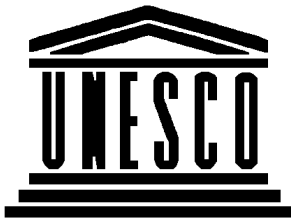


**Long-term monitoring of biodiversity and
culture in two coastal villages near the
South Africa – Mozambique border**

Centre for Environmental Studies, University of Zululand



United Nations Educational, Scientific and Cultural Organization

OBJECTIVES:

- to underpin land use and resource management decisions through passive monitoring of environmental health in the context of coastal development.***
- to engage in activities that maintain bio-diversity and promote the aesthetic value of coastal resources as eco-tourism attributes.***
- to generate environmental awareness and assist community development in participatory projects.***

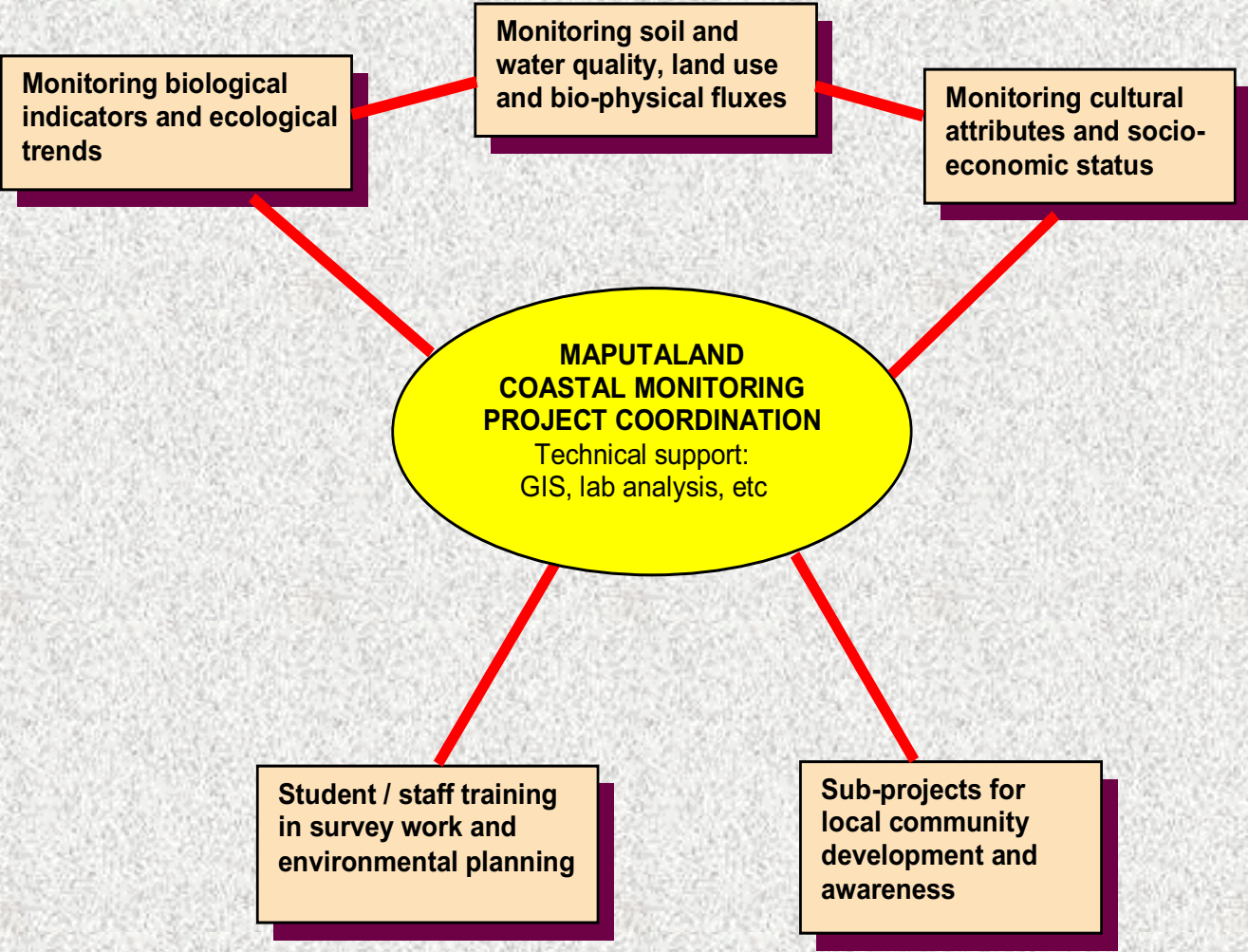
KEY QUESTIONS:

- What are the cultural and ecological responses to development?*
- What are the fluxes of water, nutrients and pollutants in the coastal zone?*
- What factors influence the migration of tropical species? How will the loss of coastal forests and wetlands affect these pathways?*
- What is the coastal sand budget in the point-bay systems of Mabibi and Ponta, and how does it impact beaches, dune vegetation and coral reefs?*
- What coastal bio-diversity is evident at selected eco-tones along the two transects? What are the long-term trends and disturbance to biodiversity?*
- How does the aesthetic value of coastal resources compare with extractive value? How can the project help local communities gain a greater share of economic benefits?*

Personnel:

- M. R. Jury**
Leader / data archivist
micro-climate and economics
- A. Mthembu (Co-leader)**
social / demographic surveys
- G. Mulder (Co-leader)**
Coastal geomorphology
- Transient graduate students**
- Z. Mathenjwa (1999)**
subsistence value
- Y. Govender (1999+)**
biotic assessments
- S. Guyot (1999-2002)**
history and governance
- E. Bulfoni (2001+)**
agriculture project
- J. Mitchell (2001)**
beach morphology
- S. Hatesse (2001)**
community development
- N Nyathikazi (2003+)**
agriculture project
- A Naidu (2003)**
biotic assessments
- B Dlamini (2003)**
environmental awareness
- S Morajane (2003)**
micro-economics
- E. Masinga (2003+)**
Mozambique liaison

**RESEARCH PROJECT:
Environmental influences on the
coastal resources of Maputaland**



Components and organisation of the project.



WHERE?

Outline:

- Physical studies
- Biological assessments
- Sustainable development
- Transborder comparison

Quarterly surveys at Mabibi and Ponta do Ouro have measured:

- micro-climate, - nearshore drift, - beach profiles
- water quality, - soil nutrients, - bio-diversity

across ecotone gradients; and

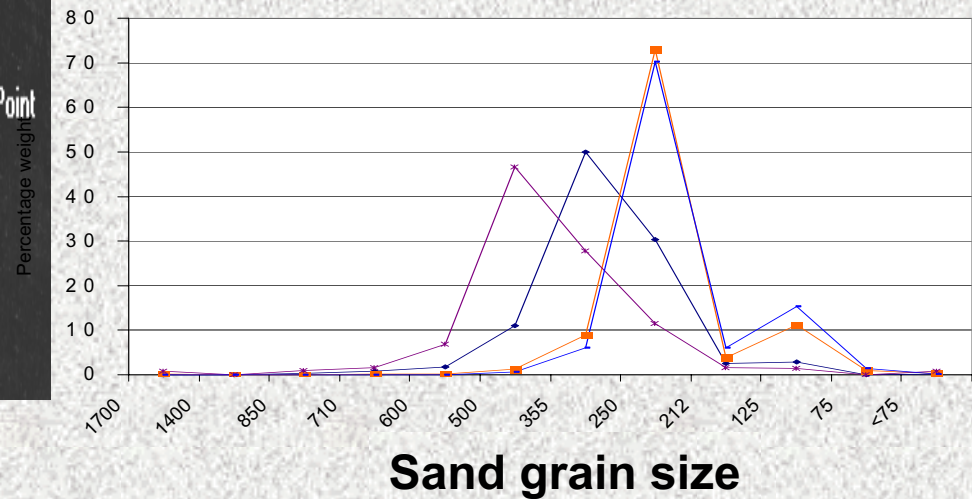
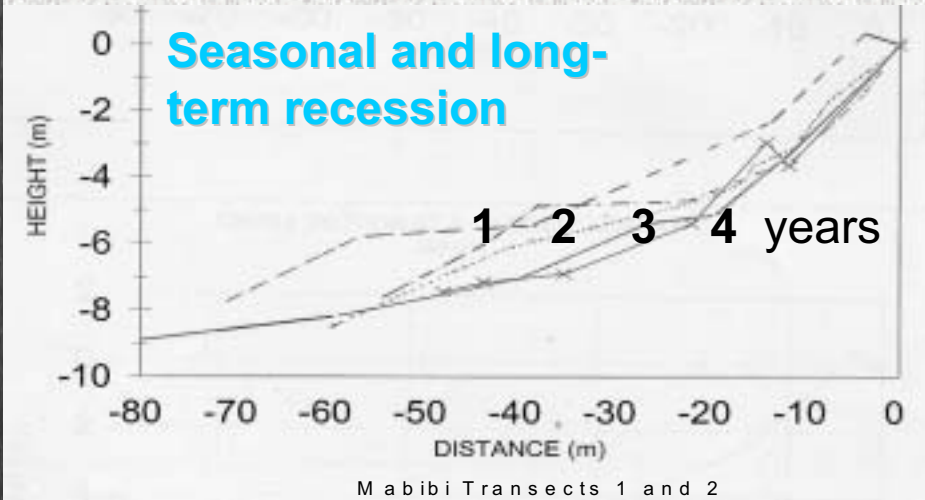
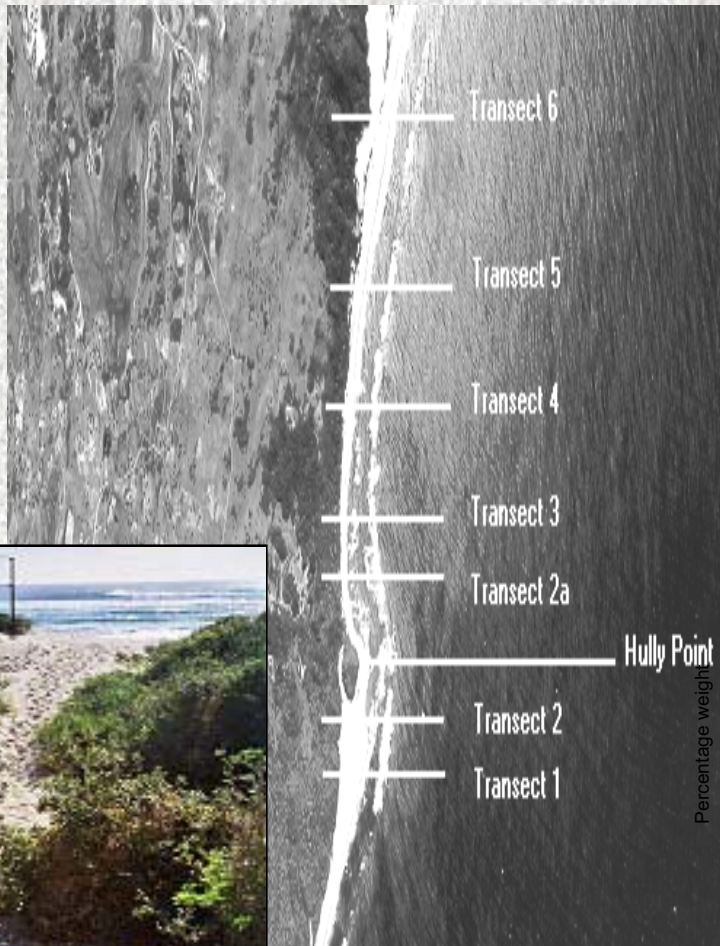
socio-economic status & perceptions of locals

since 1999

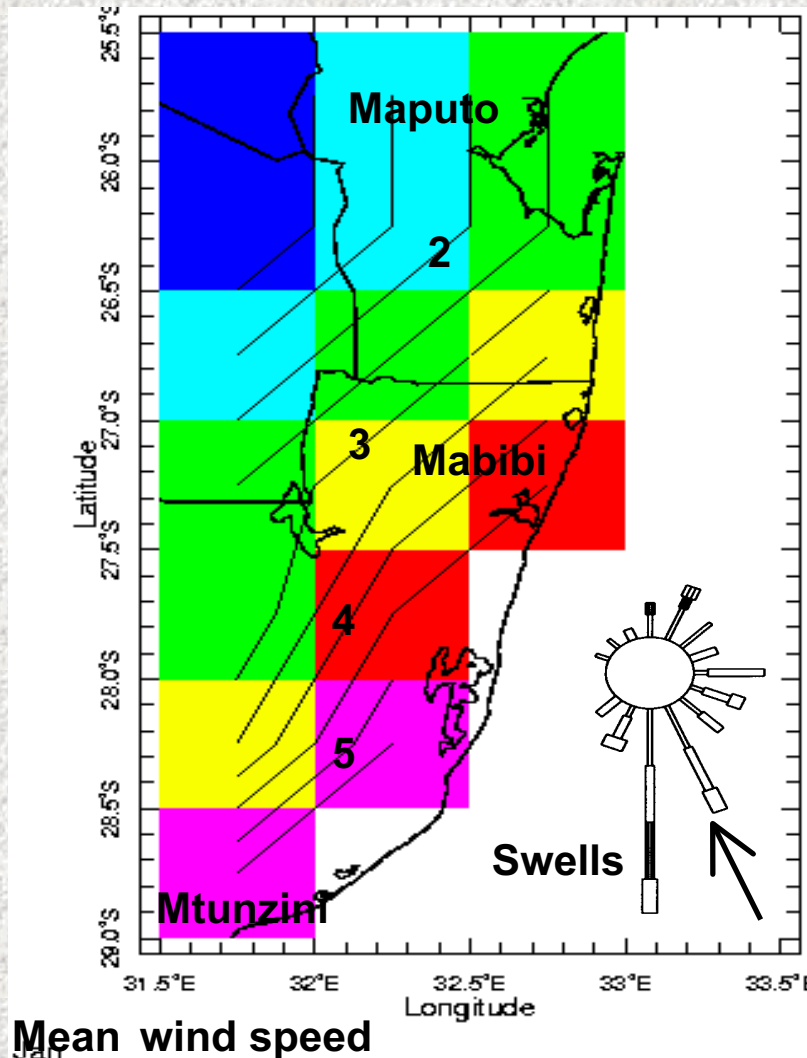


Beach dynamics

Mabibi section



Factors affecting sediment transport: winds and waves



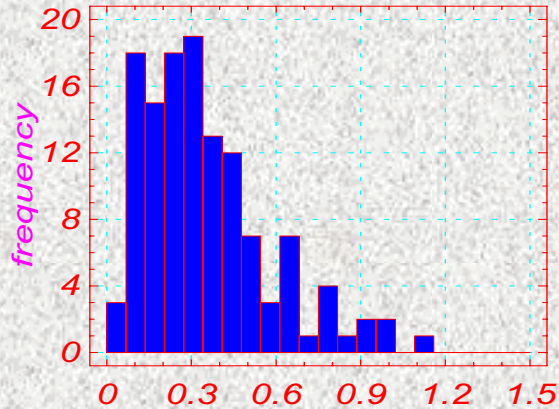
Wave energy is calculated from information on height, direction and period: result – net northward transport

Wind transport is calculated from information on grain size, wind speed and direction: result – balanced impact

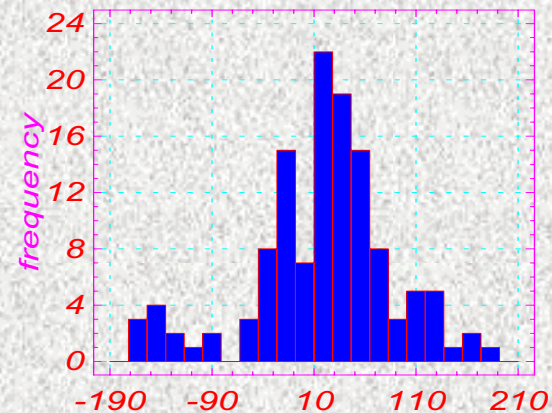
Nearshore circulation and sediment budget

Sand movement in the nearshore zone is calculated from information on currents, grain size and water depth: result $\sim 10^5 \text{ m}^3 / \text{yr}$ is mobilised, but $< 0.1\%$ is 'lost'

Frequency histograms based on > 100 releases over 4 years



Speed



Direction

northward=0, onshore=90

Inventories of plant and animal species richness have been recorded. Ecological data are incorporated into educational material for presentation to local schools.

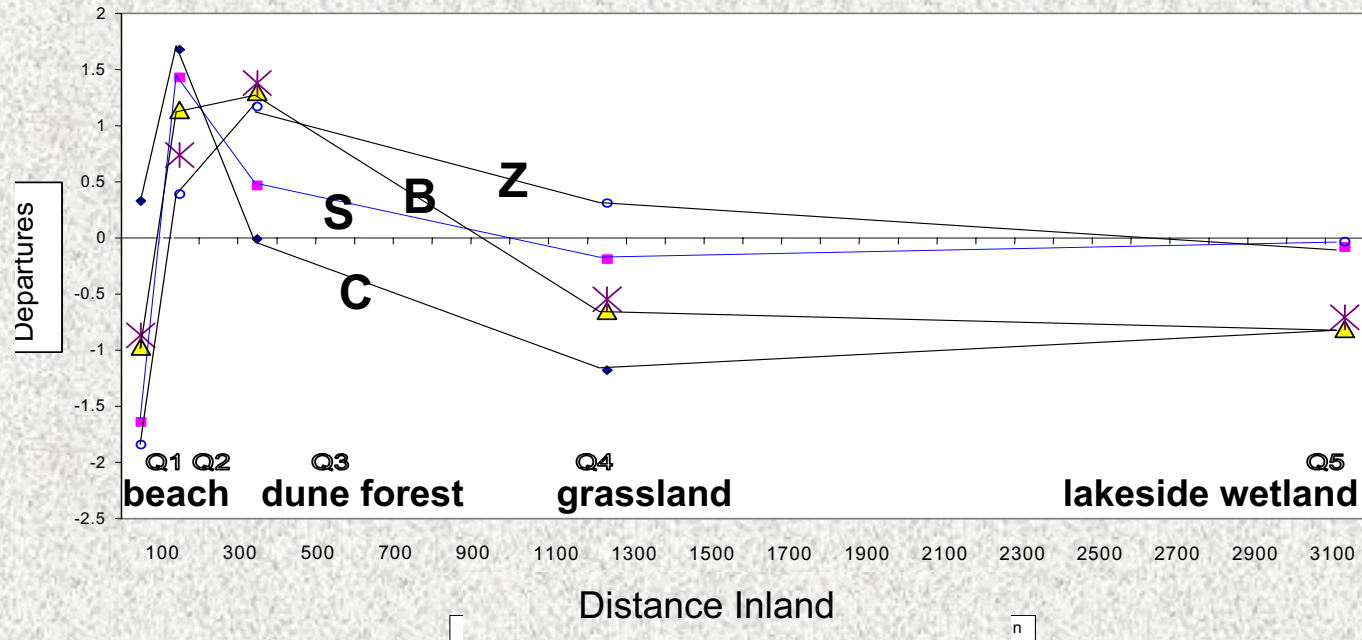




Ecological results

- **72 plant species have been recorded on the Mabibi transect: beach (3), f.dune forest (14), b.dune forest (22), grasslands (32), lake (6) – variations correlated with temperature, wind speed and elevation.**
- **Of 73 insects found, > 80 % in dune forests – variations associated with elevation, soil nutrients (pH, P, Mg, Ca).**
- **Of 42 birds encountered, 62 % unique, dune forests highest – variations associated with soil nutrients (pH, P, Mg, Ca), elevation, humidity, and botanical diversity.**
- **31 species of tropical fish were recorded in the tidal pool at Mabibi.**
- **12 species of coral reef or coralline algae recorded.**
- **15 species of butterfly observed in dune forest near campsite.**

BIO-PHYSICAL MODELLING



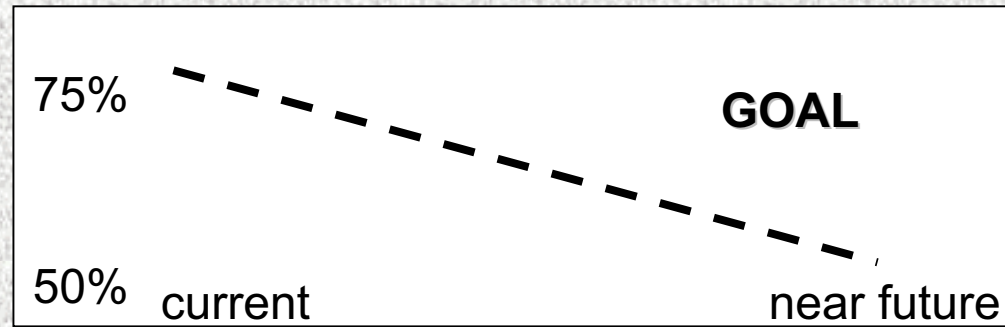
Outcome of model equations to describe environmental influences on biotic richness.

Indices constructed from the correlation value across the ecotone gradient:

- **Climate = +rel.hum. +temp -wind.speed**
- **Soil = +Mg +Ca +P +pH**
- **Botany = +adjusted plant species**
- **Zoology = +birds +insect species**

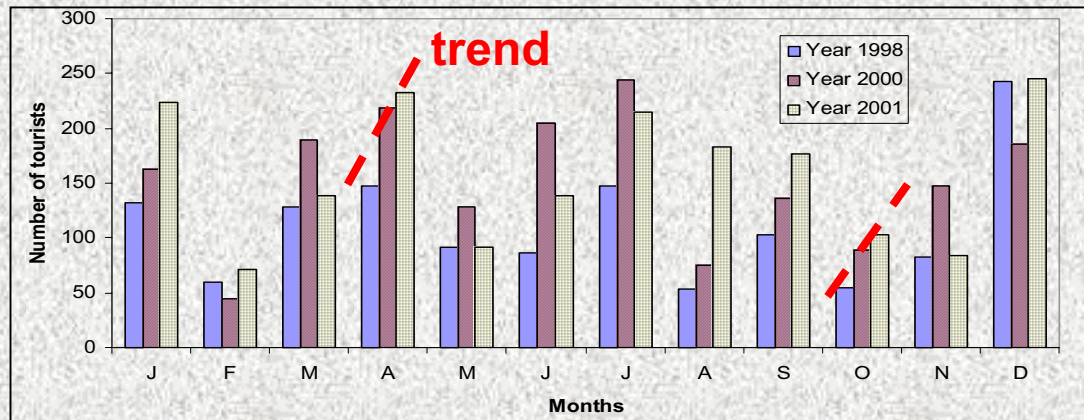
SURVEYS OF TOURISM POTENTIAL

“75% of local people have a negative perception of conservation, though they understand the need to attract tourists”



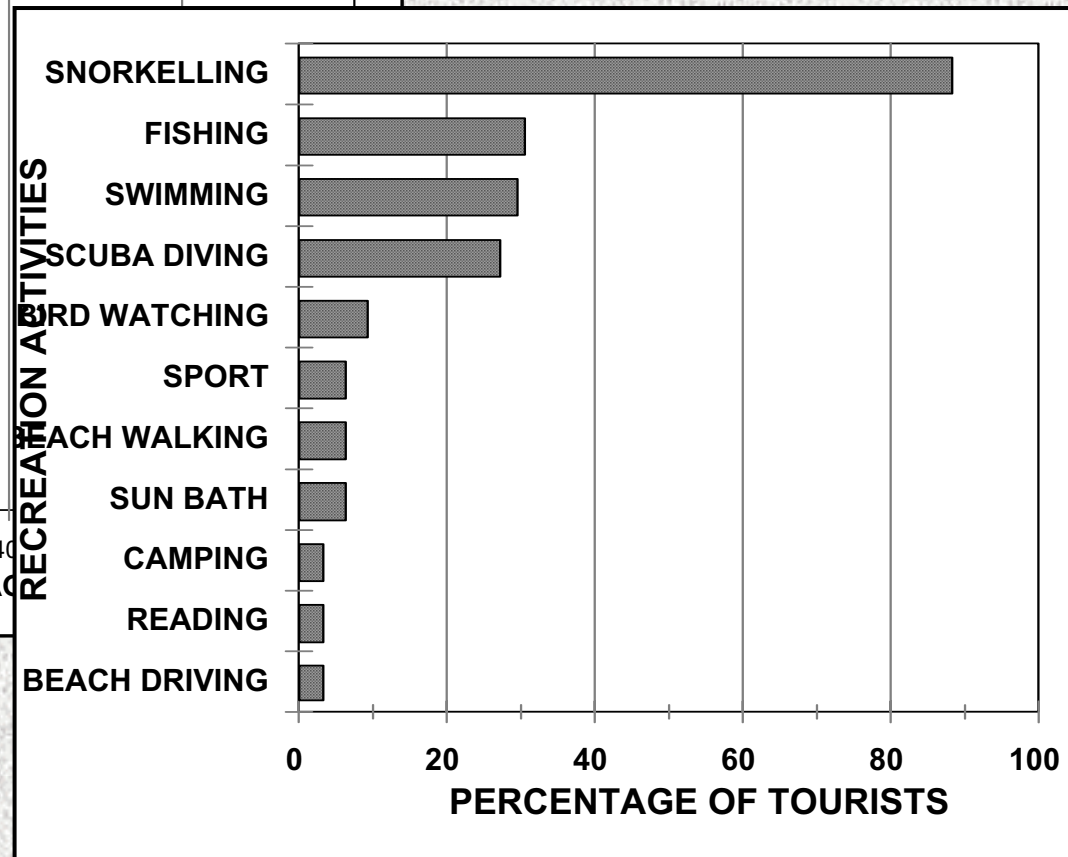
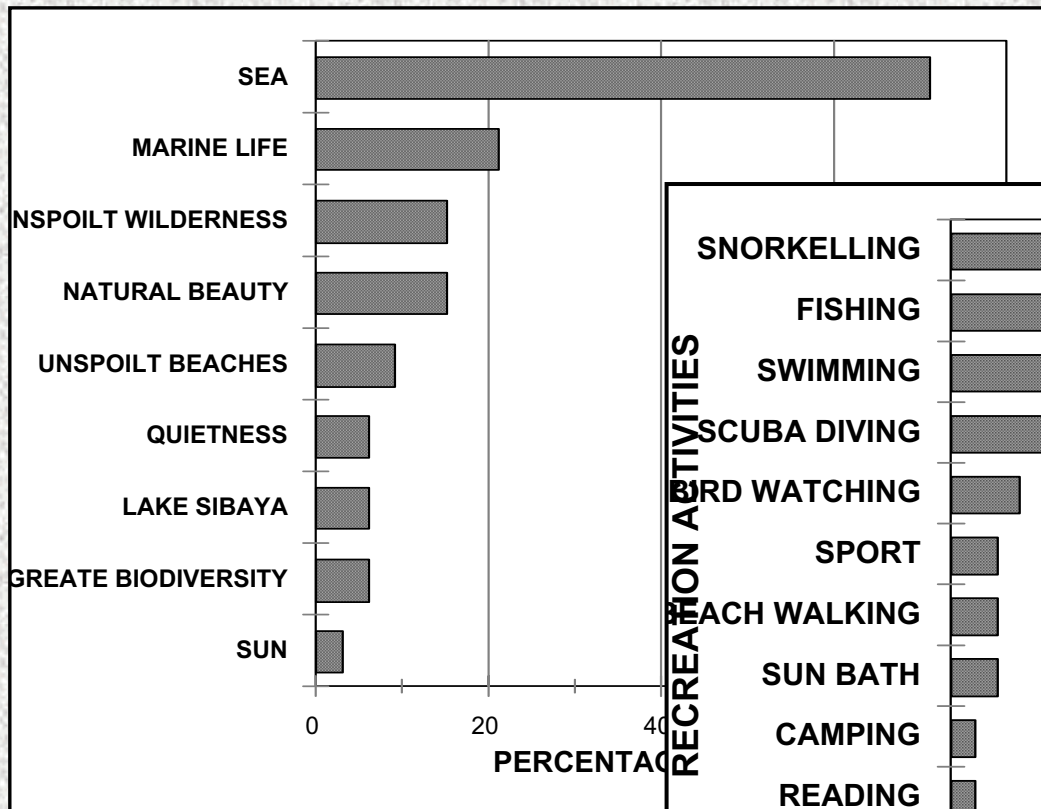
“95% of tourists do not want development”

tourist's origin:
39% Gauteng
39% KZNatal
10% overseas



TOURIST PERCEPTIONS

Why do you come to the area? What do you do here?



**The high density of indigenous settlement near pans is indicative of human dependence on wetland resources for:
water supply, crop cultivation**

(Maize, Peanuts, Sweet potatoes, Onion, Tomatoes, Cabbage, Spinach, Yam, Pumpkin, Fruit, etc)

grazing of livestock, building materials

Before 2002



After 2003



SOCIO-ECONOMIC SURVEYS

interviewed 58 households - 602 people at Mabibi

86% resided > 10 years, about 10% have formal income

- 98 % use firewood for cooking**
- 75 % rely on cropping for food**
- 64% use natural resources for crafts**
- 47 % harvested marine resources**
- 28 % hunted wildlife for food**

35 plants are used for medicinal purposes

ESTIMATED TOTAL ECONOMIC VALUE

200 botanical and zoological species at R10 000 each = R 2 M

10 000 visitors /yr spend about R 20 M, only 10% locally = R 2 M

extractive activities generate R10 000 / yr X 200 people = R 2 M

Hence intrinsic ecological value, indirect recreational value and direct extractive value are nearly equivalent. Whilst recreational activities are neutral, intrinsic value and extractive activities are in conflict.

Typical profile of a subsistence farmer

Respondent: Alexinia S. Zilchali,
Household composition: 11 people -
3 men, 4 women and 4 children.
Main income from sale of surplus
crops locally and in Mbazwana.
Their farm generates an income <
R10 000 /yr. The total farm area is
about 4 ha, about 50% of which is
cultivated at any one time. They
have a kraal with 15 cattle.

Crop	Area (ha)	Yield (kg/yr)	Value (R/yr)
Maize	1 ha	800 kg/yr	500 R/yr
Peanuts	1	750	3000
Sweet potatoes	0.25 ha	375	100
Onions	small plot	50	300
Spinach	small plot	5	100

A new farming project seeks to limit ecological impacts through improved technology

Mabibi is vulnerable to poverty due to the limited agricultural potential of the land. A community garden has been introduced by tribal authorities to lift the standard of living, but its low productivity means that people tend to crop in the surrounding wetlands. This is detrimental to the ecology that supports eco-tourism. Thus there is a need to improve production outside the wetlands.



Development needs

Mabibi residents and GSLWP authorities identified priorities for development at a roundtable discussion

- **improved road to Mbazwana**
- **market to sell products**
- **water supply**
- **community hall**
- **eco-tourism job opportunities**



- **Community leaders were asked to consider ways to provide tourism services and conserve the wetlands.**
- **We learned about the new Tonga Beach Lodge project: employing 30 people – it will double community income!**

A contrasting cultural system: Ponta do Ouro

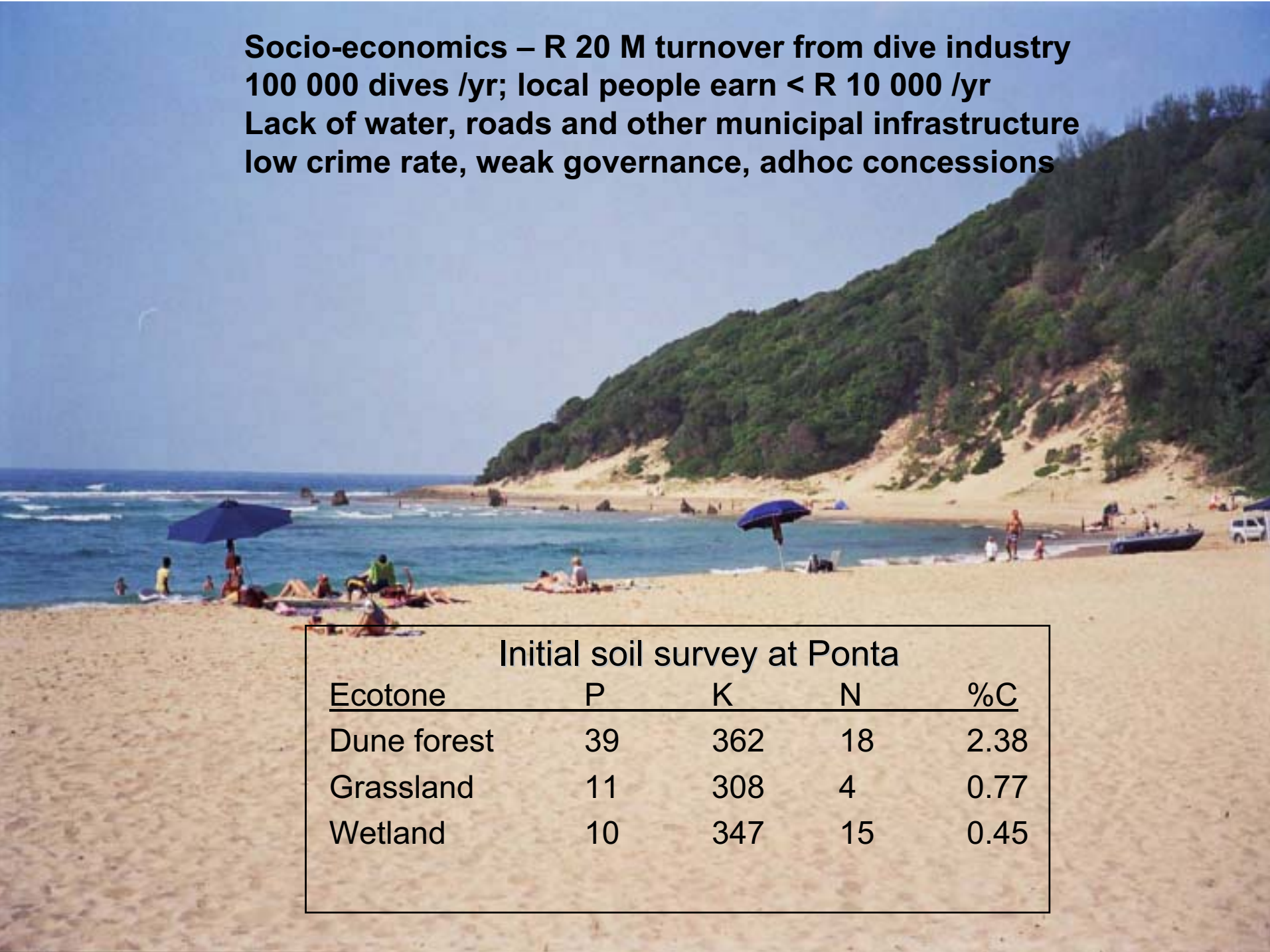


- Environmental surveys have been conducted since 2001
- Rapid development is starting to impact natural resources
- Work there is done in partnership with Mozambican colleagues

A baseline survey of botanical richness at Ponta

Species Name	Common Name	Forest	Grassland	Wetland
<i>Eragrostis capensis</i>	Heart-seed love grass		+	
<i>Perotis patens</i>	Cats tail		+	
<i>Diplachne fusca</i>	Swamps grass		+	+
<i>Ischaemum afrum</i>	Turf Grass		+	
<i>Brachylaena discolor</i>	Coast silver oak	+		
<i>Eugenia capensis</i>	Dune myrtle	+		
<i>Euclea natalensis</i>	Tonga Guarri	+		
<i>Oplismenus hirtellus</i>	Basket grass	+		
<i>Panicum deustum</i>	Broad-leaved panicum	+		
<i>Brachypodium flexum</i>	-	+		
<i>Sideroxylon inerme</i>	White milkwood	+		
<i>Albizia adianthifolia</i>	Flat crown	+		
<i>Mariscus congestus</i>	-		+	+
<i>Melica racemosa</i>	Fluffy grass			+
<i>Imperata cylindrica</i>	Cotton wool grass			+
<i>Bromus catharticus</i>	Rescue grass		+	
<i>Andropogon appendiculatus</i>	-		+	
<i>Digitaria argyrograpta</i>	Silver finger grass		+	
<i>Sorghum versicolor</i>	Black-seed wild sorghum		+	
<i>Aristida stipitata</i>	Long-awned three-awn		+	
<i>Hyparrhenia anamesa</i>	Bundle thatching grass		+	
<i>Hyparrhenia filipendula</i>	Fine thatching grass		+	
<i>Vangueria infausta</i>	-	+		
<i>Digitaria eriantha</i>	Finger grass		+	
<i>Eustachys paspaloides</i>	Fan grass		+	
<i>Acroceras macrum*</i>	Nile grass			+
<i>Cenchrus ciliaris</i>	Blue buffalo grass			+
<i>Chloris gayana</i>	Rhodes grass			+
<i>Chloris virgata</i>	Feathered chloris			+
<i>Eragrostis tef</i>	Teff			+
<i>Paspalum dilatatum</i>	Common paspalum			+
<i>Phragmites australis</i>	Common reed			+
<i>Antheophora pubescens</i>	Wool grass		+	
<i>Eragrostis nindensis</i>	Wether love grass		+	
<i>Eragrostis pallens*</i>	Broom love grass		+	
<i>Eragrostis plana</i>	Love grass		+	
<i>Allophylus natalensis</i>	False currant	+		
<i>Chaetacme arista</i>	Thorny elm	+		
<i>Cordia caffra</i>	Septee	+		
<i>Deinbollia oblongifoli*</i>	Dune soap berry	+		

**Socio-economics – R 20 M turnover from dive industry
100 000 dives /yr; local people earn < R 10 000 /yr
Lack of water, roads and other municipal infrastructure
low crime rate, weak governance, adhoc concessions**



Initial soil survey at Ponta

<u>Ecotone</u>	<u>P</u>	<u>K</u>	<u>N</u>	<u>%C</u>
Dune forest	39	362	18	2.38
Grassland	11	308	4	0.77
Wetland	10	347	15	0.45

Website information and theses produced in the project

- <http://www.unesco.org/csi/act/maputaland/maputa1.htm>
<http://www.unesco.org/csi/act/maputaland/summary23.htm>
- Bulfoni, E, 2002. Sustainable agriculture in Mabibi, South Africa, MSc Thesis, University of Udine, Italy, 145 pp.
- Govender, Y, 1999. Impact of conservation measures on community development and water quality at Lake Sibaya, BSc Hon Thesis, Geography Dept, University of Zululand, 96 pp.
- Govender, Y, 2001. Environmental factors maintaining biodiversity in Maputaland, South Africa, MSc thesis, Geography Dept, University of Zululand, 197 pp.
- Guyot, S, 2003. Environmental conflicts along the KwaZuluNatal Coast, PhD Thesis, University of Paris, France, 408 pp
- Hatesse, S, 2002. Incorporating the Mabibi community into regional development, MSc intern thesis, University de Lille, France, 197 pp
- Mathenjwa, Z, 2000. Agricultural potential of Mabibi village, BSc Honours thesis, University of Zululand, 103 pp.
- Mitchell, J, 2001. A study of Maputaland's beach dynamics, BSc honours thesis, University of Zululand, 89 pp.

Unesco's Maputaland project: a partner in sustainable development

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