VETIVER SYSTEM TECHNOLOGY FOR INFRASTRUCTURE STABILISATION

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INTRODUCTION

• **The Vetiver System (VS) is was first developed by the World Bank for soil and water conservation and now being used in over 100 countries for various applications.**

• **R&D conducted in several countries showed that vetiver grass is tolerant to the most adverse soil and climatic conditions, such as drought and flood.**

• **Due to the above features VS has been used successfully for soil erosion and sediment conservation and, infrastructure in Australia, Africa, Asia, North and South America and southern Europe**.

SPECIAL MORPHOLOGICAL AND PHYSIOLOGICAL FEATURES OF VETIVER GRASS

Stiff and erect stems up to 2m tall and over 2.5m with flower head. It flowers but setting no seeds.

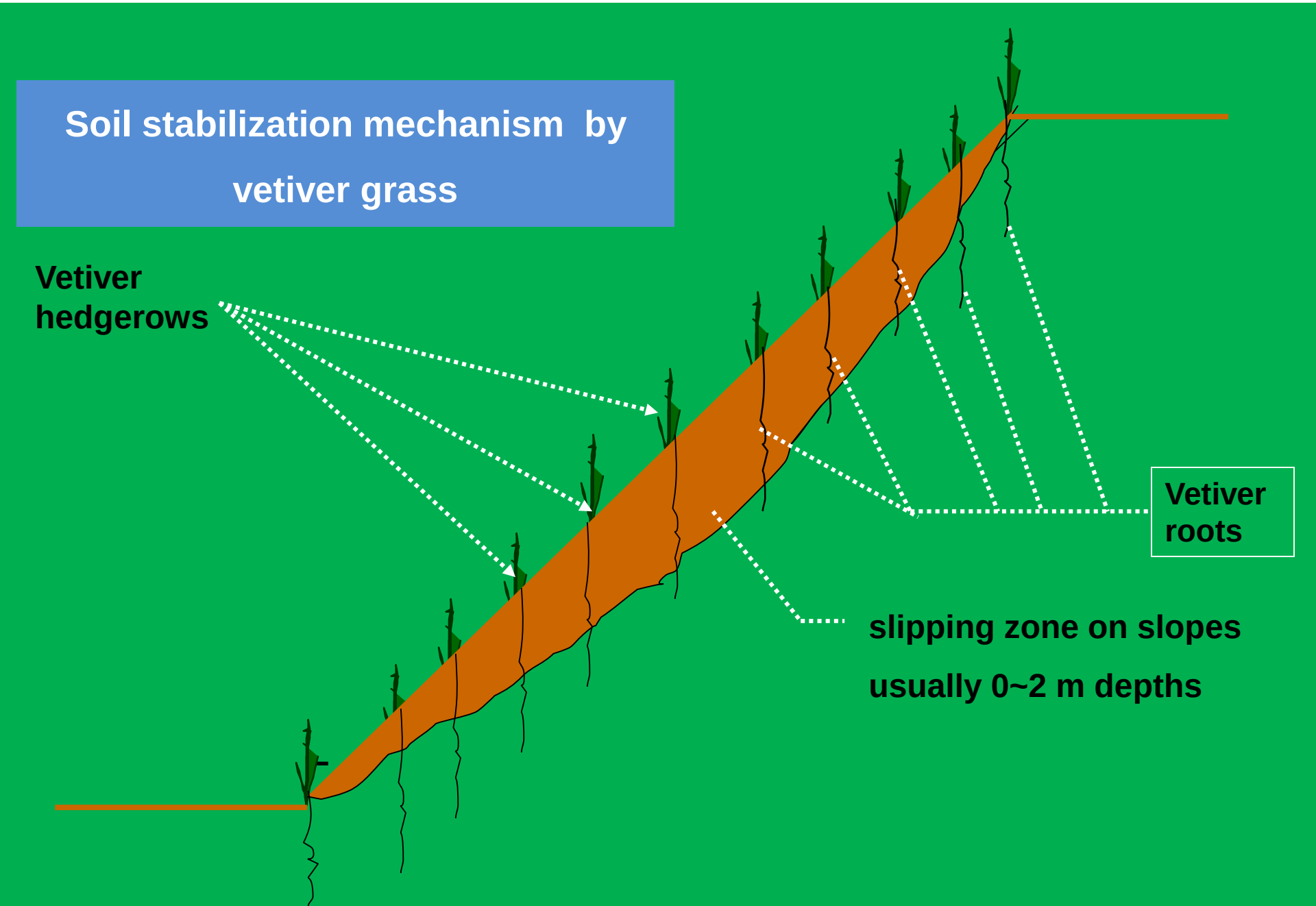
Forming a thick hedge when planted in row which can spread and slow down runoff water

DEEP, EXTENSIVE AND PENETRATING ROOT SYSTEM

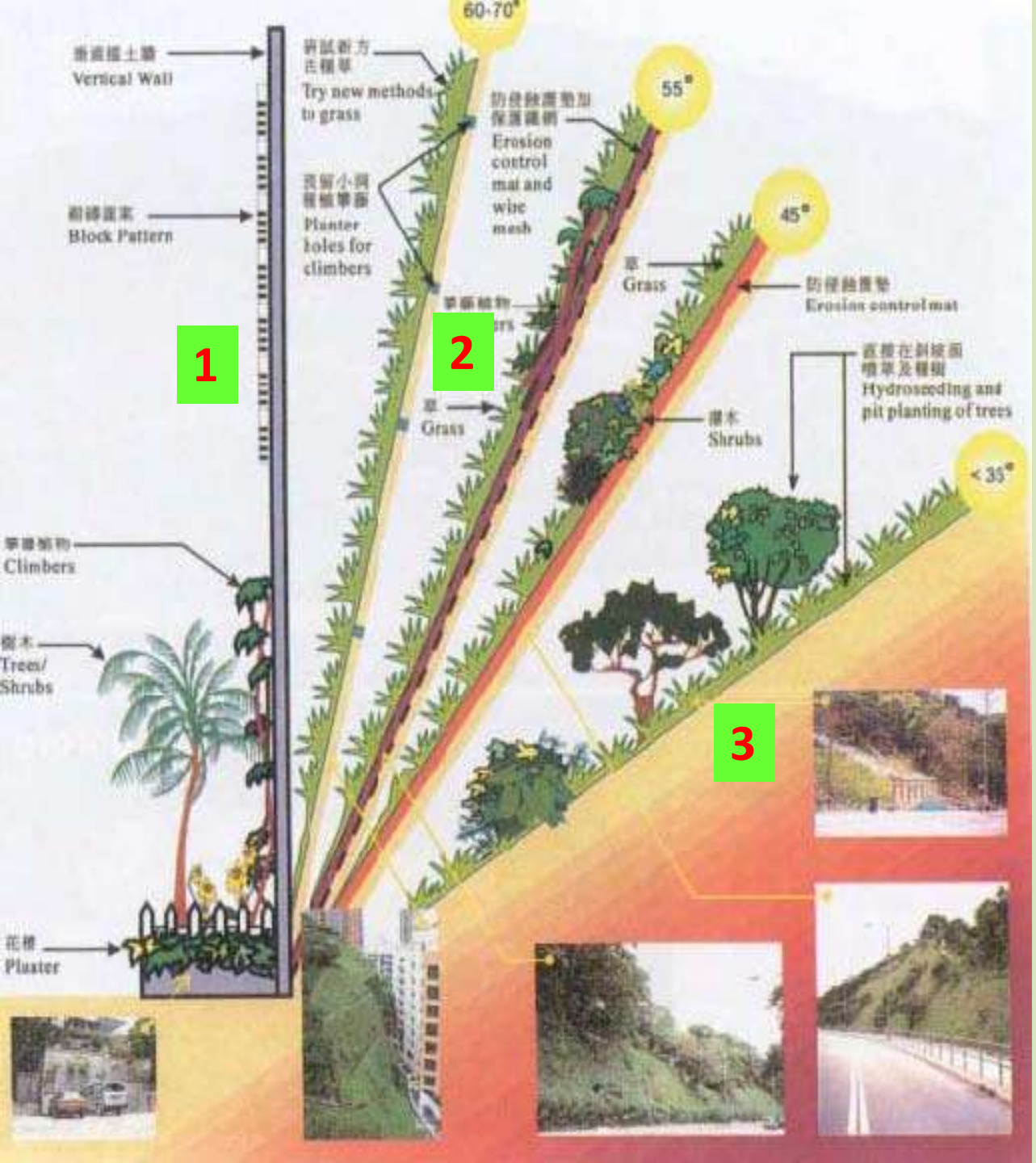
China: One year old with 3.3m deep root system

Vietnam: Agriculture & Forestry University, Saigon

STABILISATION OF INFRASTRUCTURES



These roots are strong enough to stop the slide and the concrete path is cracked



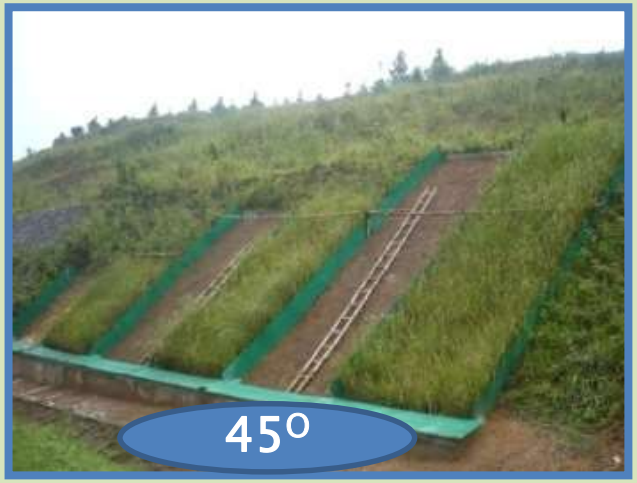
Options for Slope Protection:

1. Hard structures
2. Combination of hard and soft bioengineering including geofabrics
3. Bioengineering alone including geofabrics on erodible soil

Asep Sunandar and Nanny Kusminingrum

Indonesian Institute of Road Engineering (IRE) conducted a series of experiments with slopes ranging from 30o to 80o

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

Soil Type: Clay Loam , Stability Index: Stable, 4 Month Old, Nagreg West Java

Slope 80°,
Age: 4 months
Before trimming

Slope 80°,
Age: 4 months
After trimming

PC P Truong

Indonesian Institute of Road Engineering (IRE)

Trial comparing 3 Vetiver planting densities, Bahia grass and bare slope at Nagreg West Java

PC P Truong

PC P Truong

Very steep, 80° slope on highly erodible red volcanic soil

CONCLUSION

- **Vetiver system can be used effectively to control surface erosion and shallow failure of road batter**
- **Vetiver system can be used effectively at slope between 30^o – 60^o**
- **Vetiver system could be applied by road authorities to cope with erosion and shallow failure of road slope**
- **At road slope >60^o, vetiver technology is not recommended to be applied solely (must combined with geotextiles and/or mechanical methods)**

Based on the above technical data, vetiver system has been used very effectively in stabilising extreme and highly erodible slopes around the world

The following photos show successful applications of VS on extreme slopes:

- **Without Geofabrics and**
- **With Geofabrics**

Without Geofabrics : BRAZIL Road Batters

Without Geofabrics : CHINA Zhejiang Province

National Highway 330 on slope area of 10 600m2 to prevent landslides

PC P Truong

Without Geofabrics

COLOMBIA

Construction site

PC P Truong

Without Geofabrics

COLOMBIA

Construction site

Hydromulch

Vetiver

Without Geofabrics : INDONESIA East Java

PC A Sunandar

Before

1 month

2.5 months

4 months

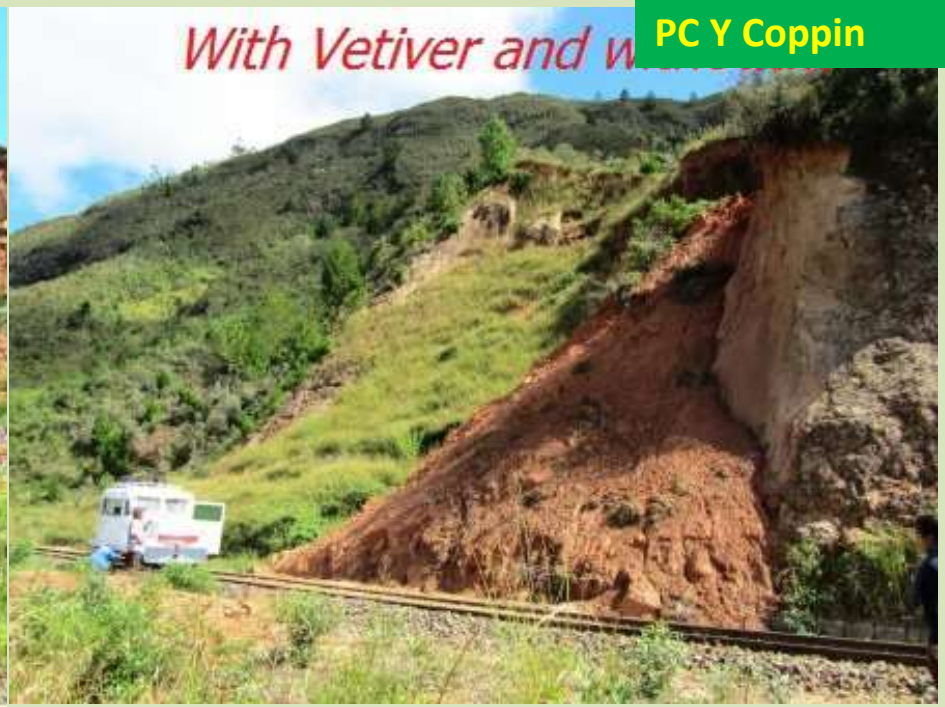
Slope length: 300m, height: 14 m,

Regular trimmings after 4 month

Without Geofabrics : INDIA Assam, Doria Bridge

PC S Bhattacharyya

PC Y Coppin



Without Geofabrics : PHILIPPINES Central Luzon Highway

Without Geofabrics

Drainage channels. Democratic Republic Congo

PC A Ndona

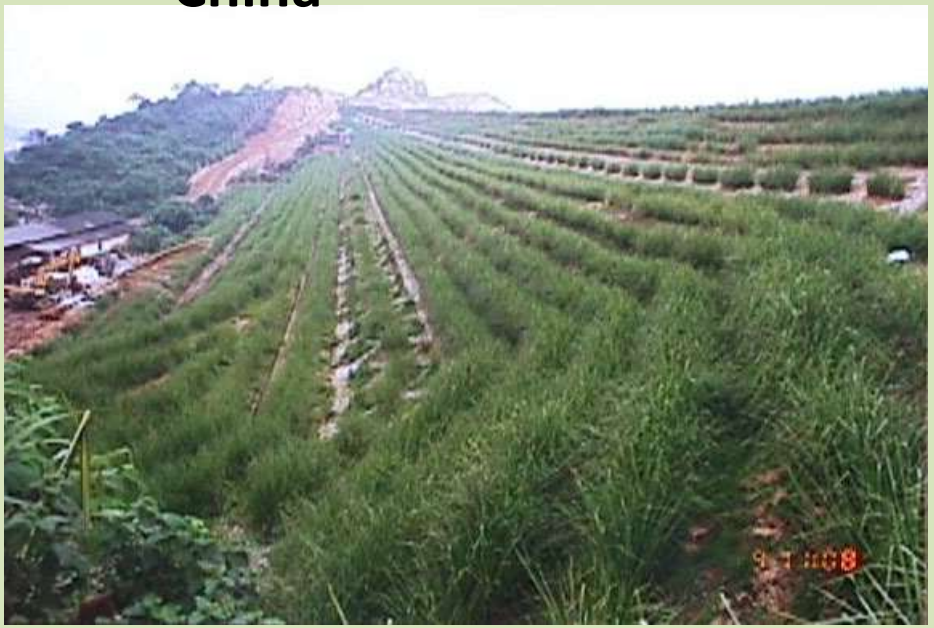
For this project the Chinese imported 1 million plants by Jumbo jet to the Congo

Without Geofabrics : Dam wall Protection

Australia

South Africa

China



Without Geofabrics : Highway batters

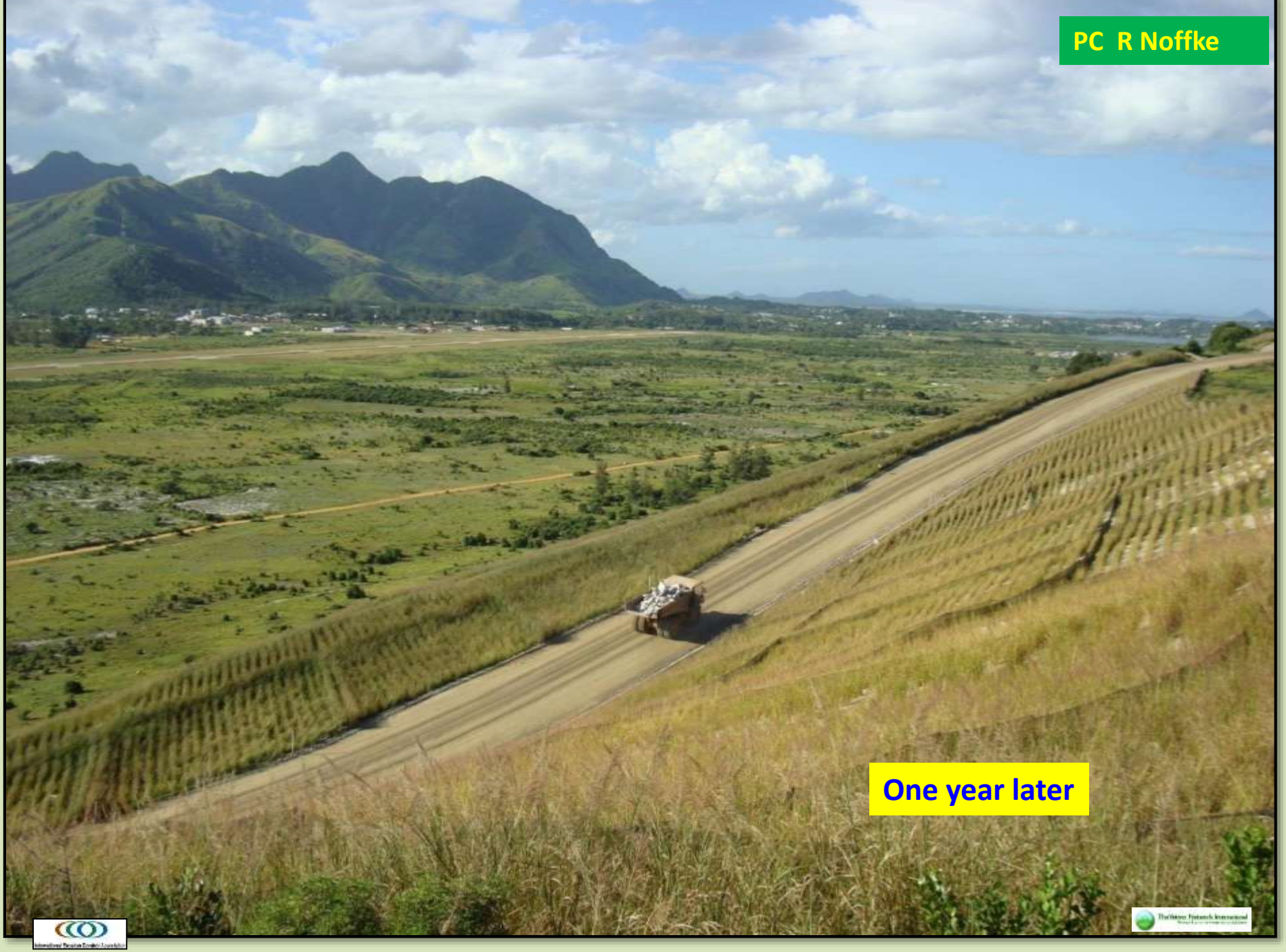
THAILAND Central Highlands

PC S Sanguankaeo

MADAGASCAR: RIO TINTO Erosion control on access road to Iliminite sand mines

PC R Noffke

PC R Noffke


PC R Noffke
One year later

Without Geofabrics : VENEZUELA Road Batters

PC R Luque

Without Geofabrics : VIETNAM Ho Chi Minh Highway

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Ho Chi Minh Highway – Central Vietnam

With Geofabrics : AUSTRALIA Brisbane

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Highly erodible sandy soil with gradient up to 50o at some sections

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Vetiver planting

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Six months after planting

With Geofabrics : BRAZIL Road Batters

PC PL Pereira

PC PL Pereira

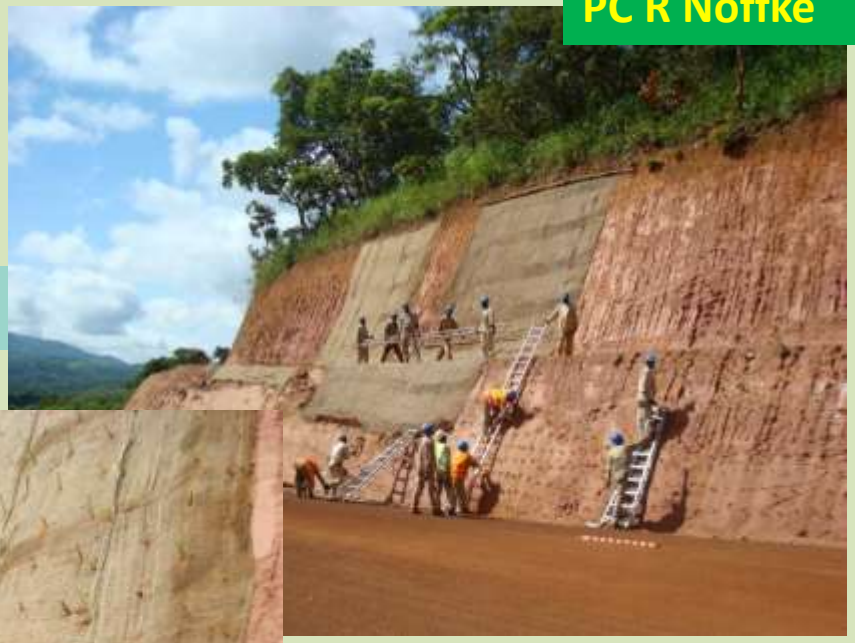
With Geofabrics : GUATEMALA

PC L Castro

Batters on 72º slope with geofabrics

With Geofabrics : GUINEA (West Africa): Road Batters

PC R Noffke



Still stable after 8 years

PC R Noffke

With Geofabrics: DCR CONGO Road Batters

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On 60°-70° vertical slope using Green TerraMesh walls at Selembao Kinshasa.

With Soil Nails: COLOMBIA: Medellin

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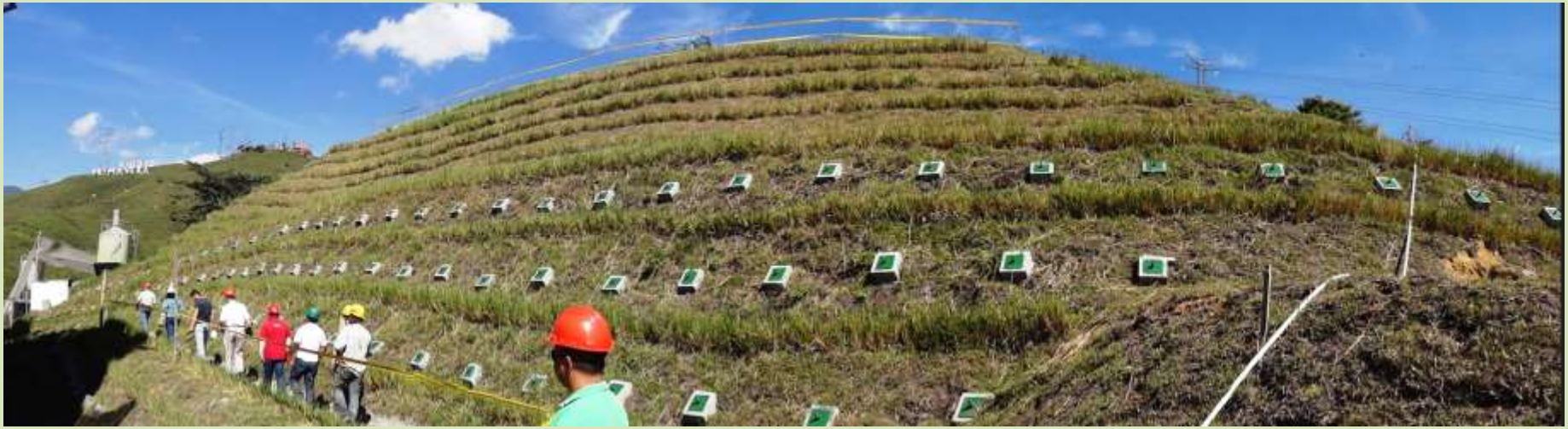
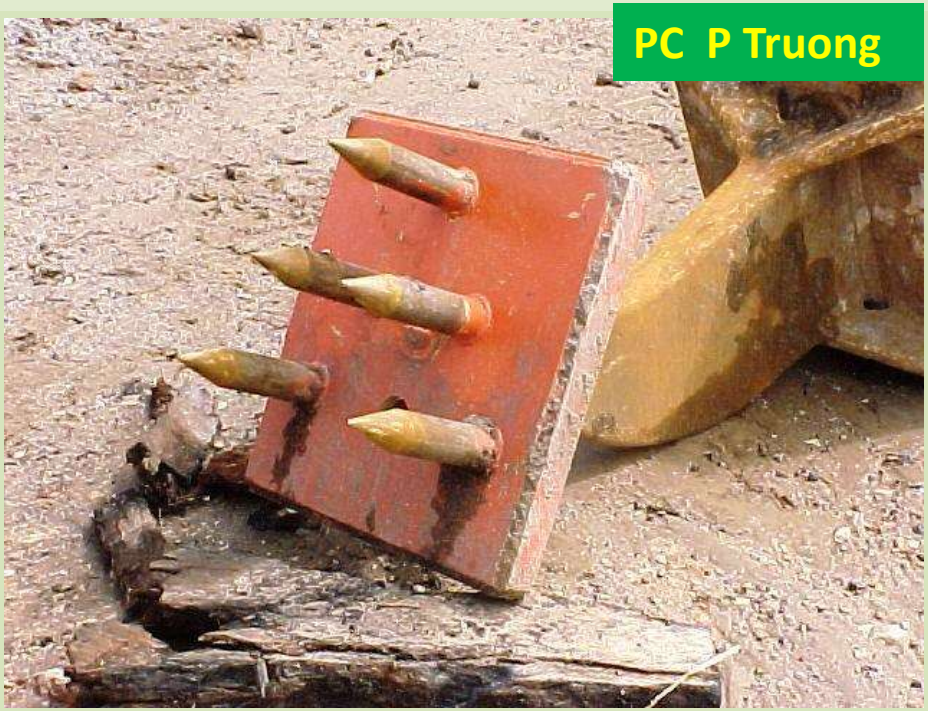
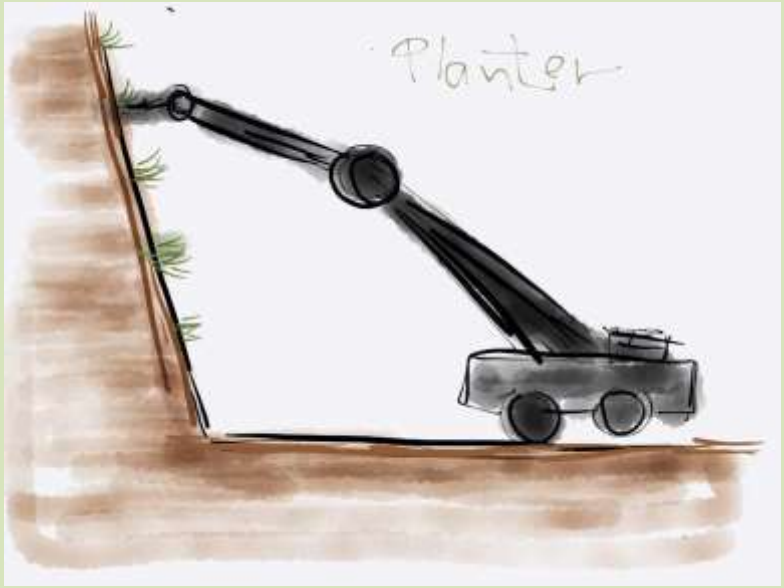


Ten months after planting

Some Instruments Used on these Extreme Slopes

This Australian "Hole puncher" is mounted on a backhoe to make holes for vetiver planting on the steep wall





Ladder, Portable Drill and Strong Hands in GUINEA (West Africa)

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CONCLUSION

- **Vetiver System Technology (VST) can be used effectively to control surface erosion and shallow failure of road batter at slope between 30^{o} – 60^{o}**
- **At road slope >60^{o}, VST is not recommended to be applied solely (must combined with geotextiles and/or mechanical methods)**
- **To achieve successful application, VST has to be implemented correctly and professionally**
- **The layout design varies with slope gradient, cut or fill slope, soil types, rainfall of a particular site**
- **From this information, the VST specialist will decide on whether the site needs geofrabrics, hydromulching and other measures**
- ***Failure of VST is most likely due to incorrect and unprofessional implementation***

REFERENCES

Mining Rehabilitation

- **Roley Noffke**: Mine and associated rehabilitation projects in africa and indian ocean islands
  http://www.vetiver.org/LAICV2F/0%20Plenary/P4Noffke_PpE.pdf

Thank You