

## CONFERENCE SUMMARY

### *Application of the Vetiver System for Environmental Protection: Prevention and Treatment of Contaminated Soil and Water.*

Rabat, Morocco, 14 November 2006

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The objective of the conference was to provide a general introduction of the Vetiver System (VS) with emphasis on its use in treating liquid and solid wastes, decontaminating polluted soils, and as a soil conservation and reforestation technique. It is a first step to create a knowledge base in Morocco that can be transferred to applications, research and expansion of its use in the Mediterranean basin, Africa and elsewhere. The conference was by invitation for a targeted audience of decision makers in the public, private and civil sectors.

The one day event was divided into three parts; power point presentations and papers, a demonstration site visit and a short workshop.

#### **I. Presentation of papers/Power Points**

Opening was by Professor Mohamed Badraoui, Director of the Program against Desertification and Natural Protection within the High Commission on Water and Forests. He stressed that the importance of the conference lied in our ability to test the application of the VS in Morocco and to identify appropriate uses within the varied Moroccan climate and soil environment.

The opening was followed by five presentations;

1. A general introduction to the main uses of vetiver throughout the world by Criss Juliard (Morocco);
2. Application of the VS in phyto-remediation and an update of research in different parts of the world by Paul Truong (Australia).
3. Application of the VS in the rehabilitation of mine tailings by Paul Truong (Australia).
4. Results of the VS use to reduce advances of desertification and vetiver's resistance to drought Dale Rachmeler
5. Agricultural application of vetiver particularly in banana plantations by Charles Prins, a local banana producer.

Presentations were followed by questions and a lively discussion period.

#### **2. Site visit**

A bus took participants to The Farm, a private 60 ha plant and tree farm near Ain El Aouda owned by Nabil and Luna El Shouk where we visited a waste disposal demonstration site, that was established June 30, 2006 and in which vetiver planted around and on top of a mound of

solid waste. Cut-away sections had been made on four sides that exposed the 5 month old vetiver roots, penetrating plastics, styrofoam, and rubble to a depth of about 40-50 cm. The site was watered for the first three months after initial transplanting. Pictures of the before and after situations are attached below. Participants also visited The Farm's vetiver nursery where vetiver had been multiplied in hedgerow fashion and planted out in bare root form. A walk through the farm also allowed participants to witness the different types of tree crops, vegetables and flowers being grown on the grounds.

### 3. Workshop/Discussion

Participants had a chance to ask additional questions to conference speakers and The Farm owner related to the demonstration site, and to discuss what they would like to see as "next" steps. Questions raised included the aromatic application of vetiver, results of heavy metal absorption in the roots rather than in the leaves and possible use of vetiver to "mine" metals and minerals using vetiver, disposing of absorbed heavy metals, mycorrhiza role in vetiver's adaptation.

Regarding next steps, participants suggested:

- Move directly to implementation; for some this would be a personal action; for others, it would be a collective action, but each according to their field or personal interest.
- Organizing follow-on conferences in different parts of Morocco and one on value-added aspects of vetiver; e.g., medicinal, aromatic, essential oils
- Launch actual application sites of the VS in different parts of Morocco, in different soils, comparing results as a way to promote the VS;
- A proposal was made to include vetiver among plants in a rural development project in Errachidia. It was proposed that a vetiver project be established in northern Morocco under the Development Agency for the North; and
- Approach development projects and suggest they promote the VS by adding VS elements to their project activities thereby maintaining the momentum created by this conference.
- the need for coordination to launch a vetiver initiative in Morocco and participants were encouraged to send proposals to a coordinating group composed initially of three individuals, Hachim El Alaoui ([h.elalaoui@iav.ac.ma](mailto:h.elalaoui@iav.ac.ma)), Abdelkader Allali ([allali05@yahoo.fr](mailto:allali05@yahoo.fr)) and Criss Juliard, ([cjuliard@mtds.com](mailto:cjuliard@mtds.com));

A highlight of the afternoon site visit was the discovery of Doctoral dissertation that had been completed by one of the participants (Dr Nadia Saidi, of the Applied Geoscience Laboratory, Science Faculty, Kenitra) entitled "Le Bassin Versant de la Moulouya: Pollution par les metaux lourds et essais de Phytoremédiation." This was a fascinating research conducted on local and non-indigenous plants' capacity to survive and to remediate polluted soil from abandoned mineral mines in the North East part of Morocco. Vetiver was one of the four plants that survived and produced encouraging results. A summary of the Vetiver section was sent to us for our review. Below is Paul Truong's summary of the document.

It was equally interesting to note that Dr. Paul Truong, a conference speaker, was cited many times in the thesis for his numerous research publications on the subject.

The coordinating committee along with others will try to keep you informed regularly of developments of the VS in Morocco.

The following is a short summary of the results of Prof Nadia Saidi's report:

*The region investigated is the Haut Moulouya, which sits between the Middle and High Atlas mountain range of Morocco. The area concerned is contaminated with heavy metals due to Pb and Zn mining in the past and is a watershed for one of Morocco's heavily used water ways for agricultural irrigation. Heavy metal levels found in the soil and sediment are: Pb from 51 to 3 061ppm, Zn from 113 to 10 740ppm, Cu from 18 to 258ppm and Cd from 0.2 to 34ppm. In addition old foundry residues also left extremely high levels of these elements: Pb from 3 031 to 73 936ppm, Zn from 1 495 to 409 741ppm, Cu from 334 to 1 899ppm and Cd from 21 to 1 046ppm.*

*Results indicated that vetiver successfully established on all 10 kinds of substrates, without any toxic symptoms despite their very high concentrations of Cd ( $1\ 046\ \text{mg kg}^{-1}$ ), Cu ( $1\ 899\ \text{mg kg}^{-1}$ ), Pb ( $73\ 936\ \text{mg kg}^{-1}$ ) and Zn ( $40\ 9741\ \text{mg kg}^{-1}$ ).*

*These results show that vetiver has a good ability of establishing and developing in substrates contaminated by Cd, Cu, Pb and Zn. In addition to its power of decontamination, a plant, considered to be a good candidate for phytoremediation works, must also have a good potential of soil stabilisation. The latter's ability is subjected to the architecture of its root system. Vetiver grass has a massive root system, vigorous and fibrous in all substrates used in this study. It grows vertically and often down to 3m depth and is non-invasive.*

*Dr Nadia Saidi concluded that vetiver grass has a good ability of establishing and developing in different substrates in Morocco. Its root system is well developed and good for the stabilisation of soil layers. Therefore the plant is a good candidate for use in the phytoremediation of regions contaminated by Cd, Cu, Pb and Zn.*

## PHOTO GALLERY

**Reception**



**Registration**



## FIELD TRIP LANDFILL DEMONSTRATION

**Garbage dump**



**Covered with 50cm of soil**



**Planting vetiver on top of the mound**



**Four months after planting and irrigated**



**Four months after planting, note the roots penetrating the garbage layer**



### **FIELD TRIP VETIVER NURSERY**

**One year old plants**



## WORKSHOP

**Criss Juliard leading the Workshop**



**Mr Nabil El Shouk, the proud owner of THE FARM, the landfill and Nursery sites, and Paul Truong in front of the Landfill**