural departments. These departments also contract in consultants, private sector agencies and NGOs to assist in delivery. If these departments are familiar with and supportive of Vetiver technologies they will write the various applications into project briefs. This forces their clients and contractors to make use of the technology. A parastatal such as Umgeni Water (bulk water infrastructure and supply) is a specific example of where an organisation that is familiar and supportive has written the use of Vetiver technology into the technical briefs of numerous works projects. Umgeni Water has actually gone a step further by setting up a nursery to supply stock to its external contractors. With encouragement, those organisations that regularly have large civil construction projects can combine entrepreneurial development options using Vetiver with large-scale rehabilitation and stabilisation operations. These organisations generally know at least two years in advance where large works projects will take place. They can identify local entrepreneurs, support the establishment of nurseries, and when the rehabilitation takes place can purchase the locally available Vetiver stock – both sides benefit.

Local Champions: Coordinators of networks rarely have the time or resources to engage Vetiver propagation and works projects directly, or to network at the very local level. In fact, this is often counter-productive as the effort could be better spent on more strategic leverage. We need to rely on local individuals and organisations to do this. These local champions require continual and pro-active nurturing, support and encouragement so as to lever maximum activity at a local level. Where do we find these champions and what are we looking for in a champion? Beyond an obvious interest in Vetiver, ideally we need to source individuals that are located in an organisation with a natural resource or agricultural focus. The day-to-day activities of the individual should regularly bring them into contact with activities and individuals with interests in or need for rehabilitation and stabilisation works. They

should preferably be local and settled rather than an external temporary staff member. Individuals from development, conservation and agricultural NGOs make ideal candidates. They usually have extensive networks ranging from government through the private sector to rural communities. They are well placed to lever funds, and they can generally operate more freely than individuals located in government and the private sector.

Mass circulation publications: The mining, civil construction, rural development, conservation and agricultural sectors all have widely circulated technical and non-technical publications and they are generally looking for pertinent articles. Articles specifically designed for these sectors can have a considerable positive impact on Vetiver technology use.

NGOs: In less developed countries, especially those where government's ability to delivery is limited, the responsibility often rests with a variety of non-government organisations. In South Africa, up until recently, small-scale farmers and rural residents generally knew more about Vetiver than the other sectors. This was because NGOs such as Eco-Link, The Valley Trust and the Institute operating in the rural development, conservation and agricultural sectors had actively championed it. These organisations are usually very effective in accessing communities and introducing new technologies as part of their operational activities.

Information dissemination With the advent of electronic networking and the move to web-based publications access to and dissemination of information on Vetiver has become far more efficient. Information is at one's fingertips, world experts are an e-mail message away and, in the case of our most accommodating Vetiver experts, responses are often immediate. However, in developing countries the vast majority of people who could or do obtain benefits from benefits from network membership do not have access to telephonic communication, let alone the Internet. The challenge in the new millennium is the effective dissemination of information on Vetiver in an accessible format to these members. Conventional postage of newsletters and other information such as simple guidelines and fact sheets must remain at the core of network activities.

Research

There exists a superb foundation of research for Vetiver technology. Much of that research is readily accessible. In developing countries the challenge is not to conduct technical research but rather to use existing technical research to inform and strengthen our methods of application and to increase geographical areas for application. With this in mind two technical research efforts that might have merit are the following:

- To determine if any existing cultivars perform better than others in the cooler high altitude environments. Alternately, although I am personally opposed to genetic engineering, there would be considerable merit in creating a genetically modified variety that performs in more temperate climates. I must admit that the vision of Vetiver hedgerows criss-crossing the hills and dales of Ireland or Wales appears a little perverse. However there are numerous sites in cooler high altitude locations of developing countries where rehabilitation would benefit considerably from Vetiver applications.
- To determine more precisely the impact Vetiver has when used in landfill site rehabilitation. We have seen how the flow of leachate from these sites is curtailed when Vetiver is planted but what is happening to the toxic substances? Are they being retained on-site or is Vetiver effectively breaking them down and converting them into something more benign.

For me the major research challenge for developing countries is in the realm of business and entrepreneurial development. Unemployment and a low skills base plague Southern Africa. It is also plagued by severe land degradation largely as a consequence of rural poverty. We need to research business development that provides entrepreneurial opportunities and income for the rural poor and at the same time contributes to improved caring for the natural resource base. Vetiver is an ideal agent that can contribute to this - technologies are simple, markets exist, and the natural resource benefits have been unequivocally demonstrated. We need to analyse the entire production system from propagation through to sales and marketing, identify and find solutions to various constraints and pitfalls, and demonstrate success through pilot projects. The Institute will be engaging this as an initiative over the next two years.

Conclusion

Despite all the challenges we face, network coordinators can take heart from the fact that we are promoting and supporting an invaluable technology with future uses that we have yet to dream about. I predict that, as the ethic of natural resource custodianship evolves so will the demand for our services increase and, with this demand, so will the resources necessary to sustain our networks role in. I don't think I am out of a job just yet!

A NEW NURSERY FOR FINCA CRISTINA COSTA RICA

by Linda Moyher, Paraíso - Costa Rica

There is a new vetiver nursery in full production in Paraíso, Costa Rica. Over the past six months we

have been distributing small quantities of planting material among the local farmers, but we now have sufficient quantities available to distribute with no rationing. Our operation is not for profit but for promoting soil conservation among small and medium-sized farmers of Paraíso. The price we ask for plants is minimal, just enough to cover the cost of the transplants and maintenance.

At Cristina Farm (*Finca Cristina*) we have always been aware of the need to protect the soil which is the resource that permits us to earn a living. (Finca Cristina is an organic coffee grower and roaster owned and operated by Linda Moyher and her husband Ernesto.) On many occasions we have seen the force and the fury of the water that washes mercilessly over the denuded fields and the unprotected riverbanks. Here in Paraíso the rains have fallen for more than twenty-two months without any summer or dry season; our neighbors' losses are evident in the chocolate colored streams and rivers. Cabbage and potatoes can be replanted, but each time the soil has less to give and its productivity is more limited.

In November 1997 we obtained our first vetiver plants from Dr. Briscoe which we planted along the principal drainage ditch along with a few plants behind the house. Later we requested another sackful in order to do some trials according to the instructions published in the Vetiver Newsletter #18. We tried leaving some plantlets to soak for several days in water and another batch to soak in manure tea. We planted different batches—some straight up (vertically) and others at a 45° angle. The results were good, they all sprouted and those that had soaked in the manure tea and were planted at 45° grew best.

Impressed with what we had learned and motivated by Peace Corps volunteer Dominic "The Vetiver Kid" Ackermann, we wanted to do more. We requested assistance from the *Red Latinoamericana de Vetiver* (LAVN) and Jim Smyle and Joan Miller paid us a visit. They inspected the area we had chosen to plant the nursery and they showed us various techniques for planting and advised us about the project.

We had chosen the particular spot, not only because it is flat and treeless, but also it is located between the coffee fields and the river. For many years we had tried planting it with vegetables and beans, and as a coffee nursery without good results. We did not know why, but we decided to try vetiver since all the literature reports that it would thrive in poor soils. This turned out to be an excellent decision because the vetiver has turned an empty lot into a productive area filled with wildlife. Then we realized that it was a drainage problem and the high water table that made the site unproductive until now. This the vetiver did not mind at all, and in fact it is well adapted and has thrived in the wetness. Because of the abundant rainfall the site resembles a swamp which has become a rich habitat for different species. There are many insects and spiders that provide good feeding for the many birds that have been spotted there such as migrant warblers, wrens and the beautiful indigo bunting.

In June 1998 we received generous monetary assistance from the *Red Latinoamericana de Vetiver,* and we set to work immediately. From a nearby farm we dug up sufficient material to plant in one day. The nursery site had been already cleared and we used the existing seed beds from the previous year's coffee nursery. Three workers separated the material and planted 2,500 individual tillers at 40 centimeters between plants in three rows. This represents a total area of 350 square meters.

The tillers showed no great enthusiasm for sprouting since the mother plants had been sprayed with herbicide shortly before we dug them up. Since it was the only planting material available in the area, we had no other option than to use it or postpone the project for a year due to the pressures of time and work on the farm. This represented a significant delay due to slow sprouting and growth, but finally the plantlets recouped their strength and survived. Today there is no evidence of ill effects from the pesticide in the nursery although the vetiver has all died out on the farm from which we originally got the planting material.

We have not applied any fertilizer. The weeds grew rapidly during the first six months, but we only did two weedings. At nine months the plants closed in completely and no more weed control was necessary. But ever cautious because of the poor luck we had with other crops on the same site, we did not care to risk all the nursery plants there. Also, for reasons of curiosity and scientific interest we planted some in other areas of the farm where the soil and conditions varied. Furthermore since vetiver is not very well known in Paraíso, we wanted to plant some plots to demonstrate the multiple applications of vetiver for our many visitors.

The demonstration plots are:

1. bank stabilization around the sedimentation tank
2. coffee field drainage ditches
3. contour planting for terracing on an eroded hillside
4. reclamation of impoverished soils
5. boundaries and windbreaks for vegetable plots
6. test plot for poor sandy soil
7. use of the leaves as mulch in various places

One year after planting we harvested the first 75 clumps that upon dividing yielded 1,350 tillers for the first sale. The largest clump yielded 62 plantlets while the average was only 18. We sold 1,000

and enlarged the nursery area with 350 new plants. As of today the nursery is double its original area, allowing for a secure supply of planting material.

To date we have sold 4,600 plants and the demand is growing. With an average of twenty-five tillers the clumps are now more vigorous than before. Planting material from our nursery is now prospering in the following areas of Costa Rica:

1. Lankester Botanical Garden of the University of Costa Rica;
2. Coffee mill in Orosi for bank stabilization of the oxidation ponds;
3. Coffee mill in San Marcos for bank stabilization of the oxidation ponds;
4. Organic coffee farms in Pejivalle, Santa Maria de Dota, and Paraíso;
5. Internal roads on a coffee farm in Orosi;
6. Public road in Quepos;
7. Rural development project in Paraíso;
8. Restoration of a creek bed after a flood in Cachi;
9. Erosion control on fruit farm in Orotina; and
10. Small quantities among neighbors;

We have observed that the vetiver roots form a thick strong network to a depth of approximately 20 centimeters, even though the literature reports greater penetration. This we attribute to a combination of hard clay soil and a high water table. Another limiting factor for vetiver growth is the lack of sunlight, which suggests that the ditches in the shady coffee fields will require a different treatment.

From this experience we have learned the following lessons.

1) For a robust nursery you should use only the best quality planting material. If there are small tillers they should be planted with two or three together to assure survival and vigurous growth.
2) Periodic pruning stimulates growth and lets in sunlight.

We are not trying to make a profit from our nursery operation. Nevertheless, it should be self-sufficient. The tasks are done after regular working hours so as not to interfere with normal farm labors. This provides an additional income for the workers who have learned to appreciate the vetiver and have even taken plants for their friends to plant. The principle purpose of the vetiver nursery has always been for the use and benefit of the small farmer and this is being fulfilled.

At the Second International Vetiver Conference in Thailand these skilled Thai handicraft workers demonstrated their skills in basketing making with vetiver grass. Thailand is willing to train foreigners in these skills if they wish to come to Thailand. Photo Credit: Dick Grimshaw

Thailand: completely rehabilitated from wasteland to a beautiful forest in seven years using VS. This drianage line is ponded by a small dam and proteced by vetiver. Photo credit: Dick Grimshaw

A VETIVER INDEX
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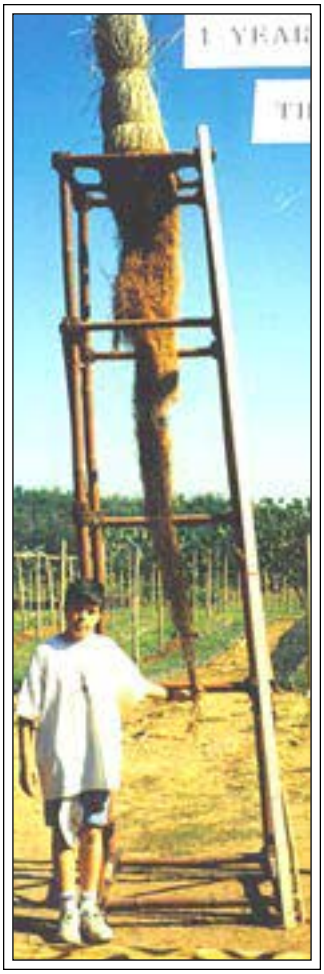
An example of Thai "fine" handicrafts based on vetiver grass weaving material.
Photo Credit: Dick Grimshaw



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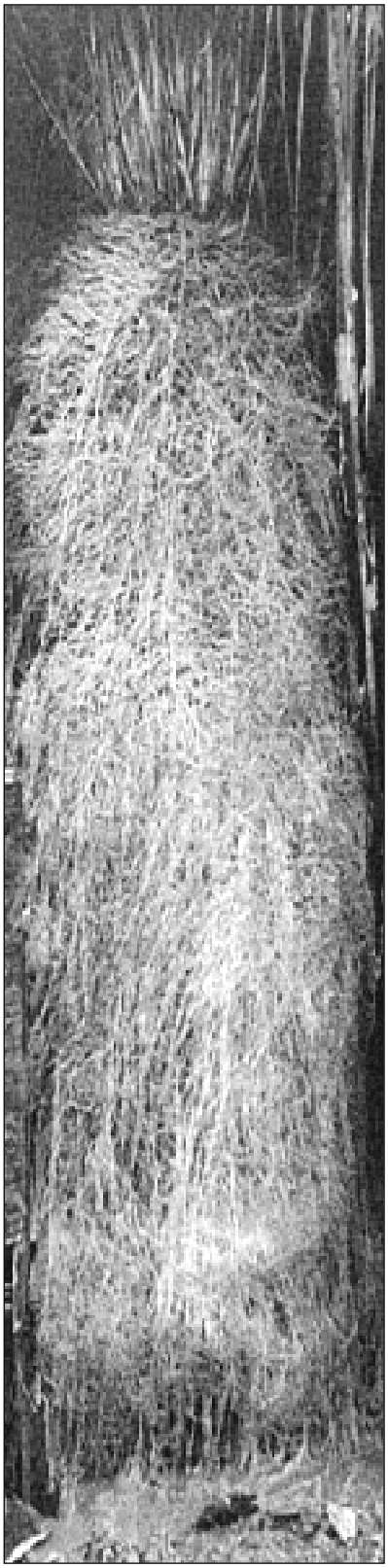

Thirteen months of vetiver root growth - 2 meters - Diti Hengchaovanich's pride and joy! Photo credit: Ditii

Vetiver grass was planted on a very unstable highway slope in Queensland. Top left shows how all the local grasses had been destroyed by the "tar" leachate from the road. Top right shows newly planted vetiver (12/22/98). Bottom left shows vetiver struggling to survive, much of it looks dead ((6/4/99). In February 2000, all the vetiver had fully recovered and the slope was stable.

Note the random planting of vetiver in upper right. This was deliberate in order to prevent build up of water on the slope (behind a conventional hedge) thus reducing soil pore pressure and chance of slippage. In fact undr this system vetiver acted as a water pump and removed excess water. Phot Credit: Paul Truong.