THE VETIVER SYSTEM

VETIVER GRASS, A UNIQUE PLANT, WITH PAN TROPICAL APPLICATIONS THAT ARE ESSENTIAL FOR AFRICA.

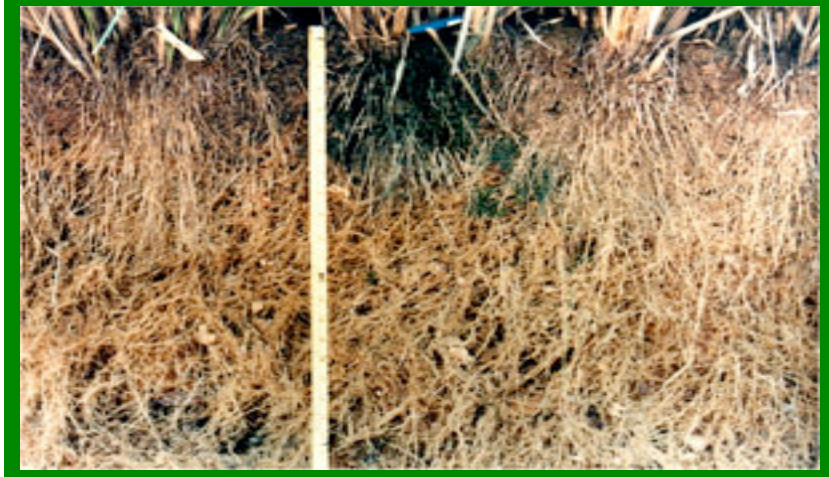
PROVEN AND GREEN ENVIRONMENTAL SOLUTIONS

Richard Grimshaw OBE

This is the plant that this workshop will focus on.

Chysopogon zizanioides

Vetiver Grass



The Hedge: a barrier above and below ground

The Plant - sturdy and stiff

The Root - 1 year old
Deep and Strong

SPECIAL CHARACTERISTICS OF VETIVER GRASS

- Grows under extreme and wide range of conditions
- Long living perennial grass
- Air temperatures: -15 º C to >55º C
- Soil pH from <3 to >10
- Annual Rainfall <300 mm to > 5,000 mm
- Tolerates at high levels all heavy metals
- Saline tolerant (salinity threshold ECse = 8 dSm-1)
- Fire tolerant
- Tolerant to long and total submergence in water
- Resistant to most pests and diseases
- Powerful (average 75 Mpa) root strength and deep root system
- Non competitive and non invasive. According to the PIER level of invasiveness criteria, non fertile vetiver cultivars are rated - 8. An acceptable level for plant importation by the most strict countries is +1

MASSIVE ROOT SYSTEM

- Just to underscore the differences between vetiver grass species, this photo from Vietnam compare *Chrysopogon zizanioides* (non fertile, south India cultivar) with *Chrysopogon nemoralis.* You can see why we promote the south Indian cultivars!!

TOLERANT TO HIGH SALINITY

Saline threshold level is at EC_e=8 dsm^{-1}, and vetiver can survive at 47.5 dsm^{-1} under dryland salinity conditions

TOLERANT TO HIGH ACIDITY

Highly erodible acid sulfate soil in coastal Queensland One year after planting

HIGH NITROGEN AND PHOSPHATE REMOVAL CAPACITY

With high capacity of removing N and P in polluted water, vetiver cleaned up blue green algae in 4 days

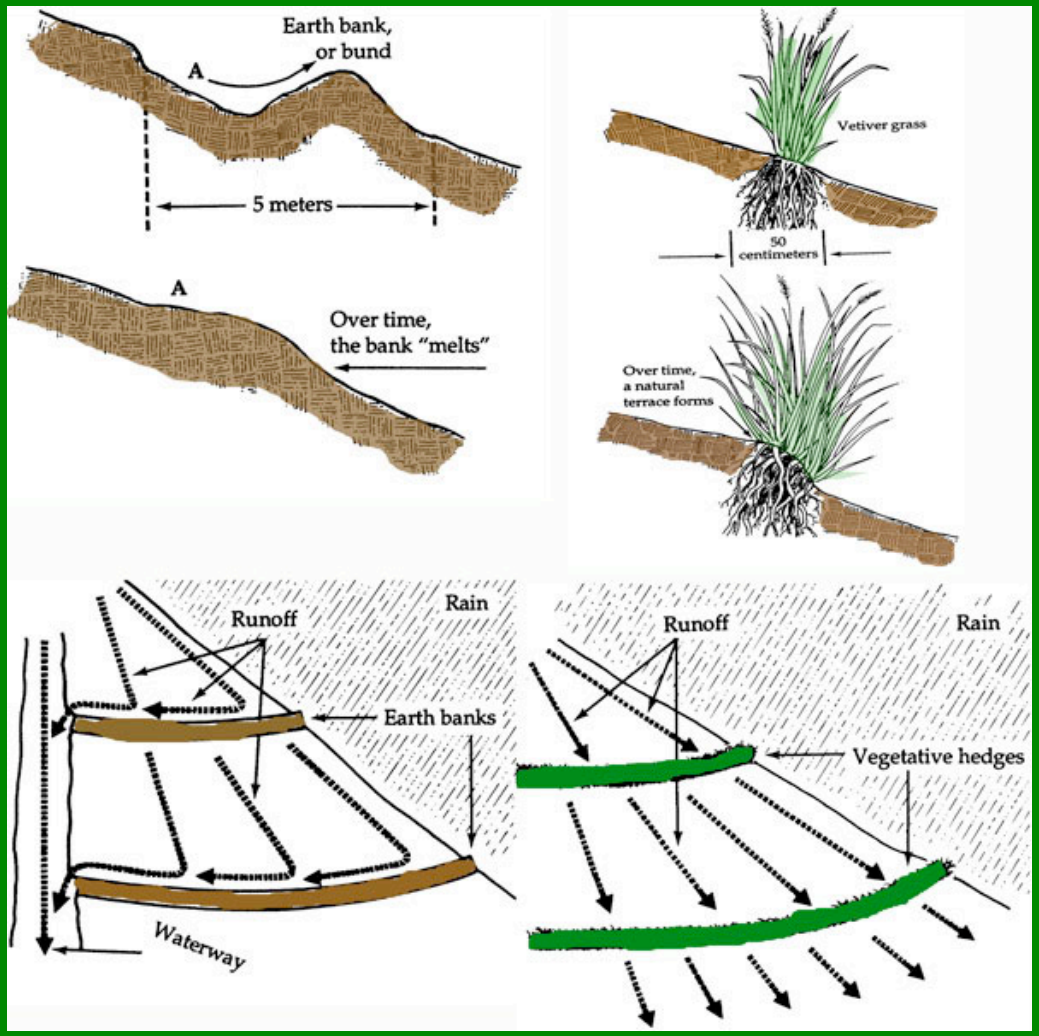
Sewage effluent infested with Blue-Green algae due to high Nitrate (100mg/L) and high Phosphate (10mg/L)

Same effluent after 4 days after treating with vetiver, reducing N level to 6mg/L (94%) and P to 1mg/L (90%)

VETIVER AND FIRE

Vetiver recovers quickly from fire (3-6 weeks) and continues to provide erosion protection even if burnt off completely

THE VETIVER SYSTEM - HOW IT WORKS



Engineered Biological

VETIVER FORMS A THICK BARRIER

Acts as a very effective filter trapping both fine and coarse sediment

EROSION CONTROL UNDER FLOOD CONDITIONS

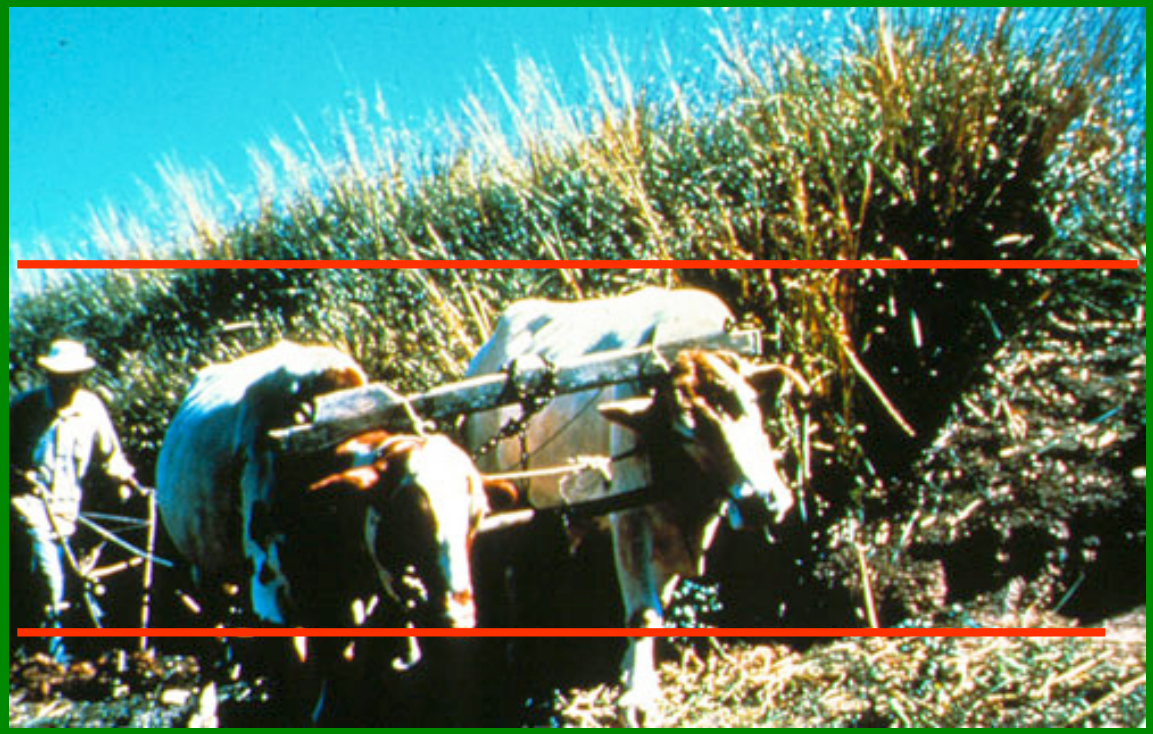
- Darling Downs, Queensland, Australia. Black cracking soils. Subject to serious flooding and erosion. Virtually flat, Max slope 2%. Vetiver hedgerow with adjacent sorghum crop.

- Same hedge system after flooding, note silt build up in low spots. Ultimately low spot will fill in. This very stiff hedge withstood flash flood conditions.

SMALL FARMERS USE THE VETIVER SYSTEM

Indian farmers in Mysore have been using the grass for generations for erosion control and farm boundary demarcation. Very few people had realized this. The leaves are cut every three weeks for forage

30 YEAR OLD VETIVER HEDGEROW DEVELOPES 2 METER HIGH TERRACE RISER



Vetiver hedgerow planted on a 20% slope in Fiji had developed a terrace with a 2 meter riser after 30 years

FIFTY YEARS AFTER PLANTING HEDGEROWS STILL FUNCTION

Vetiver hedgerows near Rakiraki, Fiji

Google Earth 2008

EROSION CONTROL

Right: 1.0 meters of sandy sediment was trapped behind this vetiver hedgerow in Malaysia in one year

Left: Vegetables grown on 50% slope in the highlands of NE Thailand with vetiver protection

SOIL AND WATER CONSERVATION

Sehore - Madhya Pradesh. India
1% slope - black cotton soil

North-west Ethiopia - 1,500 asl
20% slope - volcanic soil

EFFECTS OF VETIVER SYSTEM ON SOIL LOSS AND RUNOFF ON AGRICULTURAL LANDS

Countries	Soil loss (t/ha)			Runoff (% of rainfall)		
	Control	Conventional	VS	Control	Conventional	VS
Thailand	3.9	7.3	2.5	1.2	1.4	0.8
Venezuela	95.0	88.7	20.2	64.1	50.0	21.9
Venezuela (15% slope)	16.8	12.0	1.1	88	76	72
Venezuela (26% slope)	35.5	16.1	4.9			
Vietnam	27.1	5.7	0.8			
Bangladesh		42	6-11			
India		25	2			
Average		14.4	3.9		23.3	15.5

(Truong and Loch, 2004)

LAND REHABILITATION
The Problem

Sabi Valley, Zimbabwe:

- Trees do not prevent erosion - their roots may be massive, but they are not dense enough.

- This land had once been stabilized with engineered earth contour banks. They were not maintained and stopped functioning. The water-way that was supposed to move water from the diversion banks could not take the water velocity and became this huge gully

THE SOLUTION

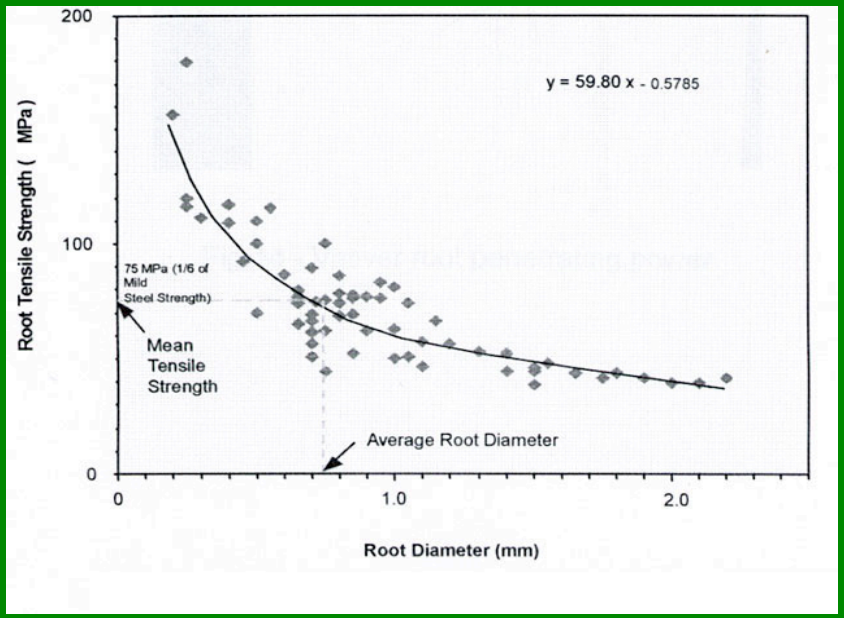
Upper Catchment - Gully Rehabilitation Using Vetiver Grass
40 Years After Planting - Fiji

VETIVER GRASS FOR SLOPE STABILIZATION

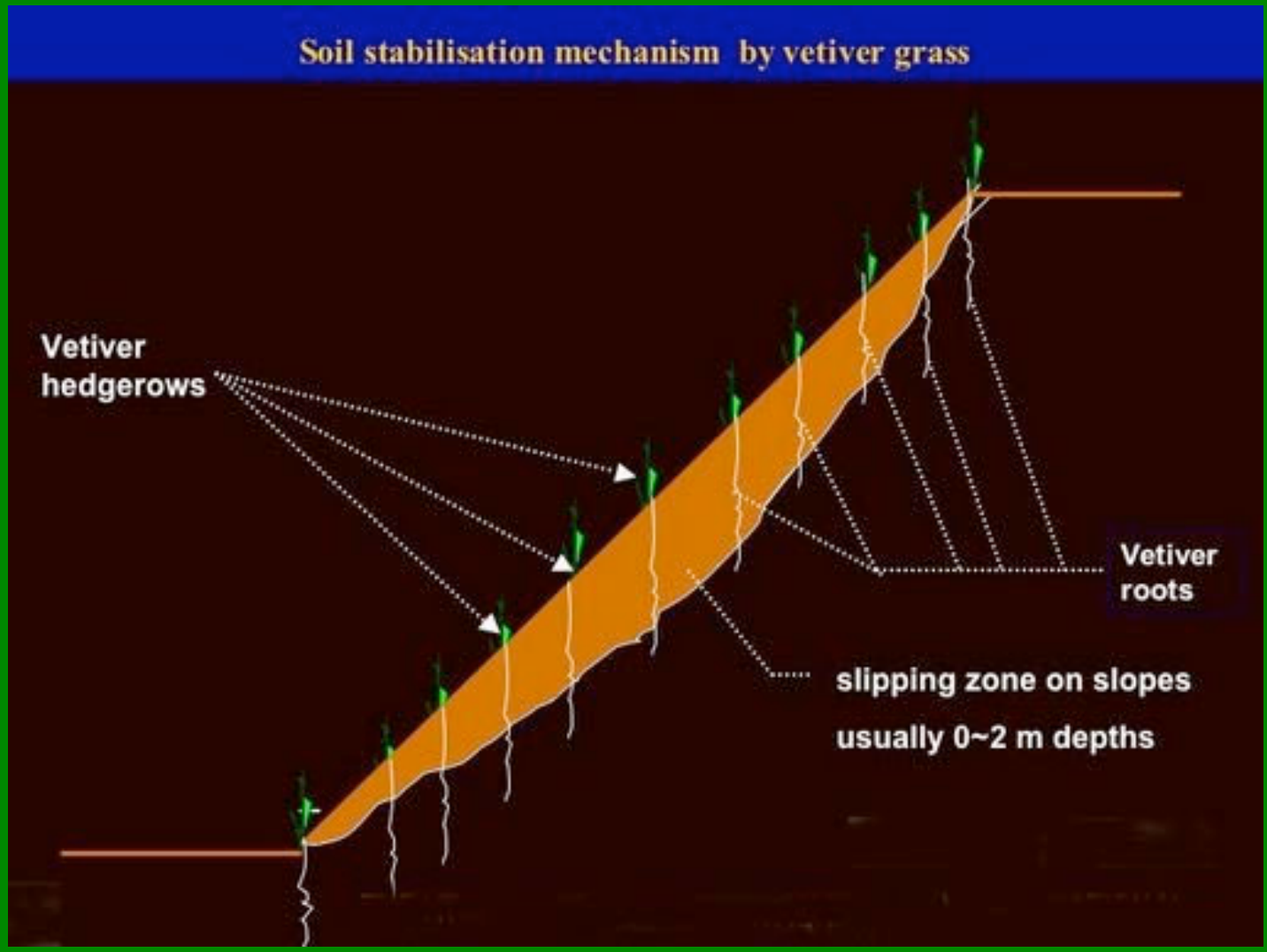
Tensile strength of vetiver roots:

- Tensile strength increases with reduction in root diameter, i.e. stronger fine roots provide higher resistance than larger roots.
- Tensile strength of vetiver roots varies between 40-180 MPa for the range of root diameter between 0.2-2.2 mm.

- Mean design tensile strength is 75 MPa (app. 1/6 of mild steel) at 0.7-0.8 mm root diameter - the most common size of roots.
- This indicates vetiver roots are as strong as, even stronger than many hardwood species (Hengchaovanich and Nilaweera, 1996).



THE VETIVER SYSTEM



Madagascar 200 km FEC Railroad annually destroyed by Typhoons. Impacts economy of 200,000 people

FARMER AND COMMUNITY VETIVER PLANTING ON FEC RAILWAY RIGHT OF WAY

COMPLETE, STABLE AND PRODUCTIVE

SLOPE STABILIZATION ON VIETNAM HIGHWAYS

Above: A big landslide in the completely weathered granite at A Roang Pass, Ho Chi Minh Highway (Thua Thien-Hue province).

Below: Even a rigid concrete retaining wall did not help - a rock slide near Phong Nha (Quang Binh province).

Construction of HCM HW causes numerous problems

Vetiver protects the cut slope of HCM HW in Quang Binh

VS FOR DYKE, CANAL AND RIVER BANK STABILIZATION

A section of anti-salinity dyke in Vietnam

The same site after several months (right).

Below: An irrigation canal in bad shape in Vietnam.

The same site at planting (up right) and after several months (lower right).

VS FOR WASTE WATER TREATMENT
Farm or urban wastewater

Hydroponics treatment of effluent in ponds

VETIVER SYSTEM - WASTE WATER TREATMENT - AUSTRALIA

TREATMENT OF CONTAMINATED LAND

This coal mine waste rock dump remains bare after 50 years

Coal Mine - One year after planting with vetiver grass

VENEZUELA

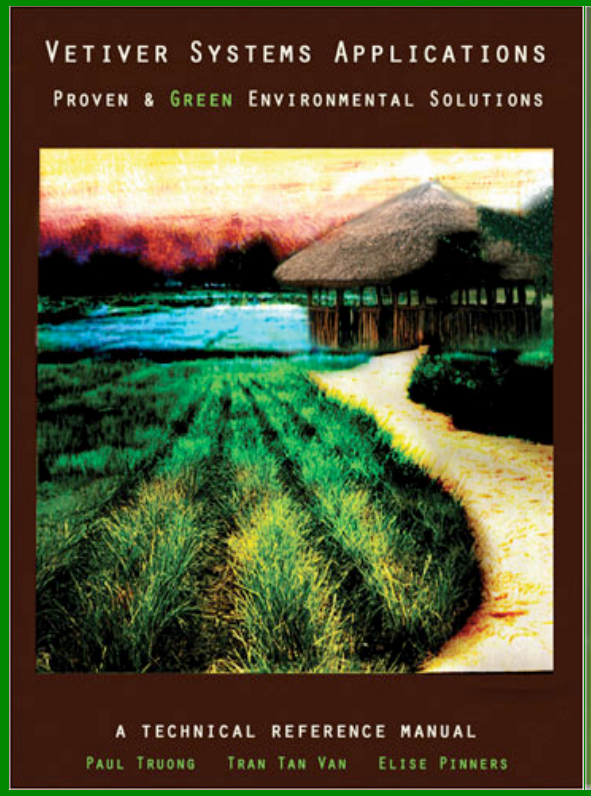
Bauxite Mine Rehabilitation Using VS

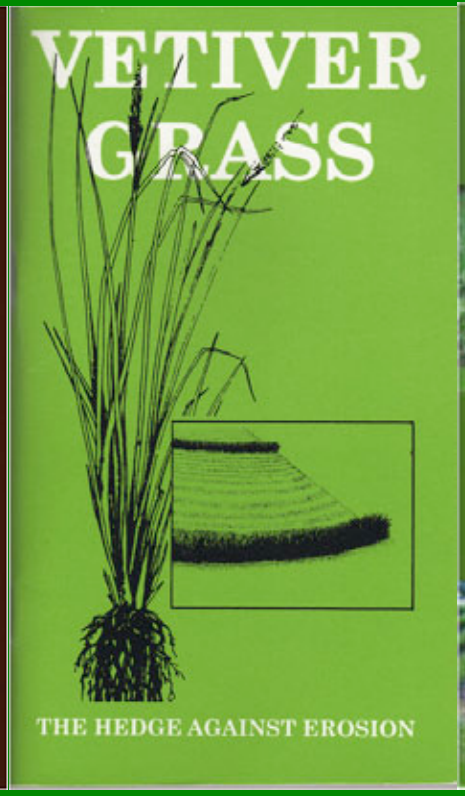
POTENTIAL BENEFITS TO GROWER OR OWNER - cost savings or net income gain	Investment savings	**Maintenance reduction**	Production increase	**Forage**	Mulch	**Paper**	Energy Biomass	**Handicrafts**	Aromatic Oil	**Medicinal**	Industrial materials	**Planting material**	Carbon credits	**Social Benefits**
APPLICATION TYPES														
Agriculture														
Soil and water conservation	+	+	+	+	+	+	+	+			+	++	+++	+
Land Rehabilitation			+	+	+	+	+	+			+	++	+++	+
Soil Fertility improvement	+	+	+	+	+	+	+	+			+	++	+++	+
Pest Control	+	+	+	+	+	+	+	+			+	++	+++	+
Farm infrastructure Protection	+	+	+	+	+	+	+	+			+	++	+++	+
On Farm pollution control	+	+		+	+	+	+	+			+	++	+++	+
Fish pond enhancement	+	+	+	+	+	+	+	+			+	++	+++	+
Non agriculturuture														
Slope protection and stabilization	+	+		+	+	+	+	+			+	++	+++	+
Land Rehabilitation	+	+		+	+	+	+	+			+	++	+++	+
Water quality improvement	+	+		+	+	+	+	+			+	++	+++	+
Pollution control	+	+		+	+	+	+	+			+	++	+++	+
River bank, dam, canal, drain, levee protection	+	+		+	+	+	+	+			+	++	+++	+
Mine tailing rehabilitation	+	+		+	+	+	+	+			+	++	+++	+
Municipal waste stabilization	+	+		+	+	+	+	+			+	++	+++	+
Health (drying up wet areas)	+	+		+	+	+	+	+			+	++	+++	+
Constructed wetlands	+	+		+	+	+	+	+			+	++	+++	+
Coastal protection	+	+		+	+	+	+	+			+	++	+++	+
Specialized planting														
Plant material production				+	+	+		+				+	+++	+
Root production (oil)									+			+	+++	+
Medicinal										+			+++	+
Climate change														
Bio-mass for fuel							+						+++	+
Carbon sequestering				+	+	+	+	+			++		+++	+

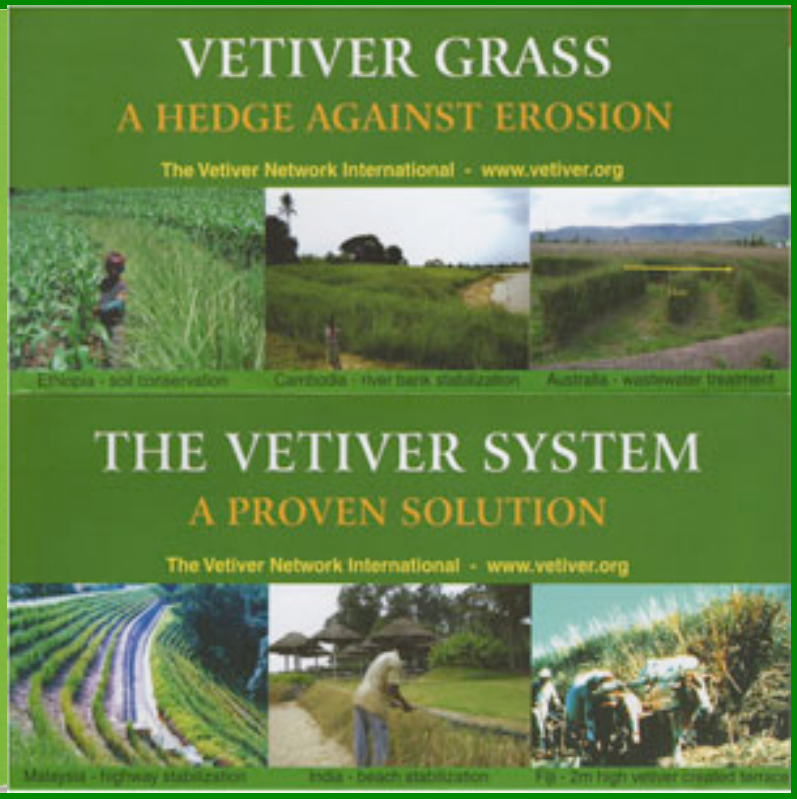
+ entirely feasible **++ possible but not always recommended**
+++ definitely sequesters carbon, carbon credits not yet established

Potential benefits to grower/owner in relationship to type of Vetiver System application

PUBLICATIONS

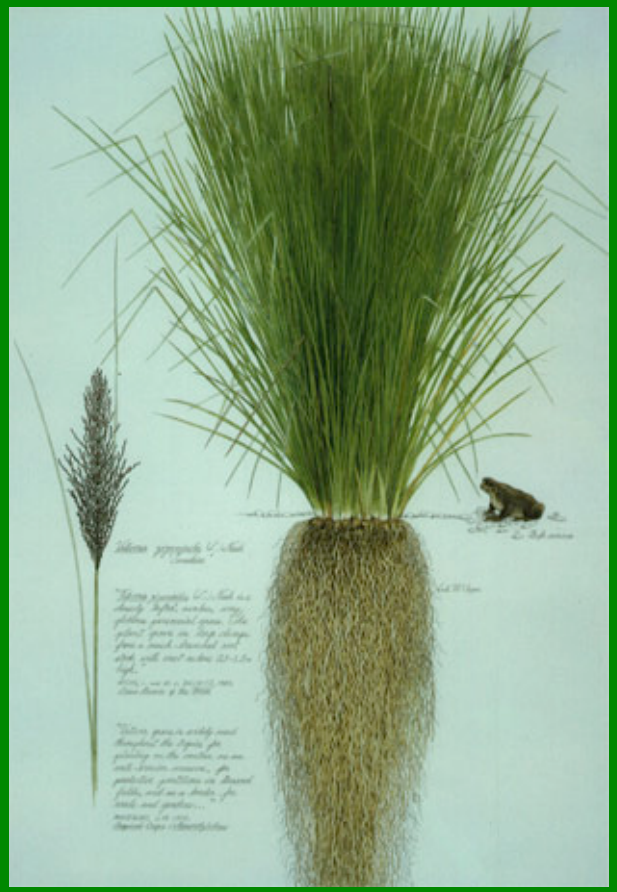






Publications are important product of the Network. Left: is the newly published technical manual (the Brown Book). Center: John Greenfield's handbook for farmers and agricultural extension workers (the Green Book). Right: TVNI's double sided brochure/poster (16" x 25"). Users are welcome to reprint, translate, and distribute them.

VETIVER SYSTEM



PROVEN AND GREEN ENVIRONMENTAL SOLUTION

USE IT !!