Introduction to the Vetiver System and its Global Applications

Past Achievements and Future Direction of The Vetiver Network International

by
Richard G Grimshaw O.B.E

Global Applications of the Vetiver System Technology

by
Paul Truong

Past Achievements and Future Direction of The Vetiver Network International

by
Richard G Grimshaw O.B.E

Five Major Phases of Development and Achievement

1. Soil and Water Conservation in Farm Land
2. Land Stabilisation for Infrastructure Protection
3. Environmental Protection: *Rehabilitation of Contaminated land*
4. Environmental Protection: *Phytoremediation of Contaminated Water*
5. Socio- economic impact on rural communities

Vetiver Grass - *Chrysopogon zizanioides*

Vetiver Grass: Fast growing, massive and deep roots, forming biofilter hedges

Vetiver Grass Hedgerow Technology

Early On-Farm Applications (1940-1980)

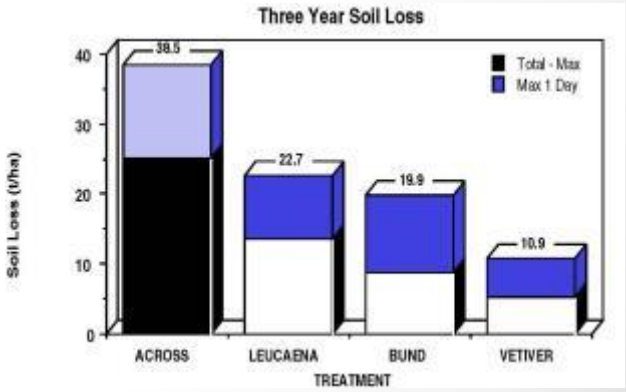
St Lucia (1940s)

Fiji (1950s) 30 year old; on 20% slope

Cuba Vetiver protected farm land in Cuba

Cross section of VG hedge.

India (1980s) erosion control.



Indian Research (1980s)

The Vetiver System – Agriculture Ethiopia (1986-1993)

Vetiver hedgerows in western Ethiopia

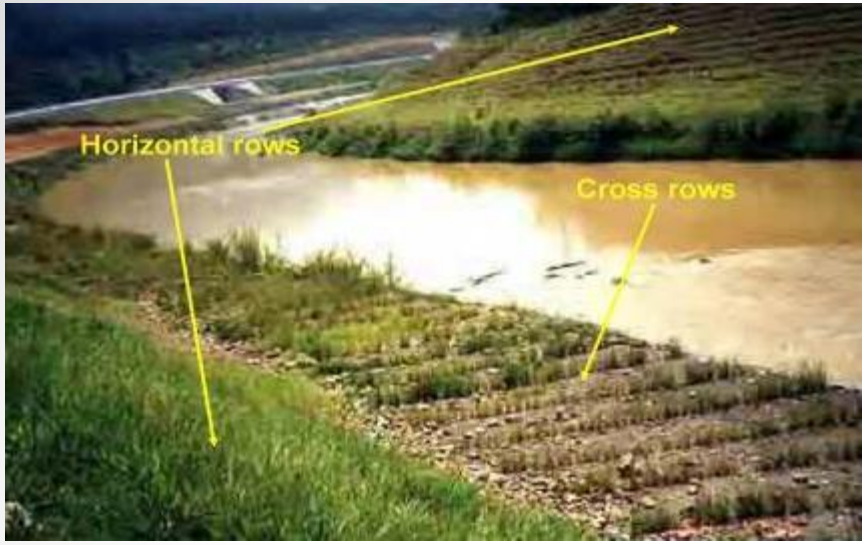
- **erosion control soil loss reduced by > 90%**
- **reduction in rainfall runoff by 70%**
- **crop yield increases by 30%**
- **drought proofing 100%**
- **groundwater recharge**
- **protection against extreme flooding**
- **forage, thatch, mulch, and biofuel**
- **thousands of users, farmer to farmer promotion and dissemination**

The Vetiver System – Land Slope Stabilization (1994 – 1999)

Top row: vetiver on right, local species on left: China Highway, Vietnam: Ho Chi Minh Highway.

Bottom row: Hong Kong Causeway ,Brazil Highway, Madagascar mine

The Vetiver System – Riverbank Stabilization (1994 – 1999)



River bank stabilization (Malaysia),

Mekong River Cambodia.

Canal and storm dyke protection (Vietnam);

Bridge abutment, Assam, India

The Vetiver System – Disaster Mitigation Before and After (2010 – 2013)

Landslide rehabilitation in Brazil

Urban erosion rehabilitation in Brazzaville Congo

Vetiver System for Contaminated Land Rehabilitation (2000 – 2003)

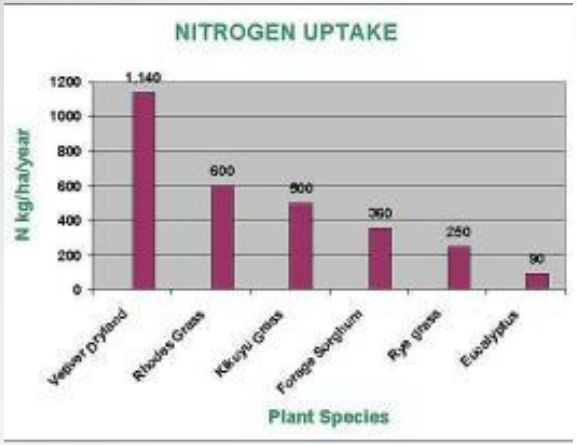
Gold mine tailings in Australia

Bauxite mine in Venezuela

Landfill dam in China

Bauxite Redmud in Australia

Vetiver System for Wastewater Treatment (2004 – 2009)



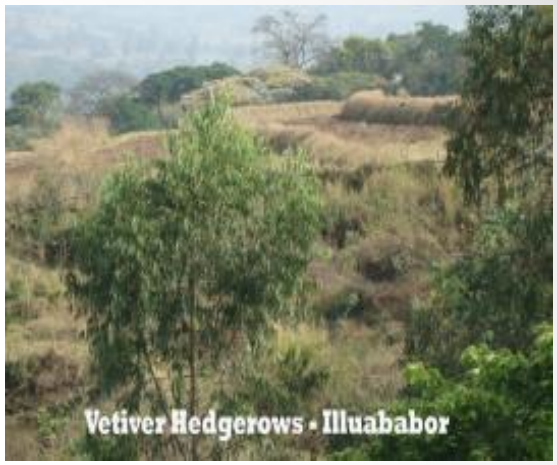
Research in Australia

Domestic sewage effluent treatment in Australia

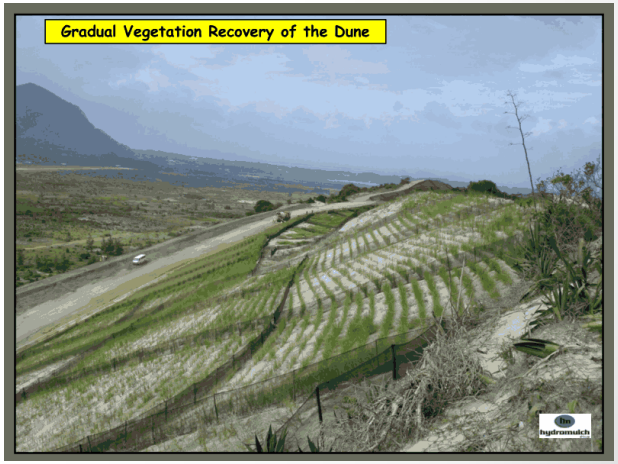
Hydroponic treatment of industrial effluent in Australia

Community sewage effluent treatment in Australia

The Vetiver System for Socio-Economic Development (2010 – 2013)



Ethiopian farming communities rehab their farm land and create income.



Madagascar community earned US$200,000 in producing plant material for stabilizing these huge sand dunes.

The Vetiver System
What Next?

The Vetiver System building on 25 years of experience should play an important role in mitigating the effects of climate change by:

1. **Enhancing food security (including ground water recharge).**
2. **Reducing poverty through increasing farm incomes and providing VS related employment.**
3. **Mitigation of extreme events, landslides, flooding, and intense and damaging rainfall.**
4. **Providing for a low cost and effective bio-engineering solution for infrastructure stabilization.**
5. **Rehabilitation and protection of degraded land and water sources.**
6. **Decontaminating land and water, and thus improving public health and wildlife.**
7. **Bio-product use especially as an energy source.**
8. **Sequestering atmospheric carbon.**

The Vetiver Network International
What Next?

TVNI should continue much as it is doing now:

1. **Continue as a knowledge based organization.**
2. **Support and generate user interaction.**
3. **Support workshop conferences and training.**
4. **Provide where possible expert technical support.**

In the immediate future:

1. **Commission an in-depth review of TVNI and VS covering the past 25 years.**
2. **On the basis of the review create a strategy where policy makers, designers and project/program executors take notice and use VS to tackle the land and water issues that are being impacted by climate change.**
3. **Restructure TVNI on the basis of available funding (the latter could include some sort of professional fee structure for VS members).**

THANK YOU

Global Applications of the Vetiver System Technology

Paul Truong

Director TVNI, Asia and Oceania

Veticon Consulting Pty Ltd ,

Brisbane, Australia

BRIEF HISTORY ON THE DEVELOPMENT AND APPLICATIONS OF THE VETIVER SYSTEM TECHNOLOGY

1. Soil and Water Conservation in Agricultural Land
2. Stabilisation of Infrastructures
3. Environmental Protection
   - *Phytoremediation of wastewater*
   - *Phytoremediation contaminated lands*
4. Socio-economic impact on rural community
   - *Poverty alleviation*
   - *Rural employment*
5. Other major uses of vetiver plant
6. Mitigation of Climate Change impact

Soil and Water Conservation in Agricultural Land

The followings are works conducted by the Land Development Department, Ministry of Agriculture and Cooperatives, Bangkok, Thailand, Presented by Dr Pitayakon Limtong

Slope >35% preserve as forest

Slope 31-35% VI= 8 m.

Highland area

Slope 21-30% VI= 10 m.

Slope 11-20% VI= 12 m.

Upland area

Slope 6-10% VI= 20

Slope 3-5% VI= 30 m.

Lowland area

Slope 2% VI= 40 m.

Soil and Water Conservation in Agricultural Land (Thailand)

Contour lined of Vetiver glass with terrace

Contour lined of Vetiver glass with hillside ditch

Vetiver grass lined in fruit tree plantation

Vetiver grass lined in fruit tree plantation

Soil and Water Conservation in Agricultural Land (Thailand)

Half-circle plantation for water preservation

Contour lined of Vetiver glass in upland area

Vetiver grass lined with hillside ditch in fruit tree plantation

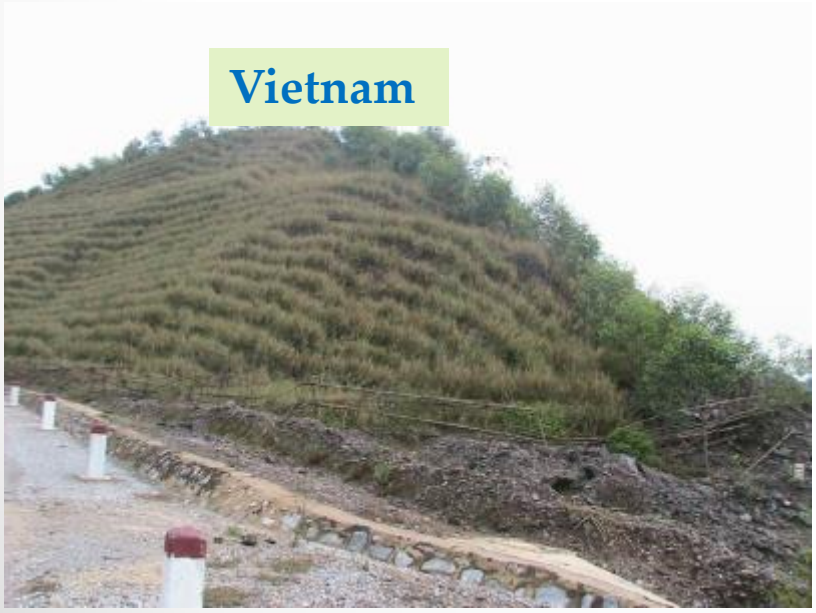
Plantation on the bank of water drain ditch

Stabilisation of Infrastructures

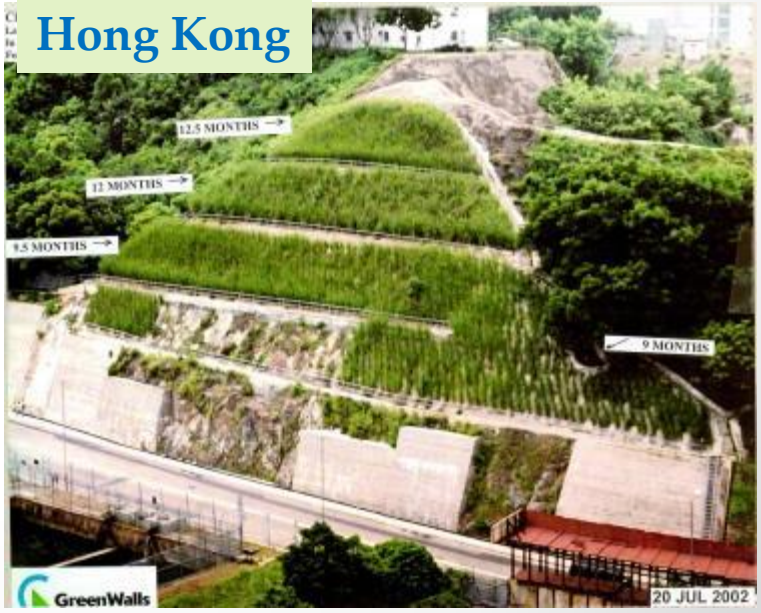
Thailand

Before and after with appropriate design and implementation

Vietnam



Hong Kong



Stabilisation of Infrastructures in Latin America and Africa

Brazil

Madagascar

Colombia

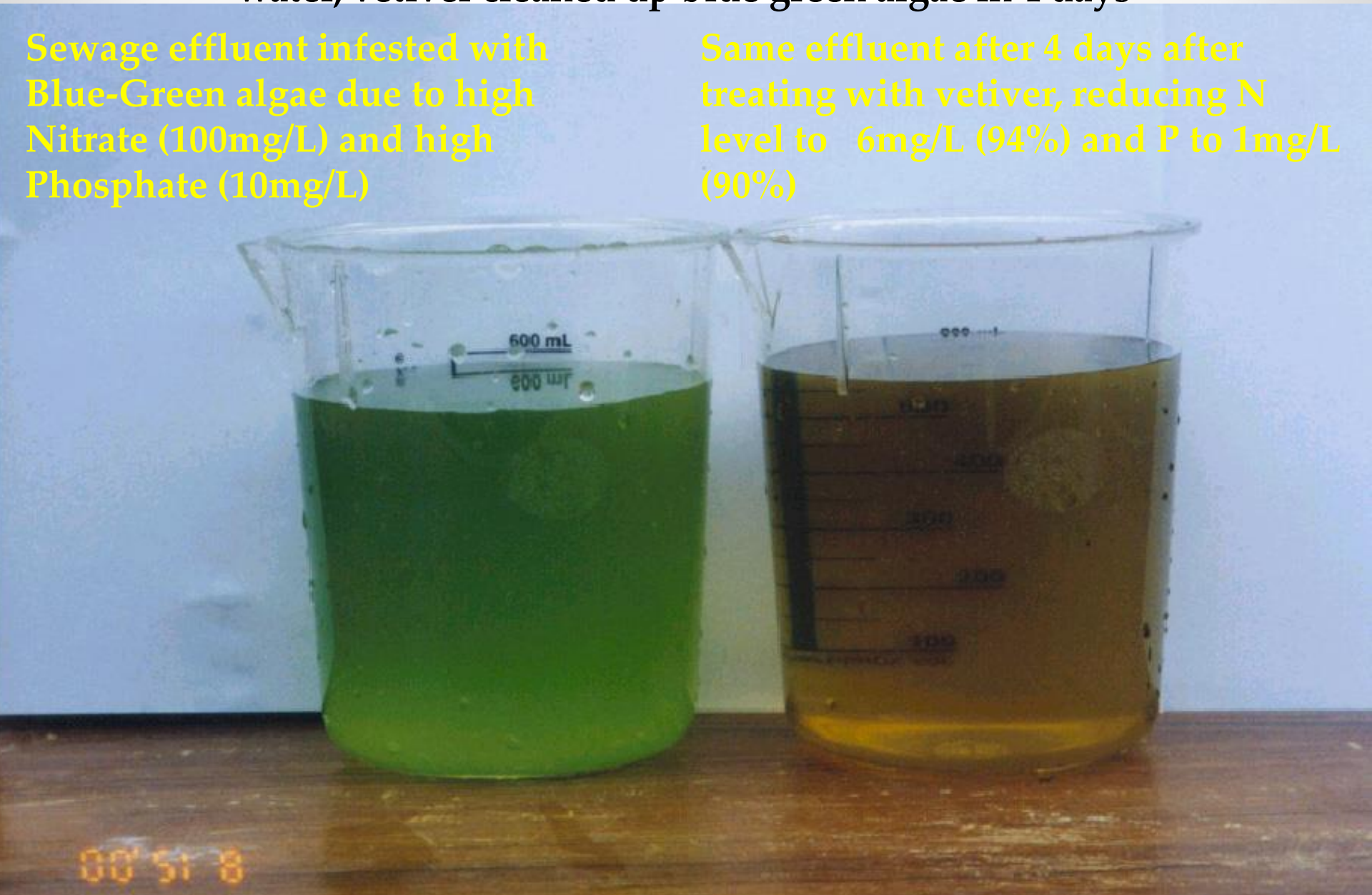
Venezuela

Comparative of effectiveness and cost between VST and conventional engineering structures (J. Barcant)

COMPARED FEATURE	The Vetiver System (VS)	Hydroseeding	Hydroseeding with Coco Mats	Concrete Retaining Wall with Nails and Grouting	Gabions
Overall Slope Stabilization	Excellent	Very Poor	Poor	Excellent	Excellent
Interrill Erosion Protection (raindrop splash induced)	Poor (unless leaves used as mulch, than medium - excellent))	Medium	Excellent	Poor	Poor
Rill erosion (surface runoff induced)	Excellent	Medium	Excellent	Medium (needs re-vegetation)	Excellent
Sediment Retention/Control	Excellent	Medium	Excellent	Medium (needs re-vegetation)	Excellent (until silts up, then poor)
Gully Erosion Protection	Excellent	Very Poor	Excellent	Excellent	Excellent
Runoff control (concentrated flows)	Excellent	Poor	Medium	Medium (needs re-vegetation)	Excellent
COST	Excellent	Excellent	Medium	Very Poor	Very Poor
Time for Planting or Construction	Medium	Excellent	Medium to Excellent	Very Poor	Poor
Time to Effectiveness	Medium	Medium	Medium to Excellent	Excellent	Excellent
Durability	Excellent	Medium	Medium	Excellent	Excellent
Natural/Green Factor	Excellent	Medium	Medium	Medium	Poor
Encourages Re-growth of Local Plants and Trees	Excellent	Medium	Poor	Medium	Poor

Environmental Protection *Phytoremediation of wastewater* (more in Workshop 2)

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



Disposal of domestic sewage effluent

Vetiver planting to absorb effluent discharge from a toilet block in a park in Brisbane.

Six months after planting this stand of 100 plants absorbs all the discharge from the toilet block

SEWAGE EFFLUENT DISPOSAL

RESULTS

IN FLOW

Average daily flow: 1 670L

Average total N: 68mg/L

Average total P: 10.6mg/L

Average Faecal Coliform:>8 000

OUT FLOW

Average daily flow: Almost Nil*

Average total N: 0.13mg/L

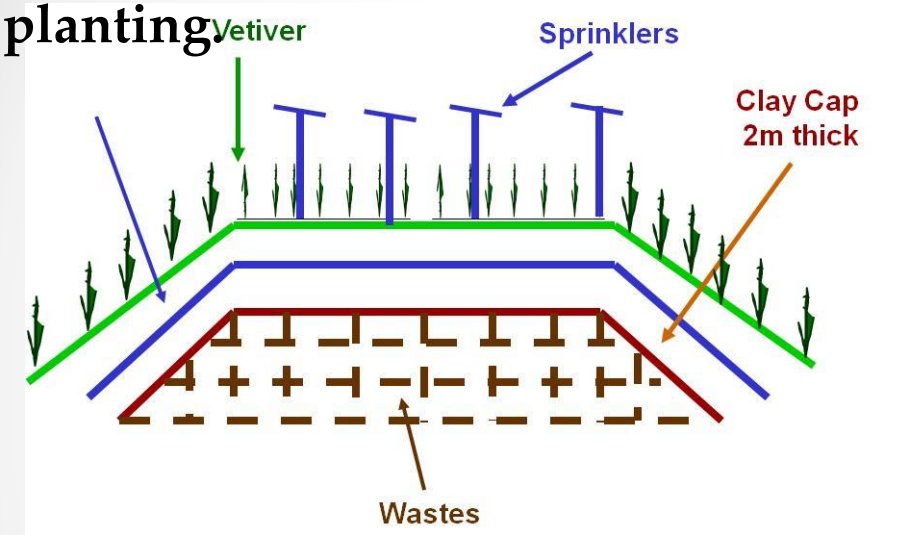
Average total P: 0.152mg/L

Average Faecal Coliform:<10

* Only flow after heavy rain

Disposal of municipal landfill leachate in Australia

Spray irrigation on landfill mound: the diagrammatic cross section of the mound (top left), vetiver irrigated every day with leachate after planting (top right), two (bottom left) and twelve (bottom right) months after planting.



Twelve months after planting, the 3.5ha site disposing 4 ML/month

Full details on wastewater treatment will be presented in WORKSHOP 2

Fresh leachate pool

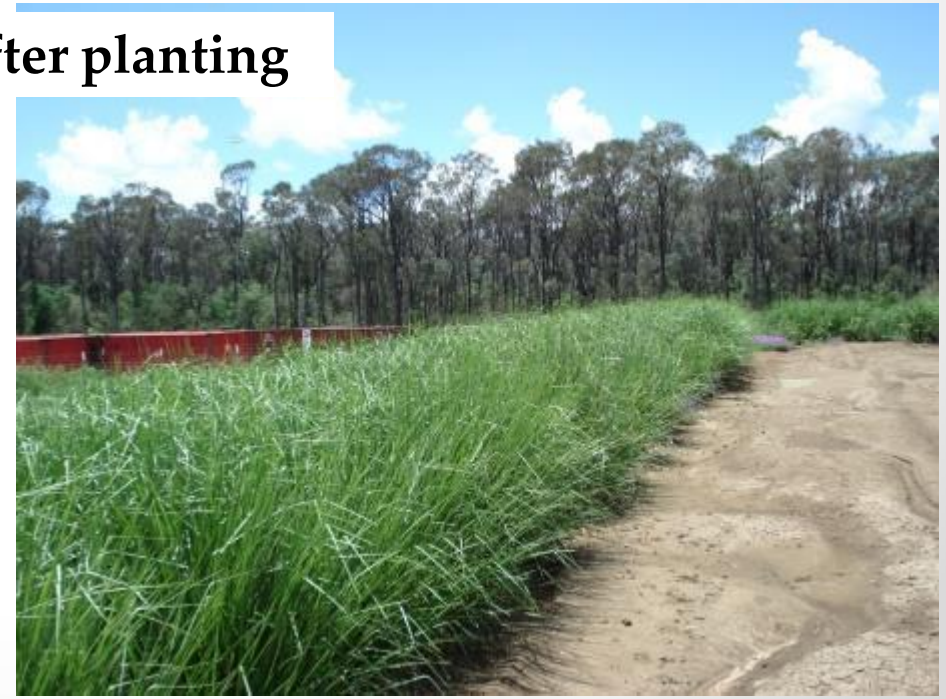
Environmental Protection *Phytoremediation of Contaminated Lands*
(more details in Workshop 3)

Ammonia and nitrate contaminated site at Bajool, Australia

This site was contaminated with extremely high levels of Ammonia and Nitrate as a result of explosive manufacturing.

Land surface area: 7 300m2
Soil depth: 2.5m to 3.0m
Contaminate soil volume: 20 000m3
Soil Ammonia level, ranging from 20 -1 220mg/kg, averaging 620mg/kg
Soil total N level, ranging from 31-5 380mg/kg, averaging 2 700mg/kg
Water Ammonia level, ranging from 235-1 150mg/L, with one sample at 12 500mg/L
Water total N level, ranging from 118 – 7 590mg/L, with one sample at 18 300mg/L

8 months after planting



Environmental Protection *Rehabilitation of Mining Wastes* in Australia

Before and after (more details in Workshop 3)

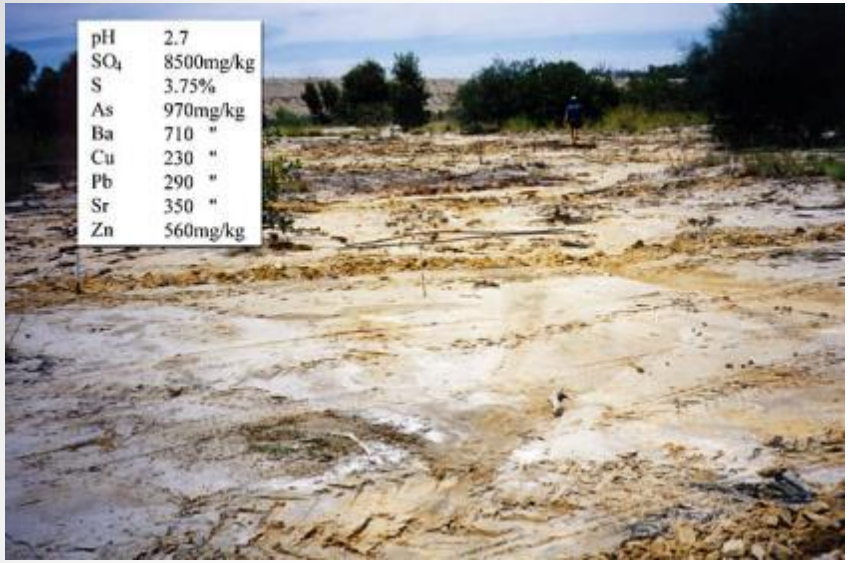
Coal mine overburden

Bauxite Redmud

Bentonite tailings

Environmental Protection *Rehabilitation of gold tailings* in Australia

Before and after



Old tailings

Fresh tailings

Full details on mine rehabilitation will be presented in WORKSHOP 3

Environmental Protection *Rehabilitation of mine tailings*

Before and after

Old Pb-Zn tailings in China

New iron ore tailings in India

Socio-economic impact on rural community *Poverty alleviation*

Protection food crops from soil erosion.

Stabilising rural road for easy access to market education and heal care in Bali

Providing extra income from "home nurseries" in Madagascar

Socio-economic impact on rural community *Rural employment*



Employment of women and children in community nurseries in Vietnam



Employment of women and men for vetiver planting in China


Employment of women and children in handicraft production in Venezuela

Other major uses of vetiver plant: *Handicraft*

China

India

Philippines

Senegal

Thailand

Venezuela

Other major uses of the vetiver plant

Grazing in India

Feedlot in New Zealand

Grazing in Australia

Ornamental in China and Vietnam

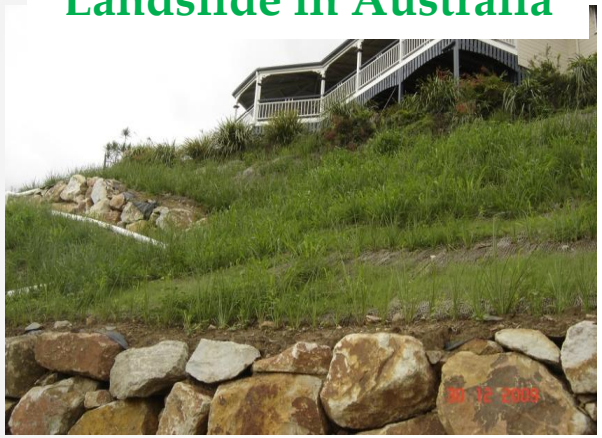
Thatching in Africa

Mitigation of Climate Change Impact

Landslide in Australia

Gully erosion in Congo

Landslide in Madagascar



Before and after: Landslide in Brazil

Thank You