



Water in Africa: Hydro-Pessimism or Hydro-Optimism?

Água em África: Hidro-pessimismo ou Hidro-optimismo

Centro de Estudos Africanos da Universidade do Porto
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UNIVERSIDADE EDUARDO MONDLANE
FACULDADE DE ENGENHARIA
DEPARTAMENTO DE ENGENHARIA CIVIL

Computation of water share and reliability of water supply for key users in transboundary Umbeluzi river

Dinis Juízo

2nd October 2008
Transboundary Water Politics
Room 1



ORGANIZATION OF THE PRESENTATION

- 1 – RESEARCH OBJECTIVES
- 2 – OVERVIEW OF WATER RESOURCES IN AFRICA AND SADC REGION
- 3 – SHARING THE UMBELUZI WATER RESOURCES
- 4 – WATER ALLOCATION TOOLS
- 5 – MAIN RESULTS AND DISCUSSION
- 6 – CONCLUSIONS AND OUTLOOK



1 – RESEARCH CONTEXT AND OBJECTIVES

TRANSBOUNDARY WATER RESOURCES MANAGEMENT

- ❑ GWP-TAC, 2000: SUSTAINABLE DEVELOPMENT AND CROSS SECTORAL PLANNING
- ❑ IN TRANSBOUNDARY SYSTEMS SOVEREIGNTY ISSUES INCREASE THE COMPLEXITY OF ANALYSIS AND DECISION MAKING.
- ❑ IN WATER SCARCE REGIONS, TO ALLEVIATE TENSION OVER UTILIZATION OF LIMITED RESOURCES IT IS NECESSARY TO HAVE AGREEMENTS.
- ❑ THESE AGREEMENTS NEED TOOLS AND METHODS THAT ARE AGREEABLE TO ALL.



1 – RESEARCH CONTEXT AND OBJECTIVES

OBJECTIVES

- ❑ ASSESS THE REQUIREMENTS FOR IMPLEMENTATION OF IWRM IN TRANSBOUNDARIES SYSTEMS LIKE UMBELUZI:
WHAT DO WE LEARN FROM WATER ALLOCATION MODELS.



4 – MAIN FEATURES OF THE REGION

- THERE ARE 263 KNOWN TRBs WORLDWIDE 63 IN AFRICA.
- COVERING 2/3 OF LAND AREA.
- 75% OF POPULATION.
- 93% OF TOTAL SURFACE WATER.
- HENCE THE NEED FOR FAIR AND EQUITABLE SHARING.
- MOREOVER, THERE ARE LARGE GAPS IN KNOWLEDGE.

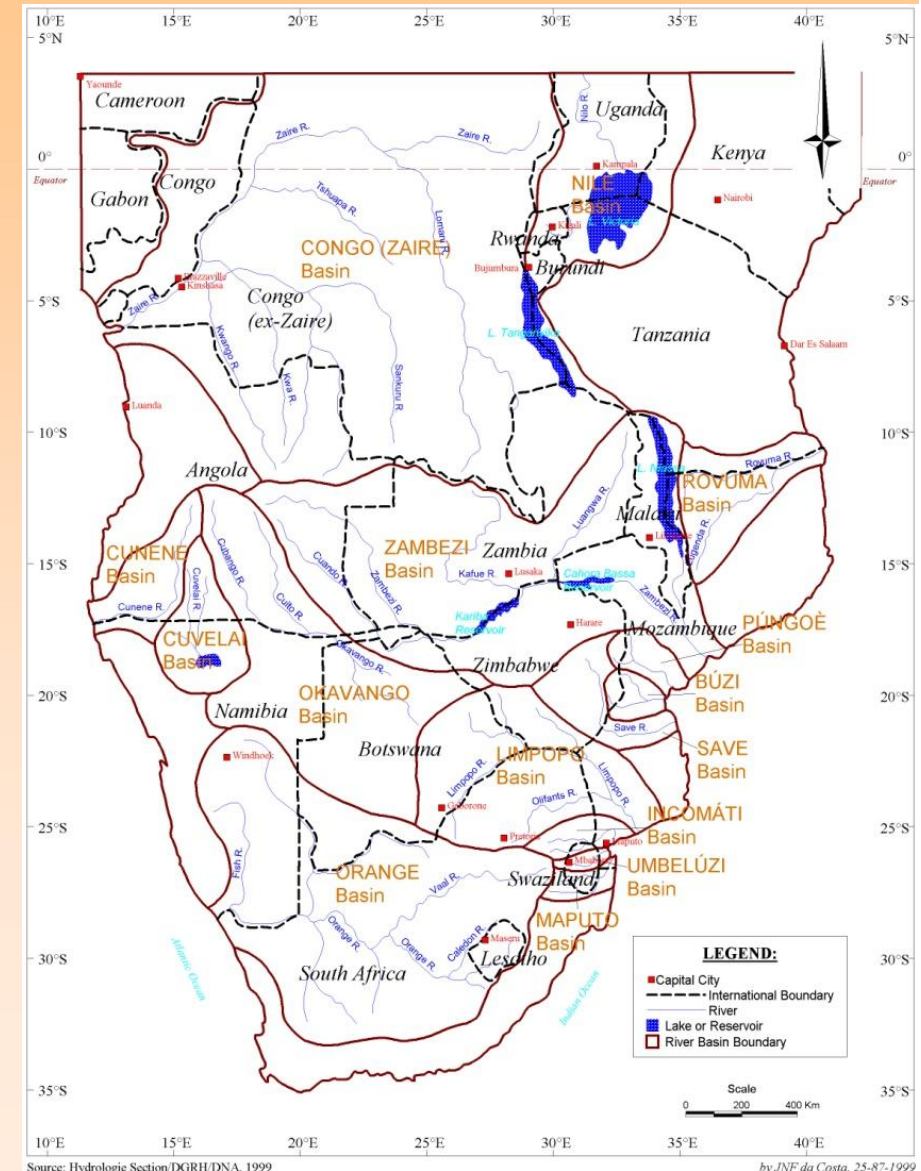




4 – MAIN FEATURES OF THE REGION

- ❖ THE SOUTHERN AFRICA DEVELOPMENT COMMUNITY (SADC) COMPRISES 14 STATES (INCLUDING MADAGASCAR AND MAURITIUS)
- ❖ With 15 INTERNATIONAL RIVER BASINS
- ❖ MORE THAN 70% OF LAND AREA FALL WITHIN A DESIGNATED IRB TERRITORY

Dr. Dinis Juízo e-mail: juizo@uem.mz





4 – MAIN FEATURES OF THE REGION

SMALL DOTS
SADC RIVERS

LARGE DOTS
SELECTED
COUNTRIES

GOOD
RESERVOIR
MANAGING
AND USE OF
DIRECT
RAINFALL IS
CRUCIAL

Mean annual runoff (mm)

• UMBELUZI

Mean annual precipitation (mm)



4 – MAIN FEATURES OF THE REGION

COMPARISON OF WATER SCARCITY SITUATION WITHOUT TAKING INTO ACCOUNT THE IMPORTANT ROLE OF RAINFALL.

Water Barrier Scale projection for selected SADC countries compared with Israel and Jordan, 1950-2025. (Flow unit = one million m³ of water per year)

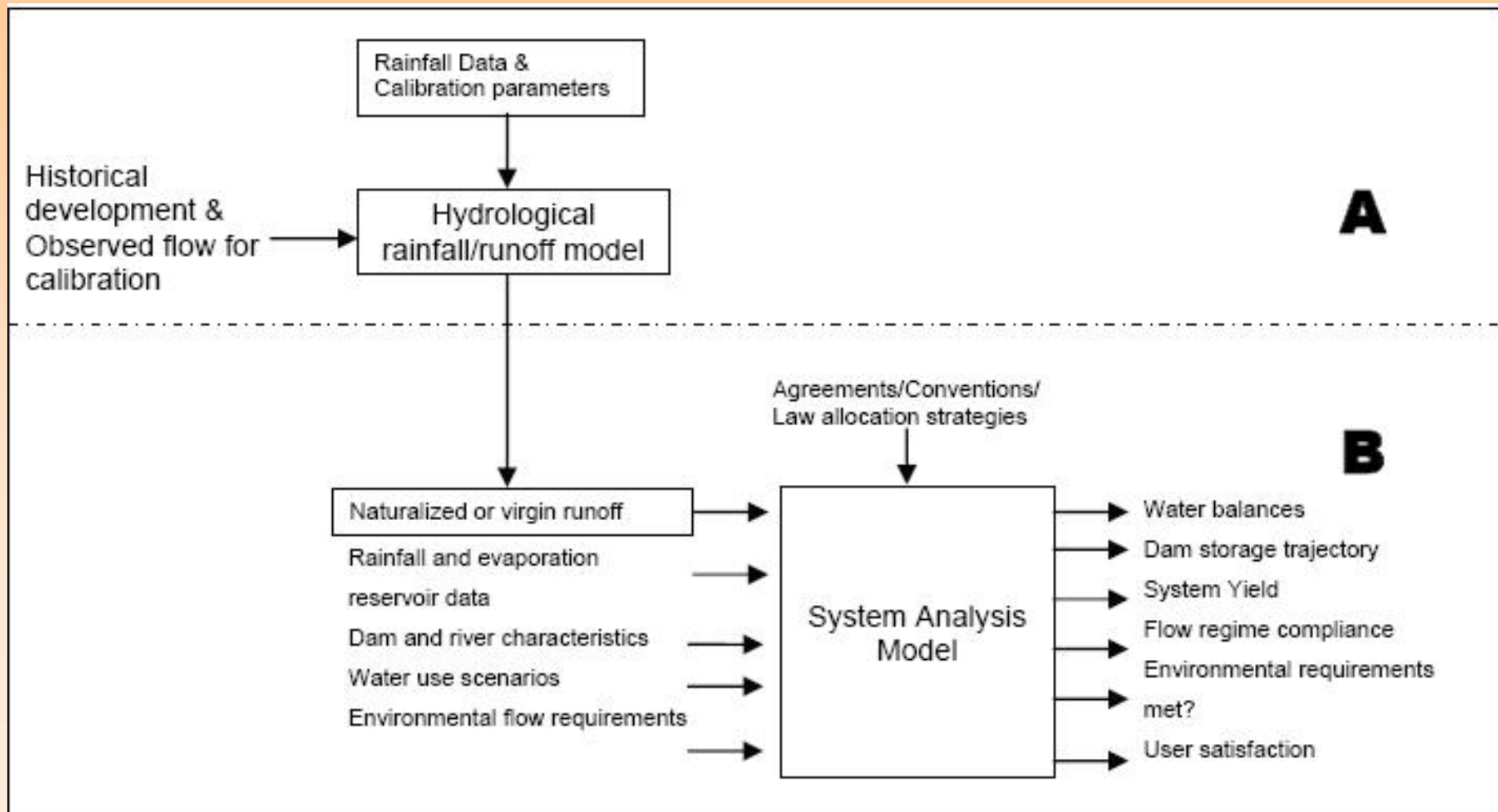
	Well Watered <100 persons per 'flow unit'	Mid-European 100-600 persons per 'flow unit'	Water Stressed 600- 1000 persons per 'flow unit'	Chronic Scarcity 1000-2000 persons per 'flow unit'	Beyond Water Barrier >2000 persons per flow unit
1950	Zimbabwe South Africa Mozambique Swaziland			Israel Jordan	
1960	Zimbabwe South Africa Mozambique Swaziland			Israel	Jordan
1970	Mozambique	Zimbabwe South Africa Swaziland		Israel	Jordan
1982	Mozambique	Zimbabwe South Africa Swaziland			Jordan Israel
2000	Mozambique	Zimbabwe Swaziland	South Africa		Jordan Israel
2025		Mozambique Swaziland	Zimbabwe	South Africa	Jordan Israel

Source: Reproduced from Suki Jobson (1999) added data for Mozambique and Swaziland based on population projections obtained in UNECA, 2006 .



5 – MAIN RESULTS AND DISCUSSION

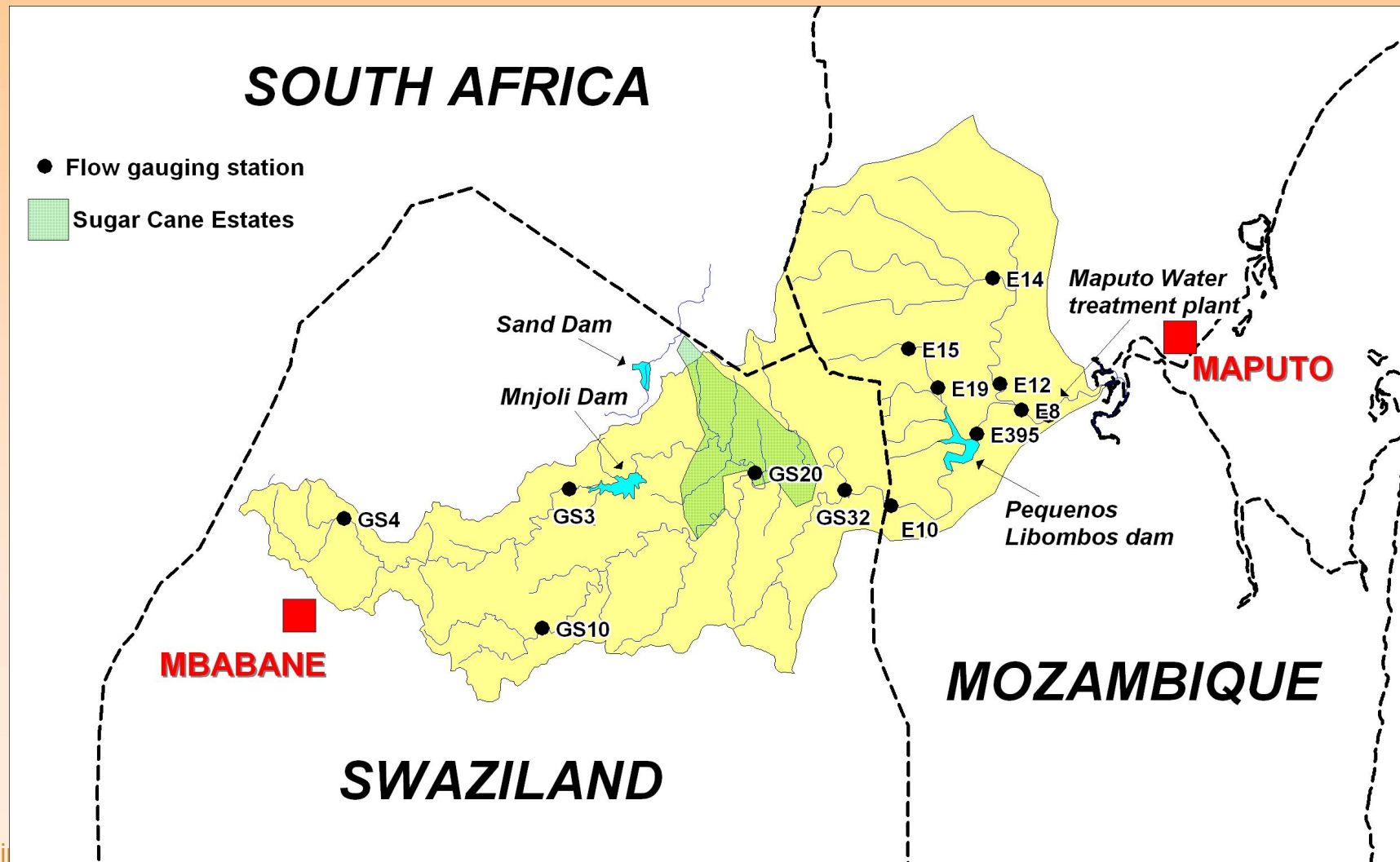
WATER ALLOCATION FOR AGREEMENTS





5 – MAIN RESULTS AND DISCUSSION

WATER ALLOCATION – APPLIED TO THE UMBELUZI RIVER





ESTIMATED WATER DEMAND FROM UMBELUZI RIVER

	SWAZILAND		MOZAMBIQUE	
	Present	2025	Present	2025
Irrigation	229	292	17	39
Urban	12	20	76	184
Other	12	21	4	29
Total	253	334	97	252

2025: Total demand of 586 million m³/year

Natural runoff estimated to 535 million m³/year



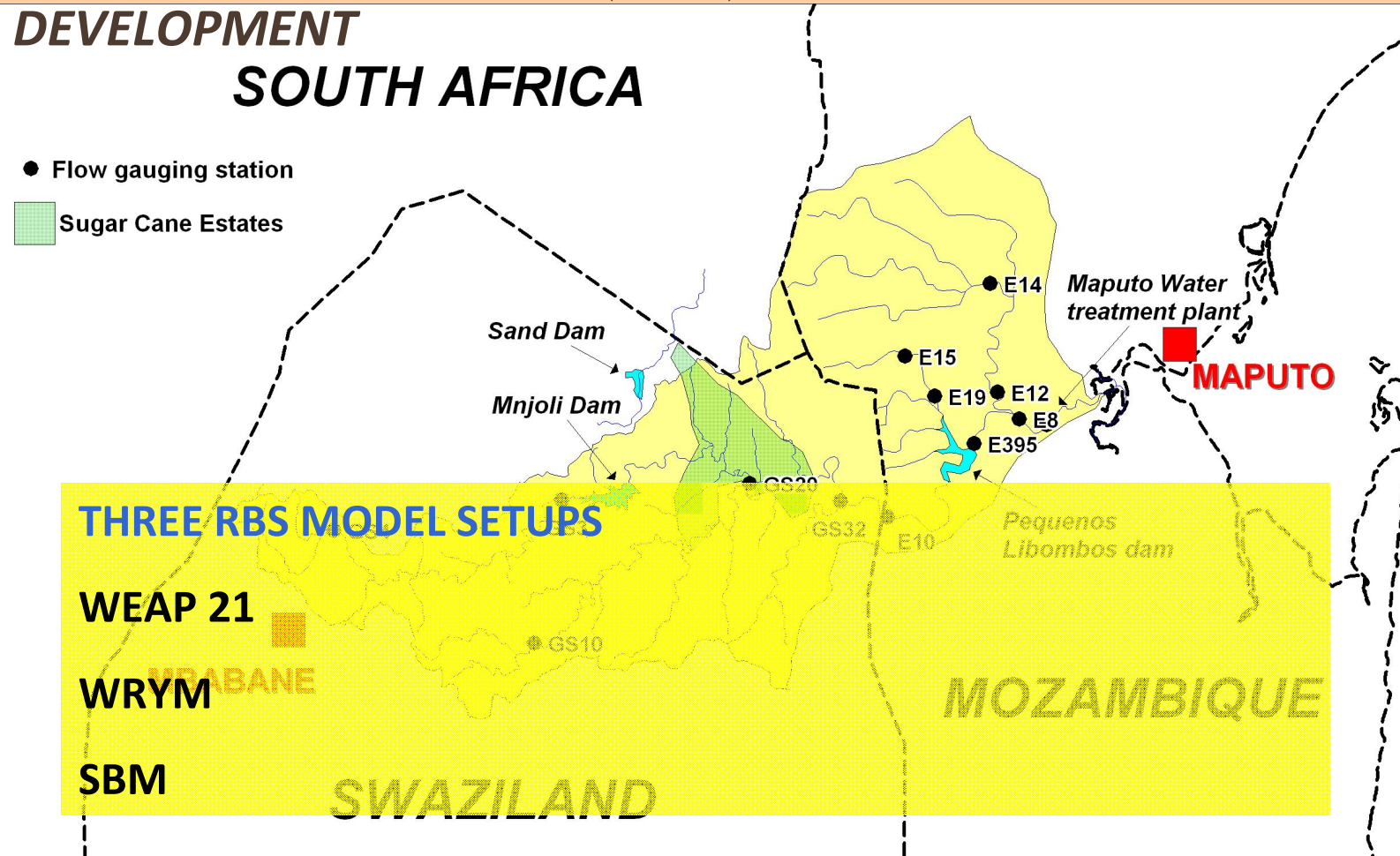


5 – MAIN RESULTS AND DISCUSSION WATER ALLOCATION

AGRICULTURE



URBAN DEVELOPMENT





5 – MAIN RESULTS AND DISCUSSION

WATER ALLOCATION

Comparison of results by the three models showing satisfaction levels (%) for selected users (Scenario IV), Channel user number corresponds to annotation used in schematic

Channel user	103	105	106	107	108	109	116	119	120	121	201	202	203	204	205	206	207
WAFLEX	100	100	100	100	100	100	89	94	100	98	67	84	60	73	66	51	76
WRYM	100	100	100	100	99	80	88	100	100	100	70	81	71	66	75	70	84
WEAP	100	87	100	100	97	90	88	100	94	99	57	76	63	55	68	62	77

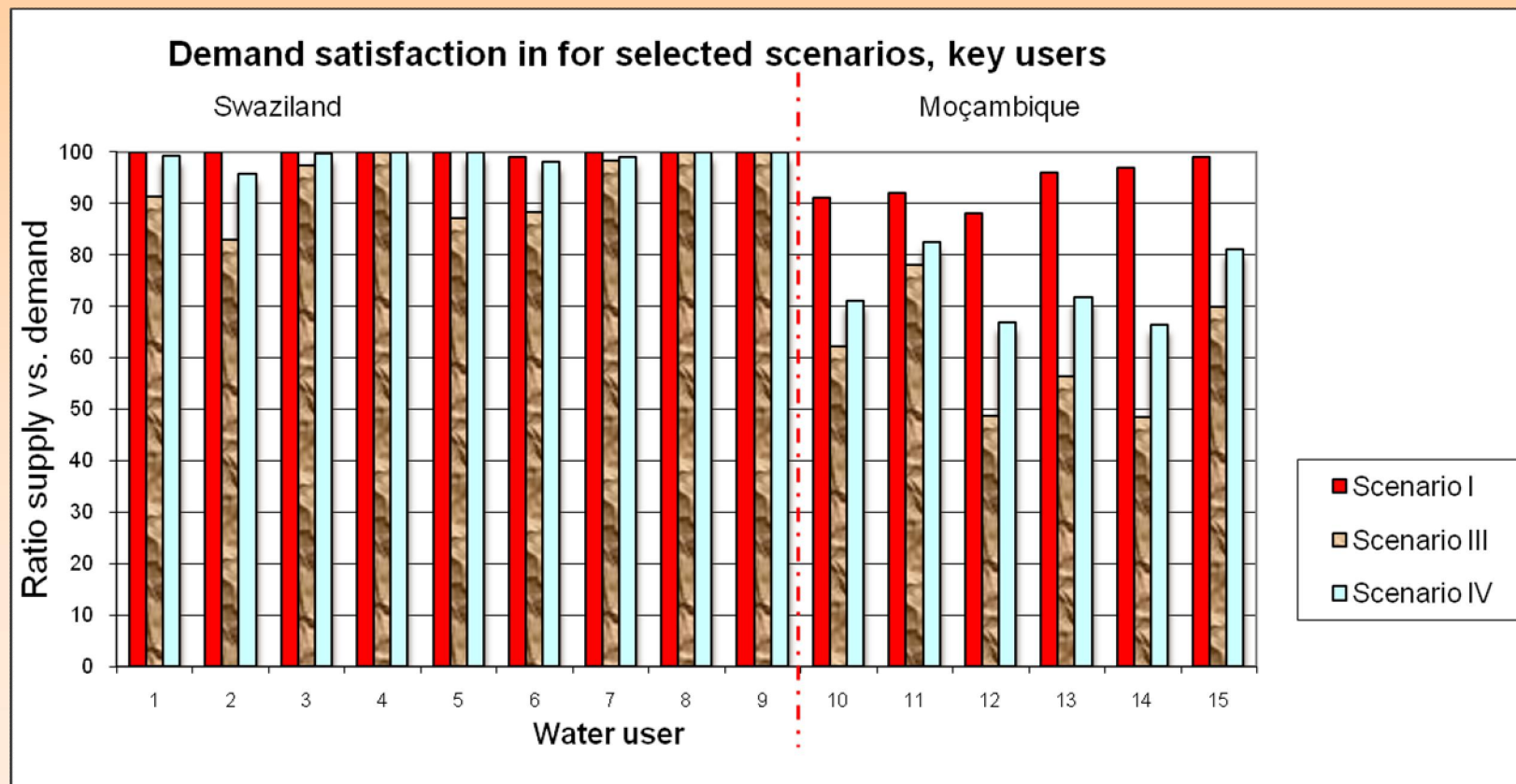
Total level of satisfaction for all users in the Umbeluzi River for different development scenarios and using different system analysis models

	WRYM	WAFLEX	WEAP21
SCENARIO 1	99	97	99
SCENARIO 3	84	79	79
SCENARIO 4	88	85	85



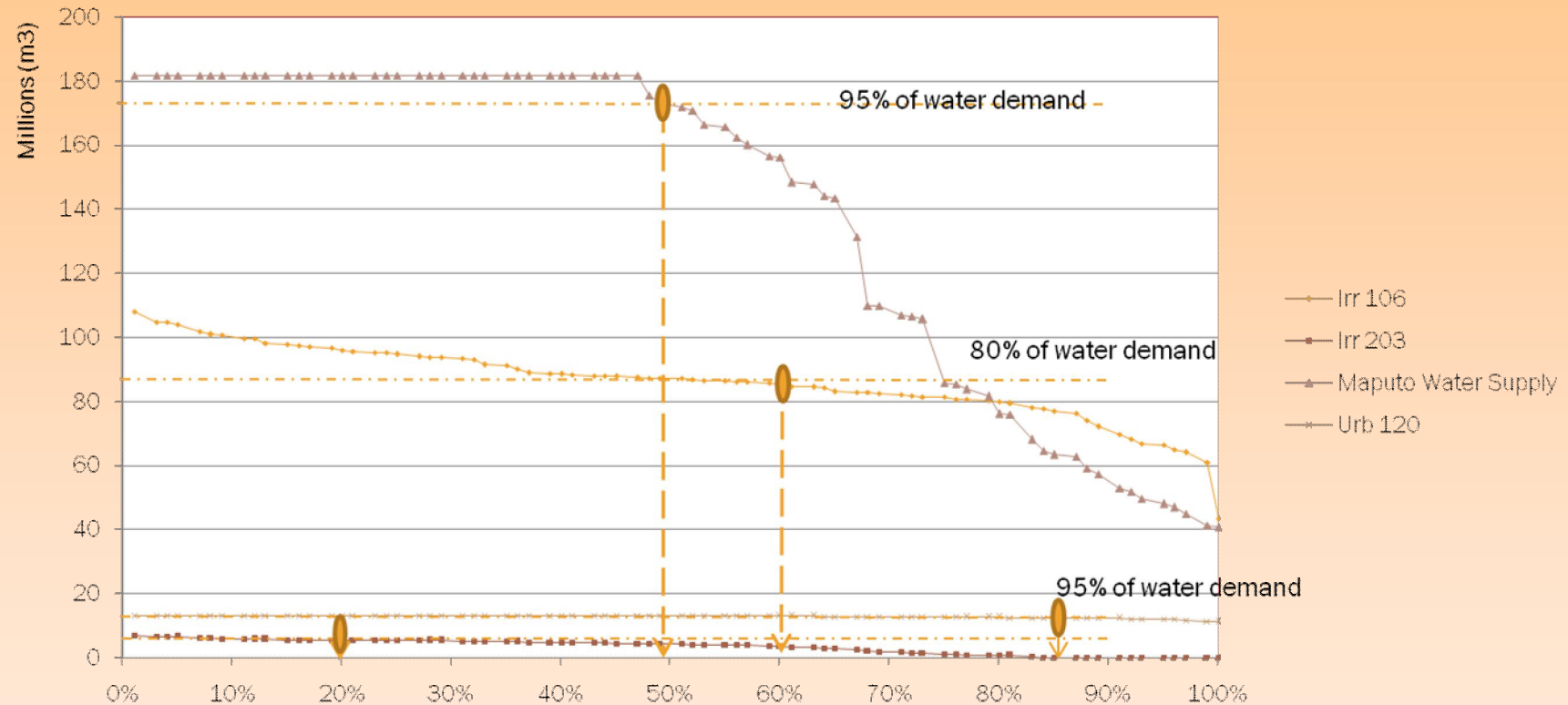
5 – MAIN RESULTS AND DISCUSSION

WATER ALLOCATION



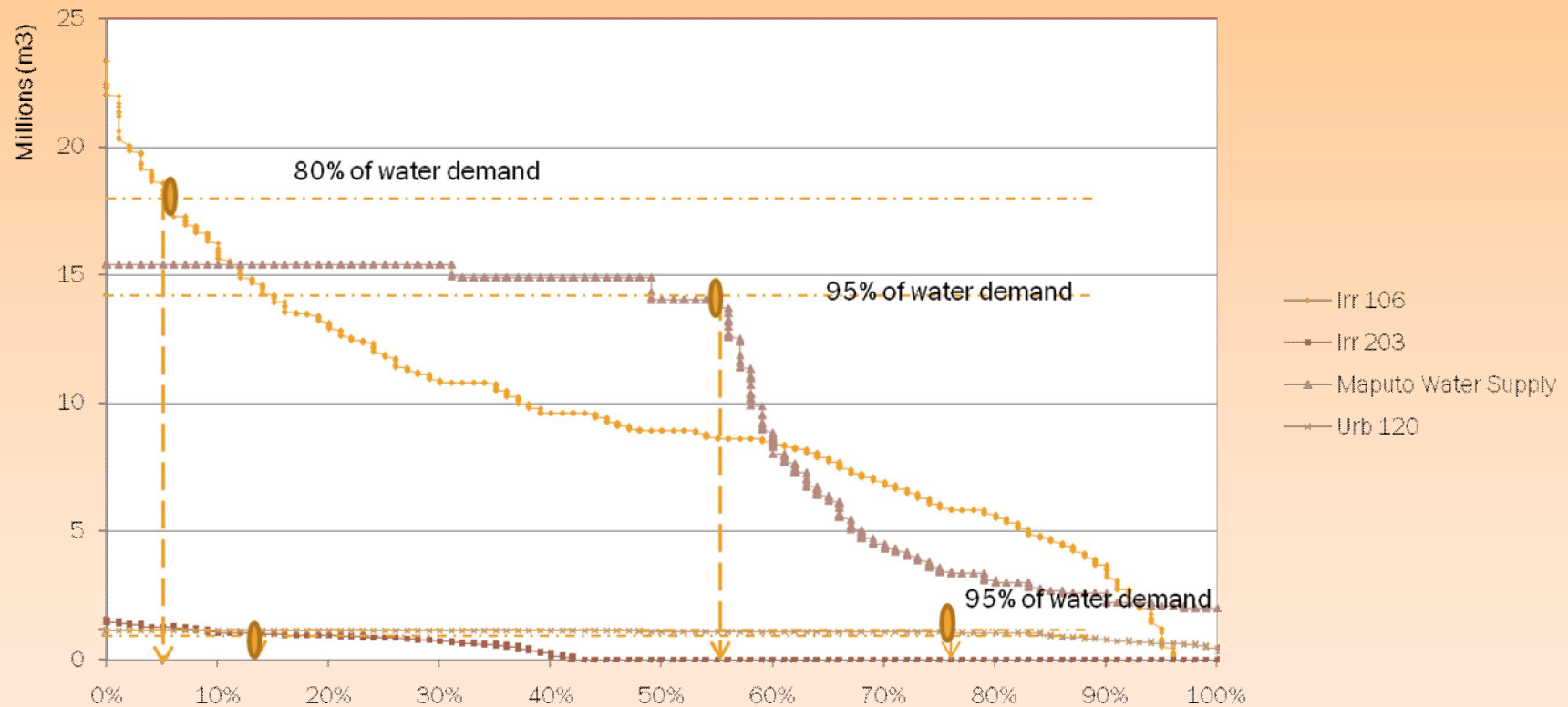


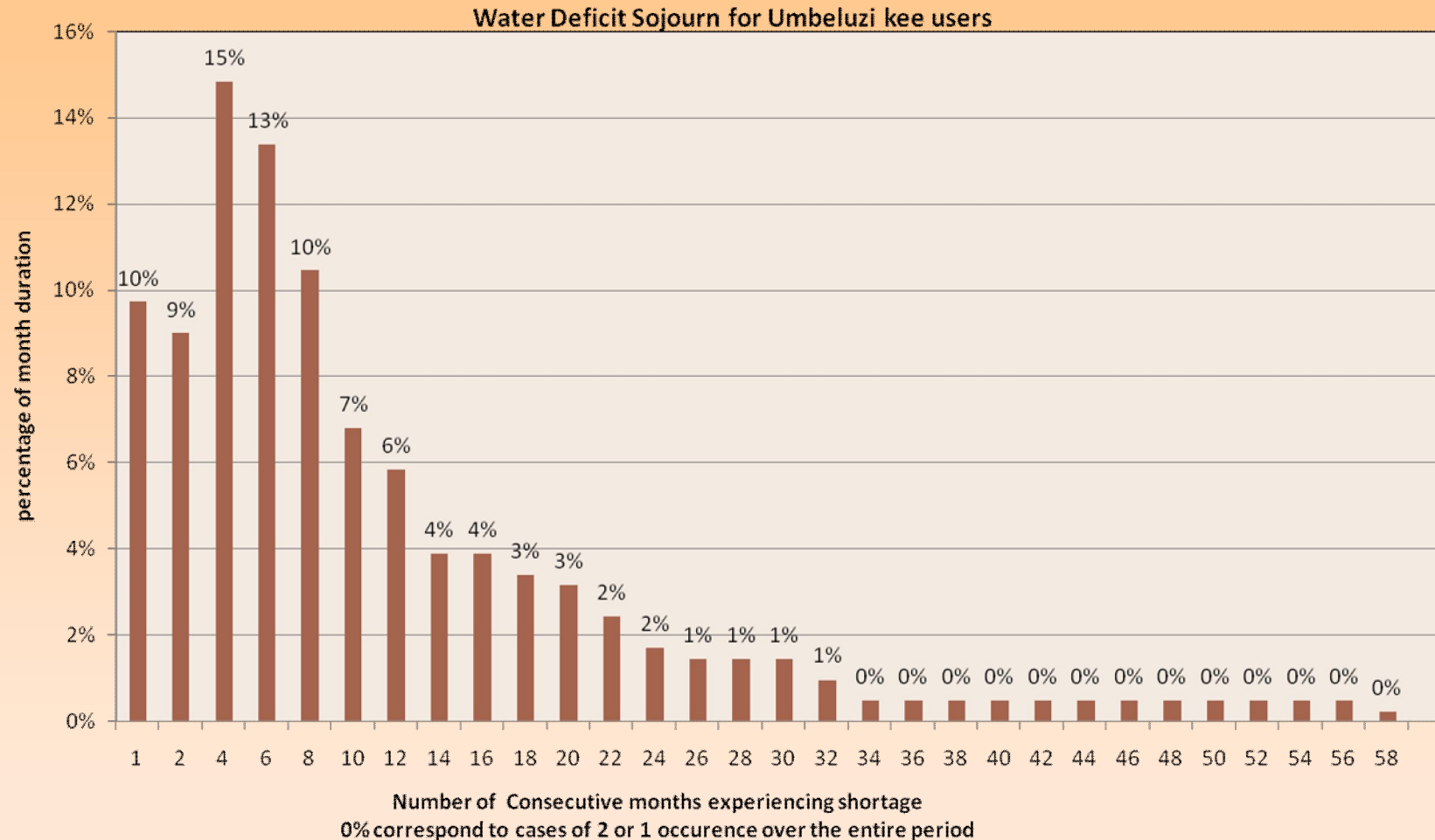
RELIABILITY OF SUPPLY – SC-iv



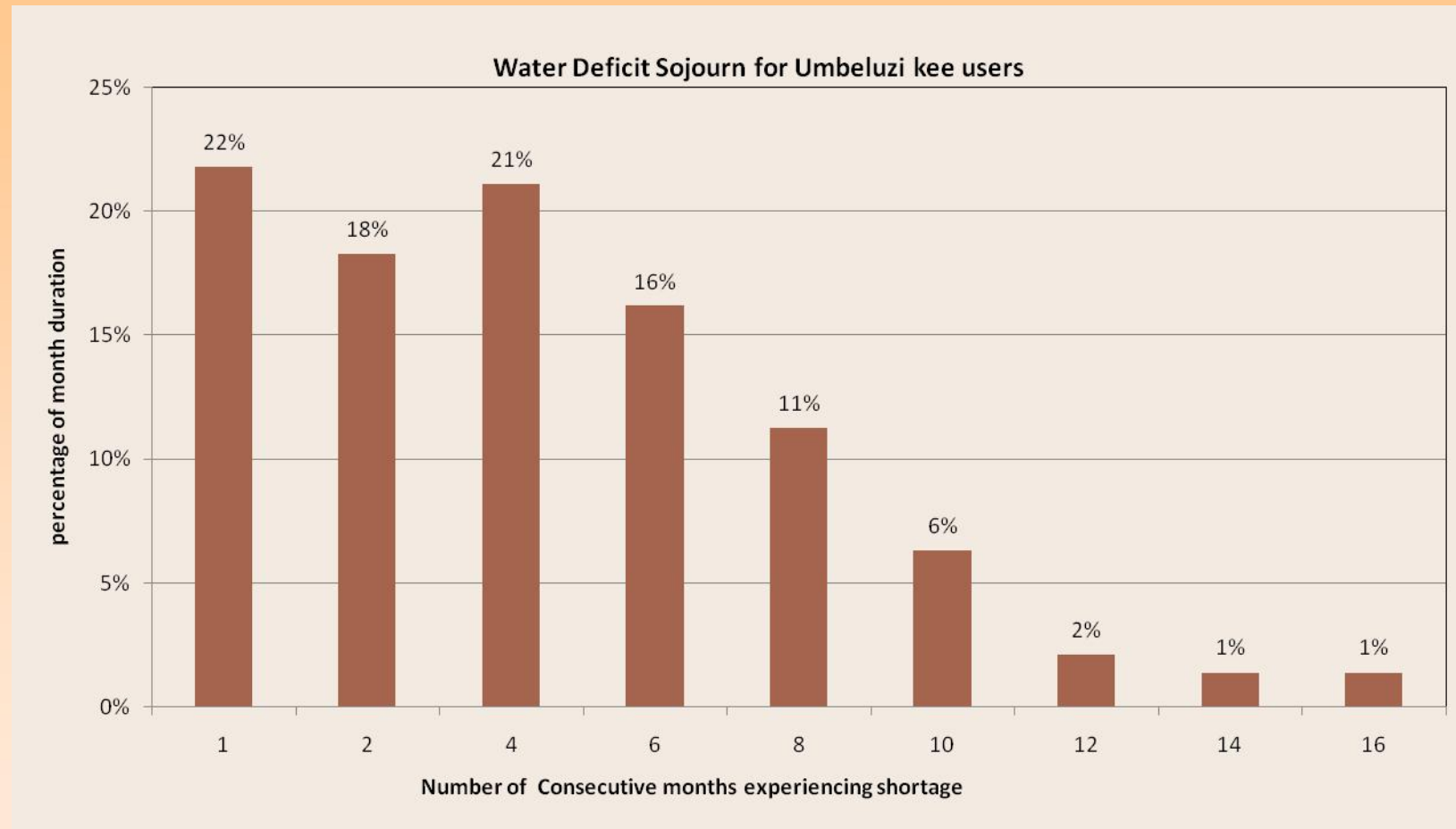


RELIABILITY OF SUPPLY – SC-III





For the 75 years of analysis MWS would experience 411 cases of water shortage with durations of between 1 to 57 consecutive months. The distribution of the frequency of each deficit sojourn is given in graph above



For the 75 years of analysis the large irrigation scheme in Swaziland would experience 141 cases of water shortage with durations of between 1 to 16 consecutive months. The frequency distribution of each deficit sojourn is given in graph above



5 – MAIN RESULTS AND DISCUSSION WATER ALLOCATION

Model trust and data issues

MODEL RESULTS ARE BOTH AFFECTED BY THE DATA QUALITY AND ABILITY AND USERS EXPERIENCE.

ISSUES REMAINS ON DATA HARMONIZATION AND THE SETUP OF HYDROLOGICAL MODELS FOR INPUT DATA.

SEVERE PENALTY IS USEFULL FOR DECISION MAKING ON SENSITIVE PROJECTS

THE ISSUE OF CROSS BORDER EQUITABLE SHARING IS NOT TACKLED.



6.1 – CONCLUSIONS

- Water sharing in regions experience drought and over-commitment of resources require intensive cooperation between stakeholders and river basin organizations.
- The average satisfaction levels often used to select the best development scenarios is not sufficient to describe the severity of drought and its length as well as its impacts in different users.
- Computing the deficit duration and the severity of shortage are additional tools that should be considered in discussing scenario development.



6.2 – OUTLOOK

- ✓ THE EMERGENCE OF WATER STRESSED COUNTRIES IN THE SADC REGION WILL EVENTUALLY TRIGGER IN LARGE SCALE WATER TRANSFER SCHEMES.
- ✓ MODELING OF INTERCONNECTED SYSTEMS WILL SOON BECOME NECESSARY AS PART OF DECISION SUPPORT IN THE REGION.
- ✓ RESEARCH IS ALSO NECESSARY IN ORDER TO INFORM THE POLICY ON ECONOMIC DEVELOPMENT TAKING THE ADVANTAGE OF THE FREE TRADE ZONE AND REGIONAL INTEGRATION.



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MUITO OBRIGADO!