Everything a water manager always wanted to know…

Water accounting

Water policy decision making processes

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Everything a water manager always wanted to know…

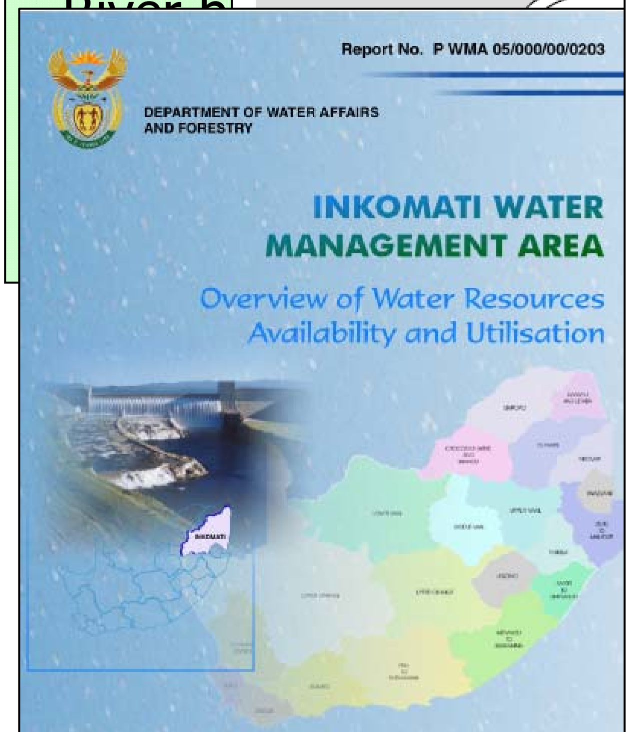
Water accounting

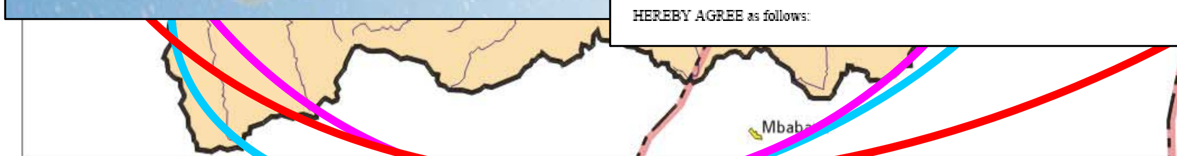
- Water management begins with keeping track of the water balance
- Water management is data intensive
- Innovative forms of water management are even more data intensive

Everything a water manager always wanted t… …y…

Management levels:
- Transboundary
- National
- Catchm…
- River b…

Transboundary tripartite committ…





TRIPARTITE INTERIM A…
THE REPUBLIC OF…
AND
THE REPUBLIC OF SO…
AND
THE KINGDOM OF SWA…
FOR CO-OPERATION ON THE PROTECTI…
UTILISATION OF THE WATER RESOURCES O…
MAPUTO WATERCOURSE…

PREAMBLE

The Republic of Mozambique, the Republic of South Africa and the King… (hereinafter jointly referred to as the "Parties");

BEARING IN MIND the principles advocated in the Declaration by the H… of Southern African States "Towards the Southern African Development… of the Southern African Development Community signed on 17 August 1… on Shared Watercourses in the Southern African Development Community…

HAVING RESOLVED to pursue the guidelines established by th… Government of the Republic of South Africa and the Government of… regard to Rivers of Mutual Interest and the Cunene River Scheme sig… which the Republic of Mozambique succeeded in 1975 and the Kingdom… 1967;

MINDFUL of the spirit of co-operation and good understanding reached… Piggs Peak Agreement of 15 February 1991;

TAKING INTO ACCOUNT the modern principles and norms of Internat… Convention on the Law of the Non-Navigational Uses of International W… General Assembly of the United Nations on 21 May 1997;

CONSCIOUS of the mutual advantages of concluding agreements… watercourses;

DETERMINED to co-operate and seek mutually satisfactory solutions for the needs of the Parties towards water protection and to the sustainable utilization and development of the water resources with a view to improving the standard of living of their populations;

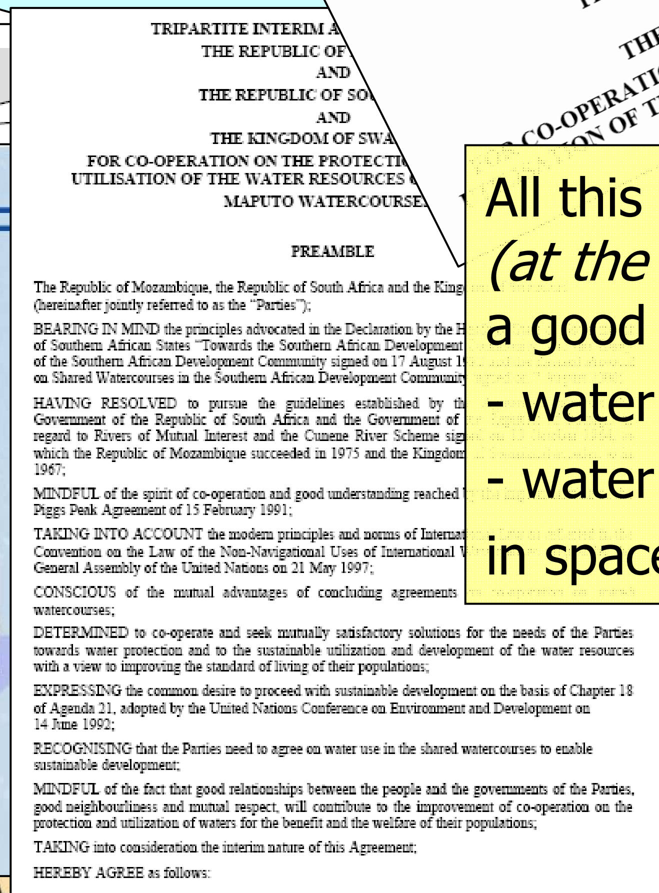
EXPRESSING the common desire to proceed with sustainable development on the basis of Chapter 18 of Agenda 21, adopted by the United Nations Conference on Environment and Development on 14 June 1992;

RECOGNISING that the Parties need to agree on water use in the shared watercourses to enable sustainable development;

MINDFUL of the fact that good relationships between the people and the governments of the Parties, good neighbourliness and mutual respect, will contribute to the improvement of co-operation on the protection and utilization of waters for the benefit and the welfare of their populations;

TAKING into consideration the interim nature of this Agreement;

HEREBY AGREE as follows:



TRIPARTITE INTERIM AGREEMENT BETWEEN
THE REPUBLIC OF MOZAMBIQUE
AND
THE REPUBLIC OF SOUTH AFRICA
AND
THE KINGDOM OF SWAZILAND
…O-OPERATION ON THE PROTECTION AND SUSTAINABLE
…ON OF THE WATER RESOURCES OF THE INCOMATI AND
MAPUTO WATERCOURSES [1]

All this planning requires *(at the minimum)* a good knowledge of:
- water availability
- water demands

in space and time

Everything a water manager always wanted to know…

Effective system operation requires:

- clearly defined water rights
- system understanding
- real-time monitoring of water availability and use
- looking beyond national borders
- ..

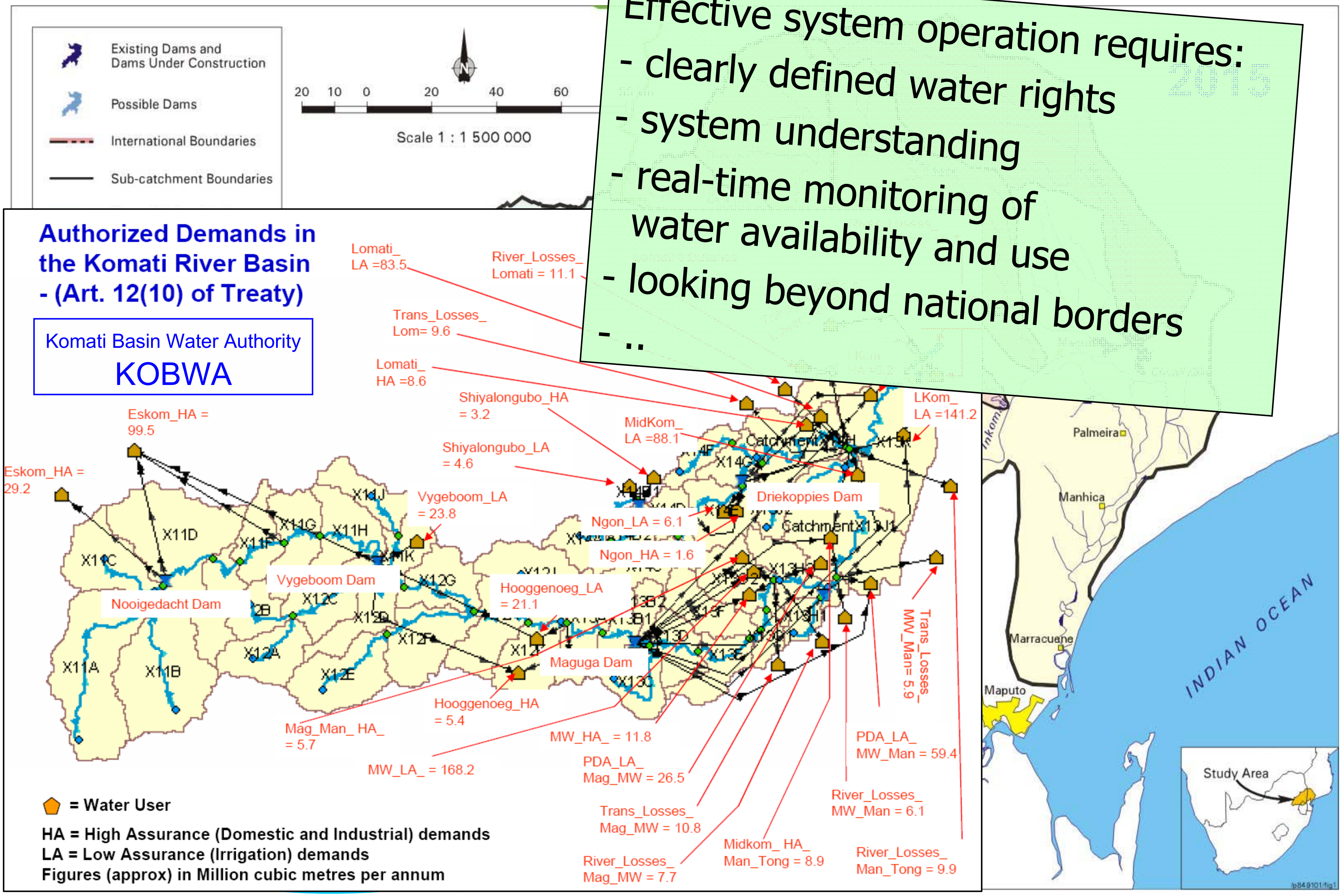
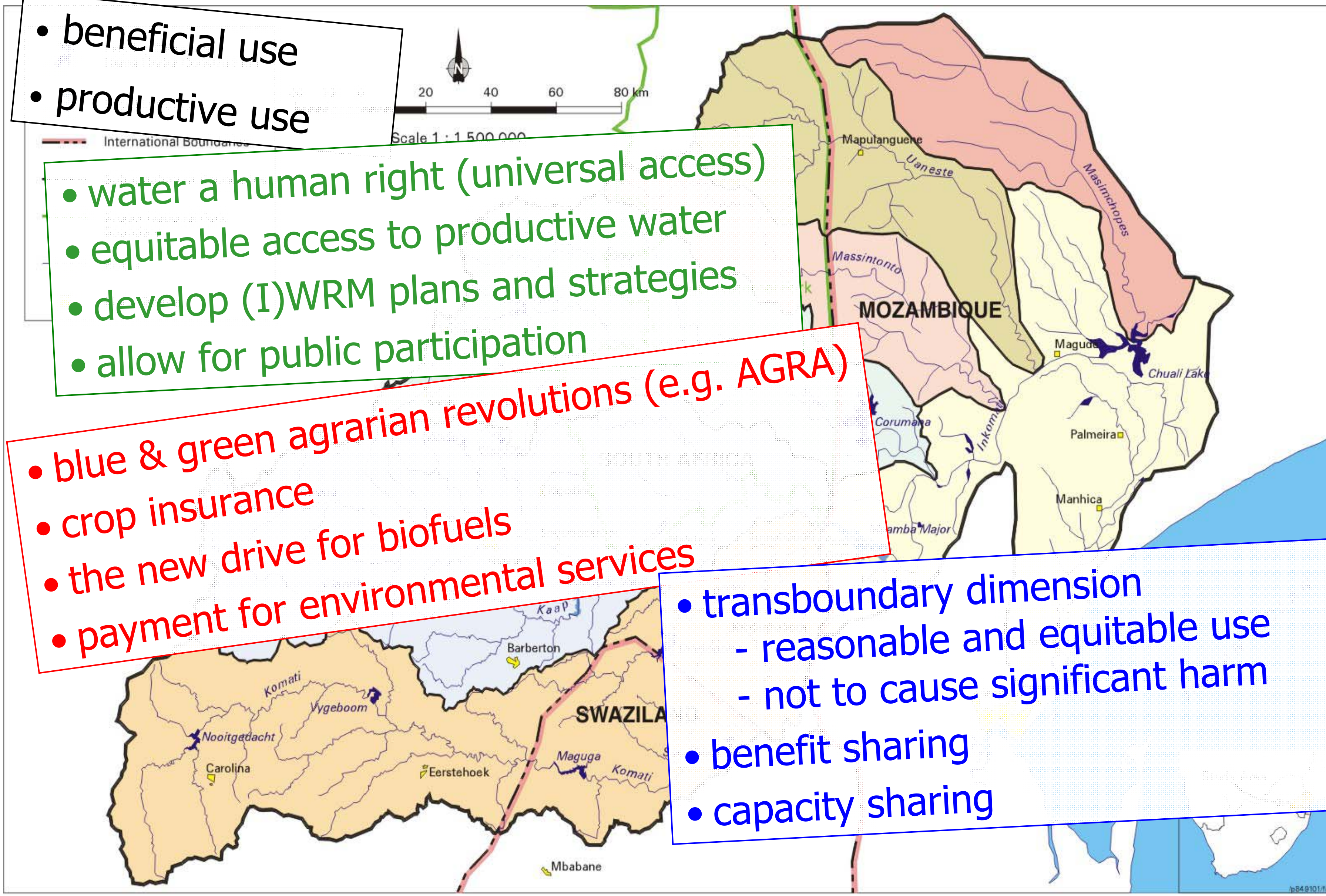


Figure courtesy Komati Basin Water Authority KOBWA

Everything a water manager always wanted to know…



- beneficial use
- productive use

- water a human right (universal access)
- equitable access to productive water
- develop (I)WRM plans and strategies
- allow for public participation

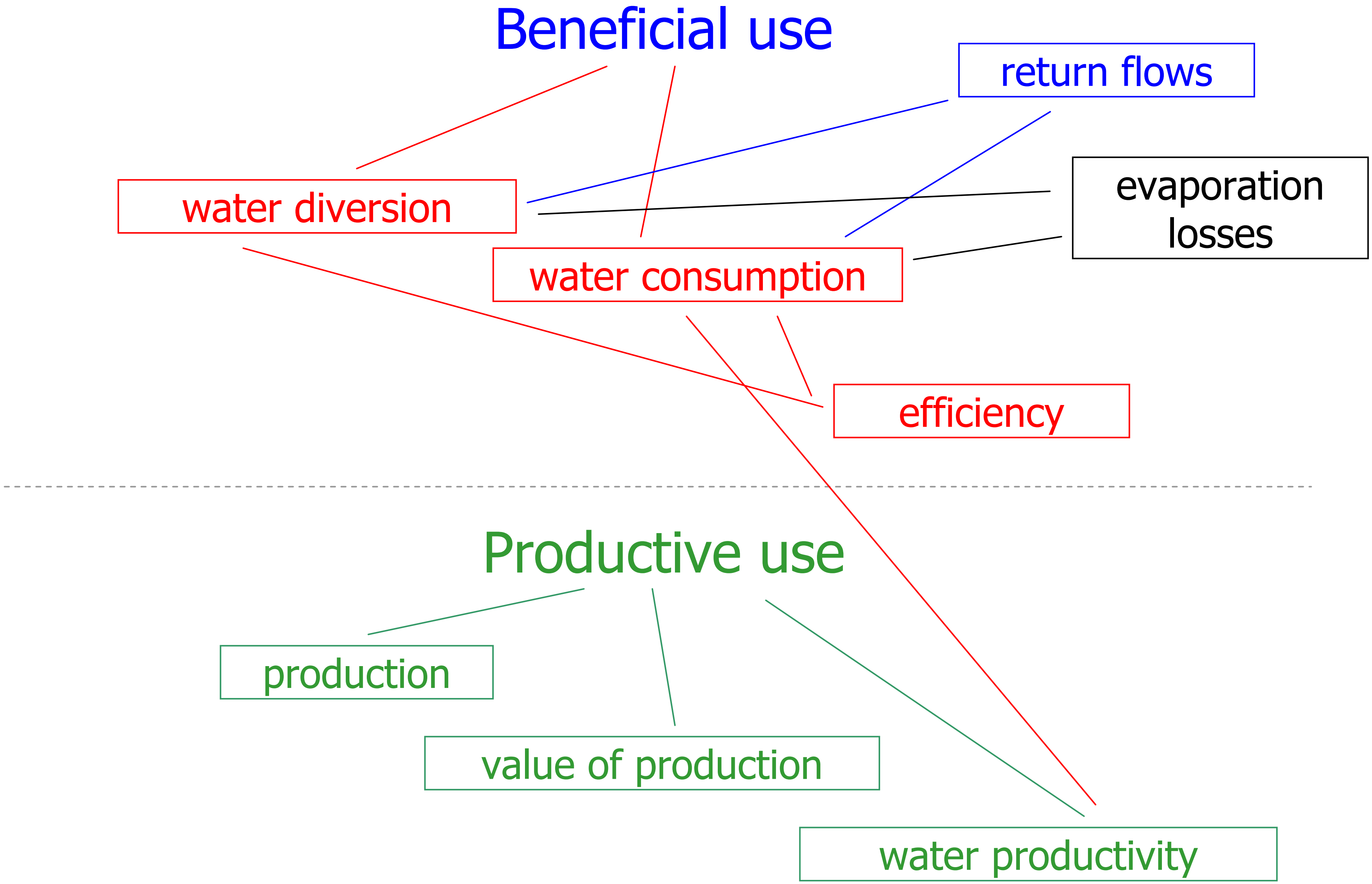
- blue & green agrarian revolutions (e.g. AGRA)
- crop insurance
- the new drive for biofuels
- payment for environmental services

- transboundary dimension
  - reasonable and equitable use
  - not to cause significant harm
- benefit sharing
- capacity sharing

Everything a water manager always wanted to know…

Selected policy issues

- Beneficial use / Productive use
- Equity
- Payment for environmental services
- Crop insurance
- Capacity sharing
- Benefit sharing


Beneficial use
return flows
water diversion
evaporation losses
water consumption
efficiency
Productive use
production
value of production
water productivity

Equity

water availability

spatial and temporal distribution

water needs

spatial and temporal distribution

$$Q_{r,i} = \left(Q_{t,i-1} + W_g \sum_{i}^{n} Q_g + (1 - R_b) \sum_{i}^{n} Q_b \right) \frac{N_i}{\sum_i^n N}$$

$$\begin{aligned} Q_{t,i} = \min \lfloor\, & Q_{t,i-1} + W_g Q_{g,i} + (1 - R_b) Q_{b,i} - Q_{r,i}, \\ & Q_{t,i-1} + (1 - R_b) Q_{b,i} \,\rfloor, \end{aligned}$$

Van der Zaag et al., 2002

$Q_{b,i}$ = blue water generated in country i (Gm^3/yr)
$Q_{g,i}$ = green water generated in country i (Gm^3/yr)
$Q_{r,i}$ = right to blue water of country i over and above the reserved blue water (Gm^3/yr)
$Q_{t,i}$ = surplus blue water to be transferred to downstream countries (Gm^3/yr)
R_b = fraction of blue water reserved for each riparian country
W_g = weight of green water relative to blue water

Payment for environmental services

Green credits (ISRIC)

voluntary transaction

well defined environmental service

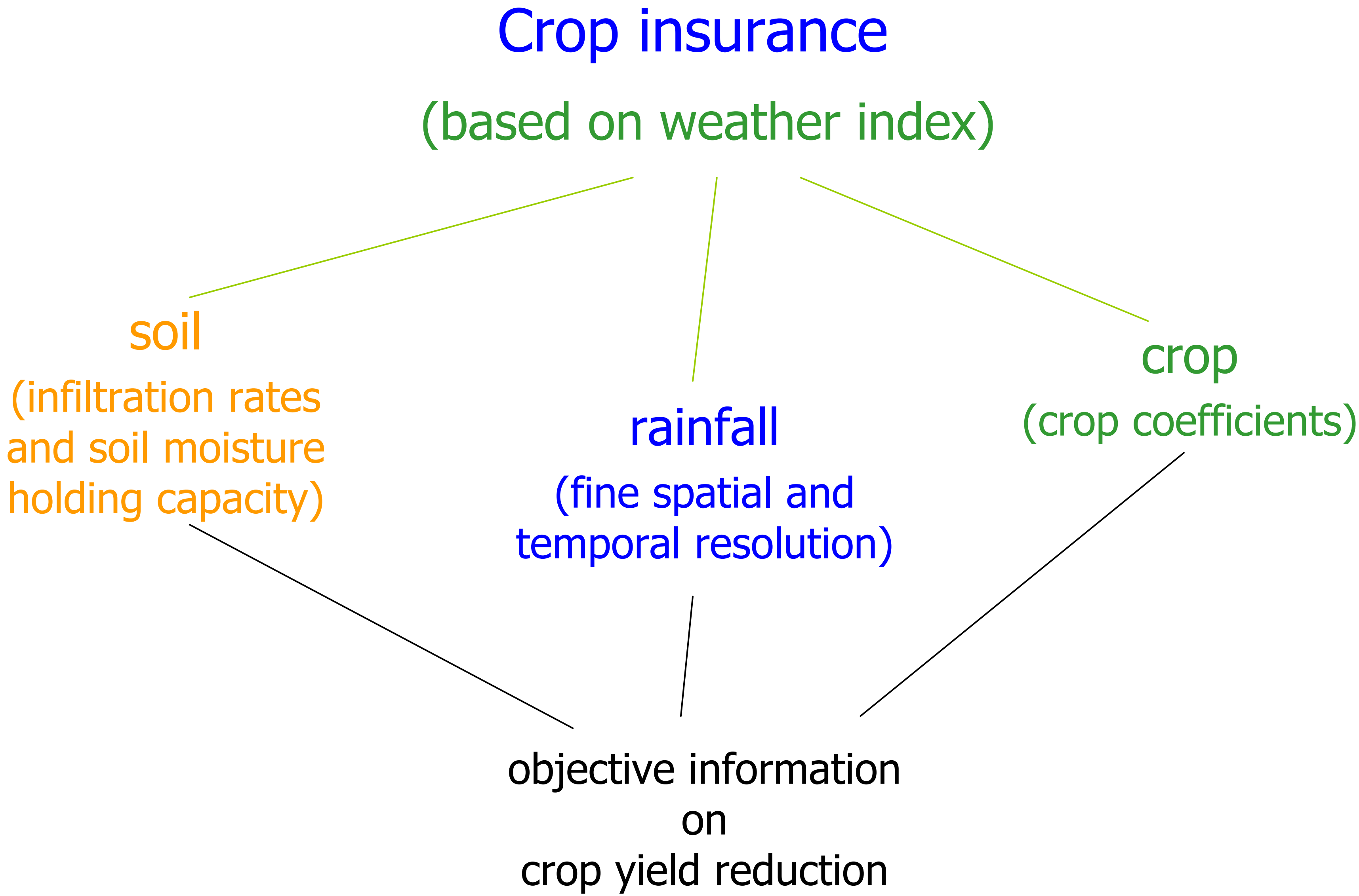
service provider

service buyer

requires precise understanding of the impact of land-use change

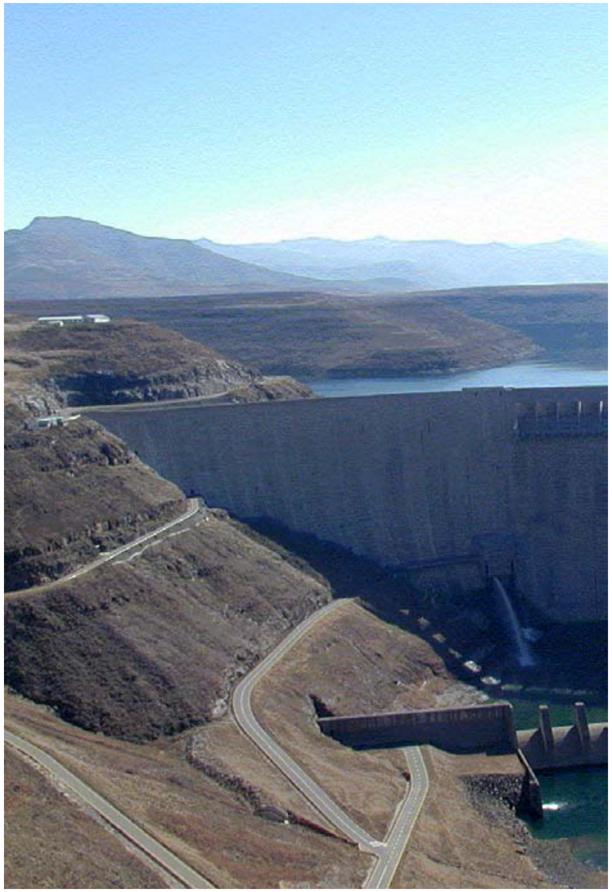
Quantify and predict change in:

- unproductive evaporation / productive transpiration
- wet season flow / dry season flow
- sediment loads

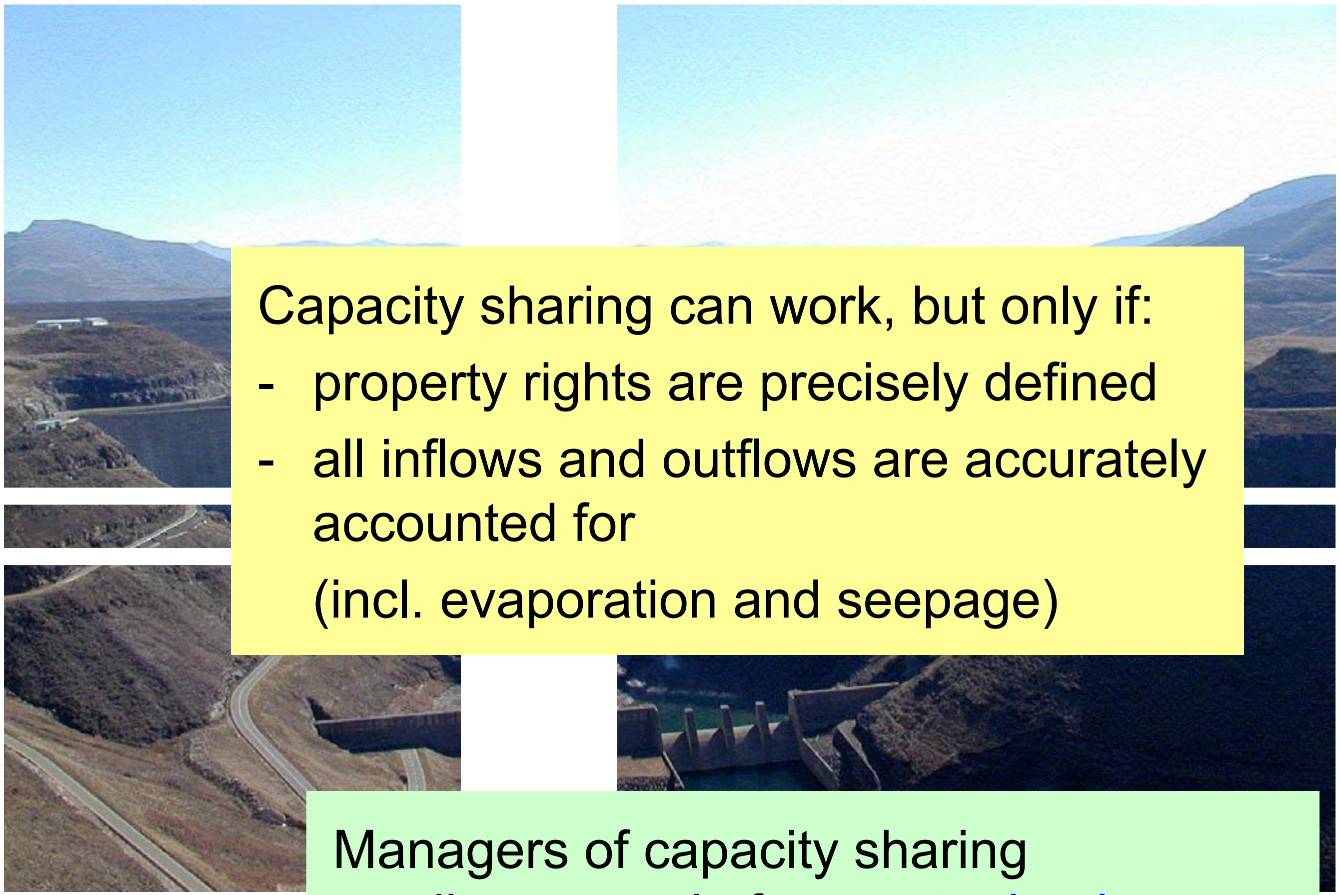

Crop insurance
(based on weather index)
soil
(infiltration rates
and soil moisture
holding capacity)
rainfall
(fine spatial and
temporal resolution)
crop
(crop coefficients)
objective information
on
crop yield reduction

Capacity sharing

Capacity sharing



Capacity sharing

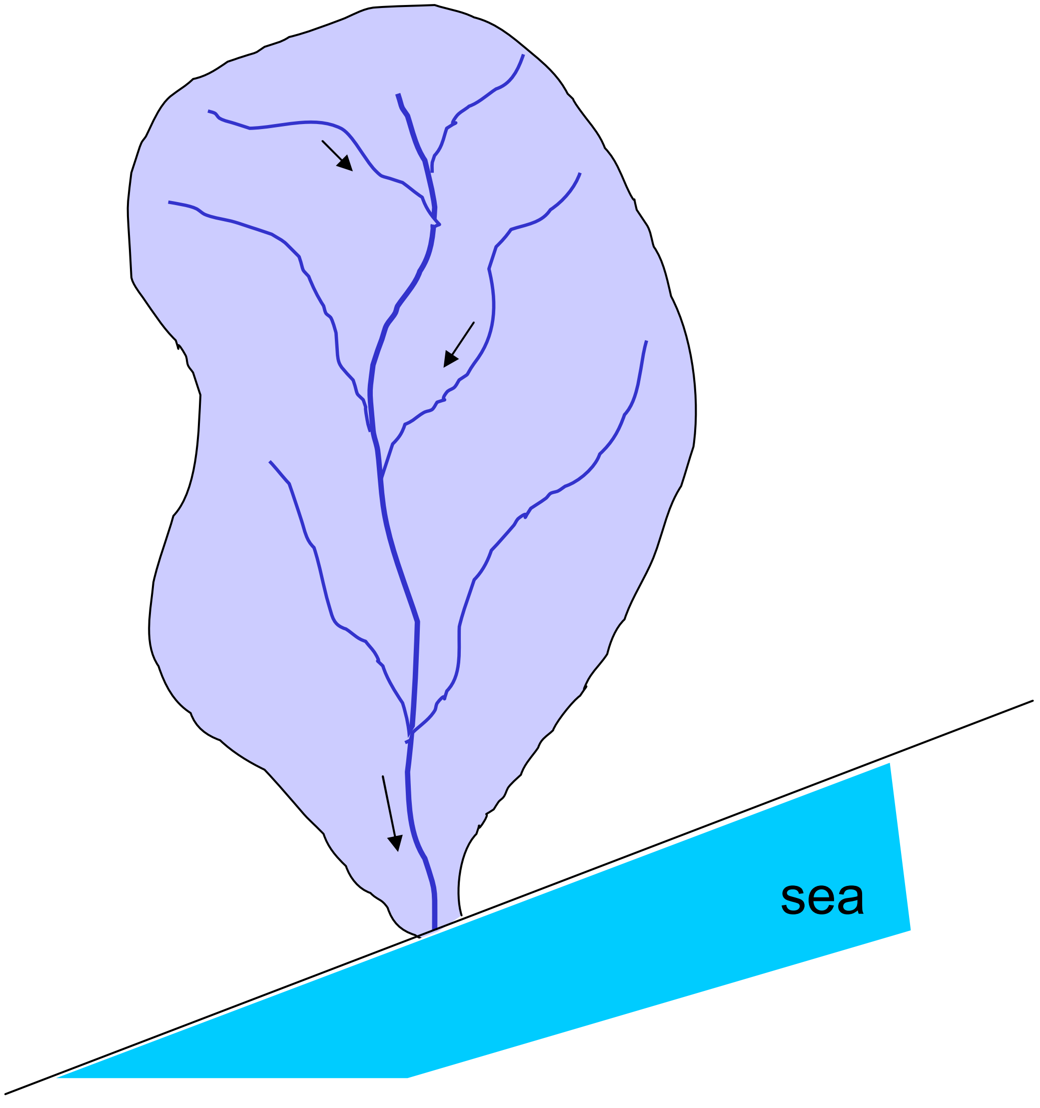


Capacity sharing can work, but only if:

- property rights are precisely defined
- all inflows and outflows are accurately accounted for
  (incl. evaporation and seepage)

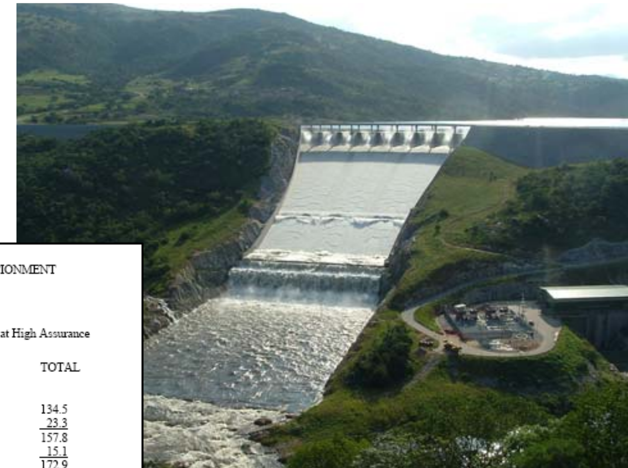
Managers of capacity sharing syndicates are in fact water bankers

Benefit sharing

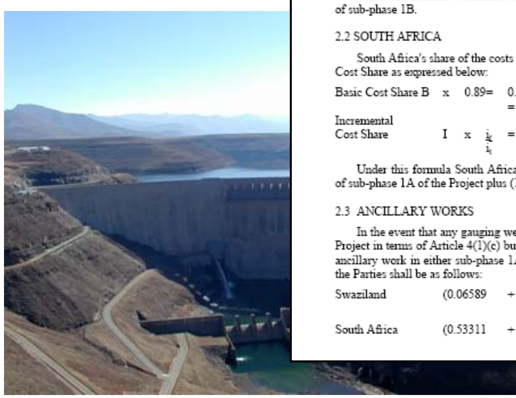


Benefit sharing

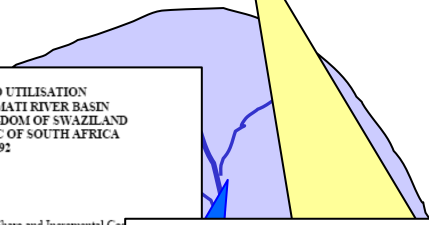
Mantantali
on the Seneg

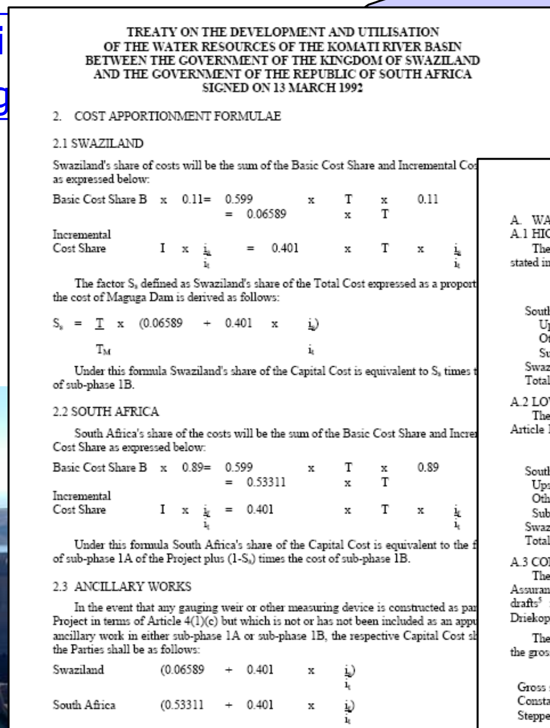


Maguga – Swaziland
omati river



Khatse – Lesotho
on the Orange-Senqu river





TREATY ON THE DEVELOPMENT AND UTILISATION
OF THE WATER RESOURCES OF THE KOMATI RIVER BASIN
BETWEEN THE GOVERNMENT OF THE KINGDOM OF SWAZILAND
AND THE GOVERNMENT OF THE REPUBLIC OF SOUTH AFRICA
SIGNED ON 13 MARCH 1992

2. COST APPORTIONMENT FORMULAE

2.1 SWAZILAND

Swaziland's share of costs will be the sum of the Basic Cost Share and Incremental Cos as expressed below:

Basic Cost Share B x 0.11= 0.599 x T x 0.11
= 0.06589 x T

Incremental Cost Share I x $\frac{i_s}{i_t}$ = 0.401 x T x $\frac{i_s}{i_t}$

The factor S_s defined as Swaziland's share of the Total Cost expressed as a proport the cost of Maguga Dam is derived as follows:

$$S_s = \frac{T}{T_M} \times (0.06589 + 0.401 \times \frac{i_s}{i_t})$$

Under this formula Swaziland's share of the Capital Cost is equivalent to S_s times t of sub-phase 1B.

2.2 SOUTH AFRICA

South Africa's share of the costs will be the sum of the Basic Cost Share and Incre Cost Share as expressed below:

Basic Cost Share B x 0.89= 0.599 x T x 0.89
= 0.53311 x T

Incremental Cost Share I x $\frac{i_k}{i_t}$ = 0.401 x T x $\frac{i_k}{i_t}$

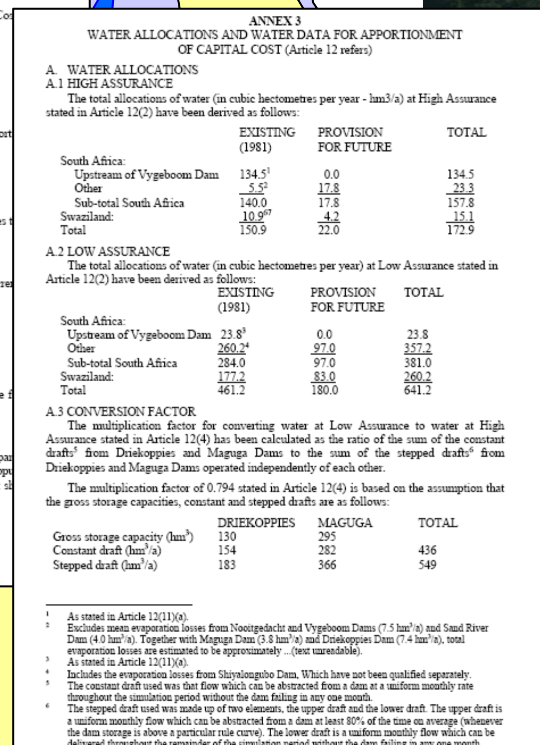
Under this formula South Africa's share of the Capital Cost is equivalent to the f of sub-phase 1A of the Project plus (1-S_s) times the cost of sub-phase 1B.

2.3 ANCILLARY WORKS

In the event that any gauging weir or other measuring device is constructed as par Project in terms of Article 4(1)(c) but which is not or has not been included as an appu ancillary work in either sub-phase 1A or sub-phase 1B, the respective Capital Cost sh the Parties shall be as follows:

Swaziland (0.06589 + 0.401 x $\frac{i_s}{i_t}$)

South Africa (0.53311 + 0.401 x $\frac{i_k}{i_t}$)



ANNEX 3
WATER ALLOCATIONS AND WATER DATA FOR APPORTIONMENT
OF CAPITAL COST (Article 12 refers)

A. WATER ALLOCATIONS

A.1 HIGH ASSURANCE

The total allocations of water (in cubic hectometres per year - hm3/a) at High Assurance stated in Article 12(2) have been derived as follows:

	EXISTING (1981)	PROVISION FOR FUTURE	TOTAL
South Africa:			
Upstream of Vygeboom Dam	134.5[1]	0.0	134.5
Other	5.5[2]	17.8	23.3
Sub-total South Africa	140.0	17.8	157.8
Swaziland:	10.9[67]	4.2	15.1
Total	150.9	22.0	172.9

A.2 LOW ASSURANCE

The total allocations of water (in cubic hectometres per year) at Low Assurance stated in Article 12(2) have been derived as follows:

	EXISTING (1981)	PROVISION FOR FUTURE	TOTAL
South Africa:			
Upstream of Vygeboom Dam	23.8[3]	0.0	23.8
Other	260.2[4]	97.0	357.2
Sub-total South Africa	284.0	97.0	381.0
Swaziland:	177.2	83.0	260.2
Total	461.2	180.0	641.2

A.3 CONVERSION FACTOR

The multiplication factor for converting water at Low Assurance to water at High Assurance stated in Article 12(4) has been calculated as the ratio of the sum of the constant drafts[5] from Driekoppies and Maguga Dams to the sum of the stepped drafts[6] from Driekoppies and Maguga Dams operated independently of each other.

The multiplication factor of 0.794 stated in Article 12(4) is based on the assumption that the gross storage capacities, constant and stepped drafts are as follows:

	DRIEKOPPIES	MAGUGA	TOTAL
Gross storage capacity (hm^3)	130	295	
Constant draft (hm^3/a)	154	282	436
Stepped draft (hm^3/a)	183	366	549

1 As stated in Article 12(11)(a).
2 Excludes mean evaporation losses from Nooitgedacht and Vygeboom Dams (7.5 hm^3/a) and Sand River Dam (4.0 hm^3/a). Together with Maguga Dam (3.8 hm^3/a) and Driekoppies Dam (7.4 hm^3/a), total evaporation losses are estimated to be approximately ...(text unreadable).
3 As stated in Article 12(11)(a).
4 Includes the evaporation losses from Shiyalongubo Dam, Which have not been qualified separately.
5 The constant draft used was that flow which can be abstracted from a dam at a uniform monthly rate throughout the simulation period without the dam failing in any one month.
6 The stepped draft used was made up of two elements, the upper draft and the lower draft. The upper draft is a uniform monthly flow which can be abstracted from a dam at least 80% of the time on average (whenever the dam storage is above a particular rule curve). The lower draft is a uniform monthly flow which can be delivered throughout the remainder of the simulation period without the dam failing in any one month.

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consensus over
titlements
s ***all*** **costs** and
s ***entire*** basin
ve **institutions**
to re-distribute the benefits fairly

Everything a water manager always wanted to know…

Conclusion

Conventional and innovative water management "products" are data intensive

They require (among others):

1) understanding the hydrological processes, and the impacts of interventions on the water system;

2) monitoring water availability and water demand in space and time;

3) evaporation (being the only real loss to the (local) water system) emerges as a key parameter.

So..

There is an increased need for water managers to keep track of the water balance..

photo: Chris Keevy, 10 February 2009

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