Investments in Ecological Infrastructure to improve ecosystem services, best implementation models going forward and potential opportunities from a carbon revenue and climate adaptation *perspective.*





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Christo Marais: Department of Environmental Affairs: Environmental Programmes

EXPANDED PUBLIC WORKS PROGRAMME

Presentation Overview

1. Can carbon sinks be looked at independently?
2. Extent of Natural Resource Degradation in South Africa.
3. Economic impacts of ecological infrastructure degradation and restoration.
4. Three examples of ecological infrastructure restoration and its potential impacts including carbon sinks.
5. Mainstreaming ecological infrastructure restoration and maintenance in government and business priorities.
6. Quantifying the employment and resource demands of the sector.
7. Lessons learnt and institutional needs.

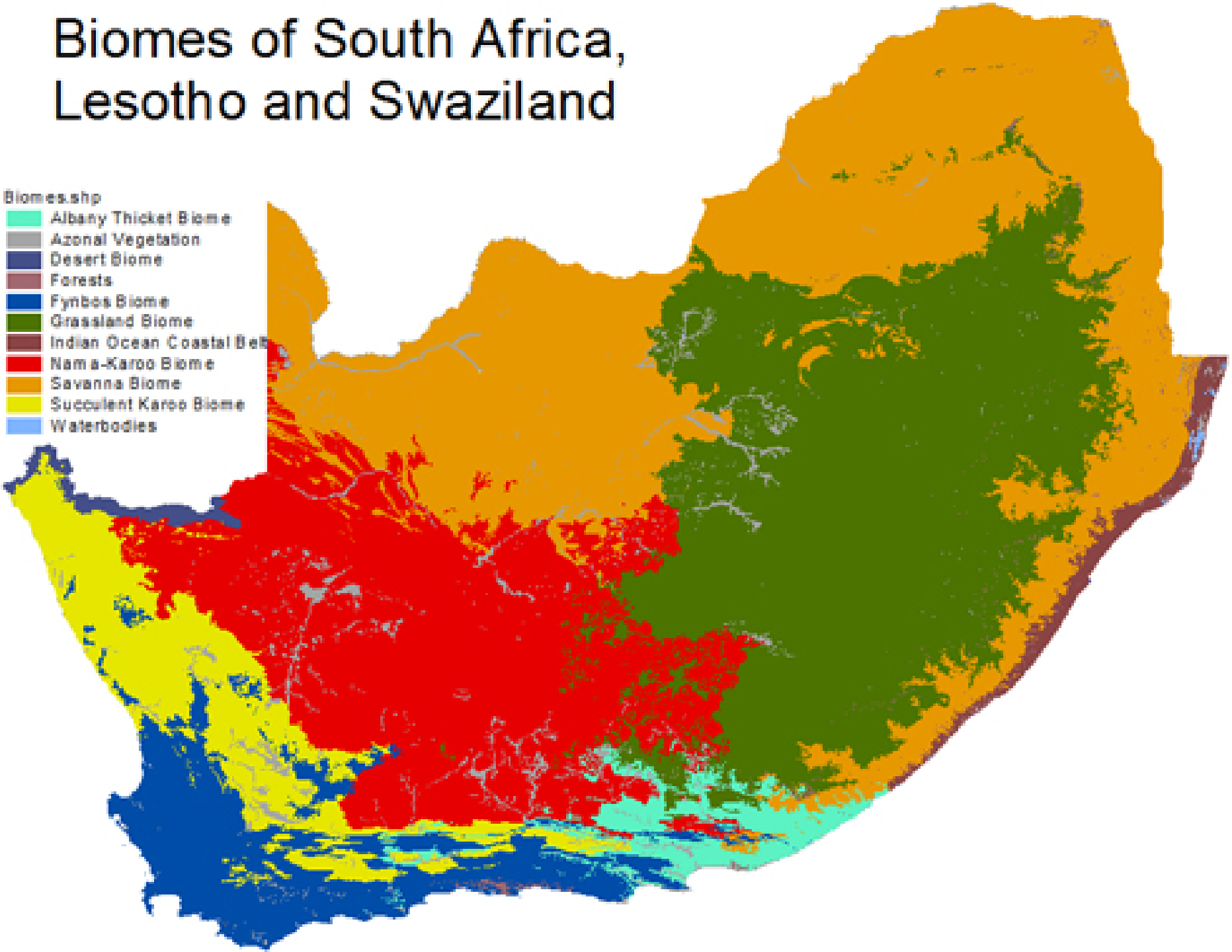
From a Ecosystem Restoration & Maintenance "Economy" Can Carbon Sinks be Dealt with on its Own?

Climate

i. Mitigation
    i. Sequestration

ii. Adaptation
    i. Droughts (Water & disaster risk)
    ii. Floods (Water & disaster risk)
    iii. Fires (disaster risk

Biomes of South Africa, Lesotho and Swaziland



Overview of Land Use in South Africa

Area by Cover for SA (millions of ha)

Cover/Land Use	Totals
Protected Areas	7.877
Untransformed	87.028
Cultivation	17.199
Degraded+Urban+Mines	6.01
Waterbodies and surrounds	2.008
Plantations	1.725
Total	121.847

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20 YEARS OF FREEDOM

"Over simplified" Spectrum of Degradation

Desertification ⟷ **Bush Encroachments & Invasives**

Extent of Natural Resource Degradation in South Africa

1. Alien plant invasions (around 19 million hectares or the equivalent of between 1.8 and 1.9 million hectares if condensed to 100% density),
2. Gully erosion (around 559 500 ha),
3. Sheet erosion (around 3.635 million ha), and
4. Bush encroachment (this has not been accurately estimated yet but could be as much as 20 million hectares).
5. Degraded wetlands (some 35% of wetlands have been degraded to a lesser or larger extent)

Economic Impacts of Natural Resource Degradation

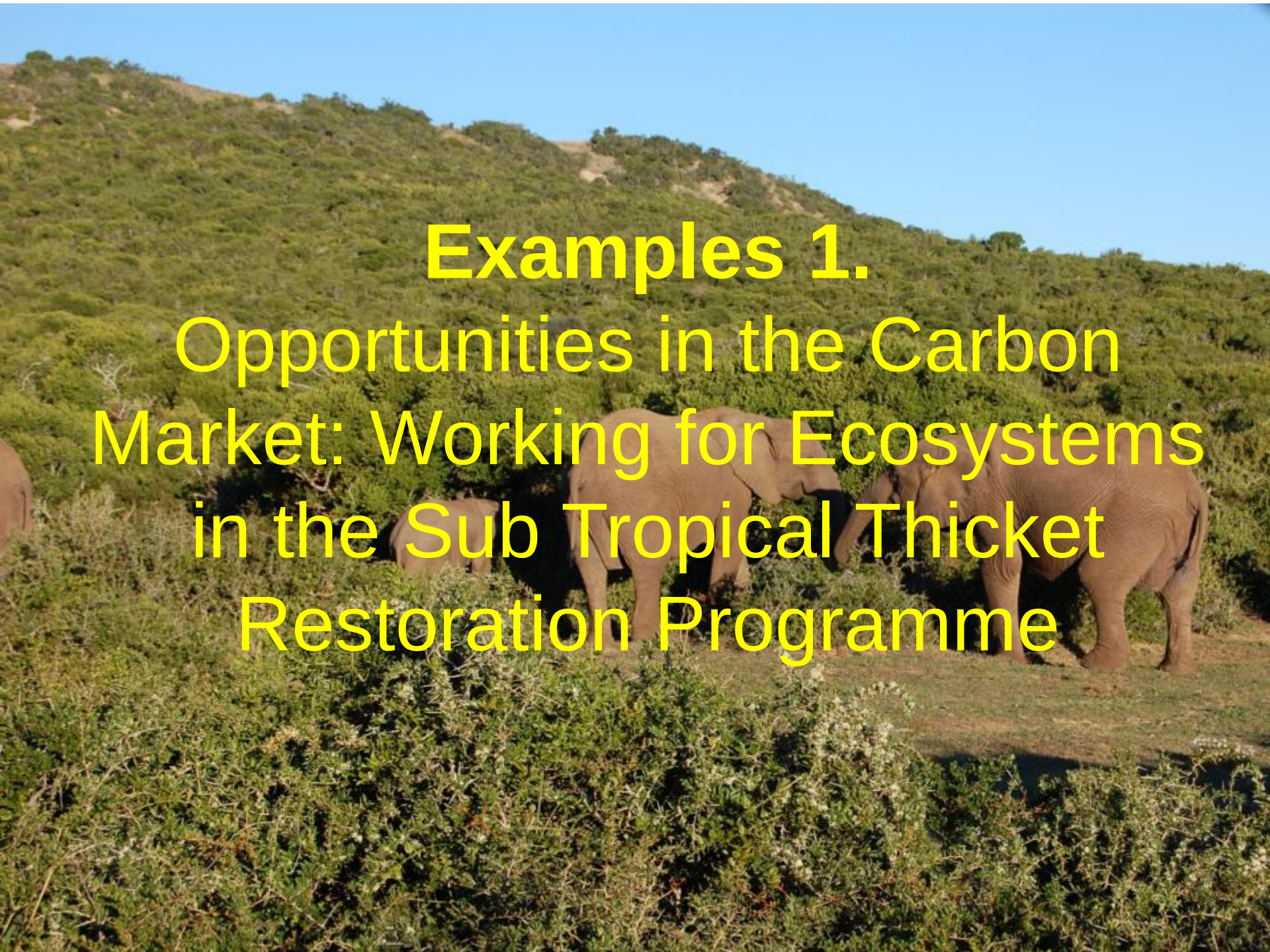
1. Reduced productive potential of land especially in the form of grazing, ecotourism (/nature based), energy sources and building materials, mainly in rural areas.
2. Reduction of water security due to;
   i. Reduced mean annual runoff as a result of invasive alien trees in watersheds, wetlands and riparian areas,
   ii. Increased wet season flows (flooding) due to reduced infiltration as a result of a loss of vegetation cover,

Economic Impacts of Natural Resource Degradation Cont.

2. Reduction of water security due to;
   iii. Reduced dry season flows (droughts) due to reduced infiltration both as a result of increased runoff during rainfall events and on the other end of the spectrum the impact of invasive alien trees in watersheds, riparian zones and wetlands.
   iv. Increased siltation of water infrastructure due to increased erosions from watersheds, river banks and wetlands,

Economic Impacts of Natural Resource Degradation cont.

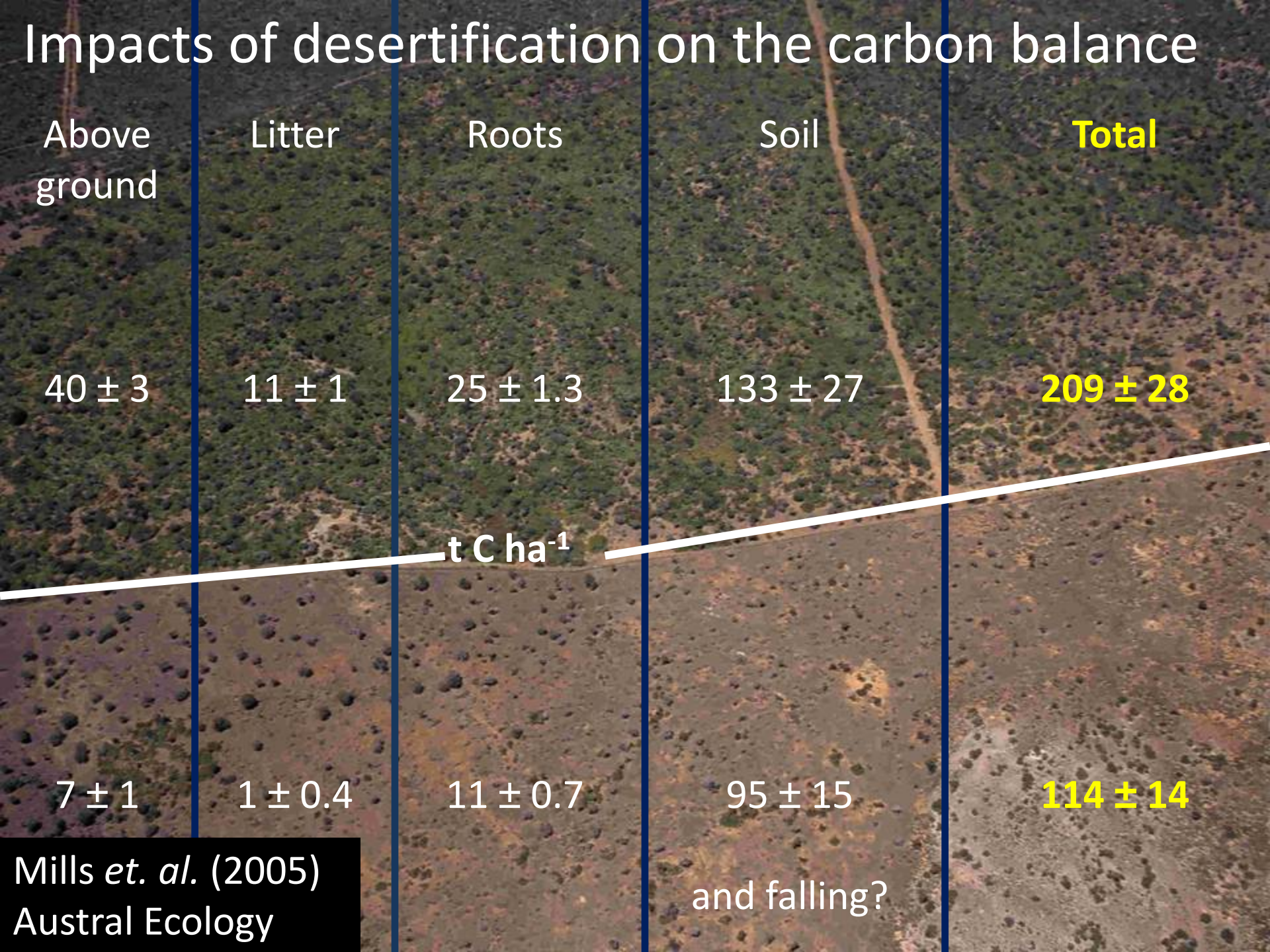
2. Reduction of water security due to;
   v. Decreased recharge of ground water resources due to increased runoff during wet season and the impact of invasive alien trees on shallow aquifers, and
   vi. Decreased quality of water due to unsustainable land management practices.
3. Negative impacts on the carbon balance due to;
   i. A loss in above ground biomass,
   ii. Reduced litter accumulation, and
   iii. A reduction in soil carbon.



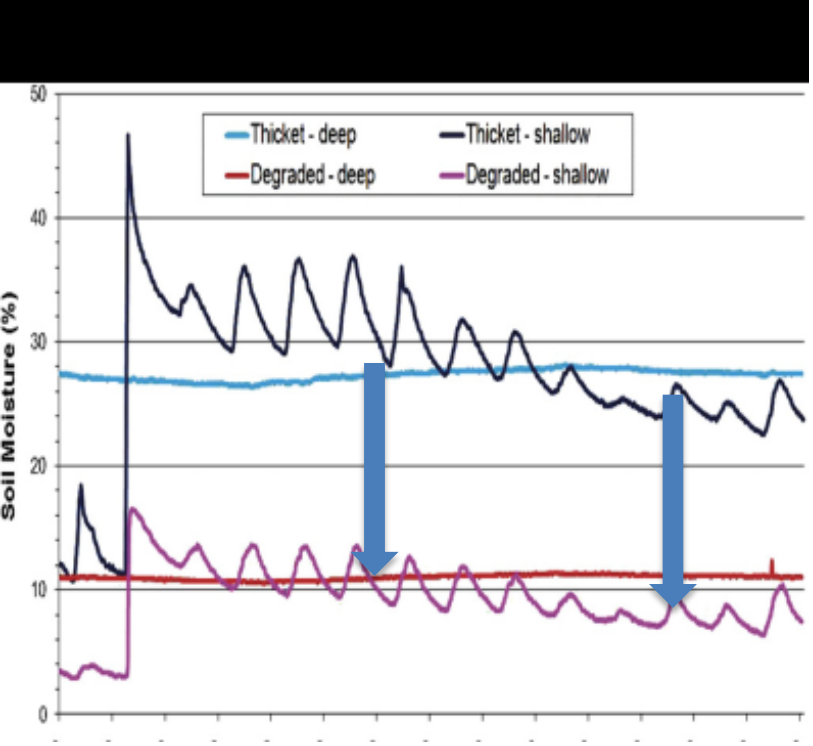
Examples 1.

Opportunities in the Carbon Market: Working for Ecosystems in the Sub Tropical Thicket Restoration Programme

Impacts of desertification on the carbon balance



Mills *et. al.* (2005)
Austral Ecology



G. van Luijk R.M. Cowling , M.J.P.M. Riksen , J. Glenday(2013)

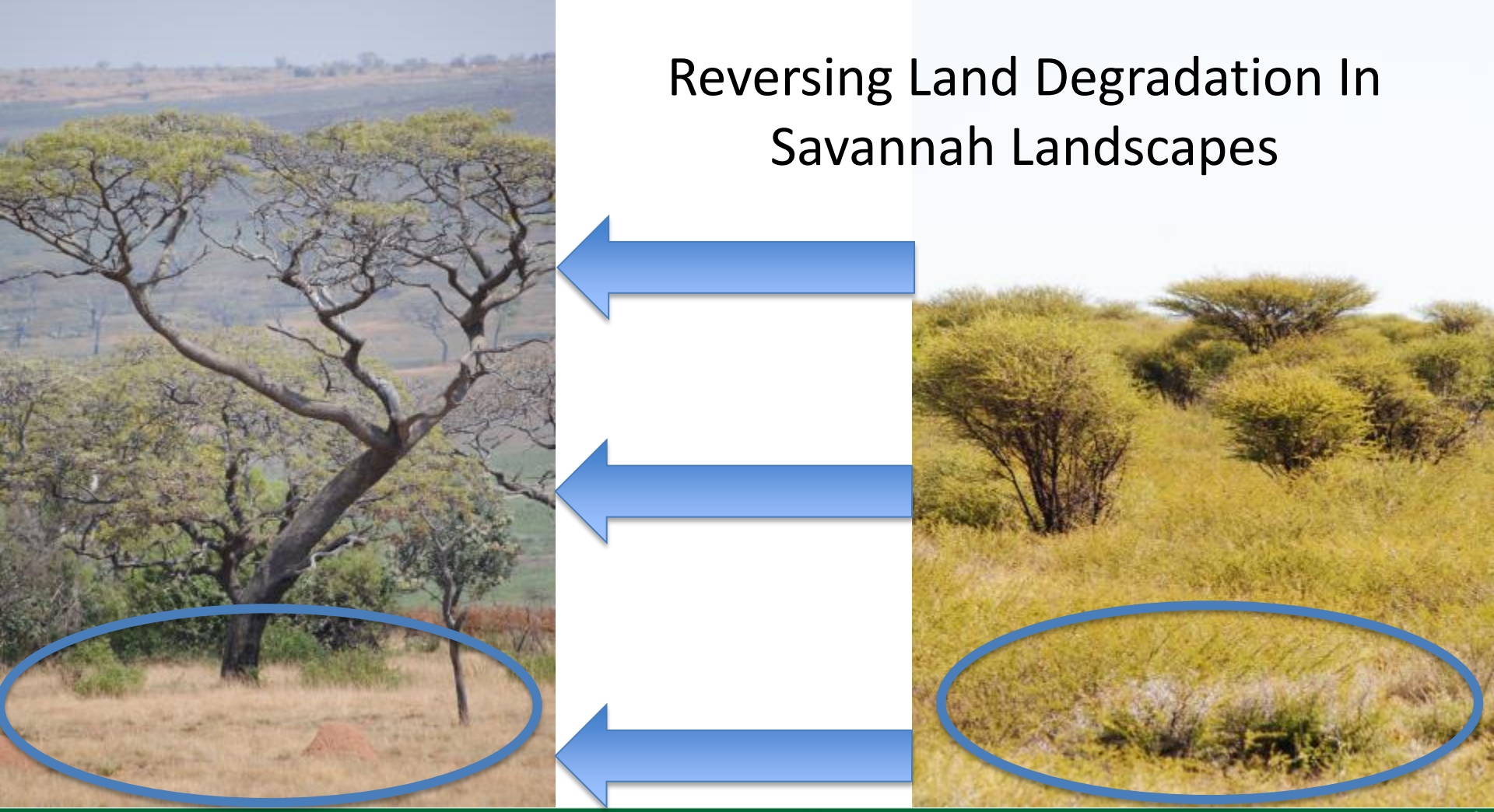
…. Comparing measurements in a grazed area without a thicket canopy to those in an area with intact thicket cover, …it was found that the loss of thicket cover had resulted in an extreme change in soil infiltration rates, a decrease in soil moisture retention, an increase in run-off, and increase in erosion.

Despite the relatively high rainfall interception rate (roughly 40%) observed for spekboom thicket, the differences in infiltration more than compensated, leading to greater soil moisture beneath intact thicket.

Example 2. Impact of Bush Encroachment on Livelihoods and soil carbon

i. Overgrazing
ii. Unsustainable fire regimes;
iii. Increased CO_2 levels favouring woody species.

Reversing Land Degradation In Savannah Landscapes



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Soil Carbon in Degraded Rangelands in South Africa

1. Snyman& Du Preez (2005) After only 5 years following degradation, organic C was significantly lower (22.15%) over the first 50 mm soil layer …
2. Du Preez & Snyman (2010) The organic C content of the soil under the three veld conditions differed significantly declining as the veld condition degraded. The largest differences were measured in the 0–50 mm layer …


Example 3.
Riparian Zone
Restoration
Projects

Carbon and Water Impacts of Trees in Rivers and Mountain Catchments

- ***Estimated above ground carbon in densely invaded Eucalyptus could be 200 tons/ha.***

But

- ***Current loss of utlizable water = 4%***
- ***If left unchecked it will increase to more than 16%***

Cullis et al 2006

Motivation for Converting Dense Stands of Single Species Invasive Alien Trees to Multi Species Riparian Thicket Where Appropriate

EFFECTIVE MANAGEMENT OF THE RIPARIAN ZONE VEGETATION TO SIGNIFICANTLY REDUCE THE COST OF CATCHMENT MANAGEMENT AND ENABLE GREATER PRODUCTIVITY OF LAND RESOURCES

by

C Everson[1], M Gush[1], M Moodley[1], C Jarmain[2], M Govender[1] and P Dye[1]

The impact of the clearing of all the trees by January 2004 was a 44% increase in streamflow. This was equivalent to 75 000 cubic meters for the catchment. The relative contribution of the riparian zone compared to the upslope region during the period when both areas were cleared (January 2004 to May 2006) was 16 mm and 78 mm respectively (the riparian zone therefore contributing 21% to annual streamflow). Since the riparian zone represented only 11% of the total catchment area (7.5 ha versus 65 ha, Table 3.1), the significance of the riparian zone to streamflow generation was clearly demonstrated.

RIPARIAN VERSUS NON-RIPARIAN STREAM FLOW REDUCTION

	Treatment	*First Year Increase in Streamflow after Treatment (m^3/ha cleared)*	*Ratio of Riparian/Non-Riparian Increase*
Westfalia (Limpopo)	Clear riparian indigenous forest	5 445	2.0
	Clear non-riparian indigenous forest	2 700	
Witklip (Mpumal.)	Clear riparian scrub & pines	7 965	1.9
	Clear non-riparian pines	4 045	
Biesievlei (W Cape)	Clear riparian pines	11 505	3.4
	Clear non-riparian pines	3 430	

Bank erosion exposed immediately after the clearing of *Acacia mearnsii* from the riparian zone

Impacts of desertification on sedimentations and flows

- In the **Thukela**, good management practice can result in an additional **12.8 million m3 in dry season flows,** the same action can **reduce sediment yields by 1.2 million m3**

- In the **Umzimvubu**, it can result in an **additional 3.9 million m3 dry season flows,** and the **reduction in sediment is 4.9 million m3 per annum**.

Restored Donga 50 m away

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Mrs. Mavundla leader of the Okhombe Trust

Un-restored donga

1 Kilometer Downstream

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10 Kilometer down at the inflow to Woodstock Dam

The dam surface 5 km down

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The Dam Overflowing

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Example: Siltation of Water Infrastructure - Upper Umzimvubu

Storage Space (m3)	**500 000**
Catchment size (ha)	**77 100**
% Silted Up after 4 year	**70%**
Volume Silted Up after 4 year	**350 000**
Years since completion	**4**

Mainstreaming Natural Resource Management into Socio-Political Priorities

- Health
- Education
- Crime
- **Employment**
- **Rural Development**

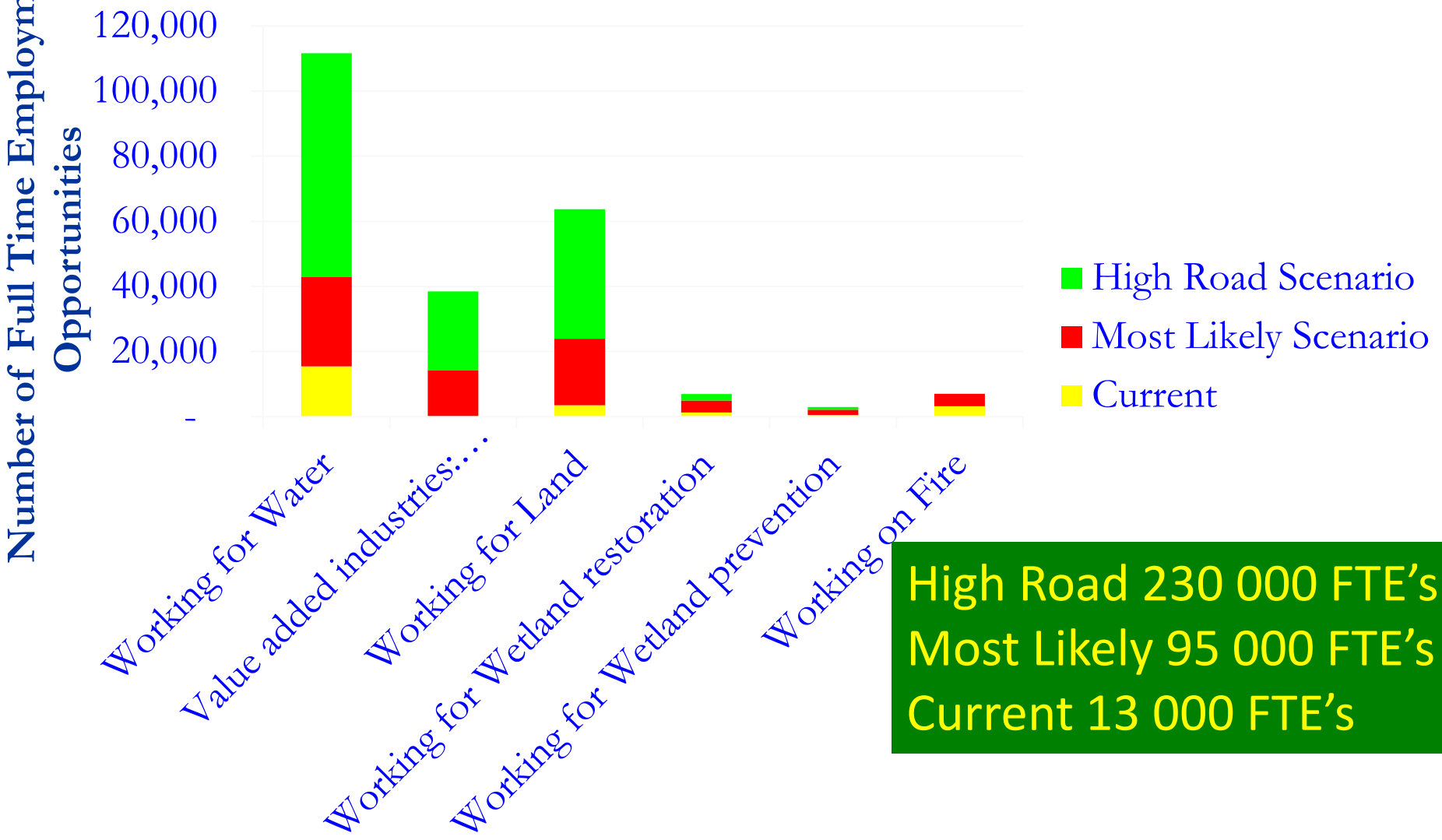
Medium Term Employment Needs

- Government and South African Business Leaders have agreed that 5 million jobs need to be created.
- 75% of these should be in the private sector (3.75 million) and
- 25% through government programmes (1.25 million)

Mainstreaming Natural Resource Management into Business Priorities

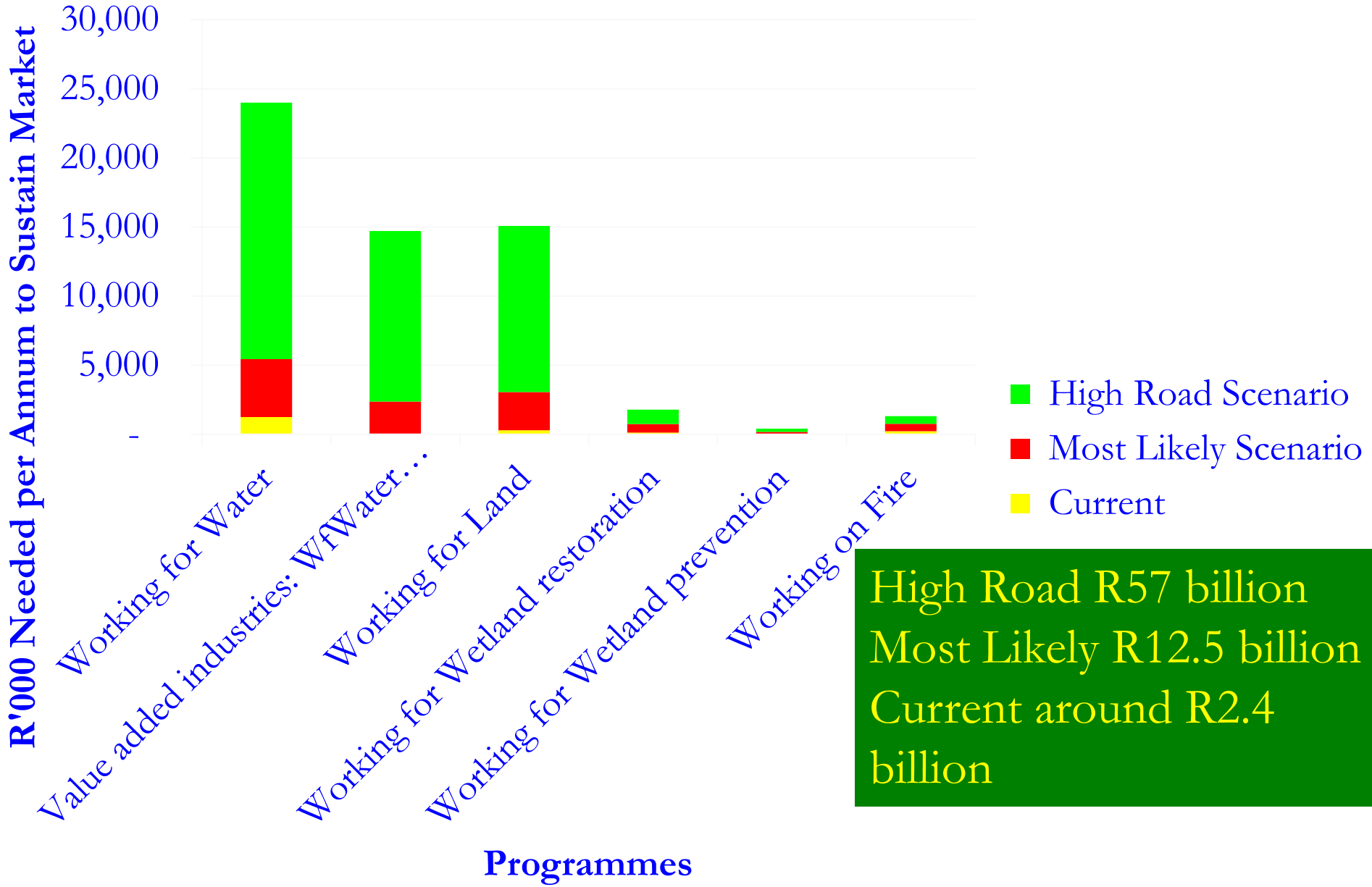
- Profitability
- **Sustainability**
- **Risk**

Full Time Equivalent (FTE) Employment Potential of Natural Resource Management/Ecosystem Services Sector



High Road 230 000 FTE's
Most Likely 95 000 FTE's
Current 13 000 FTE's

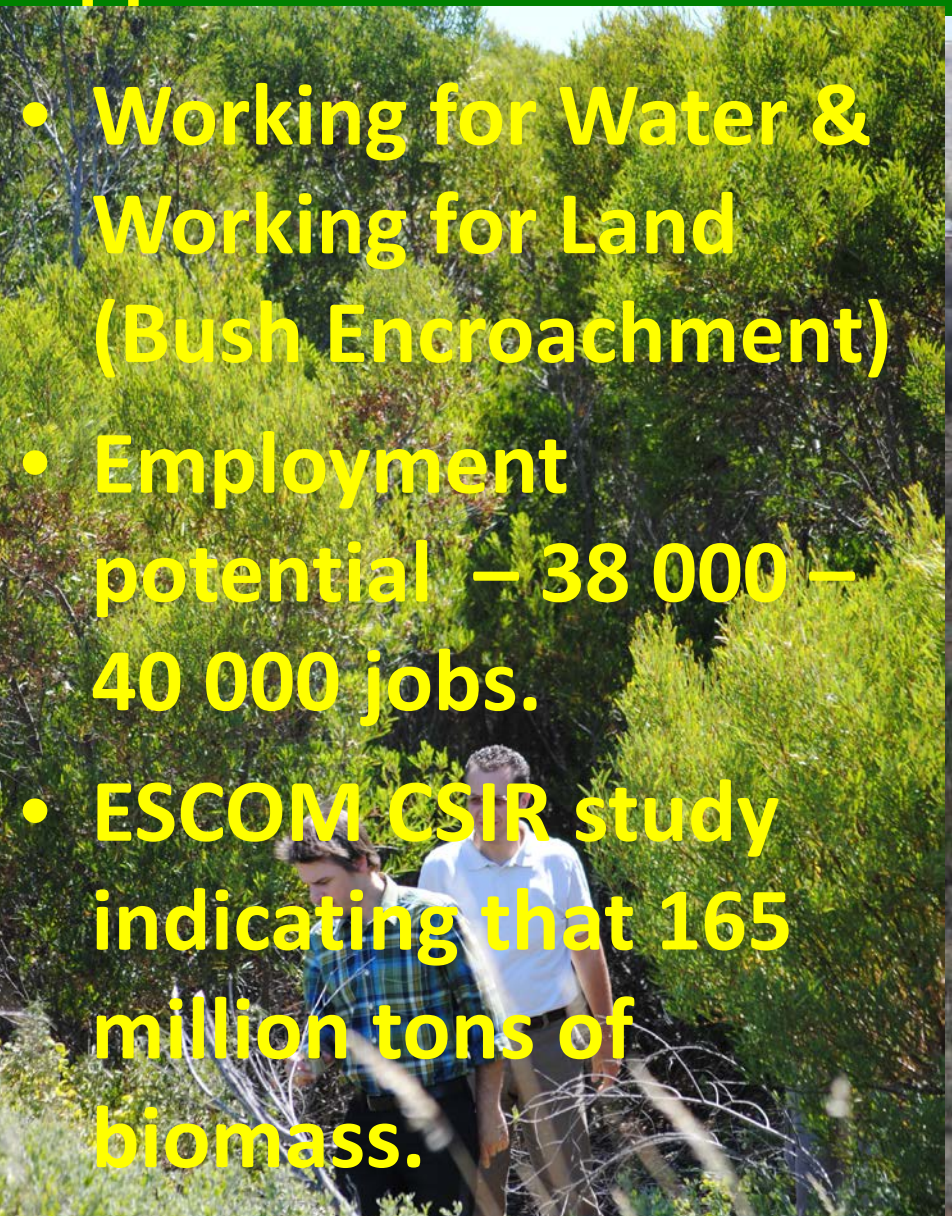
Annual Turnover Needed Per Programme for the Respective Programmes



High Road R57 billion
Most Likely R12.5 billion
Current around R2.4 billion

THE POTENTIAL FOR BIOMASS TO ENERGY

Opportunities



- Working for Water & Working for Land (Bush Encroachment)
- Employment potential – 38 000 – 40 000 jobs.
- ESCOM CSIR study indicating that 165 million tons of biomass.

Challenges

- Mainstreaming it into energy sector
- Harvesting technology labour intensive vs. Mechanical.
- Appropriate energy generation technology small scale (e.g. gasification) vs. Large scale (co-burning)

Lessons learnt and Institutional Needs

- The need is to big, the fiskus simply cannot afford it.
- Based on risk analysis the private sector will have to invest.
  - "In situ users of ecosystem services" -Land user.
  - "Ex situ users of ecosystem services" - Down stream users, of water, energy and raw materials.

Lessons learnt and Institutional Needs cont.

- **We don't have the answers yet.**
- We do know that National Department of Environmental Affairs (DEA) must be the sector leader.
- Taken into account the socio-economic realities of South Africa (1994 to at least 2024) we have to follow a pro-poor approach. It is a labour intensive sector.

Lessons learnt and Institutional Needs cont.

- Early signs are that the Not for Profit Non-Governmental Sector can play a prominent role if a pro-poor approach is adopted.
- The DEA land User Incentives Programmes are starting to show early signs of success.
- Private investors don't like partnering with government but if it can take place through NGO's they're more willing.

Lessons learnt and Institutional Needs cont.

- The Water and Energy Sectors must become more involved. They are the foundation of the economy and highly exposed to the risks related to climate change.


Thank You!!