VETIVER SYSTEM TECHNOLOGY FOR INFRASTUCTURE PROTECTION

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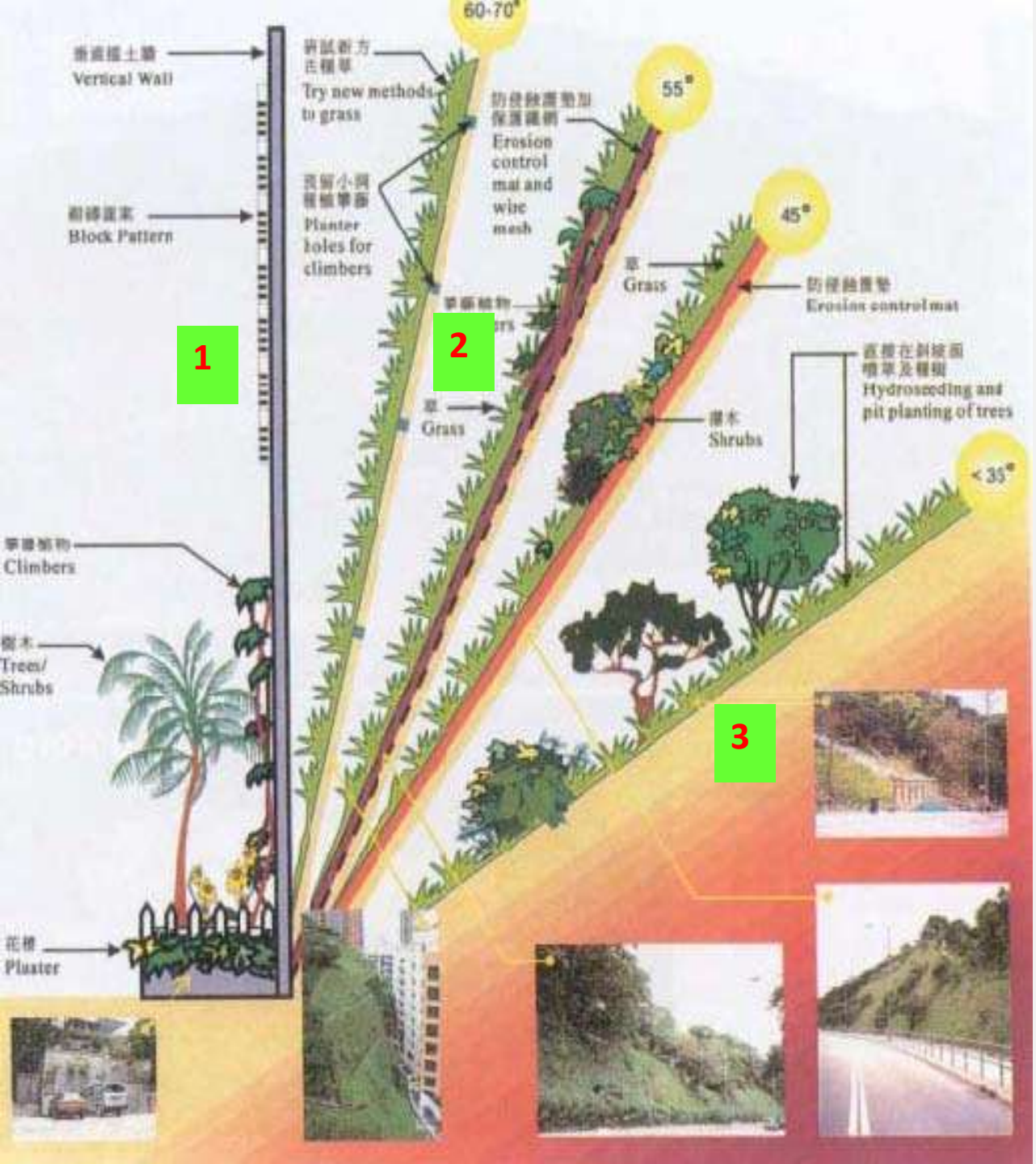
VETIVER SYSTEM TECHNOLOGY FOR INFRASTUCTURE PROTECTION

Special Characteristics Suitable for erosion control of dryland slopes and riverbank

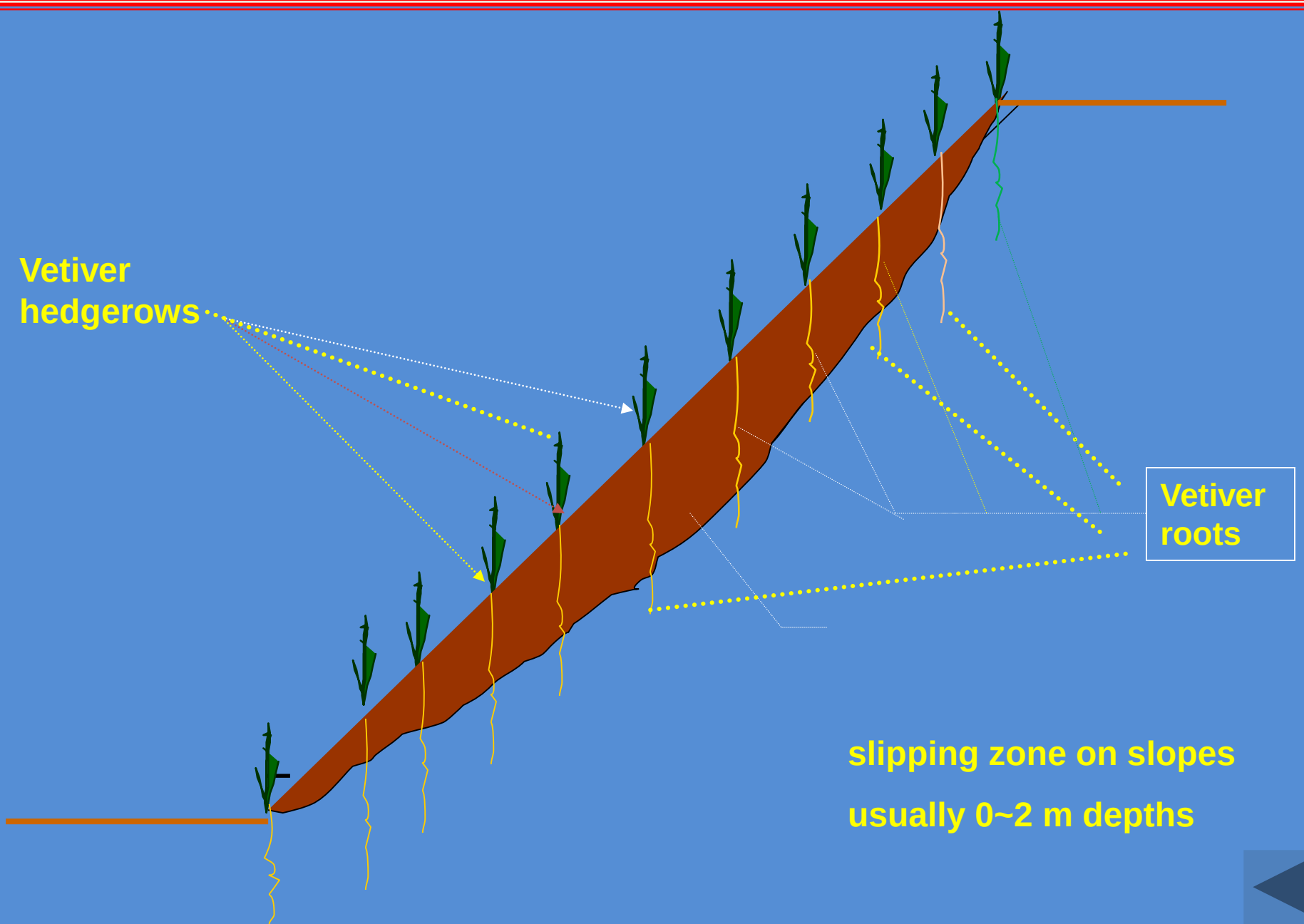
- **A deep, penetrating and extensive root system that binds the soil, and reinforces the soil structure which requires extraordinary force to dislodge.**
- **Erect and stiff stems forming a dense hedge which is very effective in retarding water flow and reducing the erosive power of the strong current.**
- **The top portion of the vetiver plant is flexible and bends over under strong flow. The bent tops act as an energy dissipater**
- **Vetiver is tolerant to drought, saline, sodic and acidic soil conditions.**
- **Vetiver survives under prolonged and complete submergence and it resumes growth after emerging from the water.**



Options for slope protection:

1. Hard structure
2. Combination of hard and soft structure
3. Bioengineering alone

LANDSLIP CONTROL MECHANISM BY VETIVER



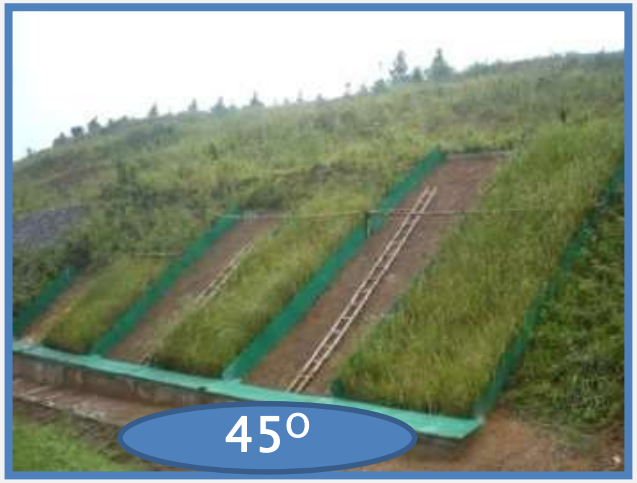
One year old plant with 3.3m deep root system

Vetiver roots have a tensile strength of 75 Mpa, equivalent to 1/6 strength of mild steel reinforcement.

Trials conducted by Indonesian Institute of Road Engineering (IRE) on slopes ranging from 30° to 80°

PC A Sunandar

Soil Type: Silty Clay Loam Stability Index: Unstable 3 Month Old, West Java



Soil Type: Dusty Clay Stability Index: Unstable 3 Month Old, West Java

Indonesian Institute of Road Engineering: West Java

PC A Sunandar

Four month old, before trimming

Four month old, after trimming

PC P Truong

Soil Type: Clay Loam Stability Index: Stable 4 Month Old

Comparison between VST and conventional structures

Shotcrete failed to protect this road batter slope during typhoon in southern China.

On the same road, at the same time a batter fully stabilised by vetiver

The concrete cellular surface failed to protect the slope in Vietnam

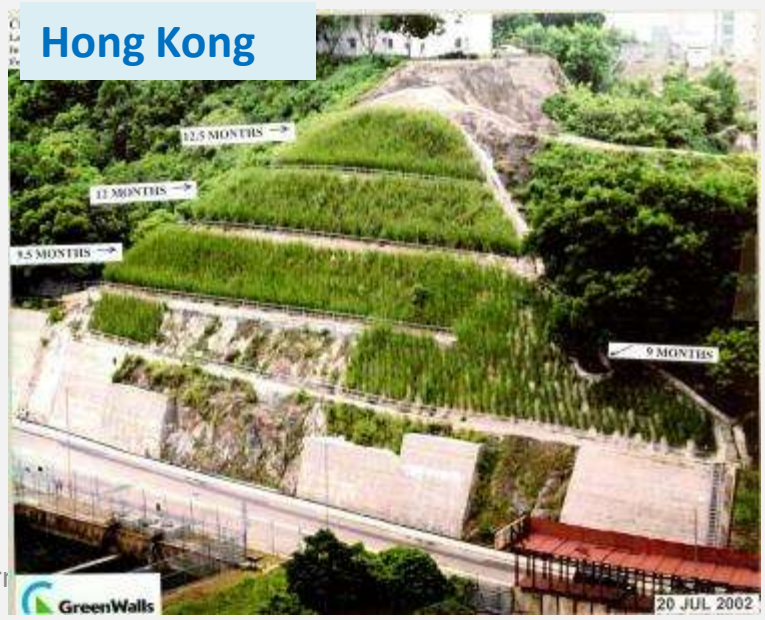
But the slope was fully protected when Vetiver was planting into the holes

Without Vetiver reinforcement, concrete blocks by themselves could not protect slope in long term

Vetiver in combination with concrete block fully stabilised this slope

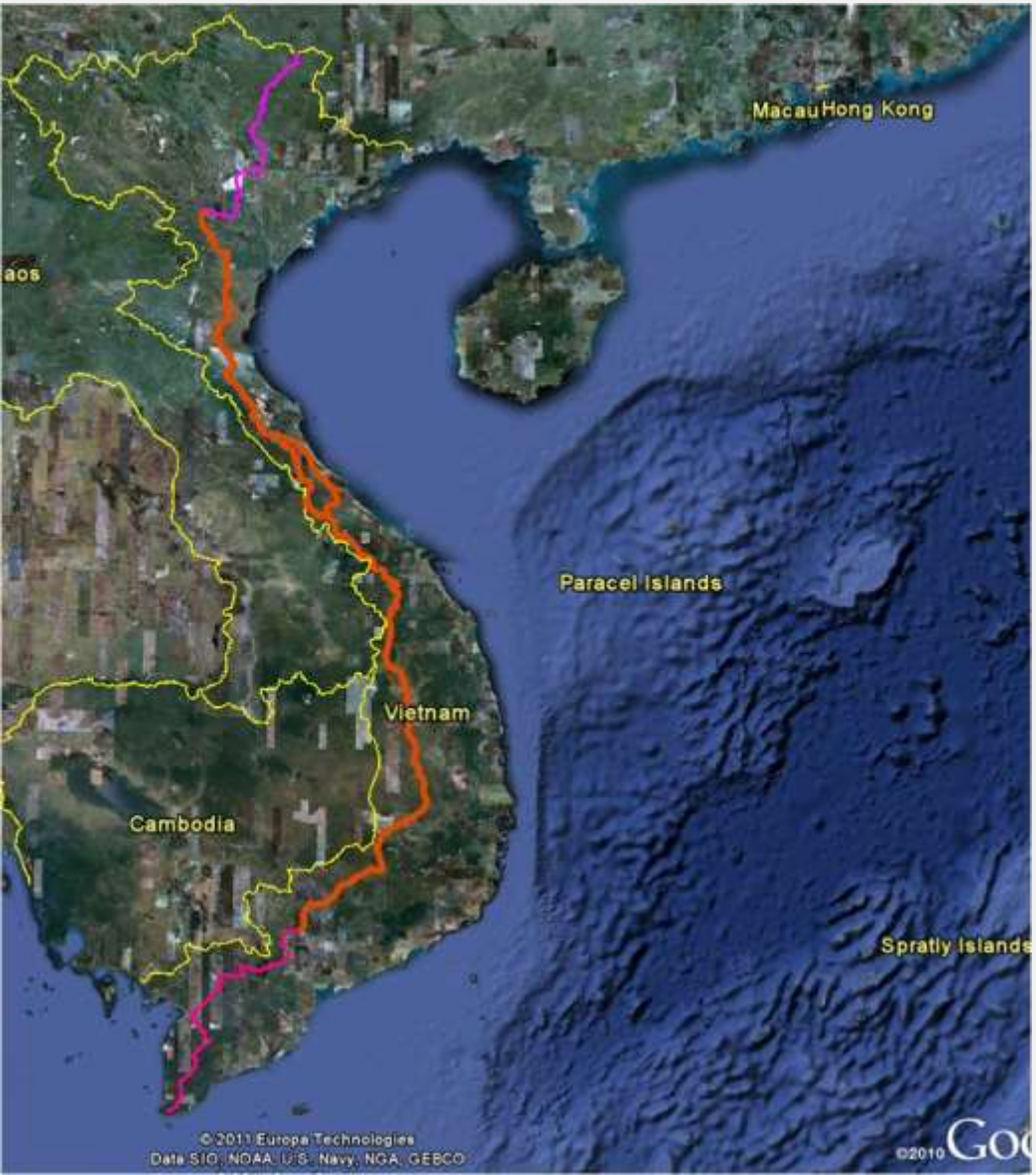
Stabilisation of Infrastructures

Before and after with appropriate design and implementation



Stabilisation of Infrastructures in Latin America and Africa

The Ho Chi Minh Highway (HCMHW)
A brief Introduction



- Master plan approved by Government in 1997
- Construction started in 2000.
- Connects Cao Bang in the North with Cape Ca Mau in the South
- Totaling in length 3,200km
- Connects with National Route No.1 by 20 traverses totaling 1,700km

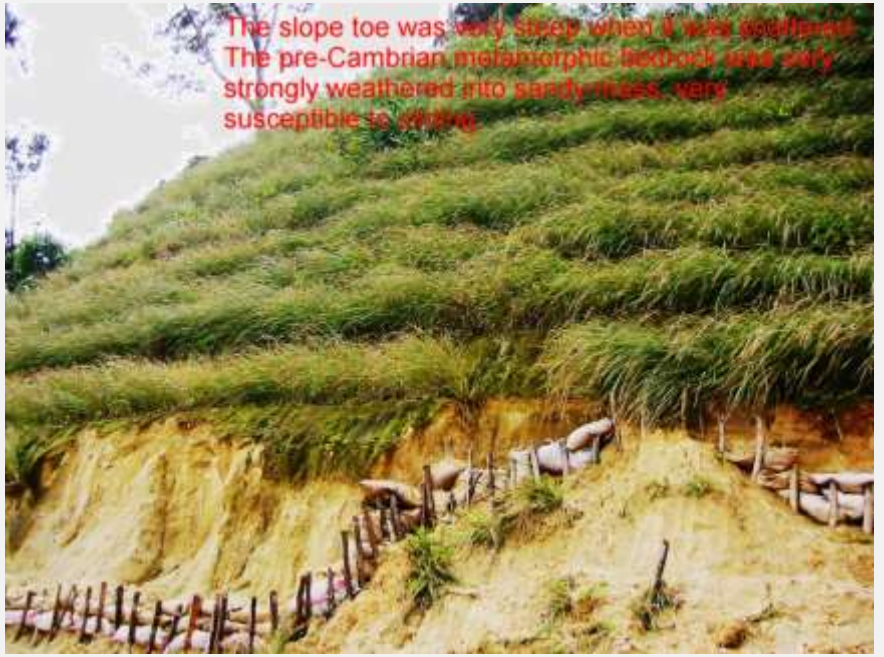
Erosion started while bitumen paving in progress

Conventional hard structure solution: Small and large retaining walls

But these massive and costly retaining walls by themselves did not stop erosion during the typhoon season

VETIVER BIOENGINEERING: *APPLICATION PHASE*

Following the obvious failure of conventional measure the Ministry of Transport adopted VST as a preferred erosion control measure



Ten month old planting, good growth but toe slope should be protected

Despite badly designed (no benching and Internal drainage), this very steep batter was successfully stabilized 3 years after planting. Survived several typhoons


2005


2011


2005


2014
Vetiver
Local plants and Vetiver

SOME BEFORE AND AFTER SCENERY

SOME BEFORE AND AFTER SCENERY

2005 ***2014***

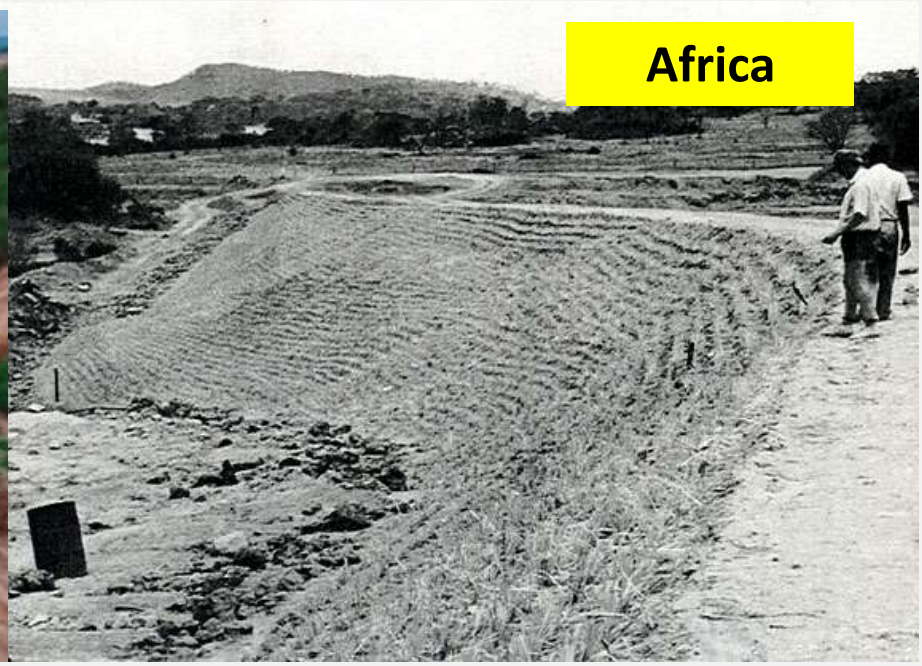
Fourteen years after vetiver planting

14 years later, some vetiver left but mostly endemic plants

- **There are no serious erosion occurs over the length of the HCMHW**
- **Occasional eroded batters and small slips occurred, partly due to uncontrolled animal grazing and poor internal drainage**

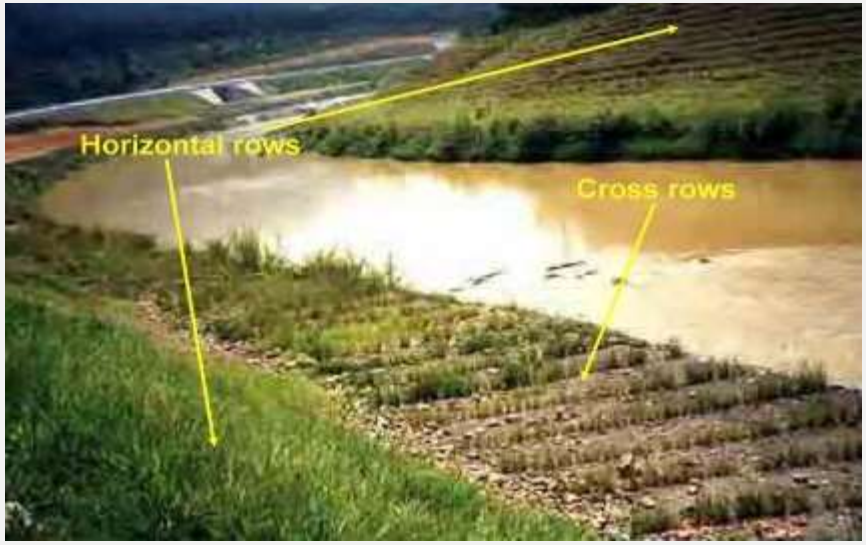
Vetiver planting created favourable condition for local species to come back and faded away due to shading, but it persisted where local species could not come back.

DAM WALL STABILISATION



HYDRO-ELECTRIC DAM WALL IN VIETNAM

Riverbank Stabilization



River bank stabilization (Malaysia),

Mekong River Cambodia.

Canal and storm dike protection (Vietnam);

Bridge abutment, Assam, India

Protección del Principal Sistema-Canal de Irrigación en la ribera del rio Bío Bío en Negrete, Sur de Chile.