

Case Study

Vetiver System for Railway Batter Stabilisation in Madagascar

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EXTENDED ABSTRACT

Madagascar, the world's fourth largest island, represents a natural biodiversity heritage for humankind and is jeopardized by rapid environmental degradation, caused in large part by deforestation and consequent erosion, especially on the high plateau, which is home to most of Madagascar's remaining tropical forest.

Madagascar's physical geography poses substantial stabilization challenges. Its lateritic soils are soft when wet and extremely erodible. (Wells and Andriamihaja 1997). It is famous not only as a natural paradise but also as the "Red Island" that seems to bleed into the sea (Juliard 2000).

In 2000 this vulnerability was shown when cyclones Eline and Gloria slammed its East Coast. Among the hardest hit was the FCE railway. The FCE (Fianarantsoa-Côte Est) railway crosses over Madagascar's last remaining band of highland tropical forest and down a steep escarpment from Fianarantsoa (1,100 m altitude) to the coastal town of Manakara. The railroad is a solitary lifeline for 100,000 people who live in an area, and serves more than a million people as it transports goods and travelers between the highland and the coast.

The train line suffered devastating damage: more than 280 landslides dumped some 150,000 m³ of earth over its 163 km length. Rail service was disrupted for some four months causing human suffering and serious economic loss

Impact of the Train on the Economy and Environment

Without the train, farmers had no means of transporting their crops to market, and therefore no revenues to buy rice and other food crops (PAGE 2000, Vol 3). With no way to sell tree crops such as coffee and bananas, they would quickly be forced to cut the trees and plant annual subsistence food crops on the steep slopes. Quickly these lands become infertile and farmers must clear new agricultural lands. This is the definition of slash and burn agriculture so disruptive to such a biodiverse country. It was estimated that 150,000 hectares of tropical forest would be cut by farmers forced to replace sustainable tree crops by non-sustainable annual food crops over the next 20 years (PAGE 2000, Vol 1). Criss Juliard suggested to the LDI project that vetiver technology could solve this problem in a cost effective and sustainable fashion and persuaded the project to bring in two Thai specialists.

The Use of Vetiver to Protect the FCE Train Line

Two Thai vetiver specialists were sent to Madagascar by the Thai Royal Development Board soon after the cyclones to investigate the possible uses of vetiver in restoring the rail line and protecting it from future erosion damage.

Two categories of interventions were carried out: the first were what we called "technical interventions." This included removing landslides, rebuilding drainage infrastructures, and

restoring washout areas. The second was a community-based intervention to reduce the cultivation of erosion inducing annual crops on the very steep slopes abutting the track and instead to introduce a vetiver based sustainable cropping system that would both protect the embankments of the rail line and ensure farmer revenues. Maintenance of vetiver plantings was first done by the project then by the communities over a 3 year period.

Farmer Vetiver Interventions to Save the Railway

Slash and burn agriculture practiced along the railroad line had to be modified and replaced by sustainable agricultural systems that protect the soil and provide profitable livelihoods. Combining knowledge of the local production system and economy with the Thai specialists' knowledge of vetiver, the project proposed an alternative production system. The farmland stabilization model was based on three components: (i) planting vetiver to stabilize the slope, (ii) planting annual crops between the vetiver lines to produce immediate revenues equal at least to the revenues of the displaced crops (manioc or rice) , and (iii) planting perennial tree crops that would provide long term income and further stabilize the slope. Vetiver hedgerows and annual crops are common to all the module options offered to farmers. Five different perennial crops were proposed, coffee, breadfruit, citrus, apple, spices (cinnamon and pepper). The key was to offer different arrangements based on the variety of sites that were located all along the railway.

- ***Recruitment of Participants***

A public education campaign showing the connection between agricultural practices and landslides was carried out. A special train with singers, a puppet show and village leaders spoke of the historic importance of the train line and the role of the villagers in keeping the line open. Shortly after the passage of this train and pursuant conferences, project staff went down the line to recruit participants in the slope stabilization effort. 90 signed on as participants in the first year, 600 participated over the 3 years.

- ***Six Steps in Hillside Restoration***

- Step 1: Obtain a land use permit from the FCE
- Step 2: Measure the field, determine the number of modules
- Step 3: Lay out the contours and plant the vetiver
- Step 4: Planting annual crops
- Step 5: Plant the trees or spices
- Step 6: Maintenance and commercialization

- ***Farmer Reaction to the Vetiver Intervention***

Initially farmers along the line were somewhat skeptical about the proposed vetiver intervention. Only by a combination of gentle pressure and incentive (such as providing the trees free) were they able to ensure an initial interest in 90 farmers. Farmer interest expanded significantly after the first rainy season, as all fields with vetiver had no erosion. It is significant that after the first year, many of the participants have been “repeat” farmers who want to progressively vetiverize larger parts of their trackside fields. From skepticism, the intervention evolved to the point where it is a mark of considerable pride to earn a gaily painted sign, which sports the farmer's name, the kilometer indicator of the field, and the slogan, “the railroad is our heritage, let's protect it” as many hundreds of fields along the line now do.

Results and Lessons Learned

Three years after Eline and Gloria, more than 2 600 000 vetiver plants are, with little fanfare but much efficacy, doing their job of erosion prevention and slope stabilization along the railway line. In 2003 only 1 slip occurred instead of 260 in 2000, all fields stabilized with vetiver held in the 2003 rainy season and have held since that time. The introduction of the modular system to plan and implement the vetiver intervention on farmers' fields was instrumental in helping the project to move quickly right after the cyclones and to work with many farmers in a relatively short period of time. It allowed the project to intervene efficiently and effectively, but also to maintain the critical element of farmer control over the activity. This was the key to success allowing choices to be made by farmers themselves. A manual was prepared based on the *modus operandi* of the FCE project to facilitate their application elsewhere. Indeed the northern railway line is now implementing a similar program.

In the three years that followed that visit, the Land Development Intervention Project (LDI) and FCER projects, in collaboration with the FCE Railway, have worked to systematically disseminate vetiver along the line, both in a technical intervention designed to restore areas hit by severe landslides, and in a community-based intervention that has enlisted more than 600 farmers in batter stabilization activities along the train line. Using an innovative "vetiver-for-vetiver loan/reimbursement" scheme and a "modular cropping" system that have facilitated dissemination and implementation with farmers over a three-year period, more than 2.6 million vetiver slips have been planted along the 163 km long train line. This has significantly reduced erosion damage and strengthened slopes and infrastructures along the line. The vetiver intervention also continues to provide farmers with a sustainable agriculture alternative to traditional slash-and-burn practices, has enhanced soil fertility and improved farmers' income.

The success achieved has prompted an adoption of these vetiver intervention techniques by another railway line in the northern part of Madagascar. The combination of appropriate technology, high quality technical assistance, sufficient project funding, active community participation, and continuous follow-up demonstrates how the vetiver system when applied correctly can solve even the most difficult of problems in very under developed regions of the world.

Key words: Landslide, erosion, dissemination, modules, slope stabilization, soil fertility.

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Brief Introduction to the Speaker

Dr. Dale Rachmeler has been with the Vetiver Network International since 1996, at the time he working in Madagascar. He is a professional tropical agronomist and agribusiness specialist. He has worked on projects funded by USAID over a career spanning more than 30 years on the African continent. He is currently working in Ghana on a business sector advocacy project. He has been a senior officer of TVNI since 2003 when he was elected President during ICV-3. He helped start-up vetiver programs in Madagascar, the Democratic Republic of the Congo, Morocco and Ghana.