Integrating economics and ecology in determining environmental flows

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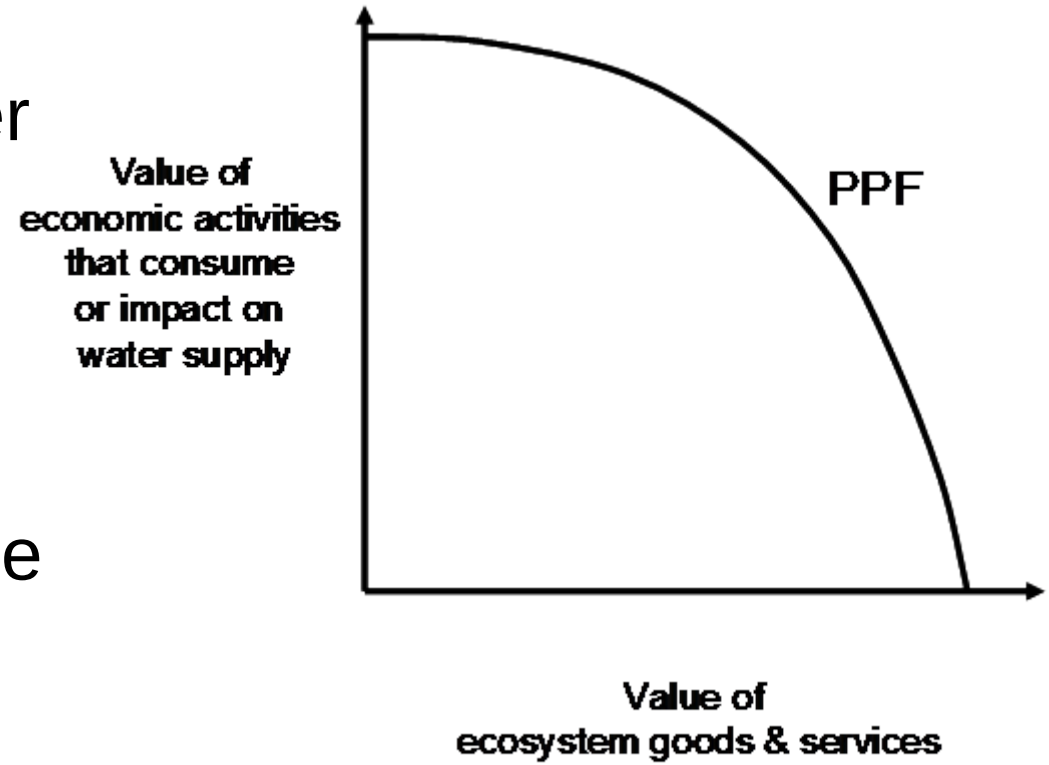
Introduction

- Southern & Eastern Africa perspective
- Catchments stressed, need for restoration of environmental flows
- Much ecological research on flow requirements
- In SA, recommendations on future health (and flows) based on biodiversity importance
- But decisions will be based on socio-economic considerations

Understanding the trade-offs

- Environment unvalued >> all water allocated.
- Environment overprotected >> opportunity costs
- Need optimal balance - maximize societal welfare.



Goods & services

Goods

(Provisioning services)

e.g. Harvested natural resources

Direct consumptive use value

Services

(Regulating services)

e.g. Flood attenuation, Water purification

Indirect value

Attributes

(Cultural services)

e.g. Beauty, rarity, diversity

Direct non-consumptive use value

e.g. Recreation

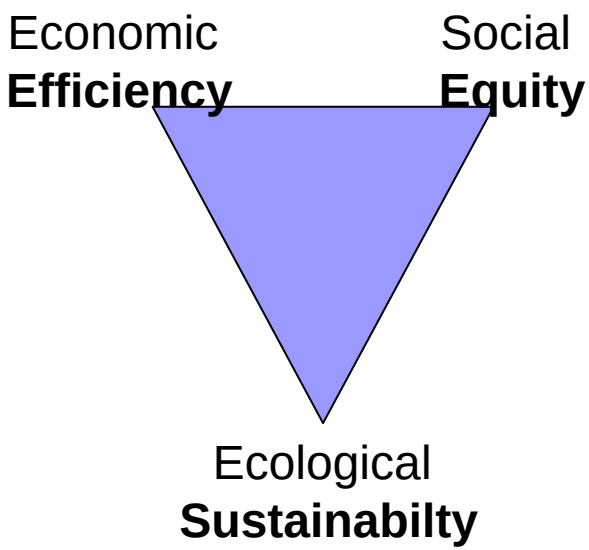
Option & Existence value

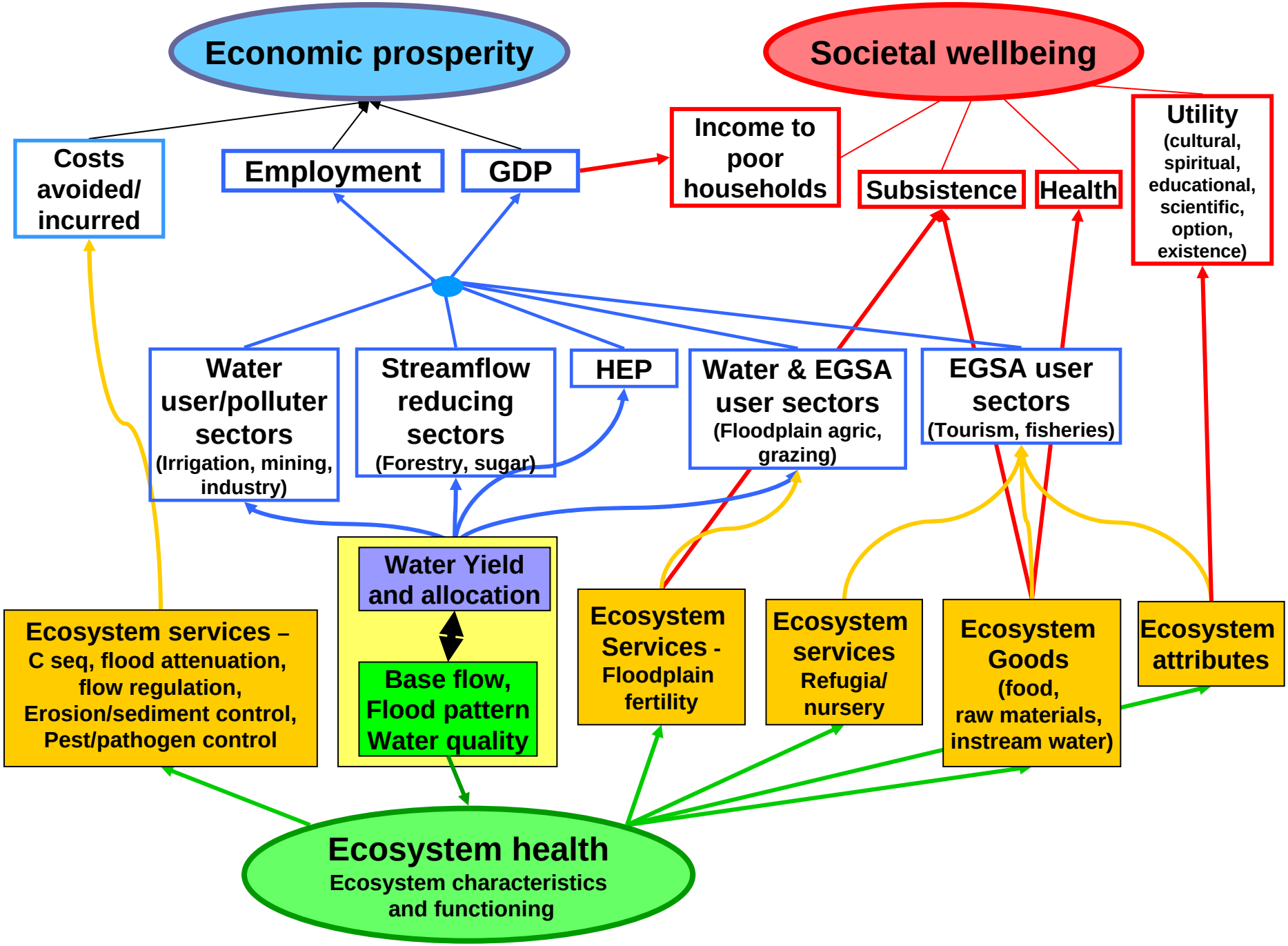
TEV

Total Economic Value

Developing a framework for analysis of trade-offs

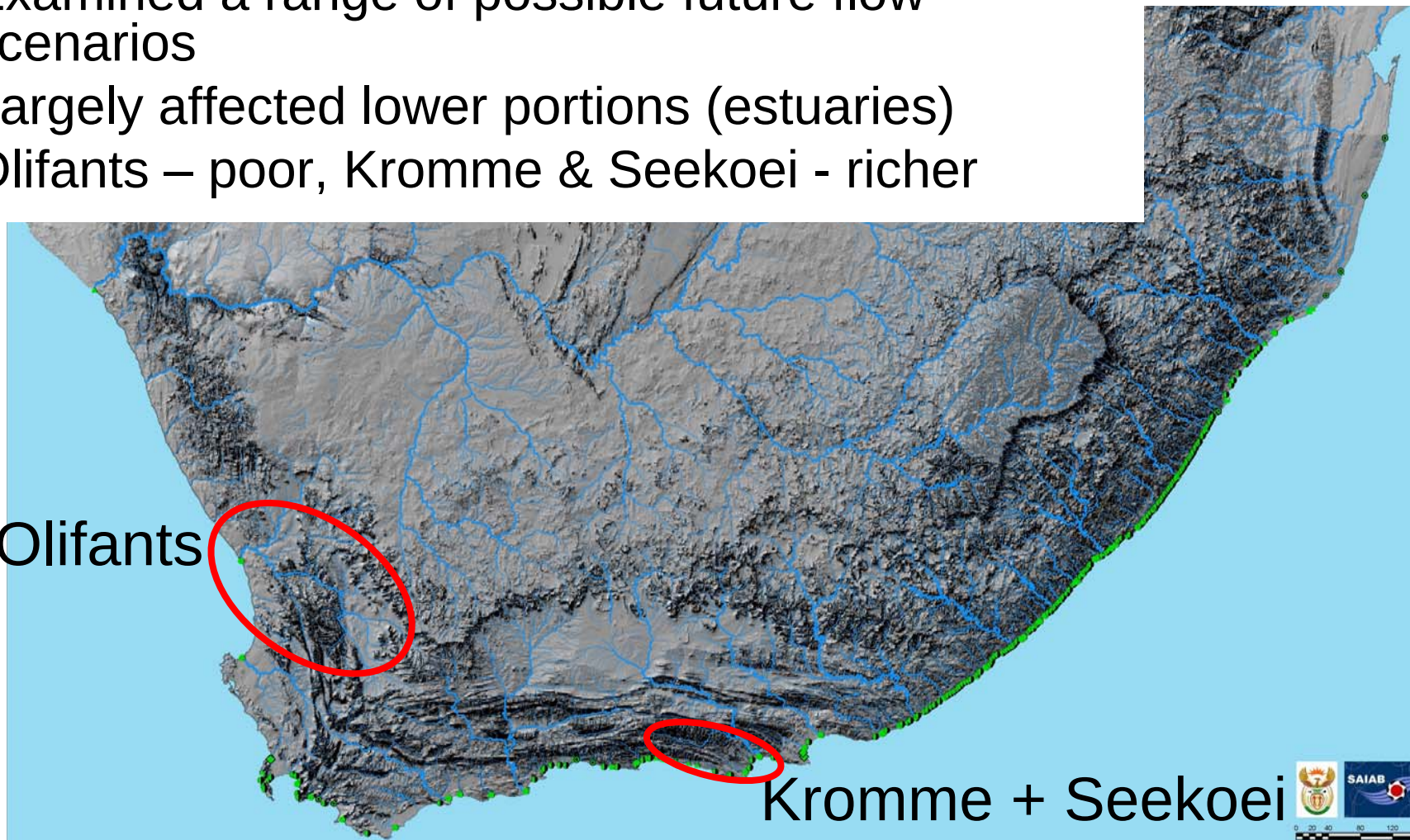
- South Africa has embarked on a process of **Classification** of all water resources
  - Determine future state of health
    - Flow requirements
- Analysis of the **ecological**, **economic** and **social** implications of alternative scenarios




Economic prosperity
Societal wellbeing
Costs avoided/ incurred
Employment
GDP
Income to poor households
Subsistence
Health
Utility (cultural, spiritual, educational, scientific, option, existence)
Water user/polluter sectors (Irrigation, mining, industry)
Streamflow reducing sectors (Forestry, sugar)
HEP
Water & EGSA user sectors (Floodplain agric, grazing)
EGSA user sectors (Tourism, fisheries)
Water Yield and allocation
Base flow, Flood pattern Water quality
Ecosystem services – C seq, flood attenuation, flow regulation, Erosion/sediment control, Pest/pathogen control
Ecosystem Services - Floodplain fertility
Ecosystem services Refugia/ nursery
Ecosystem Goods (food, raw materials, instream water)
Ecosystem attributes
Ecosystem health
Ecosystem characteristics and functioning

Olifants, Kromme & Seekoei Rivers

- Commissioned by DWAF
- Examined a range of possible future flow scenarios
- Largely affected lower portions (estuaries)
- Olifants – poor, Kromme & Seekoei - richer



Methods

- **Goods**: Harvested resources
  - Current: existing survey data, key informants
  - Scenarios: % change in fish stocks (modelling)

- **Services**: Nursery value
  - Current: value of estuarine fish in regional inshore catches (gov stats)
  - Scenarios: % change in fish stocks (modelling, expert opinion)

- **Attributes**: Recreational value
  - Current: property value + visitor expenditure (surveys)
  - Scenarios: utility model (conjoint valuation method)

Goods - fisheries

- Olifants: Subsistence fishing community
  - 200 fishers derive main hh livelihood from fishing
  - Total value R5-600 000 p.a.
- Kromme & Seekoei: no significant harvesting of resources

Services – nursery areas

- All three estuaries serve as nursery areas
- Contribute to commercial and recreational inshore line fisheries

	Regional fishery value	**Estuary contribution**
Olifants	W Coast: R0.6bn	R3.45m
Kromme	S Coast: R1.5bn	R10.8m
Seekoei		R5.2m

Attributes – recreational value

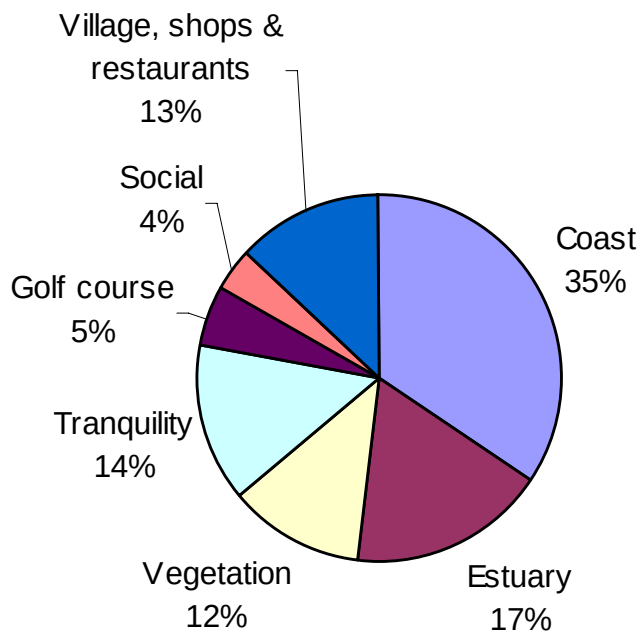
- Olifants estuary – remote, negligible
- Kromme & Seekoei – resort villages

- Property prices - hedonic pricing model
  - Estuary significant for Kromme ($P < 0.001$

Property price (1000 Rands) = 84 + 700 x bedrooms – 445 x ln (distance to estuary km)

  - Estuary = R568 million, or **R13 – 26 m /a**

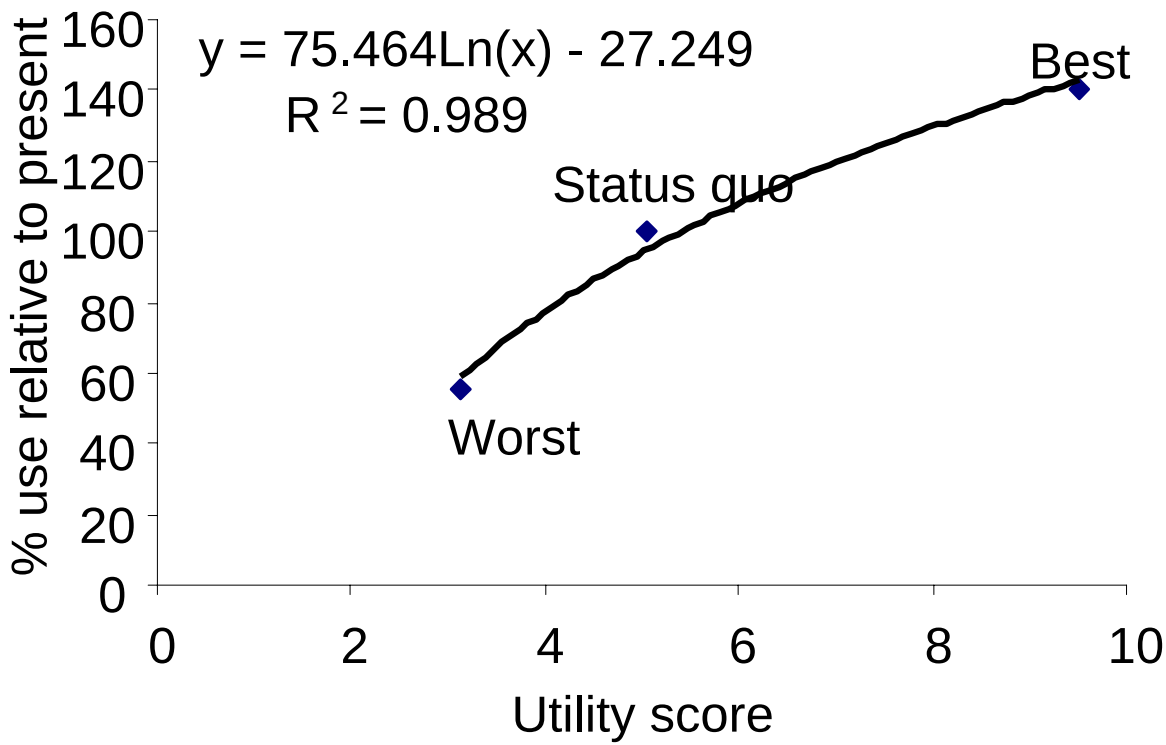
- Visitor expenditure: - stated contribution to enjoyment
  - Kromme = 17% - **R25m/a**
  - Seekoei = 11% - **R3m/a**



n = 221

Conjoint analysis

- 16 scenarios rated
- Derived Conjoint model:
  - *Kromme Utility = 3.47 + 0.033×Saltmarsh + 2.64×Fish + 3.84×Birds*
- Attached value to utility



- Valuing scenarios:
  - apply ecologists predictions, model utility, predict value

Scenario	Modelled Scenario scores	Predicted use of estuary relative to present (%)	Predicted visitor expenditure under different scenarios (R million)
Present	5.05	100	R5.7
1	11.24	155	R8.9
2	7.27	122	R7.0
3	5.96	107	R6.1
4	9.02	139	R7.9

Scenario results - Olifants

R millions	Sc. 1 maintain present health	Sc. 2 Sustainability bottom line	Sc. 3 Conser-vation
GDP water	-R790.48	-R935.36	-R1 947.66
GDP ecosystem*	+R1.34	+R4.61	+R2.82

*Estuary Fishery + Nursery value

Scenario results - Kromme

R millions	Sc. 1	Sc. 2	Sc. 3
GDP water	-R202m	-R538m	-R1279m
GDP ecosystem*	+ R2.14	+ R2.14	+ R3.20

*Real estate turnover + Tourism expenditure + Nursery value

Impact of scenarios - Seekoei

R millions	Sc. 1	Sc. 2	Sc. 3
GDP water	-R1.92	-R2.83	-R19.8
GDP ecosystem*	+R1.26	+R0.40	+R4.31
Overall	-R0.7	-R2.4	-R15.5

*Tourism expenditure + Nursery value

Problem of partial valuation

- Opportunity costs of e-flows are HIGH
- Most studies provide **partial** valuation
  - Requires understanding biophysical processes (expanding TORs)
  - Requires costly socio-economic data collection & analysis
- >> suboptimal solutions

Baseline vs alternatives

- Most studies concentrate on estimation of current value of ecosystems
- Need to be able to predict **change in ecosystem values** under alternative flow scenarios

Investing in better decisions

- Pressure for rapid/cheap assessment
- Precision > Order-of-magnitude > Benefits transfer
- Need **investment in improved decision support** (research) -> pay-offs of making the right decision

Moving beyond money

- Understanding trade-offs in monetary terms not sufficient
- Social benefits (Utility, Health, Livelihoods) not comparable to GDP
- Final analysis = MCDA