Vetiver System for Natural Disasters Reduction in Vietnam – An Overview

Tran Tan Van, D.Eng.
Vietnam Vetiver Network Coordinator
Research Institute of Geology and Mineral Resources

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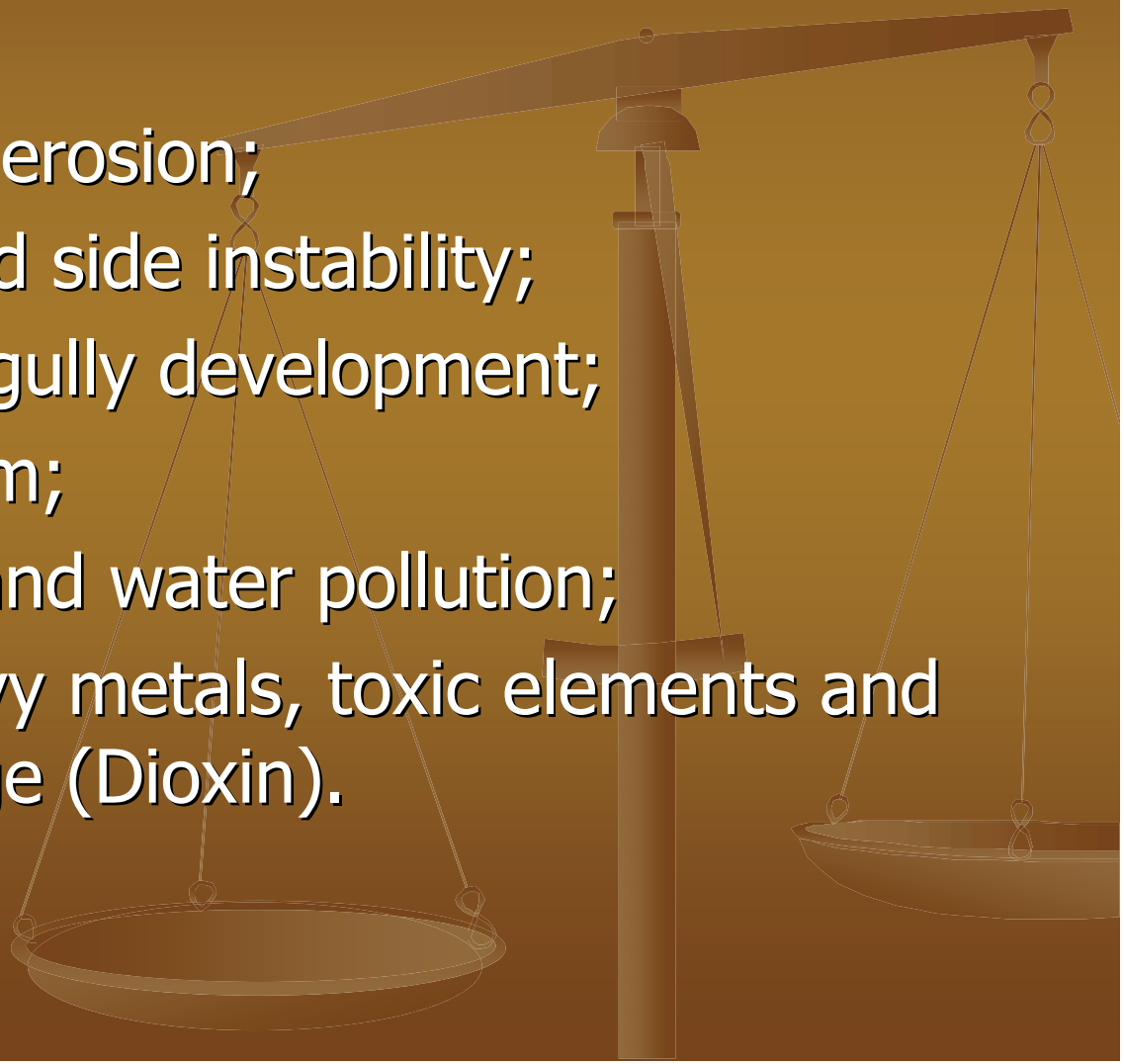
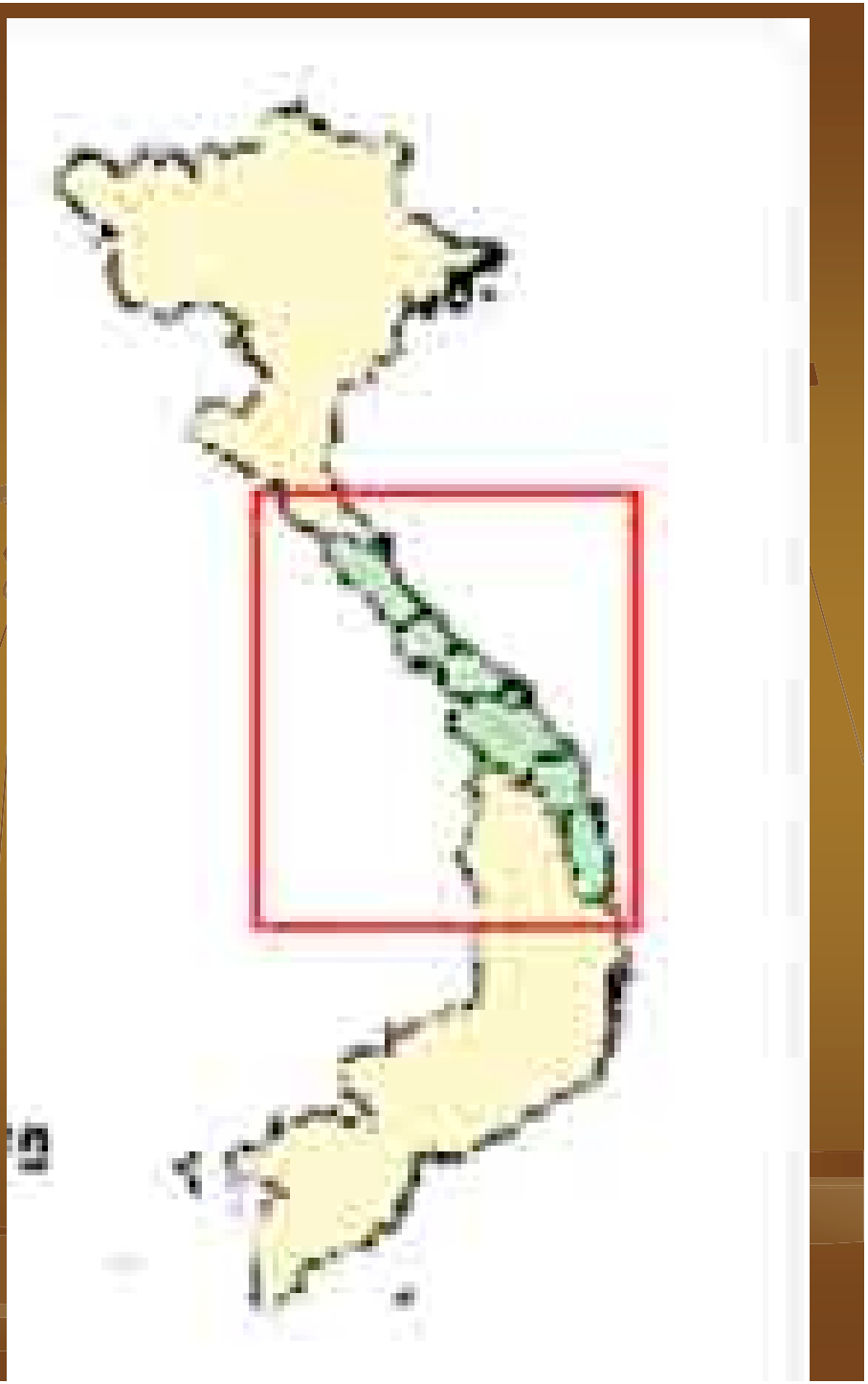
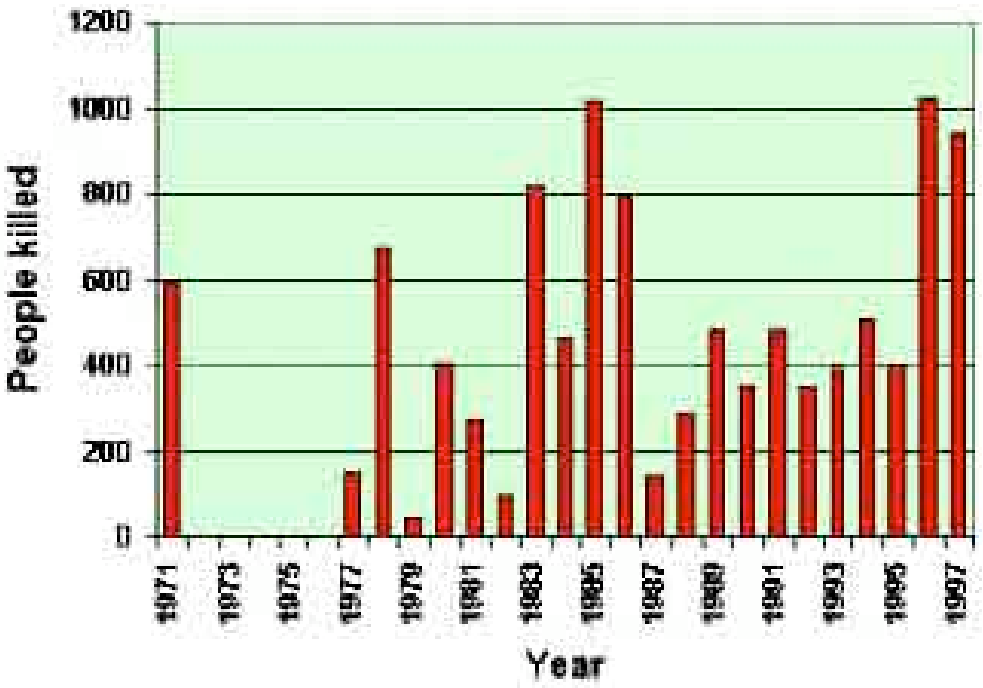
Current status of natural disasters in Vietnam

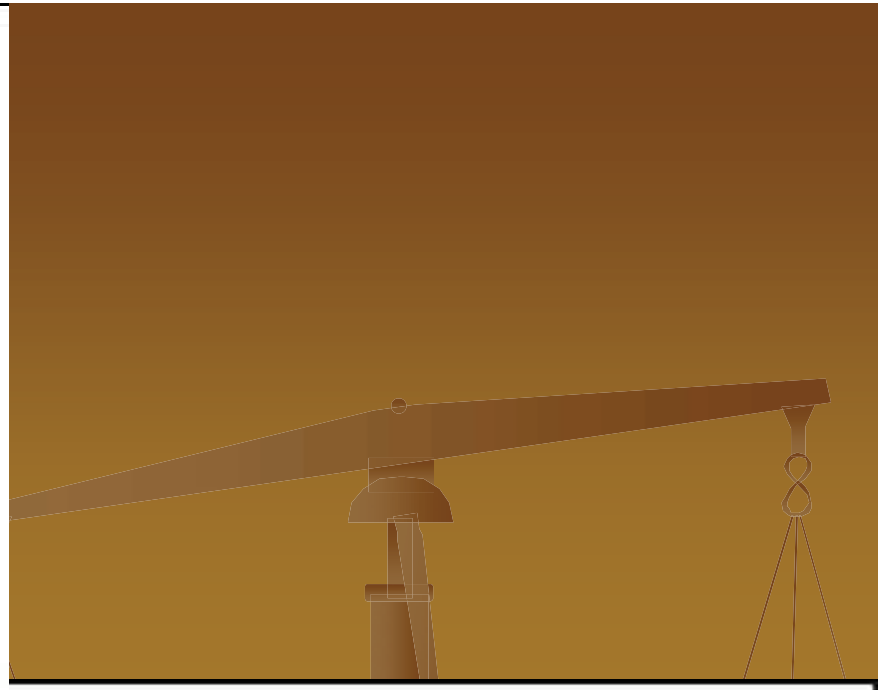
- Flooding;
- Coastal erosion;
- River bank and dyke erosion;
- Slope failure and road side instability;
- Surface erosion and gully development;
- Sand flow, sand storm;
- Sea water intrusion and water pollution;
- Soil pollution by heavy metals, toxic elements and even by Agent Orange (Dioxin).

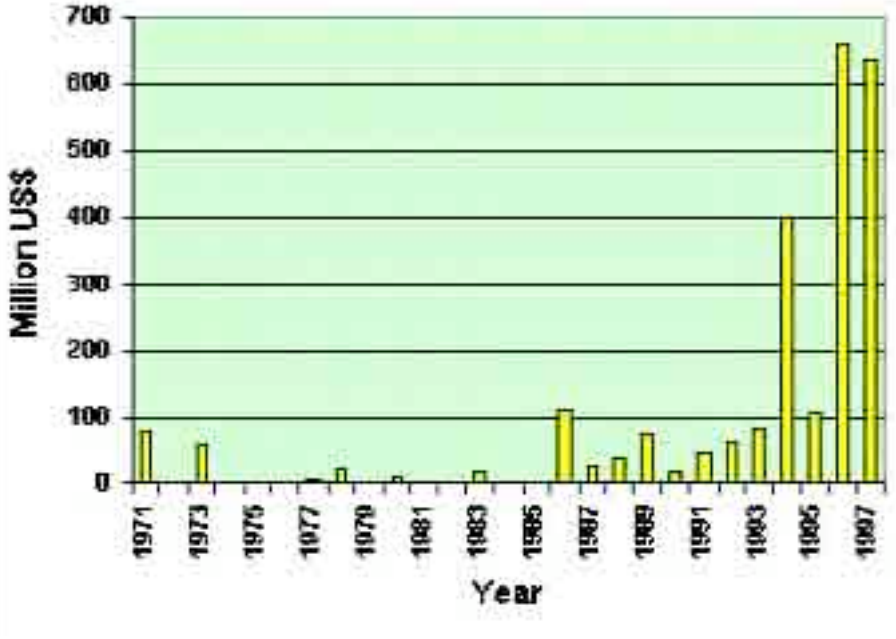


VIETNAM AND ITS DISASTER PRONE REGION




People killed by natural disasters
People killed
1200
1000
800
600
400
200
0
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
Year




Economic loss by natural disasters
Million US$
700
600
500
400
300
200
100
0
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
Year

FLOOD DAMAGES

RIVER BANK EROSION BY FLOOD

COASTAL DIKE EROSION BY TYPHOON

INLAND DIKE DIKE EROSION BY TYPHOON

ROAD AND HIGHWAY EROSION BY TYPHOON

RIVERBANK EROSION BY WAVES

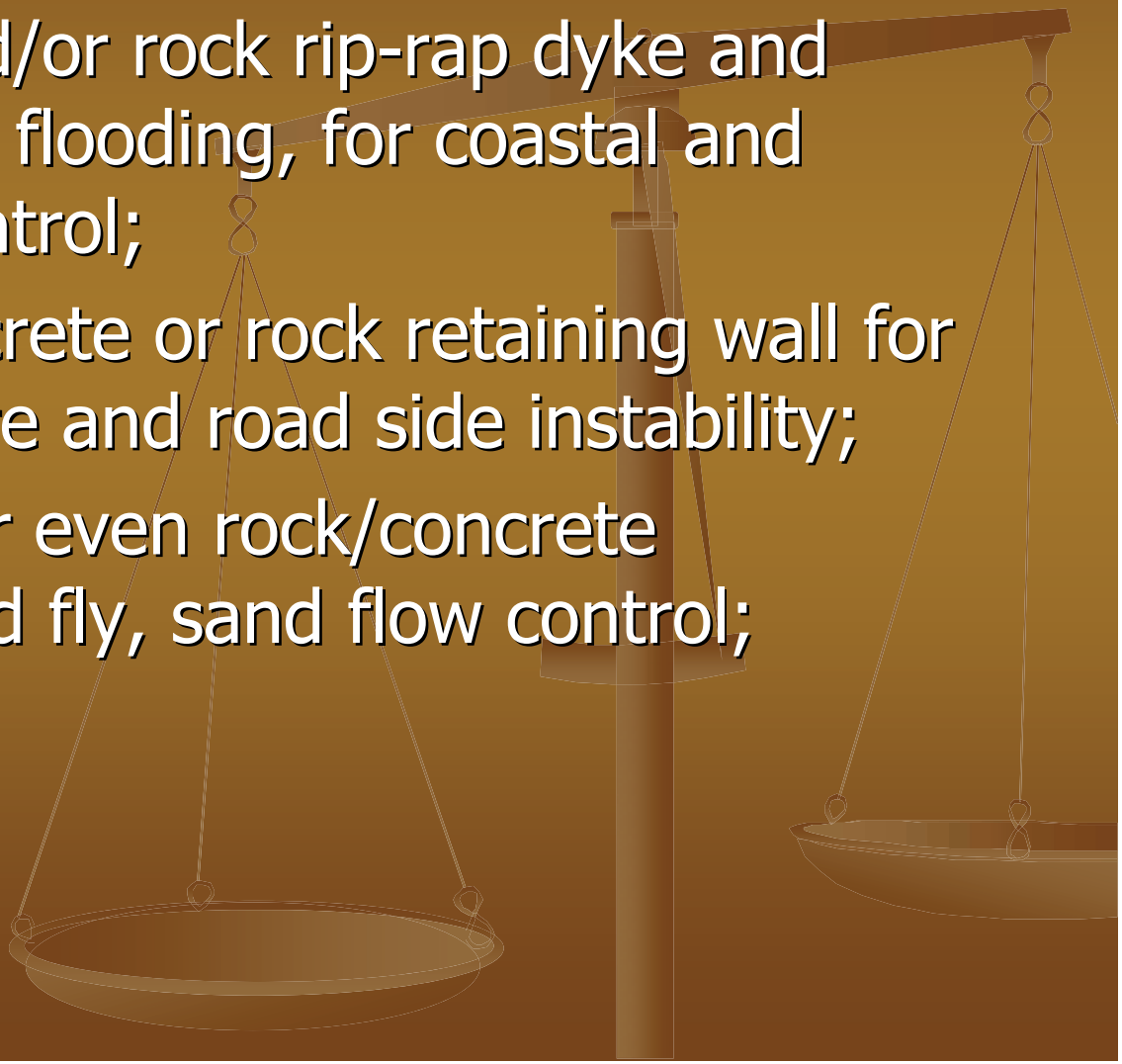
RIVERBANK EROSION BY WAVES

ROAD AND HIGHWAY EROSION BY TYPHOON

Present traditional remedial measures

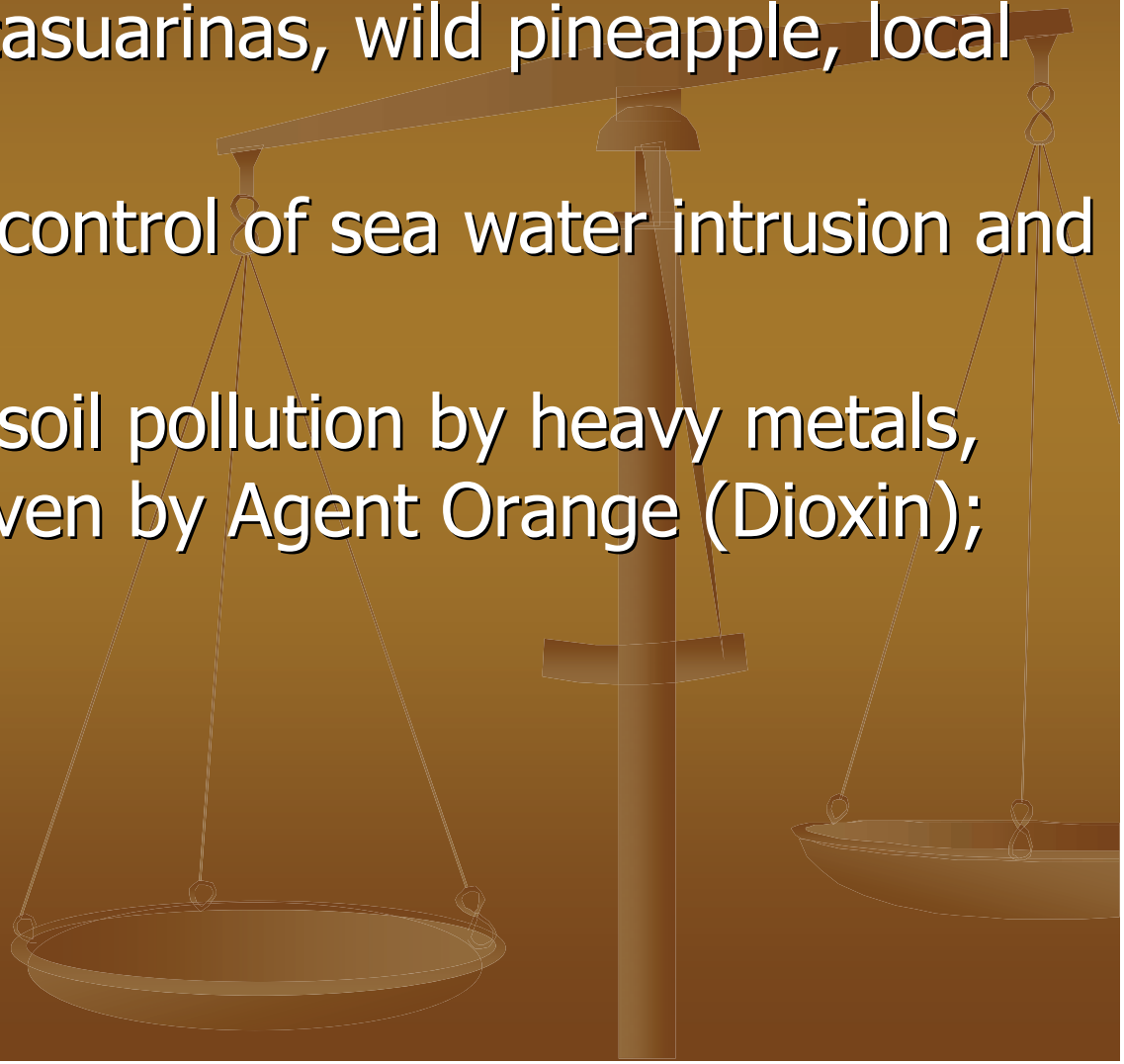
Present measures are mostly structural e.g.:

- Building concrete and/or rock rip-rap dyke and embankment against flooding, for coastal and riverbank erosion control;
- Building passive concrete or rock retaining wall for control of slope failure and road side instability;
- Building sand dyke or even rock/concrete embankment for sand fly, sand flow control;



Present traditional remedial measures

- In some cases, plants, trees and local grasses are used, e.g. bamboo, casuarinas, wild pineapple, local grasses etc.;
- No measures yet for control of sea water intrusion and water pollution;
- No measures yet for soil pollution by heavy metals, toxic elements and even by Agent Orange (Dioxin);



The bank of the Red River in Hanoi is repaired after recent flood using gabions and rock baskets

Very slowly and costly, first by a layer of small rocks then by rock baskets (large size rocks encaged in galvanised steel wire)

But the bank was protected exactly the same way in the past. Now remnants of the old rock baskets collapsed in the recent flood are still visible in the river.

Failure was due to the highly erodible alluvial foundation

Disadvantages of present structural measures

- In most cases, these measures are very localized, i.e. only for the most acute parts of the problem area. They can never be extended to remedy the whole disaster affected area;
- Very expensive (3-5 billion VND, up to 10-15 billion VND/km of embankment) but not effective;
- State budget can never be sufficient. For example, 350 billion VND per province for dyke/river bank protection but only 5 billion allocated;
- Structural measures are environmental unfriendly and not community-based.

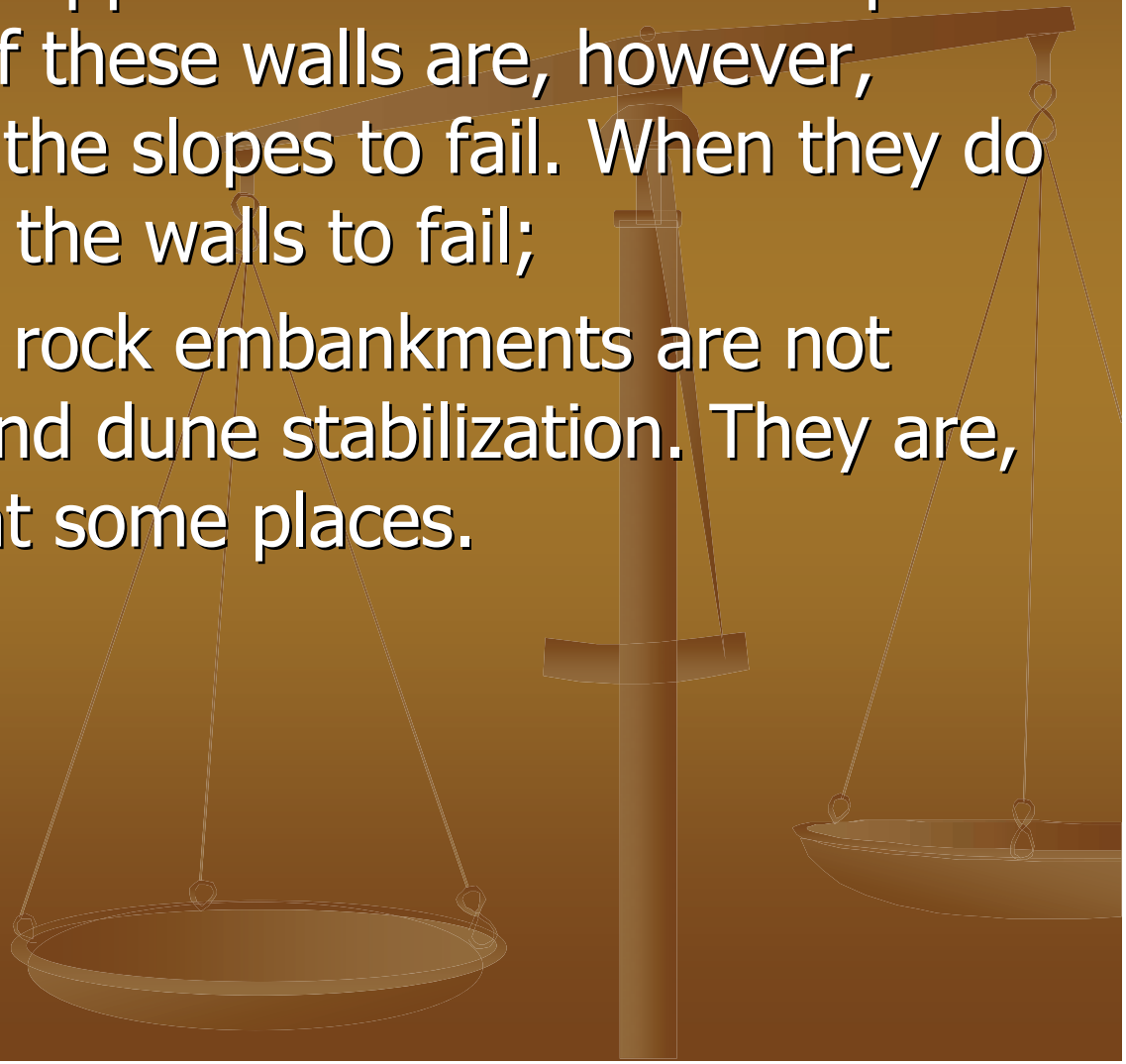
Disadvantages of present structural measures

Technically, rigid structural measures are not suitable because:

- Stone/concrete has to be mined/produced (causing environmental problem) and delivered from somewhere else;
- Much stone, sand, cement, bank soil etc. is brought or disposed into the river, raising channel bottom, causing strong changes in channel bottom and morphology that will surely worsen the flood and bank erosion problems;
- They are not compatible with soft ground. Loose soil underneath is easily eroded/washed away resulting in crack/collapse of upper layer;
- Can't stabilize the bank in case of big, deep landslides;
- Do not absorb flow/wave energy. Just divert/re-direct the disaster to another unprotected place, i.e. they often aggravate the disasters, doing more harm than good;

Disadvantages of present structural measures

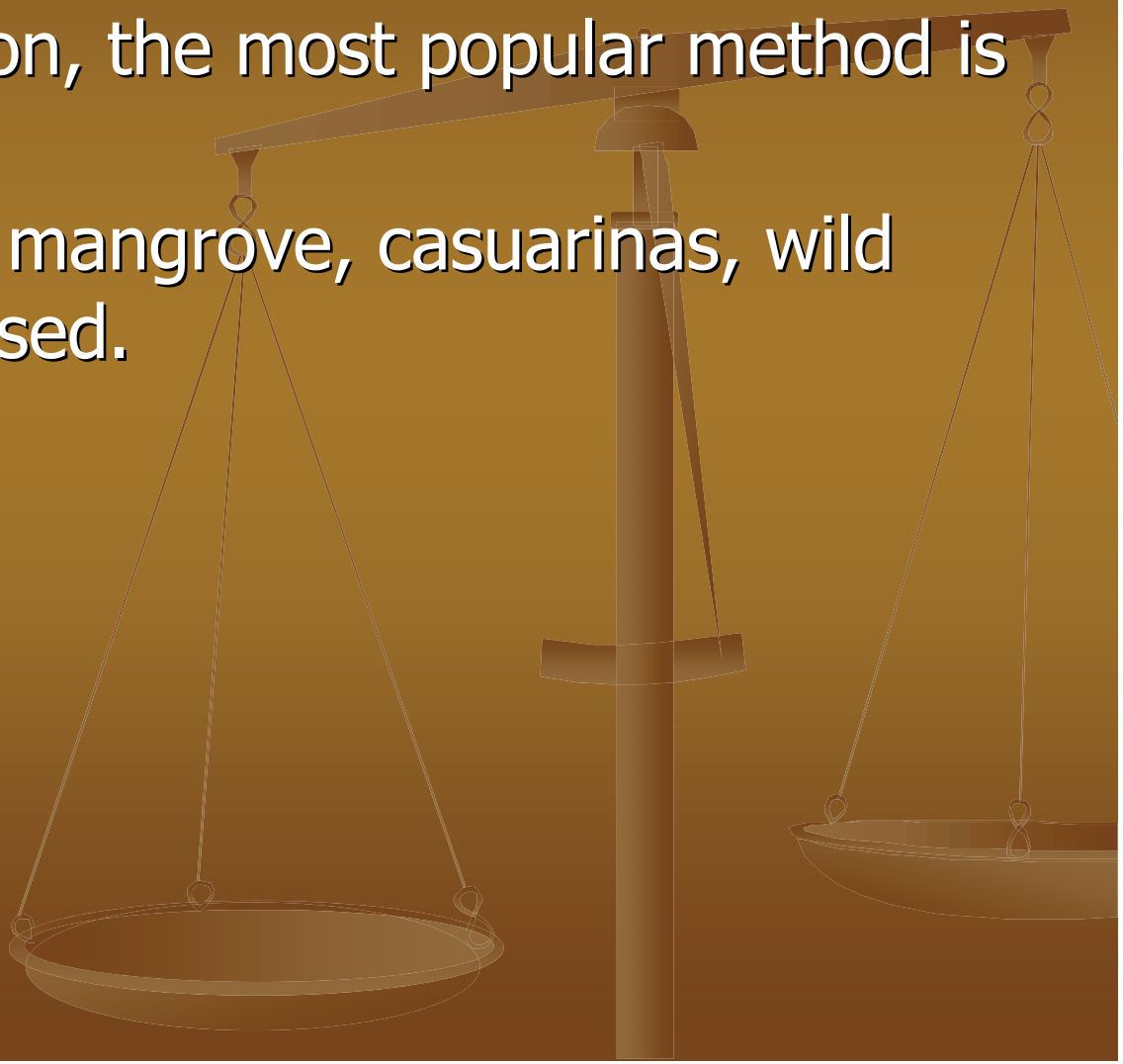
- Concrete or rock retaining wall is probably the single engineering method applied so far for road slope stabilization. Most of these walls are, however, passive, waiting for the slopes to fail. When they do fail, they also cause the walls to fail;
- Rigid structures like rock embankments are not suitable at all for sand dune stabilization. They are, however, still built at some places.



Disadvantages of present bio-engineering methods

Softer solutions, using vegetation have also been tried, though to a much less extent.

- For river bank erosion, the most popular method is planting bamboo.
- For coastal erosion, mangrove, casuarinas, wild pineapple etc. are used.



Native grass is equally ineffective

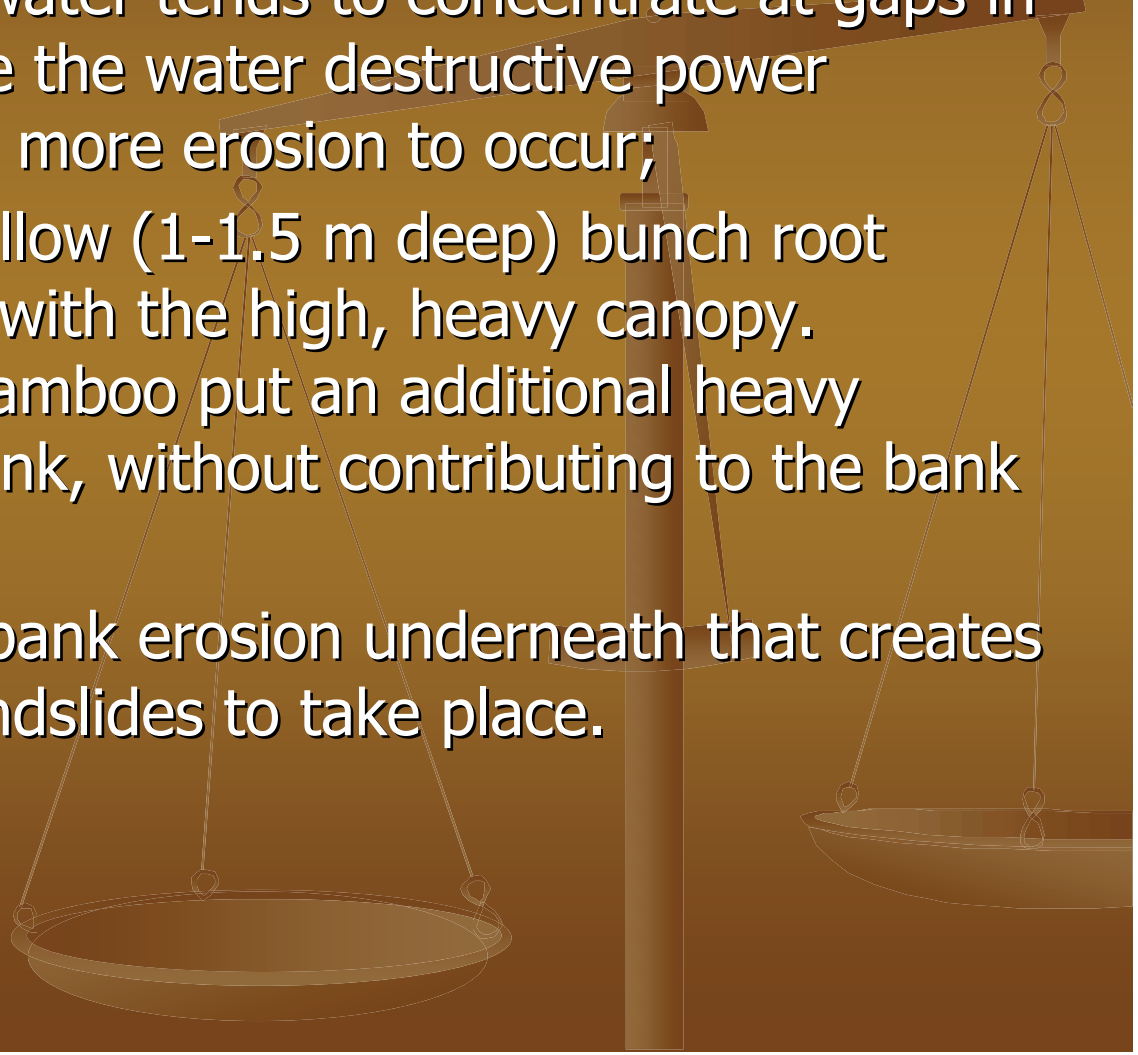
This Phragmites barrier look very impressive from the front

But erosion continues as waves from unprotected section upstream got behind it.

Disadvantages of present bio-engineering methods

However, these trees have some essential weak points, e.g.:

- Growing in clumps, bamboo can not provide closed hedgerows. The flood water tends to concentrate at gaps in-between clumps, where the water destructive power increases, thus causing more erosion to occur;
- Bamboo has only a shallow (1-1.5 m deep) bunch root system, not in balance with the high, heavy canopy. Therefore, clumps of bamboo put an additional heavy surcharge on a river bank, without contributing to the bank stability;
- Bamboo can't prevent bank erosion underneath that creates conditions for larger landslides to take place.



Solutions for natural disaster reduction

- Natural disasters e.g. flood, erosion, landslide, sand fly and sand flow are wide-spread, affecting many communities;
- Some natural disasters e.g. river bank and coastal erosion-siltation have their causes originated from very far upstream;
- Some natural disasters, e.g. flood, for some areas e.g. the Mekong Delta, may not be disaster at all if well controlled;

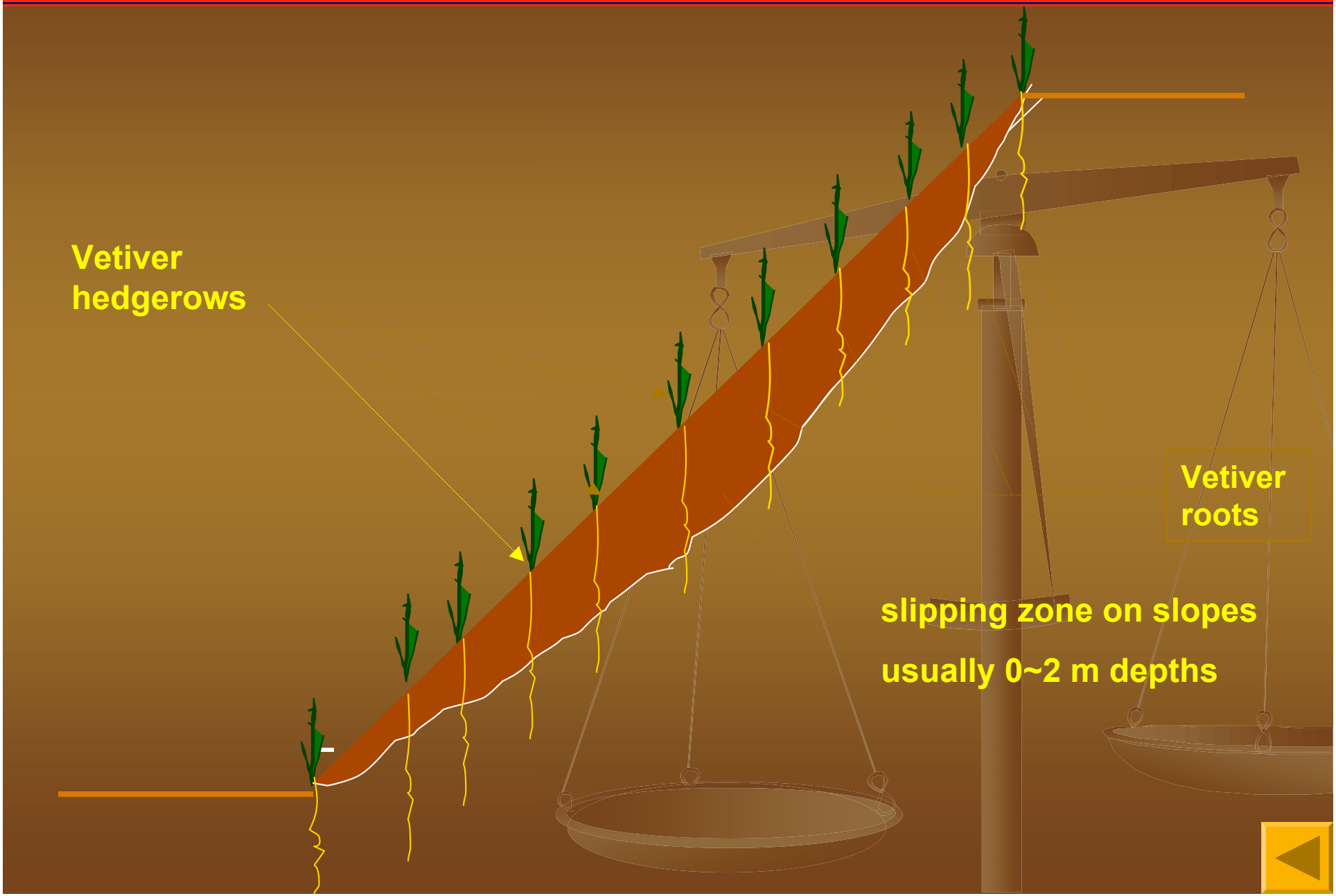
Therefore:

- Macro-scale, non-structural, basin-wide and even inter-basin management should be introduced more widely;
- The present concept of protection using rigid, localized, difficult to apply, expensive, environmental unfriendly structures should be changed;
- Reduction measures should be cheap, soft and flexible, easy to apply, community-based and environmental friendly. Therefore, suitable bio-engineering methods should be sought and practiced more widely.
- One such a solution is the use of Vetiver grass.

What is Vetiver System

- Vetiver System (VS) is a bio-engineering technology that is used by Indian farmers 200 years ago;
- But introduced by the World Bank as a measure for natural disaster reduction only in early 1980s;
- Since then, many countries tried, especially the USA, Australia, China, ASEAN countries etc.;
- In Thailand, the use of Vetiver grass is promoted by the King;
- The World Vetiver Network (TVN) has been established with many member countries;
- Various applications on-farm, along roads, rivers, dykes, etc. Many new applications are tried, e.g. for pollution control;
- Introduced into Vietnam many years ago, but as a measure for natural disaster reduction only in late 1990s, becoming a boom only since 2001 with several trial projects in Central Vietnam, Central Highland and Mekong Delta.

LANDSLIP CONTROL MECHANISM BY VETIVER

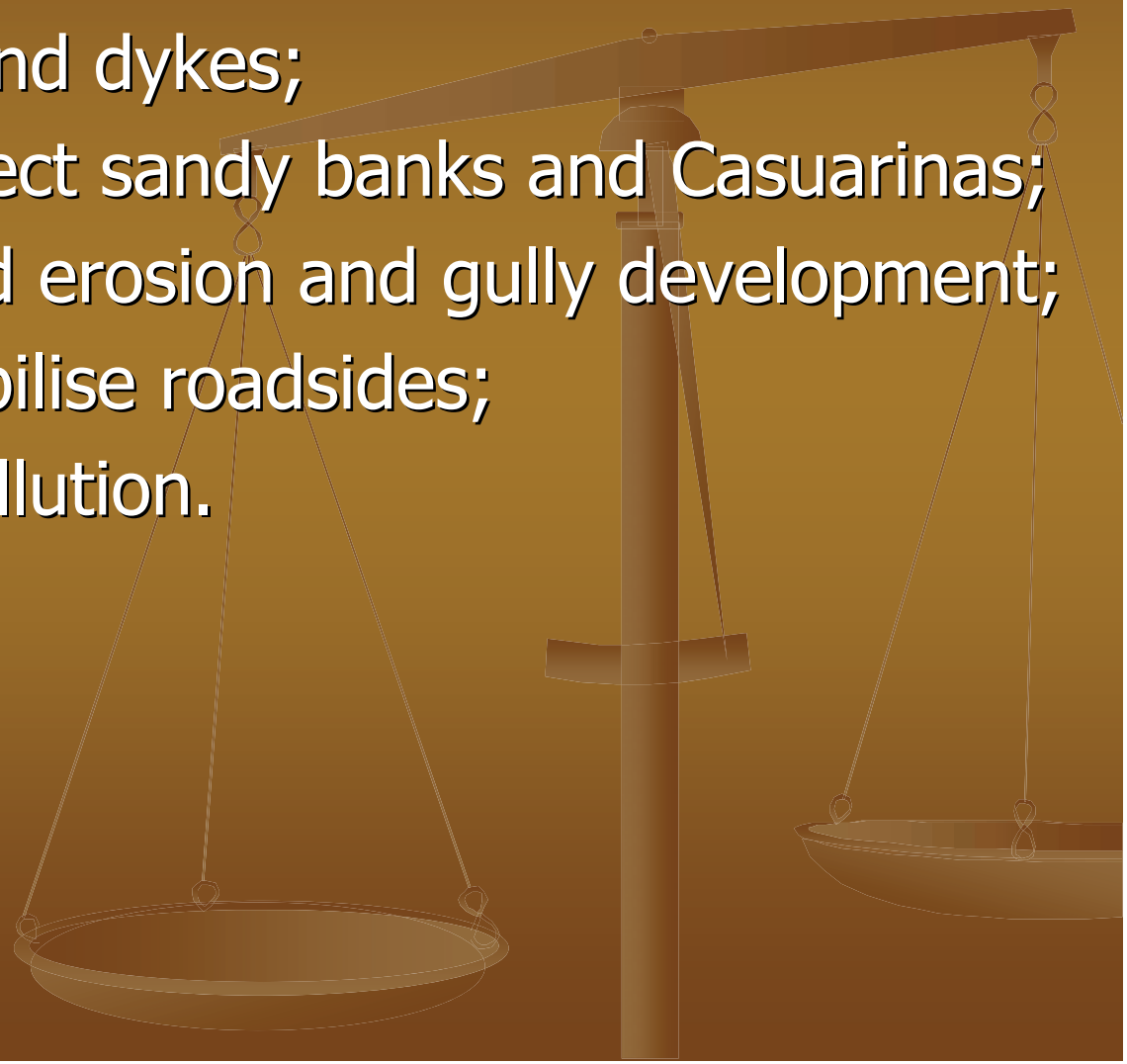


Vetiver flourished on the extremely hostile environment of a road batter, where few other plant can establish

Recent applications of Vetiver grass in Vietnam

Recent applications of VS in Vietnam show a great opportunity to:

- Protect river banks and dykes;
- Fix sand dunes, protect sandy banks and Casuarinas;
- Control on-farm flood erosion and gully development;
- Prevent landslip, stabilise roadsides;
- Control soil/water pollution.



Examples: Trial of Vetiver grass for protecting sand dunes in Quang Binh. Establishment of the demo site.

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Examples: Trial of Vetiver grass for protecting sand dunes in Quang Binh. Four months after planting.

Examples: Trial of Vetiver grass for protecting sand dunes in Quang Binh. Four months after planting. The grass is more than 1.7 m high.

The sand dune is fully stabilized after one year, favouring the growth of other trees.

On a badly eroded shrimp pond bank (along a stream/gully near Da Nang)

Local road along river, near Da Nang. This road used to be badly damaged by receding yearly floods.

Examples: Trial of Vetiver grass for protecting river bank in Da Nang. Four months after planting. The nursery.

Vetiver planting on a dyke in An Giang Province, south VN

Vetiver planting on a dyke in An Giang Province, south VN

A section of the river dyke in Quang Ngai.

The same site after several months.

The same site after one month.

The same site after several months.

A section of anti-salinity dyke in Quang Ngai.

The same site after several months.

An anti-salinity dyke in Quang Ngai at VS planting.

The same site after several months.

An irrigation canal in bad shape in Quang Ngai.

The same site at planting.

The same site after several months.

SEA DIKE STABILSATION

With Vetiver

without vetiver

The use of VS for slope stabilization along HCM Highway.

The use of VS for slope stabilization along HCM Highway.

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The use of VS for slope stabilization along HCM Highway.

BEFORE

TWO YEARS LATER

Some Conclusions

- With its special and unique characteristics as presented above, Vetiver grass can replace and/or combine with bamboo, mangrove, casuarinas and other local grasses etc. forming a closed hedgerow to help reduce many types of natural disasters;
- Vetiver grass is a very cheap alternative, costing only about 10-20% of other traditional methods;
- At the same time, it is also very effective and easy to use, so that it can be used by local communities;
- More importantly, in contrast to all rigid, structural methods, which deteriorate with time, as a living bio-engineering method, Vetiver grass improves its effect with time. It is an environmental friendly method.

Disaster Mitigation:

To solve problem like this, you have two options

The Inka way by retaining walls at Macchu Pichu in Peru.

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The Inka way by retaining walls at Macchu Pichu in Peru.

Or the Vetiver hedges on Ho Chi Minh Highway in Vietnam.


Thank
22 10 2006