THE VALUE OF GROUNDWATER AS AN ECONOMIC RESOURCE IN RURAL LIMPOPO

- **BK Mahumani.** Stellenbosch University, Agricultural Economics Department. Private Bag X1, 7602, South Africa.

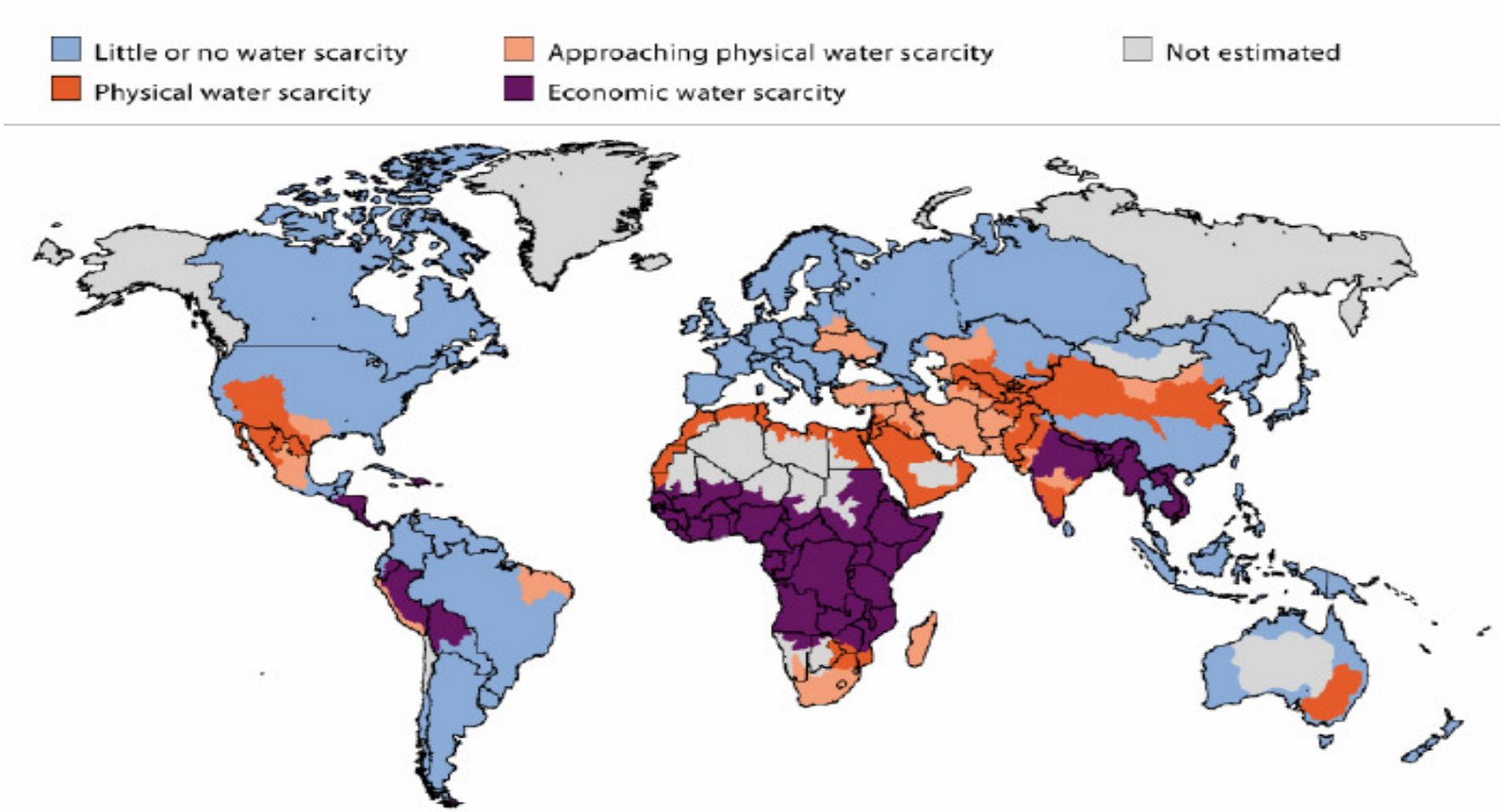
- **JP Lombard.** Stellenbosch University, Agricultural Economics Department. Private Bag X1, 7602, South Africa.

- **M de Wit.** Stellenbosch University, Faculty of Economic and Management Sciences, School of Public Management and Planning. Private Bag X1, 7602, South Africa.

The problem of water scarcity (1)

- Factors of water scarcity include:
  - Imbalances between availability and demand
  - Degradation of GW and SW quality
  - Intersectoral competition, interregional and international conflicts
- Scarcity rooted in water shortage and worst in:
  - Arid and semiarid regions affected by droughts and wide climate variability combined
  - Countries with high population growth and
  - economic development (like South Africa)
- Figure shows global distribution of water scarcity in year 2000
- One-third of the world's population live in basins that have to deal with water scarcity

Areas of physical and economic water scarcity



Source: International Water Management Institute (2000)

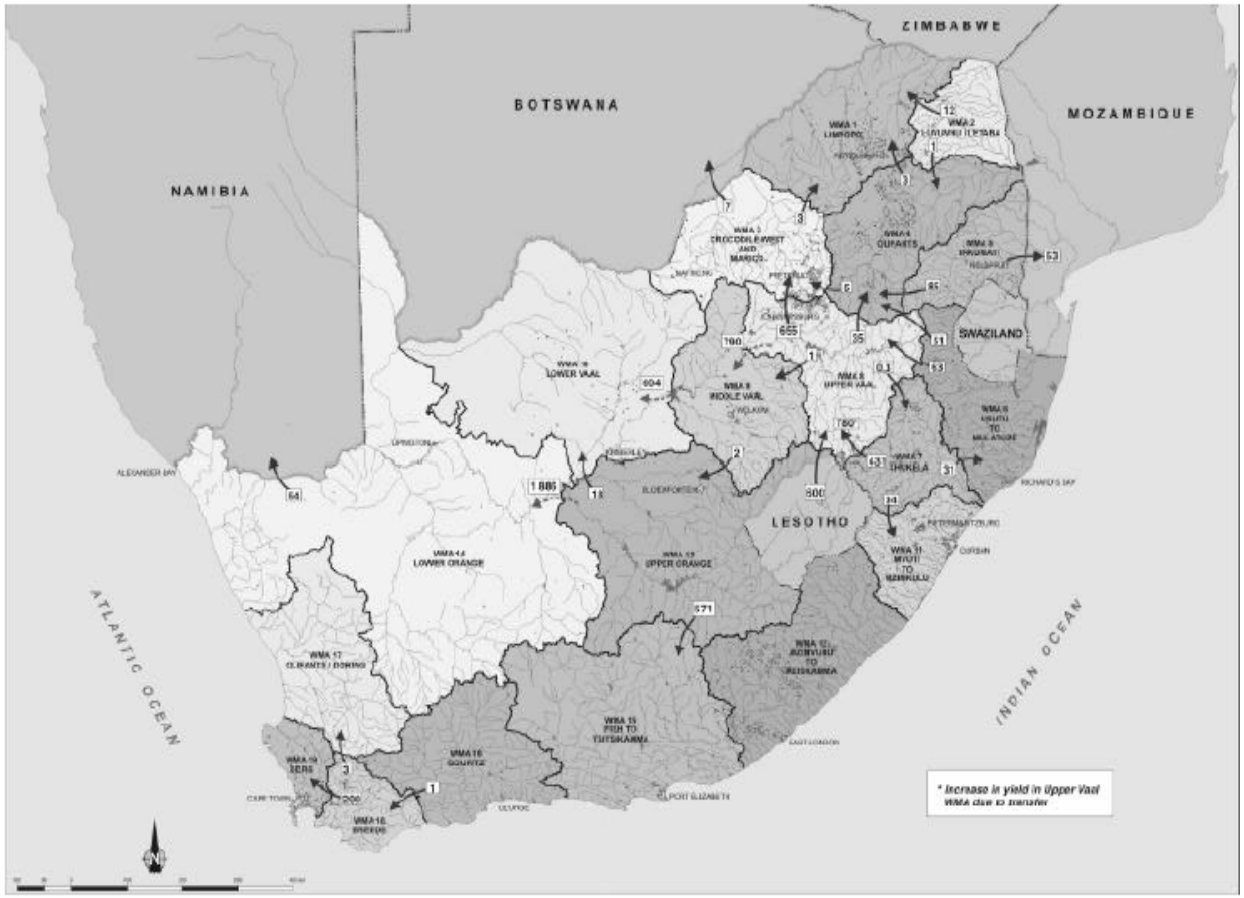
The problem of water scarcity (2)

- Little or no water scarcity: Abundant water resources relative to use, with less than 25% of water from rivers withdrawn for human purposes
- Economic water scarcity: Water resources are abundant relative to water use, with less than 25% of water withdrawn for human purposes, but malnutrition exists
- Approaching physical water scarcity: More than 60% of river flows are withdrawn. These basins will experience physical water scarcity in the near future
- Physical water scarcity: More than 75% of river flows are withdrawn for agriculture, industry, and domestic purposes.

Justification for research

- WMA surface water (SW) fully allocated, GW best for rurals far from SW
- Sub-Saharan Africa rurals: 30% &17% in need of water supply and sanitation resp.
- Insufficiency in water service problem in Limpopo
- GW a socio-economic benefit only if utilized responsibly
- 2 misconceptions “free” or impossible to value causing 2 misallocations:
  - It is not efficiently allocated
  - Authorities devote inadequate attention and funding to protect GW

Study context (1)



Source: DWAF (2004e)

Study context (2)

- WMA1 is the northern most WMA in the country
- The region is semi-arid, economic activity mainly centres on livestock farming and irrigation, together with increasing mining operations.
- Approximately 760 rural communities are scattered in WMA1
- 7 sub-catchments are the Matlabas, Mokolo, Lephala, Mogalakwena, Sand, Nzhelele and Nwanedzi regions
- WMA2 adjacent to and shares watercourses with Zimbabwe and Mozambique, Limpopo River demarcates its northern boundary.
- The Kruger National Park lies along the eastern boundary, and occupies approximately 35% of WMA2
- WMA2 consists of sub-catchments, Luvuvhu/Mutale, Shingwedzi, Groot Letaba, Klein Letaba, and Lower Letaba regions

Study context (3)

- The Limpopo Province's Groundwater Level Monitoring Network is a programme being conducted by DWAF
- Network consists of 190 stations measured at regular intervals
  - Measure areas of noticeable rise, or fall in GW levels amongst others
- According to DWAF GW quantity and quality is suitable for abstraction in Limpopo
- Existing GW dependence: WMA1: rural area between Dendron and Gilead and in WMA2 there was the rural area between Mooketsi and Elim.
- GW mgt. needed to maintain and/or improve GW in the wake of increasing demand pressures

Study context (4)

Total households served					
Service level	**No infrastructure**	**Below RDP**	**At RDP**	**Above RDP**	**Total**
Total	65 141	185 453	337 664	671 486	1 259 743
Served	1 906	183 829	262 684	569 656	1 018 076
%	**2.93%**	**99.12%**	**77.79%**	**84.84%**	**80.82%**

Source: DWAF (2008a)

Study context (5)

- DWAF Free Basic Water (FBW) website (November 2008)
- In some cases only a minimal charge was paid for R&M
- GW supply was chronically short in most villages
- Rationing system of water delivery was the norm.
- Informal local water market thrived in some villages, that desperate water seekers would rely on GW
- 70% of sampled households pay for water at exorbitant rates because of the informal water market (on average R40.00 per kl of groundwater), while only 30% were getting water for free.

Groundwater valuation

- Effective GW mgt. is contingent upon sound valuation of GW resources
- Mainstream economists treat values as extrinsic
- Propose to measure impacts in terms of satisfaction of human preferences
- To transform welfare into a single metric they use money
- Welfare change is measured as the maximum WTP for the improvement
- Established market prices are weak in capturing such hidden values
- GW mgt. should bal. economic efficiency and social equity
- Need for techniques to measure ‘unpriced scarcity’

The research methods

- Systematic random sampling
- CVM det. WTP for improved WSS
- Open ended questions used in CVM
- WTP reps. utility value (value in use) of GW
- In WMA1 4 villages Gaphago, Leokaneng, Kanana and Mohlajeng
- In WMA2 3 villages Sereni and Hamashamba
- Following Thomas and Syme (1988), an interview survey and a statistical analysis of the results of the survey was undertaken for this study.

Contextual results (1)

- 55% of HHs were female headed. Women constitute the majority of the unemployed and were more involved in gardening
- Education linked with:
  - Being GW abuse aware
  - Valuing GW services like dish washing and laundry
- Higher income HHs:
  - Valued water for car washing more than the poor
  - Consumed more water per capita per month and
  - They prioritised preservation of groundwater less than the poorer HHs
- Water stressed villages:
  - Appreciated GW services more than the better endowed with GW resources
  - Travelled greater distances on average to access water and
  - Paid for their water, while those that got water nearer generally enjoyed free water

Contextual results (2)

- Borehole owners:
  - Travelled shorter distances to get water than non-borehole owners
  - Borehole ownership was found to guarantee water availability
  - Owners generally did not buy water, except in instances of borehole breakdowns
  - Consumed more water per capita per month than non-borehole owners

Per capita water consumption by village

Village	Mean per capita monthly water consumption (litres)	Mean per capita daily water consumption (litres)
Gaphago	922.00	30.20
Loekaneng	840.00	27.50
Mohlajeng	810.00	26.60
Kanana	805.00	26.4
Mashamba	728.00	23.9
Sereni	675.00	22.10
Lemondokop	546.00	17.90
Total	**761.00**	**25.00**

Importance and priority of groundwater uses

Groundwater use	Importance mean weight	Weight description	Rank
Drinking	9.99	Extremely important	1
Cooking	9.99	Extremely important	1
Bathing	9.50	Extremely important	3
Dish washing	8.50	Quite important	4
Hand laundry	8.40	Quite important	5
Washing floors	6.80	Important	6
Garden watering	2.67	Limited importance	7
Livestock watering	2.25	Limited importance	8
Outside cleaning	1.40	Very limited importance	9
Car washing	1.40	Very limited importance	10
Machine laundry	1.00	Not important at all	11
Toilet flushing	1.00	Not important at all	12
Showering	1.00	Not important at all	13

Household Willingness to Pay (WTP) for water by village

	WTP (R/kl)		
Village	**Mean**	**Std. Dev.**	**Std. Error**
Lemondokop	2.67	1.72	0.44
Mashamba	2.32	1.65	0.30
Sereni	1.84	1.47	0.38
Kanana	3.46	1.36	0.43
Mohlajeng	2.20	0.95	0.30
Loekaneng	1.84	1.47	0.38
Gaphago	1.77	1.75	0.55
Total	**2.28**	**1.57**	**0.15**

WTP and tariffs (1)

Perspective	Tariffs								
	6-20kl (incl. VAT)			20-60kl (incl. VAT)			>60kl (incl. VAT)		
	Avg R	Min R	Max R	Avg R	Min R	Max R	Avg R	Min R	Max R
	3.51	1.55	6.16	3.93	1.61	6.93	5.24	3.00	8.97

Source: DWAF (2007)

WTP and tariffs (2)

- The DWAF survey of Limpopo recorded a minimum tariff of R1.55/kl to a maximum of R6.16/kl for the first tariff block (after free basic water).
- The average WTP value of groundwater was R2.28/kl, which falls within the range of Limpopo tariffs for the first tariff block.

Conlusion and recommendations

- Value and charges (tariffs) are two different things
  - The value of GW in alternative uses is important for the rational allocation
  - Charging for GW is applying an economic instrument to affect behaviour towards conservation and efficient groundwater usage
- HH generally consumed groundwater at the RDP level
- Utility value of domestic groundwater in rural areas is quite comparable to the utility value in urban areas.
- At present rural households are not enjoying satisfactory groundwater service delivery and yet are paying tariffs at times that are extremely exorbitant by DWAF standards.
- WTP signal that rural households allows cost recovery for the supply authority in just as much the same way as urban households' signal would, and as such, nothing stands in the way of providing improved service delivery to rural households in Limpopo

Conlusion and recommendations (2)

- When water scarce, 1st to suffer are poor in rural areas, informal settlements and slums
- Unconnected, pay high prices for trucked water, insufficient quantities and quality
- GW crucial for both production and domestic uses in rural HH
- Rural poverty quite high, therefore water management should be identified and placed in the context of rural development strategies and not only in the direction of “the economic good” concept.

THANK YOU!

God bless!