Restoration as a means to increase water supply & security for the NMBM

Joint CSIR, Asset and Living Lands Presentation to the Algoa Reconciliation Steering Committee

26 Sept 2012

Living Lands & PRESENCE LNet

Vision

Collaborations working on living landscapes

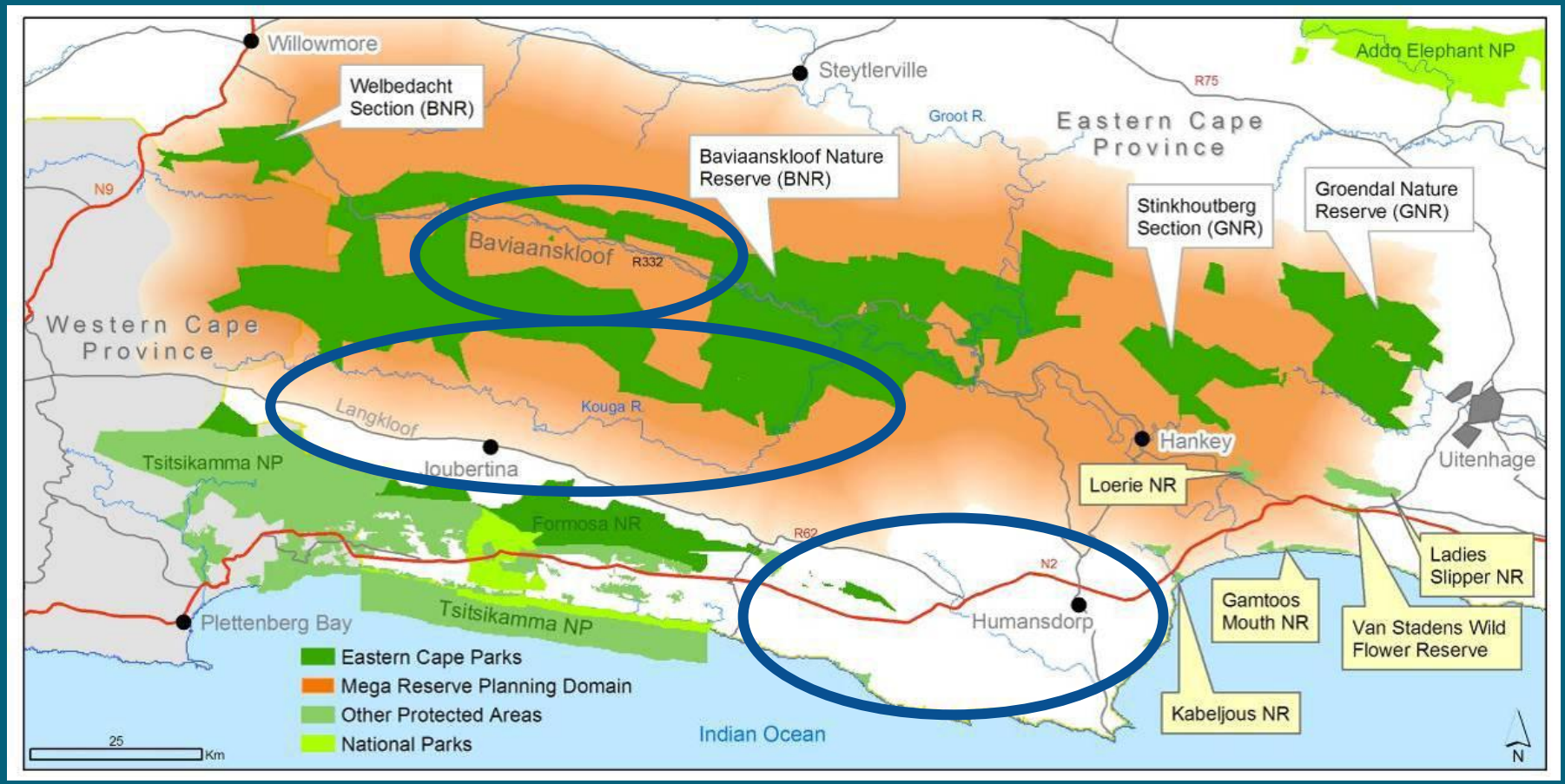
Mission

Bring synergies and added value to the landscape through:

- *Promoting living landscapes;*
- *Mobilising civil society for sustainability*
- *Enabling and facilitating social learning processes;*
- *Fostering mutually beneficial partnerships and participatory networks*
- *Building a knowledge base;*

- Activities
  - Stakeholder engagement and
  - Research

Stakeholder Engagement



Baviaanskloof Hartland

WAGENINGEN UR
For quality of life

Presence

Nowadays the production on the agricultural fields like the ones on vertonen Rivier is mainly vegetable seeds and potato. But in the future the agricultural fields may be transformed into orchards.

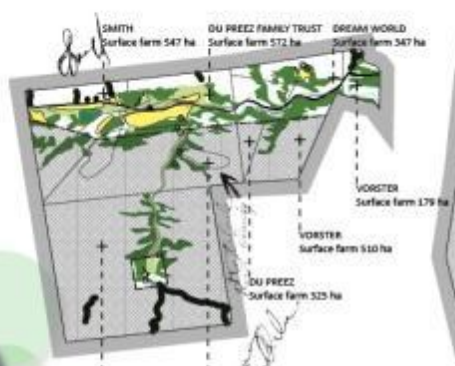
This is an overview from Kamferkloof how it looks when the thicket on the hillslopes is restored thanks to carbon farming and thicket restoration.

In the future some holiday homes with a view on the valley can be constructed. These holiday homes will generate money and jobs.

The riverbed of Rust en Vreede and Zandvlakte is incised in many places. The constructions of gabions in the riverbed will lead to the creation of wetlands which will retain the water.

The old agricultural fields on Zandvlakte are not used for a while and is already in the process of getting back in the natural state. After the fences have been put down wild animals can roam on the former agricultural fields.

Already 10 alluvial fans are in the process of being restored. When the vegetation is recovered these restoration sites are part of the natural landscape.



Op grond van die besprekings en 'n workshop in November 2011 het die land gebruikers van die Wes-Baviaanskloof besluit om die toekoms van hul leefomgewing. Die grondgebruikers is op soek na 'n volhoubare manier om op en van die land te leef. In hierdie moontlike toekomstige scenario die land gebruikers wil boer op die landerye in die vallei. 'N groot gebied word gewy aan' n groot private natuurreservaat. In hierdie reservaat sal die boere gesamentlik boere met wild. Die gedegradeer thicket sal herstel word vir koolstofkrediete. Waar moontlik sal die alluviale fans en die vleilande herstel word. Toerisme is gefokus op die landbou-toerisme in die vallei en die natuur-toerisme in die heuwels.
Met hierdie veranderinge in die landskap maak die land gebruikers hul lewende landskap. Na vier jaar van navorsing dat dit in die Wes-Baviaanskloof gedoen is deur die vennote van die PRESENCE netwerk en die befonding duer die Water for Food and Ecosystems programme het nou aan die land gebruikers self die proses voort te sit tot 'n volhoubare manier van die lewe in die Wes-Baviaanskloof. 'N manier van lewe wat sal verseker dat elke land gebruikers in hierdie pragtige omgewing kan bly!

Jordy Stokhof de Jong - November 2011

Research around Restoration

- Many studies – have built up a considerable body of knowledge but could be more valuable if more directly integrated into a stakeholder decision making process
- Mander et al (2010) PES Feasibility Study for the Baviaanskloof, Kouga and Kromme Catchments
- Asset Research – presentation of Alanna Rebelo's findings
- Current research in progress
  - Hydrological impacts of wetland & river restoration (Julia Glenday)
  - Geomorphological study (Rebecca Joubert)
  - Institutional aspects of using market mechanisms and incentive schemes (Maura Andrew)

Invest in the Kromme:

Port Elizabeth's Insurance Policy

Alanna Rebelo
& David Le Maitre

Central Research Question

What is the hydrological impact of land-cover changes in the Kromme River Catchment over the last 50 years?

Hypotheses

1. Wetland loss:

   -Shifts in the flow regime

   -Greater responsiveness to floods

   -Reduction in water quality

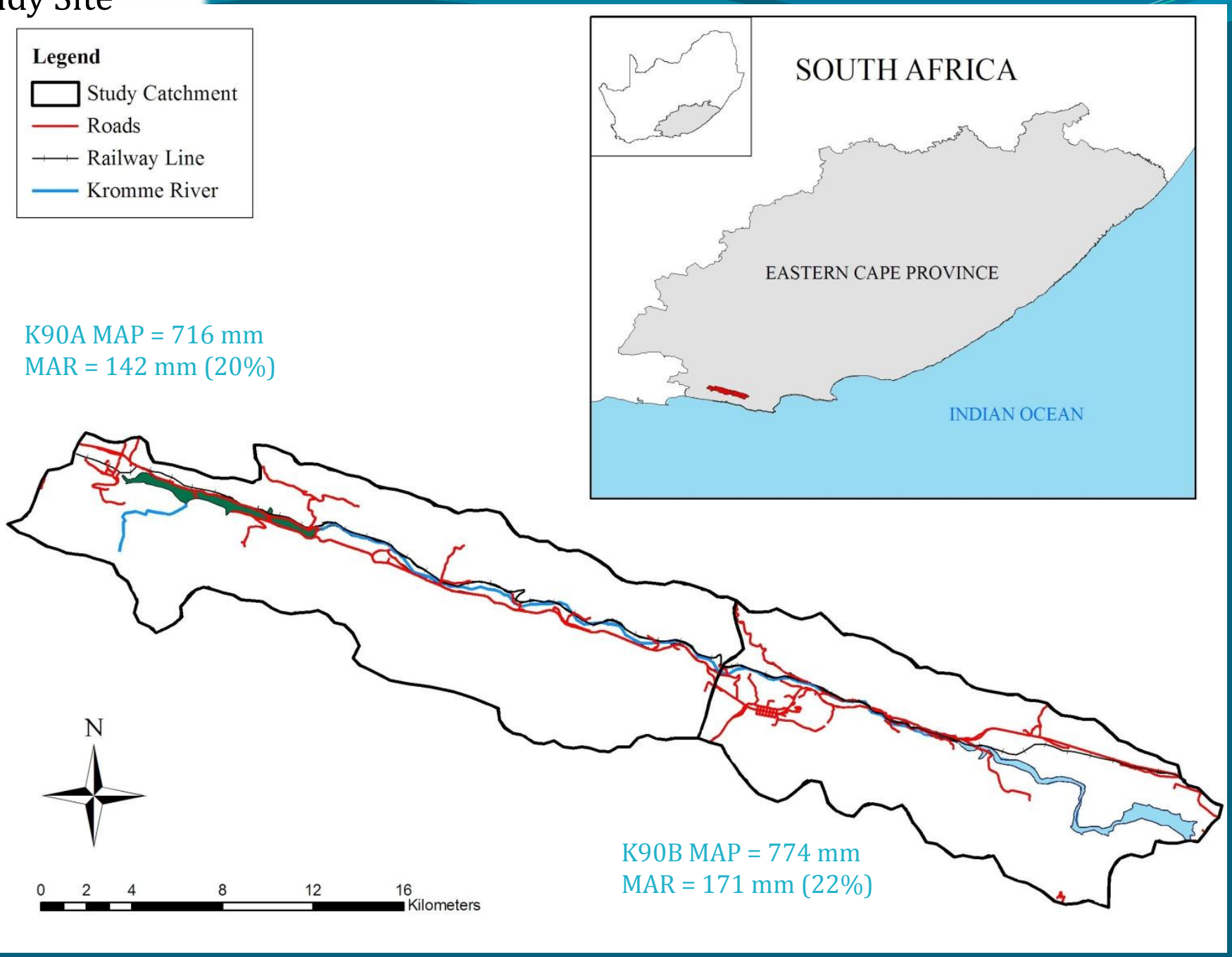
2. Riparian invasion:

   -Flow reduction

3. Cultivation of floodplains:

   -Decline in water quality

Study Site


Legend
Study Catchment
Roads
Railway Line
Kromme River
SOUTH AFRICA
EASTERN CAPE PROVINCE
INDIAN OCEAN
K90A MAP = 716 mm
MAR = 142 mm (20%)
N
0 2 4 8 12 16
Kilometers
K90B MAP = 774 mm
MAR = 171 mm (22%)

Land Cover Change

Reference

1954

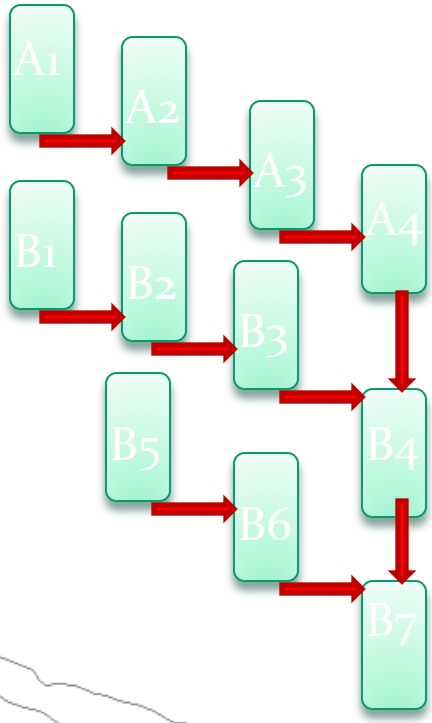
1969

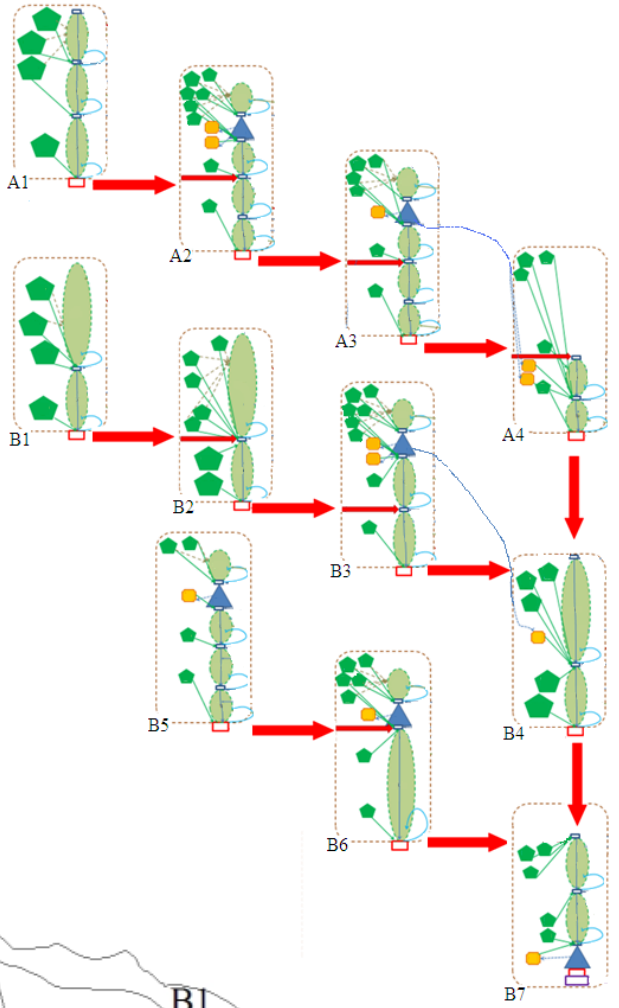
1986

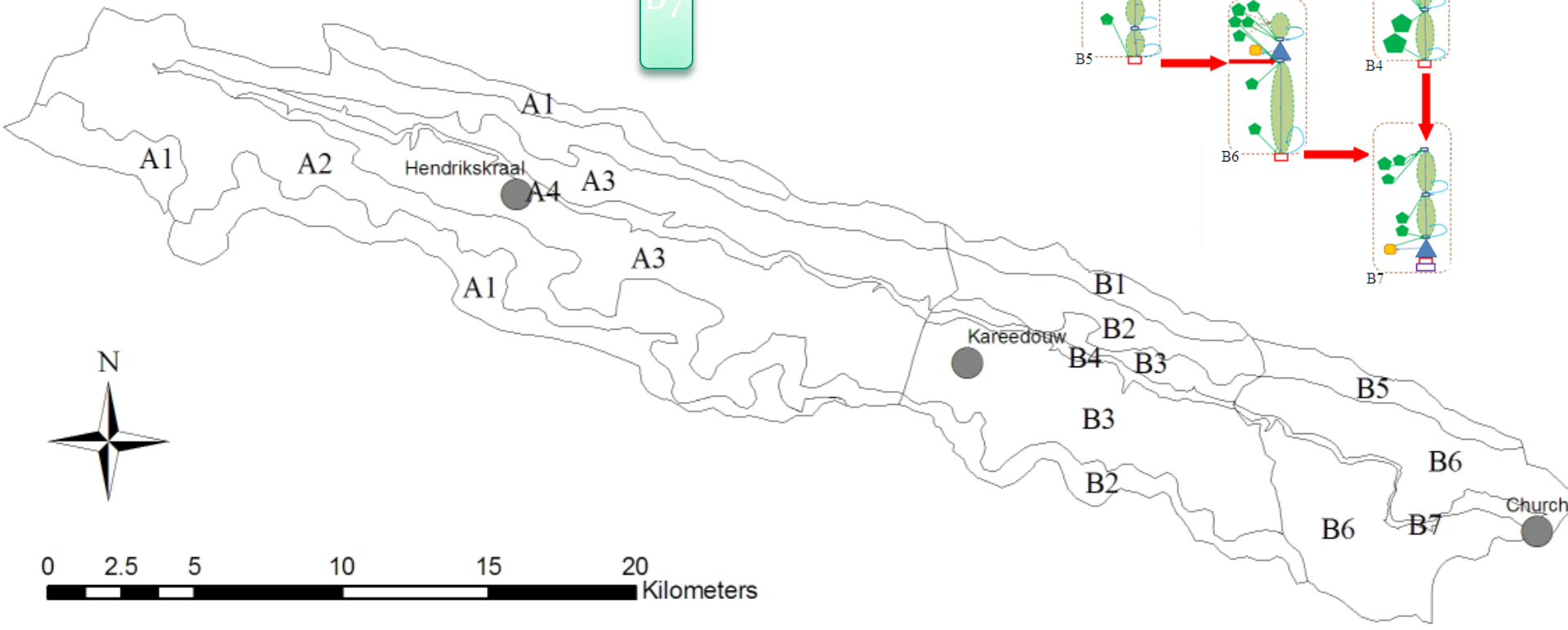
2007

Methods

- Catchment
- Subcatchment
- HRU

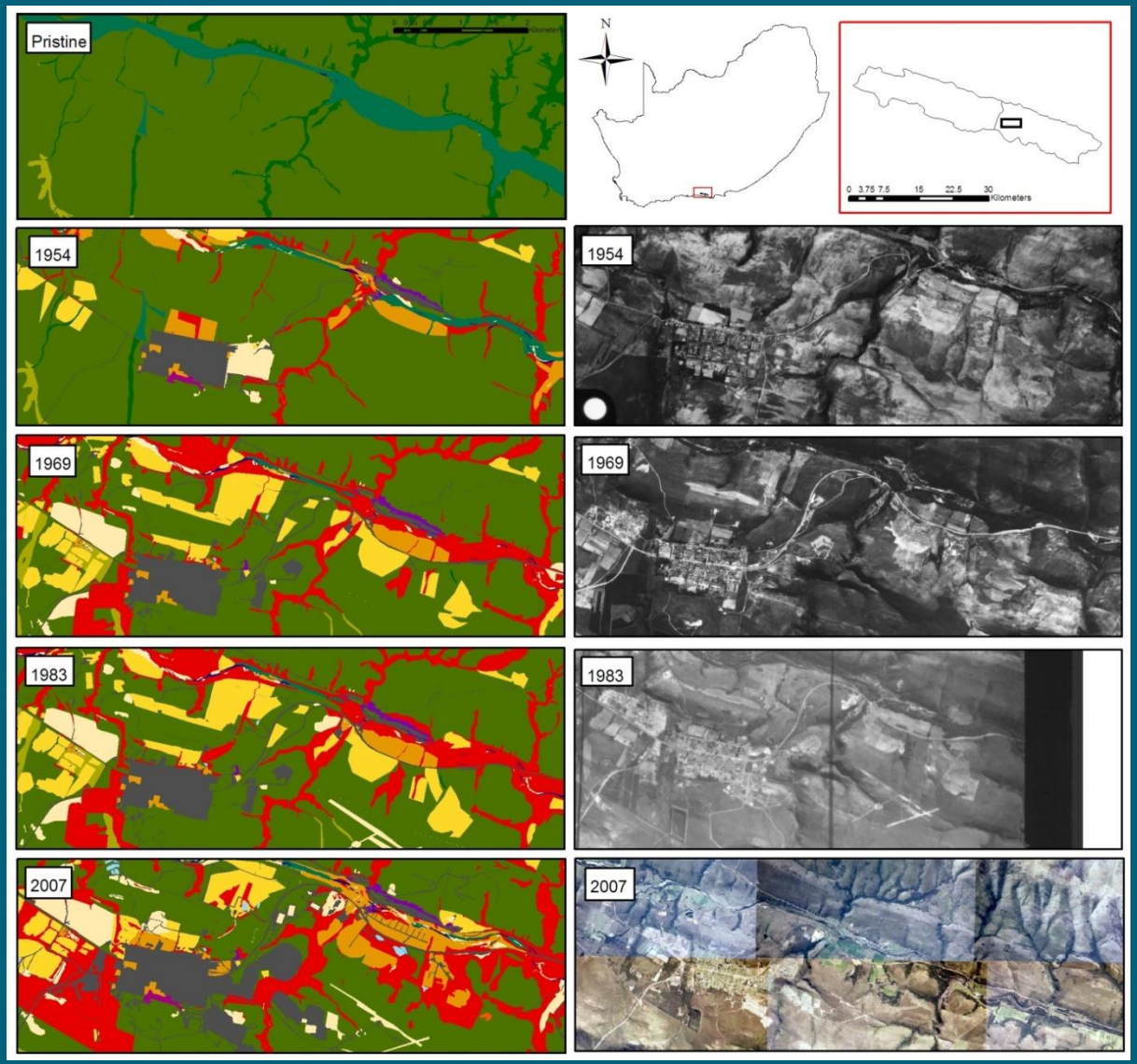




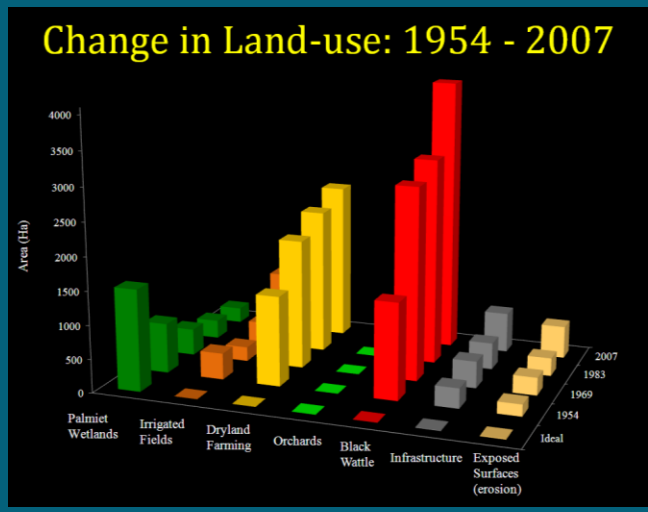


Results

Changes in land cover



	Land use
1	Dams
2	Mountain Seep Wetlands
3	Palmiet Wetlands
4	Riparian Vegetation
5	Unproductive Fynbos
6	Productive Fynbos
7	Degraded Fynbos
8	Irrigated Fields
9	Dryland Farming
10	Orchards
11	*Acacia mearnsii*
12	*Pinus Sp*
13	Alien Plants
14	Infrastructure
15	Open Soil



Evaporation from key vegetation types

Vegetation class	ACRU modelled (mm/yr)	Taken from the literature (mm/yr)	Notes
Fynbos	430	600	
Palmiet wetland	695±21	1043	
Acacia mearnsii	899±45	1160-1503	Range of sites MAP 750-1300 mm/yr
A. mearnsii vs palmiet	205	117-460	

No direct calibration possible: change in evaporation ≈ runoff

Riverflow(scenarios)

Landcover Scenario	Rainfall period	Mean Annual Runoff (mm)	Rainfall / Runoff (%)
1954	1950-2000	188.1±95.87	30.6
1969	1950-2000	169.0±86.63	27.5
1986	1950-2000	147.2±81.83	24.0
2007	1950-2000	146.1±79.97	23.8

2007 vs 1954 decrease of 22%

Baseflow (scenarios)

Landcover Scenario	Rainfall Dates	Mean Monthly Baseflow (mm)	Mean Annual Baseflow (mm)	% of MAR
1954	1950-2000	9.42 ± 7.263	113.10	60.1
1969	1950-2000	8.27 ± 6.993	99.25	58.7
1986	1950-2000	6.57 ± 7.070	78.88	53.6
2007	1950-2000	6.58 ± 9.221	78.95	54.0

2007 vs 1954 decrease of 30%

Responsiveness to floods

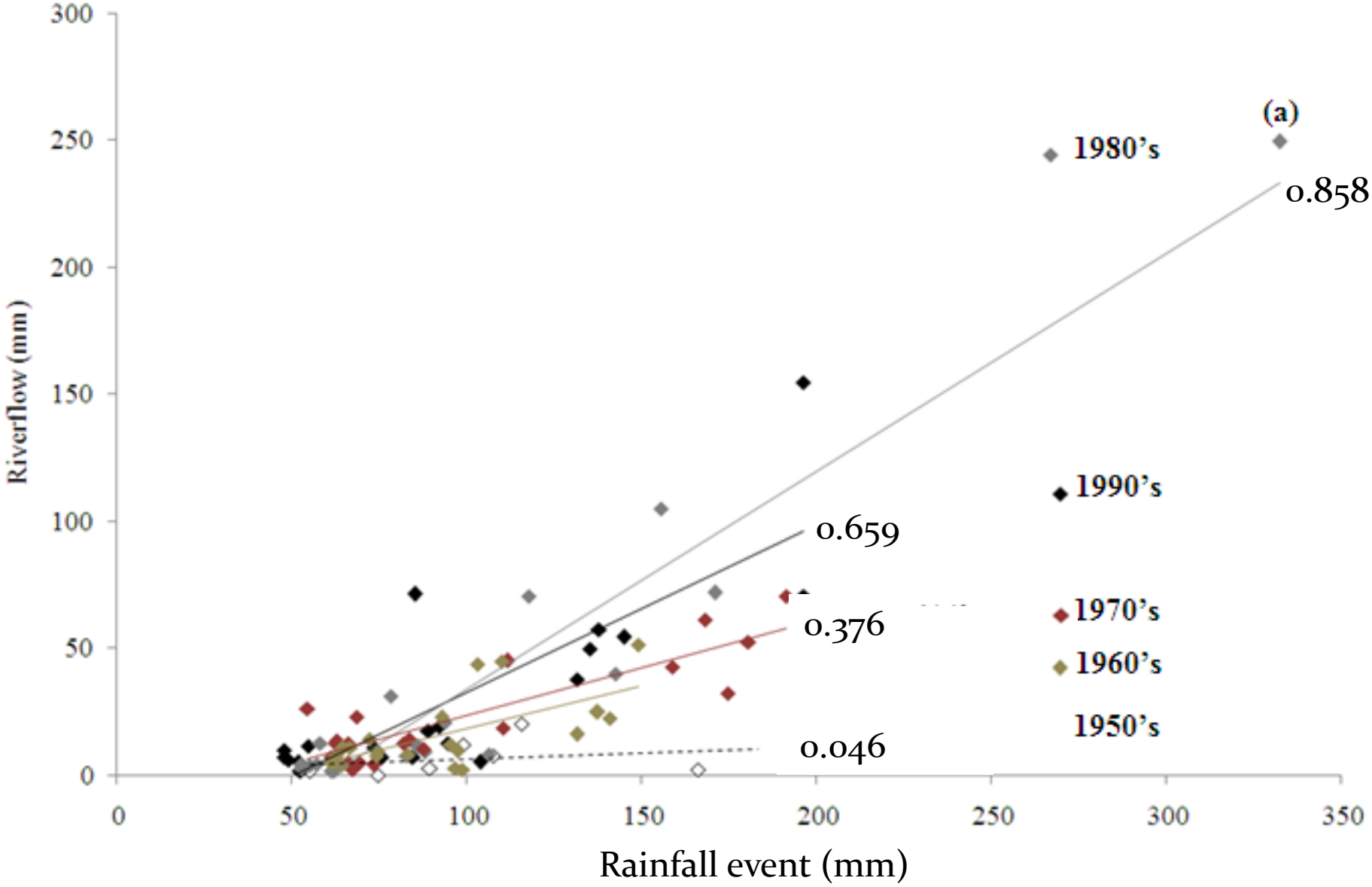
- Change in responses to rainfall events >50 mm over time from actual flow record

Erosion and sediment loss

Damage to tributaries

Loss of floodplain storage

Flood responses by decade



Scenarios of Restoration

Scenario 1: Restore to the state of 1983

Costs: Clear 10.4 km^2 of Black Wattle, restore 0.5 ha of palmiet wetlands
Benefits: Gain ±2 mm of riverflow (expansion mainly dryland)

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Scenario 2: Restore to the state of 1969

Costs: Clear 12.5 km^2 of Black Wattle, restore 1.6 km^2 of palmiet wetlands
Benefits/Insurance Premium: Gain 27.5 mm/a riverflow, 1.69 mm/a baseflow, increased flood protection, improved water quality, increased biodiversity

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Scenario 3: Restore to the state of 1954

Costs: Clear 26.9 km^2 of Black Wattle, restore 5.2 km^2 of palmiet wetlands
Benefits/Insurance Premium: Gain 42 mm/a riverflow (±15 Mm^3), 2.9 mm/a baseflow (in the 3 dry months), increased flood protection, improved water quality, increased biodiversity

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Scenario 4: Restore to a "reference" state

Costs: Clear 41.3 km^2 of invading trees, restore ±12.8 km^2 of palmiet wetlands, cease all agriculture in the catchment (all 32.2 km^2 of it).
Benefits/Insurance Premium: Gain ±50 mm/a riverflow, > 2.9 mm/a baseflow, increased flood protection, improved water quality, increased biodiversity

Credit: Katie Gull

Restoration of the Kromme

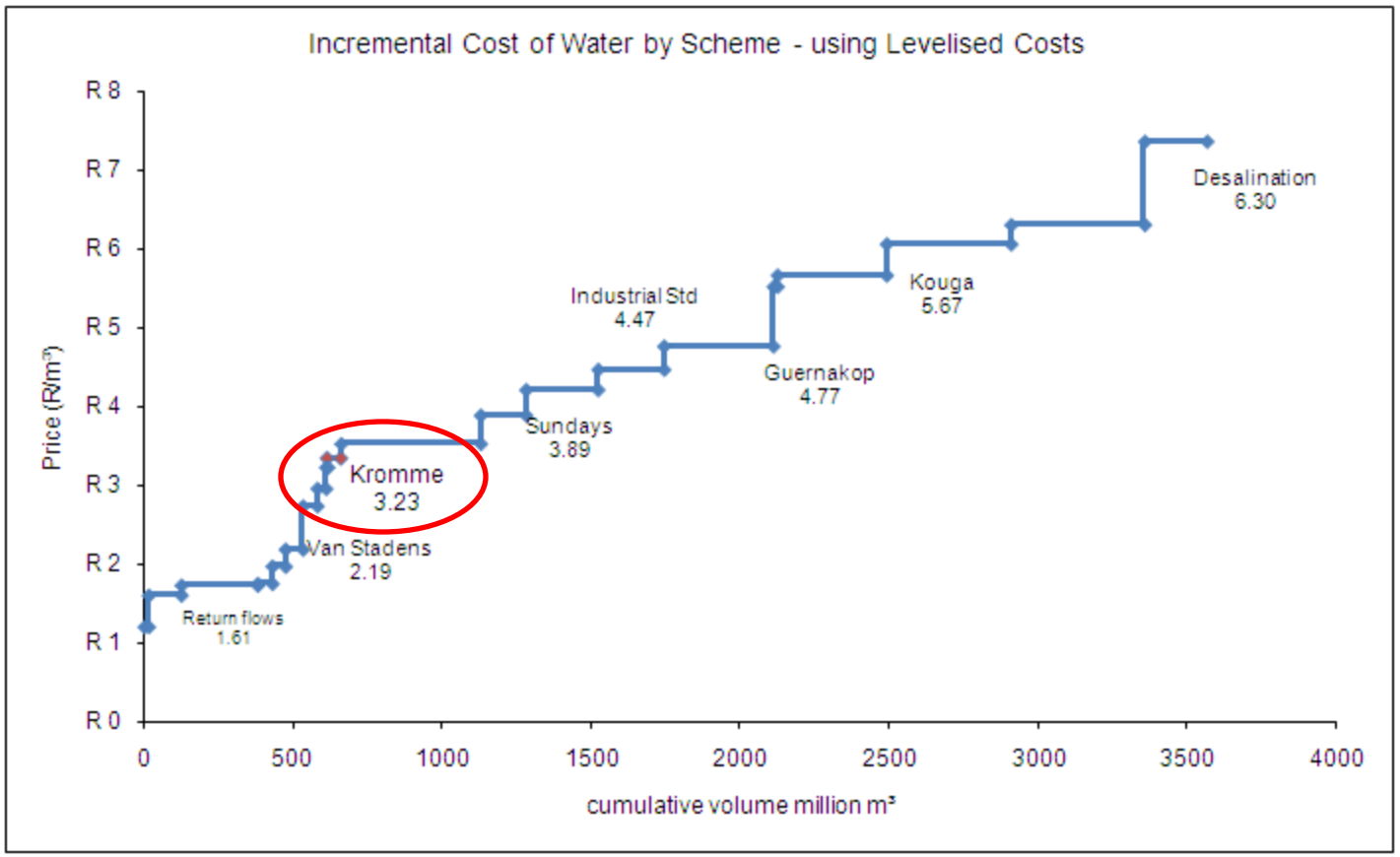


Figure 65: Incremental Cost Curve including the Kromme restoration- using Levelised Costs

Conclusion: Restoration still is more cost effective than some other supply options

Clearing has benefits but the costs of control may exceed the value of the water gains depending on proportion utilisable, water price, changes in runoff & discount rates

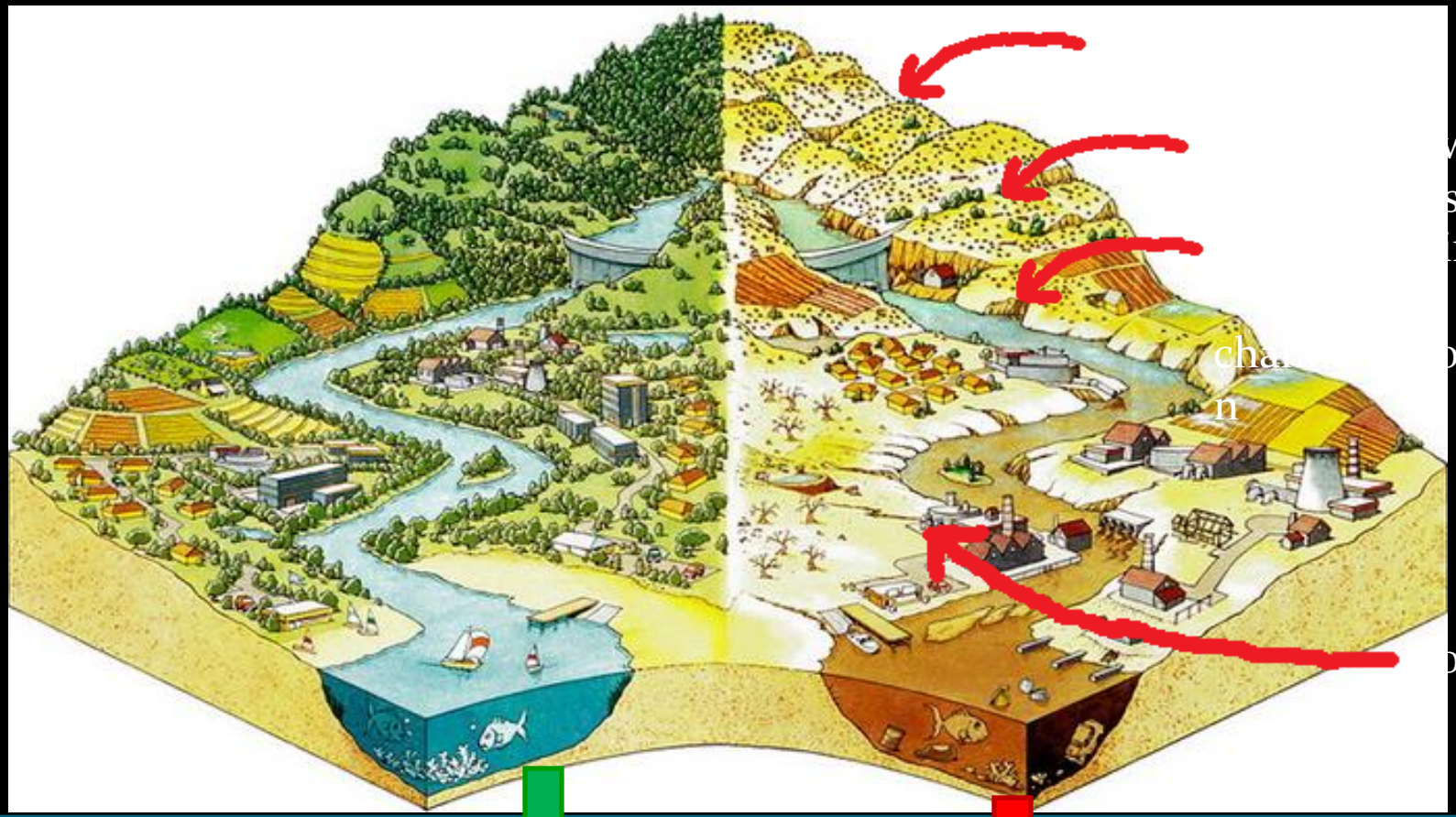
In summary

- Kromme is a high energy river system
- Natural processes provided a buffer, creating resilience
- Human actions have reduced this resilience
  - Black Wattle invasions replace palmiet (and reduce river flows)
  - Loss of wetlands due to clearing & cultivation are destabilising the system
- Doing nothing is not an option:
  - Irreversible damage in the upper Kromme is continuing, including massive loss of sediment
  - The remaining palmiet in the middle is buffering this to an extent (not in lower Kromme)
  - Over time Black Wattle will invade and destroy this buffer, further modifying and reducing flows

Restoration of the Kromme

- Many benefits:
  - Water flow gains, especially baseflows (provided abstraction is managed)
  - Reductions in flood damage
  - Capture and stabilisation of sediment
  - Reductions in water treatment costs
  - Maintaining and enhancing catchment function and resilience
  - Potential positive return on investment
- Secure water supplies for the future

Ecosystem Services



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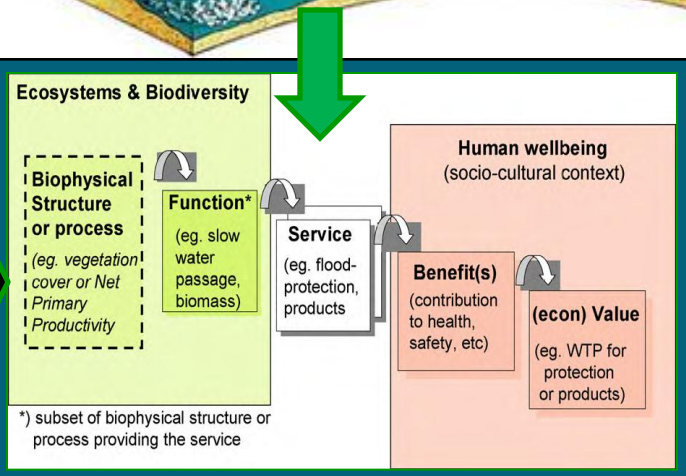

If we are good stewards of our land, it will provide ecosystem goods and services.

If we do not look after our land, ecosystem goods and services will be reduced or lost.

De Groot et al. 2010

Recommendations

- Continue clearing Black Wattle from the catchment
- Act to stop further wetland loss, restore damaged wetlands and enforce the CARA Act (no ploughing and/or farming in rivers-floodplains-wetlands)
- DWA, DAFF, NMBM & others form partnerships with residents to secure ecosystem services through sustainable farming
- Install a gauging weir in the Kromme River
- Address key uncertainties in current studies, particularly water-use (natural, invasions, agricultural) and sediment dynamics

- Restoration of the Kromme could become a model for others to follow

Obstacles to Investment in ES

- Insufficient rainfall, water flow and water use data to accurately model and measure the water resource systems and responses to restoration and sust. Land uses
- No control over water use in the upper catchments
- No enforcement of water and land use legislation
- Limited government funding for restoration and motivated by job creation not provision of ES
- Reluctance of land owners to take responsibility for restoration
- Economic pressures on land & water users to maximise use

Beneficial Govt. Initiatives

- Initiating Validation & Verification of Water Use in the Kouga and plans to do all three catchments
- Initiation of process to create Water User Associations
- Review of the Water Pricing Policy
- WfW reviewing approach to Land Owners – land user wage incentives contracts
- Sub-Tropic Thicket Restoration Programme
- Wetland Banking Policy
- ECPTA – Stewardship Programme

Way Forward

- Priority is to build collaborations on the landscape
  - Bring Living Lands (bottom up) approach together with Government (top down) initiatives to effect social change
- Develop a coordinated strategy and programme
- Establishment of Working Group to initiate process
- Participants: Living Lands, Researchers, DWA, DoA, DEA, WfW, WfWetlands, STRP, ECPTA, GIB
- Need to work towards creating effective Catchment Management Forums that involve all the water users and the above stakeholders/agencies to take this process forward