The Vetiver System, a biological solution for development and conservation in Madagascar

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1) Introduction

Madagascar has an exceptional biodiversity, with an average 75% of endemic mixed fauna and flora population (the highest in the world), and with a very large range of ecosystems: from rainforests with 3 500mm/year rainfall in the North-East to the arid areas under less than 250mm/year on the South, and an altitude between 0 and 2 876m. Moreover this wealth is far from being fully discovered, and every year some new species of lemurs, reptiles, amphibians or orchids have been discovered.

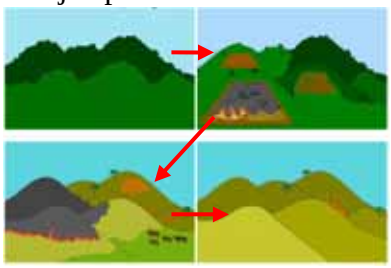
In spite of this background the agro-environmental degradation is catastrophic: according to a World Bank's study, almost 300 000ha of forest disappear each year, and there is only 10% of the rainforest left. Also according to the World Bank, Madagascar is one of the most eroded country in the world. From space, the astronauts can see two land marks made by human on the Earth: one is the impressive Great Wall of China, and one is, from December to March, the spread of the red sediments to the Sea from erosion derived from rivers around Madagascar. They said « The Red Island is bleeding ».

The Island is separated to the African continent, and was populated by humans only 2.000 years ago. The « Great Island » contains old species and the highest endemic level (average 75% of fauna and flora are endemic).

Under the rich ecosystem of rainforest, the soil is remained very fertile, but only on a thin layer, on top of a lateritic soil. Unfortunately, when the vegetative cover has disappeard, the soil is very sensitive to erosion and all the nutrients are washed away. The subsoil is lateritic and is extremely erodible.

2) Context and problems

The traditional agricultural practices (slash and burn cropping practice during the rainy season) is not adapted to the topography, soil types, climate, and especially regarding to the demographic growth : 50% of the 20 millions inhabitants are less than 18 years old. This practice is, by far, the first reason for the land degradation. The extreme poverty (80% of the population living with less than 1€ a day) prevents the major part of the farmers to have access to alternative practices.



After slash and burn, the land is bare and farmers sow upland rice just before the big rain falls. Nothing is done to take care of soil erosion, and a large part of the nutrients are washed away. The farmers will have to clear another parcel of land for the next year crop. In the third year no crop is able to grow on this severely deteriorated land. According to a World Food Program study, 400T/ha/year of soil are taken away by the erosion. The sediments end up on the wetlands, rice fields (which disappearing under sediments), rivers and finally on the sea and its coral reefs. The result is a huge degradation of environment, a very poor and acid soil, developing massive landslip, locally known as Lavaka.

Many “development” projects, GO or NGO, often with very big budgets, try to bring solutions, but only very few are effective, and until now the degradation of the lands continues and becoming worse and worse every year. Many of the politic’s makers want the “Green revolution” by using chemical fertilizers, pesticides, mechanical inputs, new seed varieties, new sophisticated techniques… but poverty prevents the major part of the farmers to have access to those, and while the soil fertility is taken away during every rainy season.

The environmental situation in Madagascar is terrible, and this presentation want to expose why and how the Vetiver Grass Technology (VGT) can be the solution facing the problems while implying the local communities, and then reduce poverty and lands degradation:

- soil erosion, fertility and soil loss
- lavaka, gully erosion and landslides,
- soil and water degradation,
- rainforest disappearance,
- non-sustainable and non-productive agricultural practices,
- pollutions,
- infrastructures degradation,
- ricefields and hydro-agricultural infrastructures sedimentation
- banks erosion and infrastructures destruction
- floods damages increasing : more runoff and less water infiltration

The nutrients are washed away by erosion and after few years the soil has definitively lost its fertility and its capacity to retain moisture. Due to this lackness of protection, several erosion can become gully erosion called lavaka, and sediments can recover the ricefields. The result is a very degraded land as you can see at this pictures.

The main thing to do in order to resolve this problem, is to control erosion and in the same time to maintain the soil fertility and conserve moisture.

These erosion problems are not only concerning the agricultural field, but also have a large impact on infrastructures, and consequently have a very negative impact on economy.

In this context, La Plantation Bemasoandro is a small private company, which want to bring the Vetiver System at its high potentiality and as an amazing tool to bring answers facing these problems.

3) The Vetiver System, an adapted solution for sustainable development

The VGT can offer several perfect solutions and is well adapted to the economical and agro-environmental context:

- easy to promote the technique
- simple and cheap to apply by the farmers themselves
- adaptable to all conditions in Madagascar
- fast, sustainable and efficient technique for water and soil conservation, slopes stabilization, infrastructures protection, waste water treatment
- promote sustainable farming: farmers can cultivate the same part of land year after year with improved yield, they do not have to move their farms every year, then they conserve their soil and protect the forests, as well as rice fields, rivers etc.
- interesting second-products: handicraft, fodder, roof, essential oil,…

Vetiver capacity:

- -90% of sediments stopped
- -70% of water runoff reduced
- -50% of soil fertility improvement
- -Better moisture, recharge of groundwater and water quality
- -Solution in the long term: once established, the hedge will work for decades, and its effectiveness will be improved year after year, contrary to many other solutions.

4) La Plantation Bemasoandro's projects realized with the Vetiver System

La Plantation Bemasoandro (what is meaning "Sunshine Plantation") is a small private company, created in January 2008, which want to bring the Vetiver System as its high potentiality and as an amazing tool to bring efficient answers facing these quoted problems.

Since its creation, this company has collected, produced, planted or used 1,5 million of Vetiver plants in three years period, and has planted 85 Km of Vetiver Hedge Rows for different purposes:

- land rehabilitation and environmental restoration
- slopes stabilization and infrastructures protection
- floods and sedimentation damages alleviation
- water treatment and urban landscaping

with almost 100% of success, seem that the correct way of using Vetiver is the main key of its success.

Through it the company has created more than 15,000 man-day employment, benefit for poor people, and has trained thousands of farmers, also hundreds of technical staff, engineers, chiefs of project. In this way, the company in charge of VS application participate not only to protect infrastructure, improve soil and water conservation, act for ricefields protection, floods damages alleviation, but also to improve environmental, social and poverty alleviation impacts.

Since its beginning, La Plantation Bemasoandro promoting and doing popularization of VGT applications: Erosion control, slopes stabilization –Infrastructure protection –Lavaka stabilization -Revegetation and land rehabilitation -Crop improvement and soil conservation -Water quality improvement -Handicraft -Nurseries with local communities -Material plant production -Landscaping -Riverbanks protection –Beach protection

4.1) Infrastructure Protection and slopes stabilization

Many projects, like mines, roads, property, should use VS, moreover that represent a nice opportunity to incorporate local communities. For the farmers, selling planting materials is another opportunity. In this way, the company in charge of VS application participate not only to protect infrastructure, but also to improve poverty alleviation impacts. The VS offers many solutions for infrastructures protection such as:

- Irrigation and drainage protection
- Roads and railways
- Buildings and property
- Riverbanks, bridges, hydro-agricultural infrastructures
- Dune, beach, littoral protection

The VS has to be applied under technical criteria to be efficient. Other techniques can be combined but never with the same efficiency to control erosion: grass turf, wood fascines, trees plantation… It should be noted that he concurrence and the shade from the other vegetation can suppress the Vetiver growth. Especially in the tropical countries, the drainage must be considered very importantly, because the runoff from the bare area is increased, like on the slopes along a road.

La Plantation Bemasoandro has done some works for infrastructures protection: the railway between Antananarivo and Tamatave, some pylons for telecommunication, a pipe-line…See below the pictures, where the arrow "→" represents a "before/after work" idea.

4.1.1) Railway TCE PK 77

This lavaka (gully erosion), taking up 1.500m² of area along the railway was a permanent problem for the railway national company (Madarail), who did not have any efficient and cost-effective solution. This erosion problem on a big steep slope sometimes forced to move the rails, and disrupted the traffic. They had difficulties to believe that we will resolve this problem with Vetiver System, which is done!

4.1.2) Railway TCE PK 147

This site was a “black point” of the line, because of many landslides, and have many times disrupted the traffic. A new infrastructure has been done, with walls, gabions, drainage, and slopes nicely prepared for Vetiver Plantation.

4.1.3) Railway TCE PK 148

This was a new infrastructure, made in order to permit the “micheline” (very old train, rehabilitated for tourism) to make a turn-back. It was made in a rush, because it had to be ready for the Ministry visit, for the line inauguration! The responsible of this infrastructure’s work told me that he had to make it in a rush, without compaction, without drainage, without any consolidation, and he was thinking that the infrastructure will be washed away by the heavy rains and the big river, situated on the bottom, at least after six months. I answered him “The Vetiver will hold your infrastructure!” which is done!

4.1.4) Railway TCE PK 154

Another “black point”, which was rehabilitated by recent infrastructures and Vetiver System application.

4.1.5) Railway TCE PK 185

This point of the line was very dangerous and occasioned some line cuts. Once again, resolved problem thanks to the Vetiver System!

4.1.6) Railway TCE PK 204

This small site occasioned some landslides on the line. Stabilized by Vetiver System.

4.1.6) Railway TCE PK 277

The biggest “black point” along the TCE railway line: many times, the line was cut at this PK 277 because of a big water runoff accumulation from the hills and valley upstream.

4.1.7) Pylon Ranomafana

This pylon got serious problem when this impressive landslide happened. This was due to an underground water infiltration. It is now resolved with the effectiveness of the Vetiver System and some other erosion control measures.

4.1.8) Pylon Didy

This 40m-high pylon, built at an altitude of 1.500m high, represents a very expensive infrastructure (spreading ADSL internet connection with hertz-waves), and needed that we took care of the slopes around. Sisal mat was applied between Vetiver lines to cover the soil.

4.1.9) Pylon Ankaramena

Another pylon, in an area with a dry climate during height months and only 800mm of rain, spread on a four month period during the year.

4.1.10) Pipe-line Andasibe

Some slopes stabilization's work for a pipe-line protection and environmental rehabilitation.

4.2) Hydro-agricultural infrastructure protection, Banks Protection, Ricefields protection against sedimentation and flood damages

The "Alaotra Lake "is the most important rice production area in Madagascar. Unfortunately, the permanent environmental degradation on the hills (soil erosion, lavaka to form, sedimentation) upstream from ricefields cause many damages on the hydro-agricultural infrastructures: sedimentation, flood damages, loss of ricefields and other cultivable lands, loss of rivers, wetlands and lakes… Consequently, the maintenance costs increase and the effectiveness of these huge infrastructures decrease. Even if the local climate do not give facilities for Vetiver use (1.000mm of rain only during 4 months, when all the problems appears after very intensive rains, and then…0 mm during 8 months!), the Vetiver System Application has been suggested by La Plantation Bemasoandro, in order to trap the sediments coming from lavakas, decrease the strength of the water flow by filtration and dispersion, and finally protect banks and hydro-agricultural infrastructures on a 4.000ha area of ricefields. Then theses infrastructures can play them role and the maintenance cost has been decreased.

First of all, the feasibility study project made an evidence that the material plants which will be used have to be very strong and able to be planted during the long dry season, and then to be enough strong to hold against big floods. The "VHR" was chosen, and many on-field training session was hold with future VHR producers.

The chosen technique by La Plantation Bemasoandro was to produce one-meter-long-pot through local communities nurseries. This type of Vetiver production technique is called by us "VHR" for "Vetiver Hedge Row", and was a 100% success, even if the problems were very high and difficult to resolve! In total, we have produced and planted 40.000 VHR (or 40.000meter) for this project.

First Training sessions was done, for hundreds of farmers and 90 technical staff, engineers and chiefs of projects working on the concerned area.

Then local famers nurseries were set up to produce the VHR required.

Once the VHR were ready to transplant, and the rainy season finished, the transplantation began for Banks Protection:

Transplantation of VHR for Banks Protection

Where the gabions and concrete failed, the Vetiver System successes!

The maintenance work was here very important, because of the long period without rain (8 months), pressure from cattle and fire. The hedges had to be enough strong when the rainy season will be start!

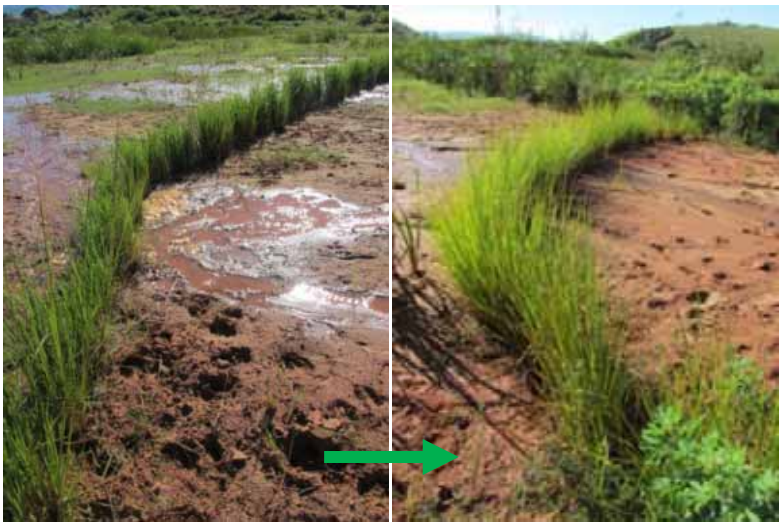
Once the VHR were ready to transplant, and the rainy season finished, the transplantation began for Sediment trapping and flood damage alleviation purposes:

In these very hard condition, the hedges have to be very strong and nicely implanted to resist against this very high rate of flow coming from the lavaka upstream (causing a huge accumulation of water runoff, bringing sediments to the ricefields, rivers, lakes, wetlands, infrastructures:some national roads are cut during few days each year)

This part of a Vetiver hedge planted was not enough strong and established to resist to the rate of flow!

This picture shows the sediments brought by the water, and a still-young Vetiver hedge doing what it can do to trap sediment and reduce the rate of flow.

Once nicely established, the Vetiver hedges are reducing the water flow by filtration and dispersion, and are trapping sediments, as shown in these pictures.



These pictures are showing the strength of Vetiver Hedges once nicely established, and its exceptional capacity to trap sediments,…and brushwoods!

4.3) Waste Water Treatment, Banks Protection, Urban Landscaping

Antananarivo is the capital of Madagascar with 2 millions inhabitants, but without proper water treatment facilities. Thus, the water quality of the important network (canals, drains, lakes, swamps, rice fields etc) is very contaminated and highly polluted. Moreover during the rainy season, many problems developed: floods, erosion, sediments… and often the drinking water is not drinkable. However Antananarivo is also an agricultural town, with a lot of rice fields, vegetables and cattle farming, fishing etc

That's why this town needs a system to improve water quality, but also to prevent erosion, floods and sediments, easy to reproduce in a big scale and to maintain, sustainable and efficient. The objective is first to show how the VS works: riverbanks stabilisation (that can also filter water coming into the swamp and its effluents) and floats to improve water quality and reduce pollutions, including the town planning. The site was a swamp previously, converted to a retention lake of 100ha area, for flood mitigation during the rainy season.

Site 1: localized along an urban green park, the Vetiver was applied here for banks protection, water treatment and landscaping. The 150m² of floats have been destroyed by illegal fishers, who saw a big fish concentration under the floats…

Site 2: localized in a highly polluted water canal, 250m² of floats were set up, but the mud flow during rainy season recovered or washed away all the floats, except a part of one, now an impressive Vetiver bush in the middle of the pollution!


These pictures are showing the pollution level in this “water”.

This is the last Vetiver bush, which have resisted against the high rate of mud flow during rainy season, and show what is the capacity of this grass to grow in extremely polluted sites.

Site 3: Banks protection and environmental conditions improvement in highly polluted urban area



4.4) Nurseries and local communities development

If we combine the tool Vetiver and its capacities, with its popularization, farmers will apply VS on their fields after a snow-ball effect. To achieve that, farmers should understand that they can, and they have to, change their traditional agricultural practices for their benefit, even if that will change their ancestral techniques Vetiver promoters as La Plantation Bemasoandro should show how the VS can bring solutions and what are the benefits, with a very low cost technique. Then the farmers can get many opportunities to use the by-products: handicraft, fodder, mulching, construction material, and to sell the slips or the clumps on the market.

When a big project using Vetiver, the best way is to mobilize the local communities: the nurseries can be set up near and along the end user site, and the propagation and maintenance works are delegated to the local farmers.

Training is very important and must de done first, with demonstration and technical brochures, materials and tools acquisition, and then the supervision must be done regularly and frequently until the job proceeds properly. Nurseries should be regularly inspected to assure that plant material is being properly managed. The payment must be adapted to the poverty level, it cannot wait until the plants in pots are ready, but it must be spread out according to the work progress. The quality of the job depends on the farmers and on the supervision.

The mobilisation of communities into Vetiver business generate a lot of positive social, economic and environmental impacts. The people who is trained to plant Vetiver (to produce plants and to control erosion) will catch nicely the interets of VS and will apply on their lands. With a snow-ball effect, many farmers will apply VS on their crops, and many lands, forests, water&soil will be saved, while agriculture yields will be improved. To sell the material plants, to produce and to propagate the Vetiver in nurseries are good opportunities for farmers. Also, a project using VS will give employment and revenues during the work for local communities.

4.5) Soil and Water Conservation for sustainable agriculture

Here are some VS uses by the farmers for sustainable agriculture, after the VS was popularized during few years. Results: sustainable agriculture with better fertility and moisture, mulching, no more soil loss, slash-and-burn practice change to sustainable agriculture, then protection of the lands, forests, water&soil.

4.6) Handicraft Production

La Plantation Bemasoandro re-use its roots from material plants collection or production, and making handicraft with Vetiver Roots.

4.7) Training

As explained before, La Plantation Bemasoandro set up many training session.

4.8) Communication and event participation

As Vetiver System nicely applied is something new for many projects and people, the communication is very important and La Plantation Bemasoandro spend thousands of dollars each year to inform, to share, and to spread this amazing tool. It is also an occasion to show our competence and how-know with Vetiver System. La Plantation Bemasoandro participates to trade-fairs, events, expositions, forums, Reforestation days with Ministry, TV emissions, Radio interviews, News-paper articles, conferences, and put many informative billboards on the site treated with VS. Also, we set up demonstration sites for nurseries, ornamental and roof purposes, handicraft makers, etc… We have participated to 3 Vetiver workshops: Kenya 2009, Ethiopia 2009 and Chile 2010, and we are proud to be part of The Vetiver Network International (TVNI), as a Senior Technical Advisor.

5) Contribution of the Vetiver use facing to the climate change

Madagascar is the most eroded country in the world with an average of 300T/ha disappearing in the Indian Ocean each year! The ground should be considered as a non-renewable natural resource. It is urgent to act, efficiently and sustainably. Yoann Coppin and La Plantation BemasoandroSARLU have planted more than 5 million Vetiver plants in Madagascar in a seven years period. By reducing the impacts of soil loss and runoff, improving water infiltration into the soil and groundwater recharge, alleviate floods and sediments damages, our activities with the Vetiver System are bringing a contribution to the necessary adaptation facing the climate change (desertification, drought and floods more intense, water quality decreasing, …).

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www.vetiver.org Archive

Brief Introduction to the Speaker:

Yoann Coppin is a Forestry Management Engineer from France, he went to Madagascar the first time on 2001, to study the rainforest on the East Coast. He heard some NGO using a grass for soil stabilization, and discovered the Vetiver on the Internet and thought that Vetiver is the perfect solution for the environmental problems at Madagascar, even he has never saw any Vetiver plant. He submitted a small project using Vetiver grass to be financed by the French Ministry of the Youth and Research to rehabilitate the lands degraded by the traditional agricultural practices. The project was undertaken successfully, 20 000 slips were planted on slopes burned, combined with crops, and 5.000 on a nursery to insure the long term if needed and if new funding will be found.

Then he worked almost 2 years as an agricultural coordinator for a NGO and, out of many activities, set up a large program against erosion: After that he worked for HYDROMULCH, responsible for the propagation through community's nurseries. In total, 2 millions plants were propagated in pots through 36 villagers nurseries.

Since the beginning of 2008 he has established his own company, the only one at Madagascar that making business with only Vetiver System Application, including a large promotion of the Vetiver Grass Technology.

La Plantation Bemasoandro website: www.vetiver-madagascar.com
Picasa photos albums: http://picasaweb.google.fr/Yoannmada
Ppt Ethiopian Workshop:http://www.vetiver.org/ETH_WORKSHOP_09/ETH_CD3.pdf