Keeping Sediment Off The Reef

A project using vetiver grass to trap sediment and re-establish indigenous forest - Aneityum Island, Vanuatu
Don Miller – Vanuatu

Photo Port Patrick 1995

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Initial work started in January 1995
Earlier New Zealand funded forestry plantings had prevented new erosion sites forming.
Trees could not be established in the infertile deep raw gullies and so red mud still reached the reef.
Trials with vetiver grass, already growing on the island, began.
Vetiver grass nurseries were established and large scale planting was undertaken.
Indigenous trees were established in soil trapped by the rows of vetiver grass.
Project funding ceased suddenly in late 2002.
Some local information

1995 photograph of northern Aneityum

Chalk Hill

Sediment outflow (controlled by 2008)

Port Patrick

Sediment outflow (still active 2008)

Red sediment on reef and shore

South East trade wind and ocean current

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Red sediments smothering old reef

Port Patrick - 1995 photo (from a distance of about 1.5 metres)
Some of the sediment sources

- about 50 ha of bare volcanic subsoil visible in this photo
“Chalk Hill” 1995

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An area of beach and reef where sediment had been accumulating

Port Patrick 1995

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The scale of the problem – massive
Cruise ships often visit the lagoon seen here
Large areas of gullies like this

- Soft volcanic rock that even pines won’t grow in.
- Low pH, high Mn and high available Aluminium %
- Very high rates of weathering
- High annual volumes of acid sediment
Acacia spirorbis

• The ideal pioneer tree for this particular island
• An indigenous nitrogen fixing timber species
• Tolerates low pH and high available Aluminium
• Very tolerant of seasonal drought
• Fast growing but easily killed by fire

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Establishing *Acacia spirorbis*

- Stiff stemmed vetiver grass traps sediment
- One year old seedling Acacia near spade

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1998 – the same Acacia
1999 – the same Acacia

- Vetiver grass continues to trap sediment
- *Acacia spirorbis* shades soil and provides nitrogen and leaf litter
Port Patrick - eroding gully in toxic soft rock

• 1997 - Initial vetiver grass planting
Vetiver grass is well established and *Pterocarpus indicus* (blu wota) stakes have taken root.

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No damage from Cyclone Yali – 370 mm rain in 12 hours.

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• A range of trees has been established in the trapped sediment.
• Nutrient cycling from nitrogen fixing trees is providing ongoing soil fertility.
Same location – August 2008

• Gully floor planted in 1997 is now fully stabilised.
• The gully walls are now ready for further planting.

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Sediment retained in gully floor - 2000

- Approximately 100 cubic metres of sediment have been trapped by the rows of vetiver grass.
Same location - 2008

- Sediment is still accumulating in the base of the gully.
- Large boulders are being gradually buried as the soil level rises. (Note volunteer pine trees in sediment.)

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• Vetiver grass rows are established a year before \textit{Acacia spirorbis} seedlings are planted
The thick covering of acacia leaf litter is an early stage in soil fertility restoration.

Vetiver grass will survive in the case of future fires.
A major source of sediment in 2001

- This soft volcanic rock loses about 50 mm of weathered material per year.
- Note sediment retained above the young vetiver grass hedge.
• A complete cover of acacia now prevents almost all sediment from leaving the slope
On this exposed site both planted and volunteer trees are establishing in sediment trapped above vetiver hedges.
Acacia and pines now blanket the slope. Vetiver survives as a back-stop in case of fire.
2008 - Same site as previous 2 slides

Bare eroding slope has been revegetated
• Uncontrolled fires are a constant problem
• Vetiver grass recovers within weeks of fire.
• If trees are lost there will be natural regeneration in the trapped soil
Vetiver is a form of fire insurance

- Quick regrowth of vetiver grass about one month after a fire, on a fertile site - 2002.

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Burnt erosion control planting site

- Full recovery of vetiver hedges after this 2007 fire will retain erodible soil and allow natural regeneration of trees

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Old logging road stabilised with vetiver hedges

- Sediment no longer reaches the sea from this formerly scoured out road.

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2008 – Total sediment control on road

- After the erosive flows of water are tamed the indigenous plants can recolonise the old road surfaces.

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2008 – Captured sediment being farmed

- This was a raw eroding gully before the erosion control work.
- The current demand for land close to the village is high.
- Cassava is now being cultivated in the sediment trapped by the 1996 vetiver grass plantings.
VETIVER GRASS FACTS

- It has no fertile seeds and must be multiplied by vegetative means.
- It was introduced to this island of Aneityum in about 1912 and has not spread at all despite widespread early planting.
- It will grow in very infertile soil.
- Its stems and leaves filter out and trap sediment.
- It resists grazing by animals.

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Vetiver can have a massive root system

In deep soils root depths of 2 metres are common.

These roots allow the grass to survive drought and resist scour in stream channels.
Vetiver’s major role on Aneityum

It has allowed indigenous vegetation to be successfully planted in trapped sediment on difficult sites. This photo was taken in 2002.

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Indigenous acacia and volunteer pine have now fully covered the gully
Changes in coastal conditions

• Thick red mud covered much of this uplifted reef in 1995 – A footprint at Port Patrick

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Chief Navaluk expressing his thanks to the project for the improved state of the shore.
Clean water “down stream” from Port Patrick - 2008

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Local fishermen are happy with the changes…

...and the Vanuatu Fisheries Department is pleased with what they have heard from the Aneityumese people.
The Future

- In some areas too much red sediment is still reaching the sea – ("upstream" from Port Patrick)
• Sources of sediment still exist and these need to be revegetated to protect other reef areas

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• More large gullies are still to be controlled
• More vetiver grass hedges are needed here to trap sediment in which to establish trees
More of this work is needed

Seen here in the dry season, the trapped sediment is ready to be planted with nitrogen fixing *Acacia spirorbis* trees.
• More education is needed on the harmful effects of fire on the island
• Education on how healthy trees benefit the soil and thus the lagoons...
...and on how the past misuse of fire has created the soil and reef problems the Aneityumese now have.
Reef Health Monitoring

- With a fast growing population Aneityum needs local protein sources such as these goat fish.
- A healthy reef system is essential
- The Fisheries Department, in association with Peace Corps, are already monitoring coral reefs on Aneityum
- They are keen to monitor the impact of any future soil erosion control work there.

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