

## THE VETIVER SYSTEM, A BIOLOGICAL SOLUTION FOR DEVELOPMENT AND CONSERVATION IN MADAGASCAR

Yoann Coppin

CEO La Plantation Bemasoandro, SUARL, Madagascar

TVNI Representative Madagascar

Lot II G 20 H Ambatomaro Antananarivo 101 MADAGASCAR

Email: [plantation.bemasoandro@yahoo.fr](mailto:plantation.bemasoandro@yahoo.fr)

Keywords : erosion control, infrastructures protection, environmental rehabilitation.



### 1) Introduction

Madagascar has an exceptional biodiversity, with an average 75% of endemic fauna and flora species, 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 150mm/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 land are burnt, and 50.000ha of forest disappear each year. Knowing only 10% of the rainforest left. Also according to the World Bank, Madagascar is one of the most eroded country in the world with an average of 400T/ha/year of soil loss! From space, the astronauts can see two land marks made by human on 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 ».



*River carrying red sediments in Madagascar, the same river during dry season...*



March 25, 2004 (ISS008-E-19233)



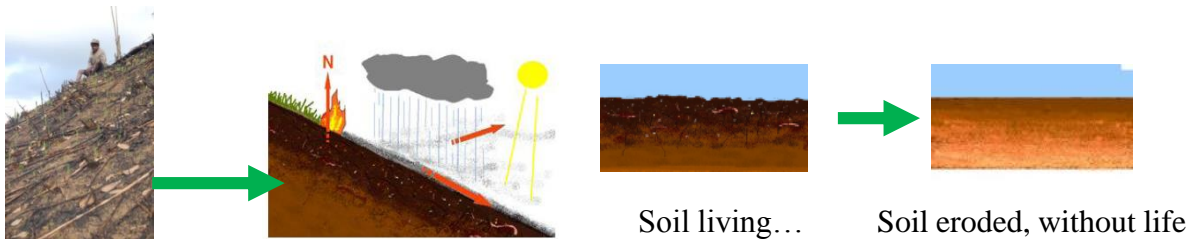
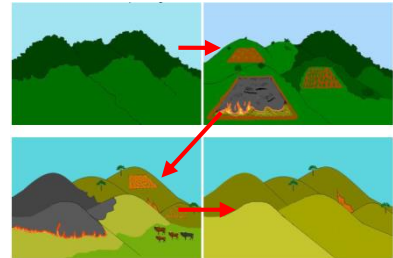


Unfortunately, when the vegetative cover has disappeared, the soil is very sensitive to erosion and all the nutrients, then subsoil, are washed away. The subsoil is lateritic and is extremely erodible.



## 2) Context and issues

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. It is also an ancestral practice. 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. The sediments end up on the wetlands, rice fields (which disappearing under sediments), lakes, 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.



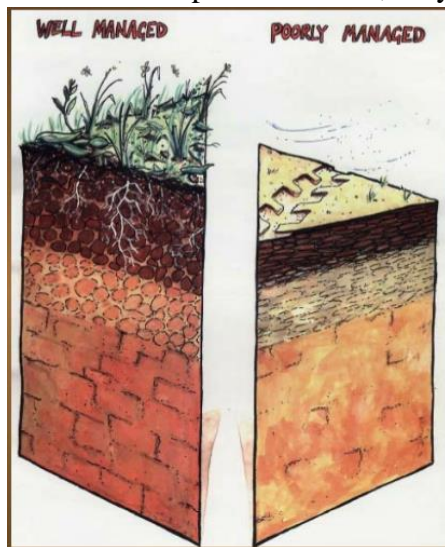
The environmental situation in Madagascar is terrible, and this presentation expose why and how the Vetiver System can be the solution facing the problems while implying the local communities, and by the way reduce poverty and lands degradation:

- soil erosion, fertility and soil loss
- lavaka, gully erosion and landslides,
- soil and water degradation,
- rainforest disappearance (decrease anthropic pressure)
- non-sustainable and non-productive agricultural practices,
- infrastructures degradation,
- lakes, wetlands, rivers, ricefields and hydro-agricultural infrastructures sedimentation
- banks erosion and infrastructures destruction
- floods damages increasing (more runoff -less water infiltration)
- soil and water pollutions...



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 are so huge that can recover ricefields. The result is a much degraded land as you can see on these pictures.

The main thing to do in order to resolve this problem, is to control erosion sustainably and in the same time to maintain the soil fertility and conserve moisture, in order to restore the water cycle going through a soil that retains water, a soil that is living. Erosion is killing the life in the soil (macro and micro fauna and flora, bacteria...) that result in an impermeable soil, very sensitive to erosion.



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.

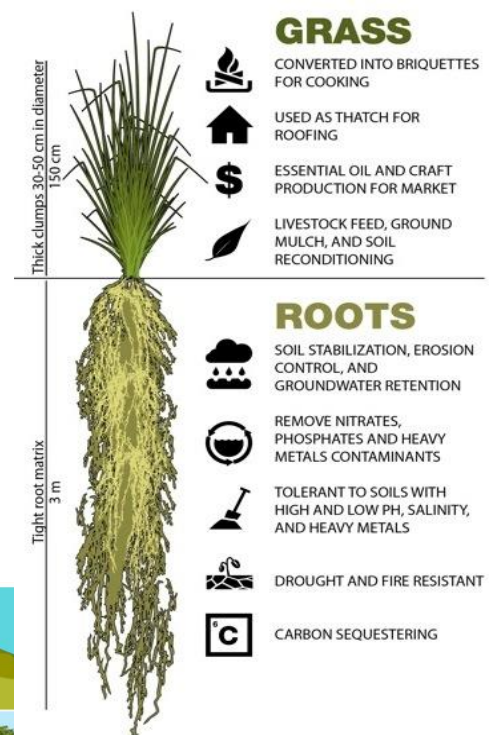
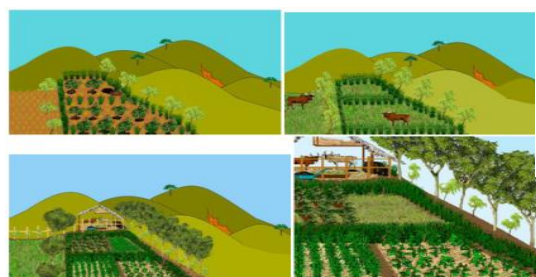
In this context, La Plantation Bemasoandro is a private company, which want to bring the Vetiver System at its high potentiality and as an amazing tool to bring answers facing these problems in the whole country and in the whole Indian Ocean Islands.



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

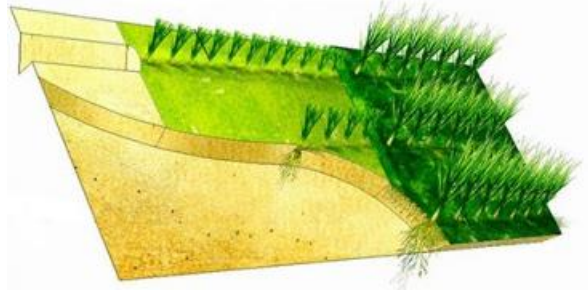
The VS used as a tool, can offer several perfect solutions and is well adapted to the economical and agro-environmental context:

- technique sustainable and affordable
- farmers themselves can produce and apply it
- adaptable to all conditions in Madagascar (soil, climate, altitude,...)
- fast, sustainable and efficient technique for water and soil conservation, slopes stabilization, infrastructures protection, waste water treatment
- promote sustainable farming: the same part of land can be cultivated year after year with improved yield, without need to change the farms every year, then forests are protected, as well as rice fields, rivers etc.
- interesting second-products: handicraft, fodder, roof, essential oil,...



Vetiver's tool capacity:

- -90% of sediments stopped
- -70% of water runoff reduced
- -50% of soil fertility improvement
- -Better moisture and recharge of groundwater
- -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.
- Natural vegetation will take place in these ecological conditions improved and finally replace the Vetiver, that will not support shade and much vegetal concurrence



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



La Plantation Bemasoandro (what is meaning “Sunshine Plantation” in Malagasy) is a 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 over 5 million of Vetiver plants in seven years period, and has planted more than 200 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
- Lavaka stabilization
- Crop improvement and soil conservation
- Riverbanks protection
- Material plant production
- 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 100,000 man-day employment, benefit for poor people, and has trained thousands of farmers, also hundreds of technical staff, engineers, and 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.

##### 4.1) Erosion control, 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.

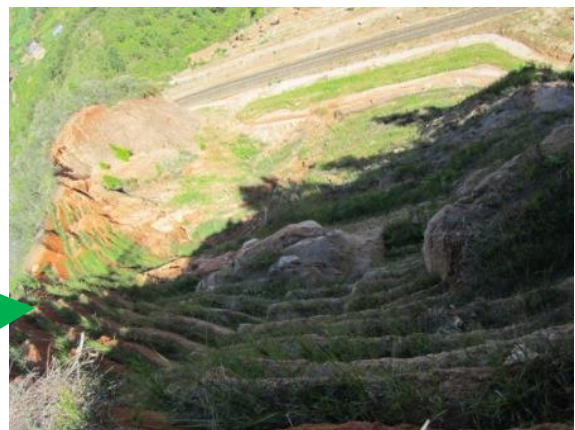
The VS has to be applied under technical criteria to be efficient. Other techniques can be combined but never with the same efficiency to control erosion: grass turf, wood fascines,

trees plantation... It should be noted that the 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. Sometimes we have to combine with mechanical structure as gabions to stabilize the toe of the slope that help for geological aspect. And, more important, drainage with rocks/concrete in order to help VS when it's needed. Fascines in wood and other small structures that can reduce runoff would be welcome, also some cover of the soil (seeds, mulch, hydroseeding, fiber mats, geotextile,...) but choice depending on the final customer! Sometimes VS is not enough alone to fight landslides. Sometimes, even trees are washed away, because of very deep landslide.

La Plantation Bemasoandro has done some works for infrastructures protection: the railway between Antananarivo and Tamatave, many pylons for telecommunication, a pipe-line, some roads, banks, 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 1.500m<sup>2</sup> 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 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.



#### PK 185





**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 AMBATOVOY PROJECT



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





This pipeline is property of Ambatovy AMSA, a mine of Nickel located near Moramanga, carrying the mud along its 220km to be treated by the plant in Tamatave, on the East Coast. Erosion is a big problem and we are now in charge of its maintenance since 2012. All problems were resolved thanks to the correct application of VS.

#### **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 are playing 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 community’s 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, plus 25.000ml by bare roots slips.



Training sessions were 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 BEFORE/AFTER*



*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 with big flow of water!*

We also started the VHR transplantation 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 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.

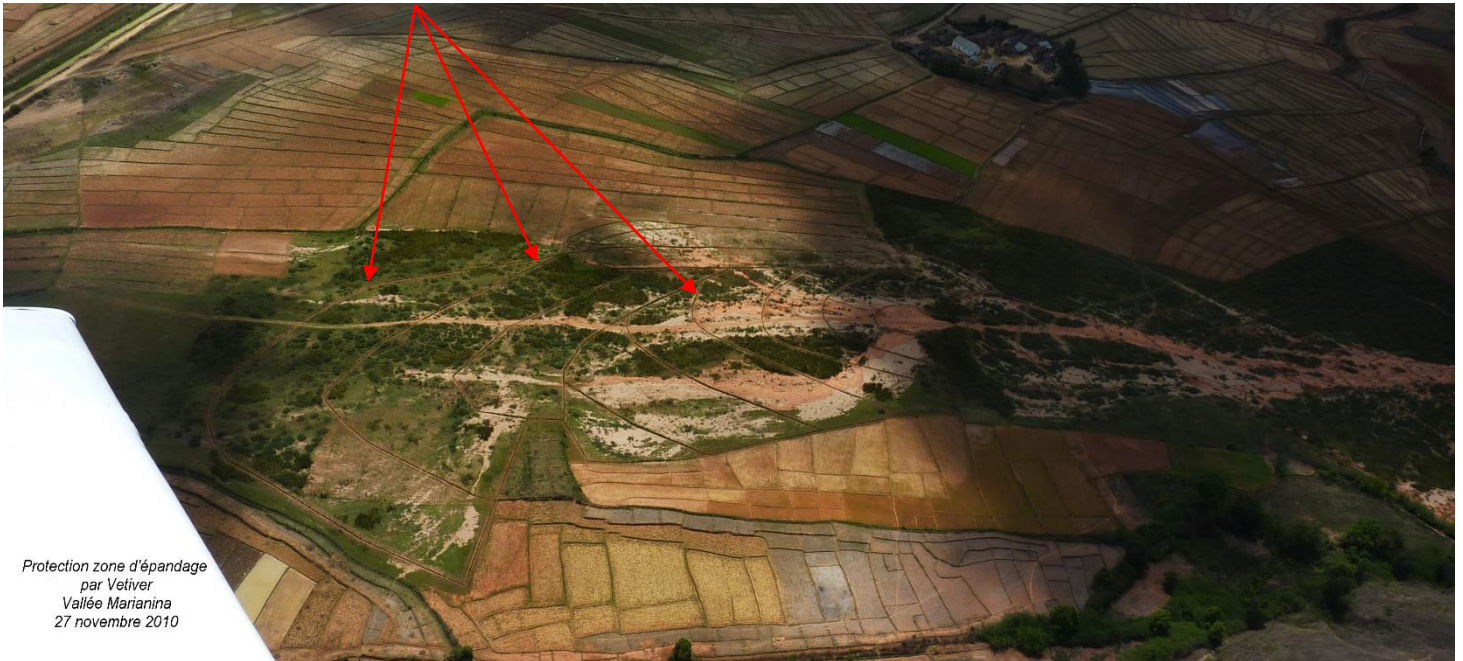


Once nicely established, the Vetiver hedges are reducing the water flow by filtration and dispersion, and are trapping sediments, as shown in these pictures.



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

Aerial view of the VHR plantation on spread area of the flow in ricefields, we can see countours of the Vetiver lines to trap sediments and reduce waterflow.

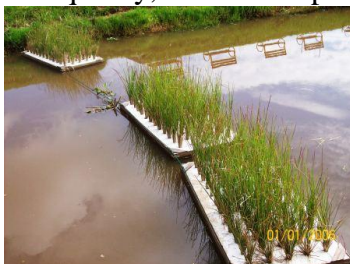


#### 4.3) Waste Water Treatment, Banks Protection, Urban Landscaping

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 150m<sup>2</sup> 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, 250m<sup>2</sup> of floats were set up, but the mud flow during rainy season recovered or washed away all the floats



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

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 be 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 interests 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 and helped by us. 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.



We also set up a project of reforestation with VS in order to protect a groundwater and to improve recharging by restoring the soil. By the way, local nursery was set up in order to purchase the future needs.



#### 4.6) Handicraft and oil essential Production



La Plantation Bemasoandro re-use its roots and leaves from material plants collection or production, and making handicraft with Vetiver Roots and leaves. We also make oil essential with our roots from our nursery. All the roofs in the nursery are made with our Vetiver leaves



#### 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, not conventional, 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 5 Vetiver workshops: Kenya 2009, Ethiopia 2009, Chile 2010, India 2011 and with Ethiopians in Madagascar 2011. Travels in Mayotte and La Réunion also. We are proud to be part of The Vetiver Network International (TVNI), as a Senior Technical Advisor.



### 5) Our Nursery

We also promoting VS in our production and demonstration site, that is located along the main national road (RN2) between the capital (Antananarivo) and the second biggest town (Tamatave, also main port), where we welcome visitors every day, schools, farmers,... The Vetiver is grown in an alluvial soil, to get easily the roots crop. Our cows eating the leaves, then the manure going through biogas, then we get a very good fertilizer for Vetiver.

*Vetiver field production (plant materials, leaves, roots)*



*Vetiver for fish pond protection*



*Vetiver for grazing, and energy production (biogas)*



*Vetiver for organic vegetable gardening*



*Vetiver for soil and moisture conservation*



## 6) Contribution of our Vetiver System use empowering sustainable development

Madagascar is the most eroded country in the world with an average of 400T/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 promoting the use of Vetiver System facing many environmental issues, knowing the development rate potential of Madagascar for the future decades, we contribute to promote and set up biological solutions that are sustainable for a green development of this country.

### References:

-Coppin, Yoann, (2005): “Rapport intermédiaire d’activités du programme de soutien au développement agricole de Vohimana” and “Conservation de la forêt de Vohimana grâce au reboisement, alternative de rente pour un développement durable”, Project Report

-Knoll, Carol (2008). Erosion control and vegetation restoration:

<http://www.vetiver.org/Graphics/Images/MAD-sandunetxt.pdf>

-Truong, P.N. (1998). Vetiver Grass Technology: Potential Applications and Benefits in the Protection of the Environment, Agricultural Lands and Infrastructure in Madagascar. Report to the United States Agency for International Development (USAID) and the United Nations Development Program (UNDP). Consultancy Project No. 623-0510. [www.vetiver.org](http://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 in 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 in 2003, 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 with Vetiver as a tool for agroecology: After that he worked for a private park and for HYDROMULCH, responsible for the Vetiver’s 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 in Madagascar that making business with Vetiver System Application, including a large promotion of the Vetiver Grass Technology.

La Plantation Bemasoandro website: [www.vetiver-madagascar.mg](http://www.vetiver-madagascar.mg)

Picasa photos albums: <http://picasaweb.google.fr/Yoannmada>

Ppt Ethiopian Workshop: [http://www.vetiver.org/ETH\\_WORKSHOP\\_09/ETH\\_CD3.pdf](http://www.vetiver.org/ETH_WORKSHOP_09/ETH_CD3.pdf)