

FERNANDA S. M. JESUS

DISCIPLINA: CST-310-3 POPULAÇÃO, ESPAÇO E AMBIENTE

PROFS.: DRA. SILVANA AMARAL/DR. ANTÔNIO MIGUEL VIEIRA  
MONTEIRO

# Quantifying water vulnerability: a multi-dimensional approach

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STOCHASTIC ENVIRONMENTAL RESEARCH AND RISK ASSESSMENT, VOL.  
25, NO. 4, P. 627-640, 2011

(IF 2015 = 2.629/ QUALIS CAPES - CIÊNCIAS AMBIENTAIS = A2)

# A autora

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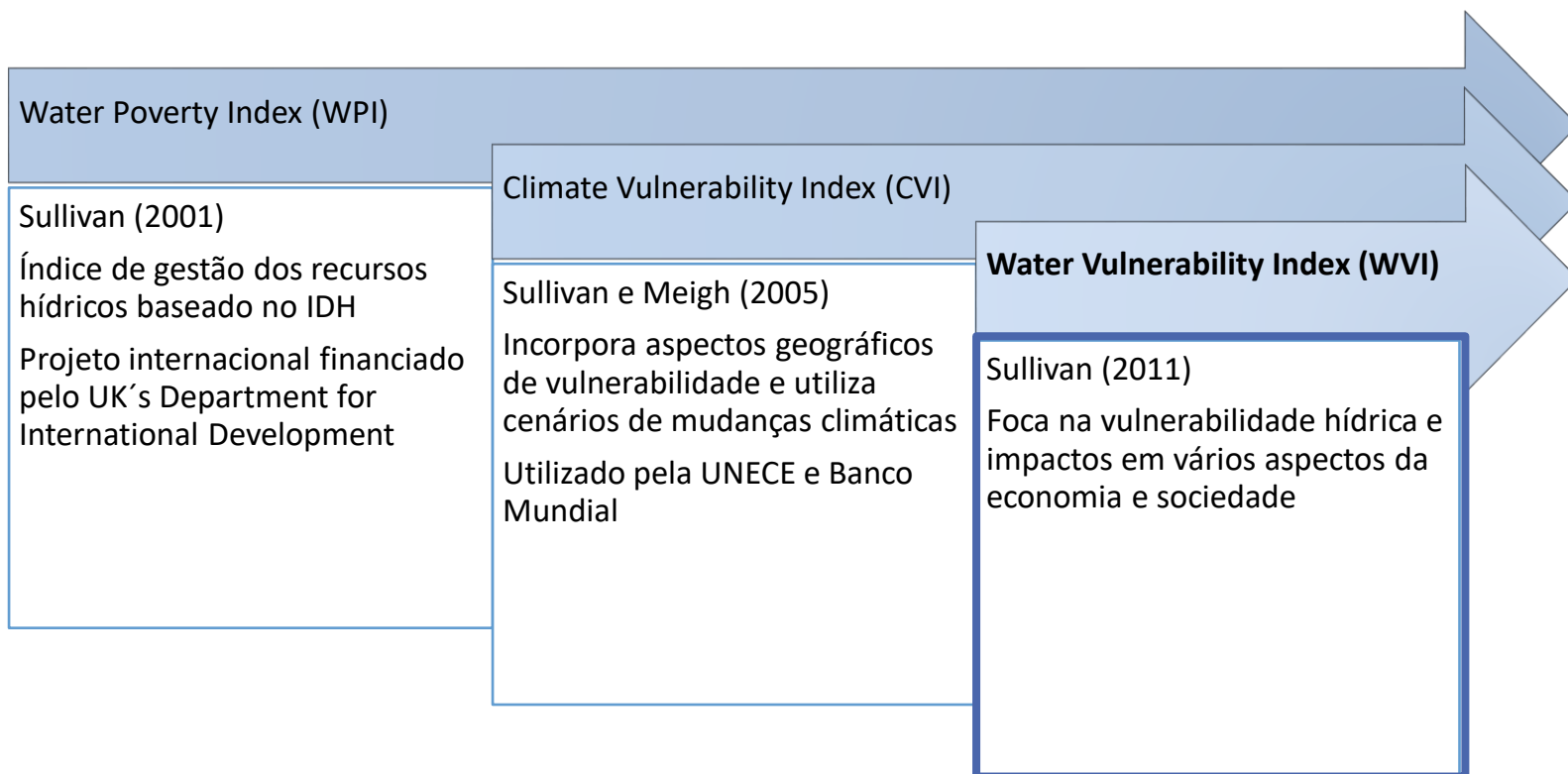
*“Climate Vulnerability Index”* desenvolvido em 2005 foi utilizado pela UNESCO nos relatórios UN World Water Development Report (2006 , 2009 and 2012)

Consultoria no desenvolvimento de índices relativos aos recursos hídricos

World Bank, African Development Bank, Ausaid, World Vision Australia, UK Department for International Development, United Nations Food and Agricultural Organisation

# Contextualização

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# Resumo

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- ✓ Vulnerabilidade de abastecimento de água
- ✓ Bacia hidrográfica do Rio Orange no sul da Africa
- ✓ Pressão da superpopulação e agrícola, escoamento agroquímicos e industriais + Condições meteorológicas severas -> erosão e degradação do solo
- ✓ Mudanças climáticas: ameaças intensificadas com aumento da temperatura
- ✓ Metodologia: elaboração de índice para avaliação da vulnerabilidade hídrica considerando vulnerabilidade devido abastecimento (*supply-driven vulnerability*) e demanda (*demand-driven vulnerability*)

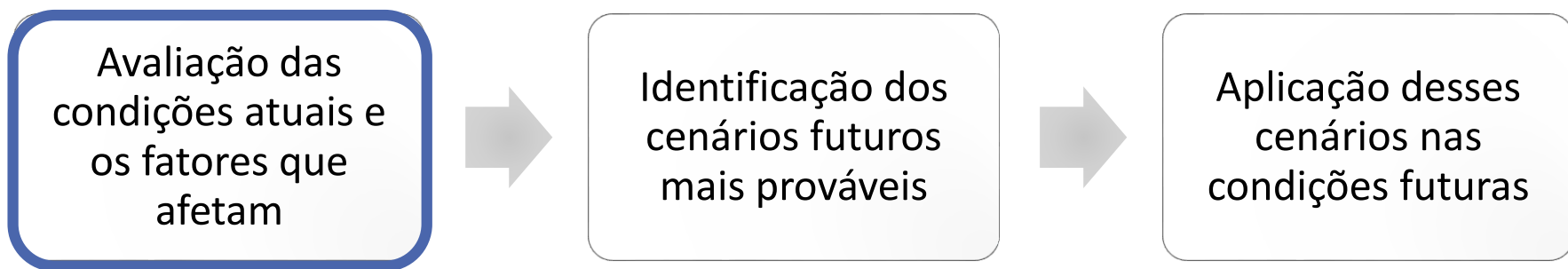
# Introdução

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- ✓ Mudanças climáticas: incremento ou redução da precipitação, aumento da temperatura, eventos extremos
- ✓ Gestão: identificação de regiões que requerem mais implementação de ações para adaptação de maneira priorizar investimentos
- ✓ Setor recursos hídricos: estratégias de adaptação requerem longos prazos (ex: reservatório de água)
- ✓ Objetivos do Milênio: reduzir pela metade proporção da população sem acesso abastecimento de água potável
- ✓ Compreensão dos motivadores das mudanças, dos estados e das respostas potenciais

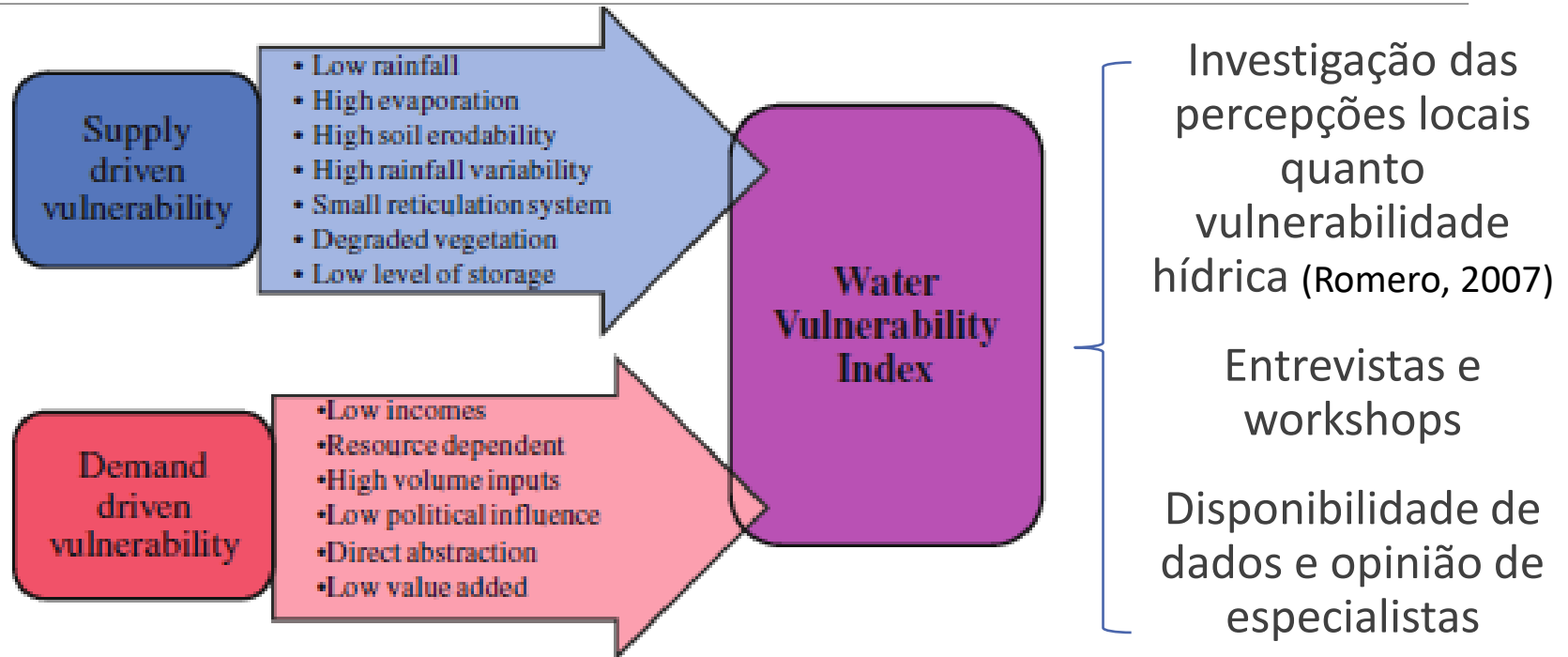
# Introdução

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Identificação do estado atual da vulnerabilidade hídrica em escala municipal em cidades do Sul da África

# Water Vulnerability Index (WVI)



**Fig. 3** Characteristics of supply-driven water vulnerability (water systems) and DDWV (water users)

# Water Vulnerability Index (WVI)

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## Water resource supply

Resource vulnerability	Mean annual run-off including upstream contributions (normalized and inverted)
	Annual groundwater exploitation potential (normalized and inverted)
Extreme event vulnerability	Number of days per annum where rainfall = 0 mm (normalized)
	Days per annum with rainfall >25 mm (normalized)
Land cover vulnerability	Percentage cover of urbanisation upstream
	Percentage cover of irrigated land
Storage vulnerability	Dam coverage (Ha per capita) (normalized and inverted)
	Coefficient of variation of mean annual precipitation

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Universidade da África do Sul (KwaZulu-Natal)

Department of Water Affairs and Forestry (DWAF)

Council for Scientific and Industrial Research (CSIR)



# Water Vulnerability Index (WVI)

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## Water resource users

Demographic vulnerability	Total population (normalized)
	Population density (persons/ha) (normalized)
Household vulnerability	Percentage of economically vulnerable households
	Percentage households using water from direct resource
Economic vulnerability	Percentage employment in water-dependant sectors (agric, manufacturing, mining)
	Percentage GVA in water-dependent sectors (agriculture, manufacturing, mining)
Bulk demand vulnerability	Total annual water demand (normalized)
	Evaporative demand (mm/annum) (normalized)

Statistics South Africa

Global Insight Southern Africa

Department of Water Affairs and Forestry (DWAF)

Universidade da África do Sul (KwaZulu-Natal)

# Water Vulnerability Index (WVI)

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suprimento                  demanda

↓                                  ↓

$$WVI = SDWV + DDWV$$

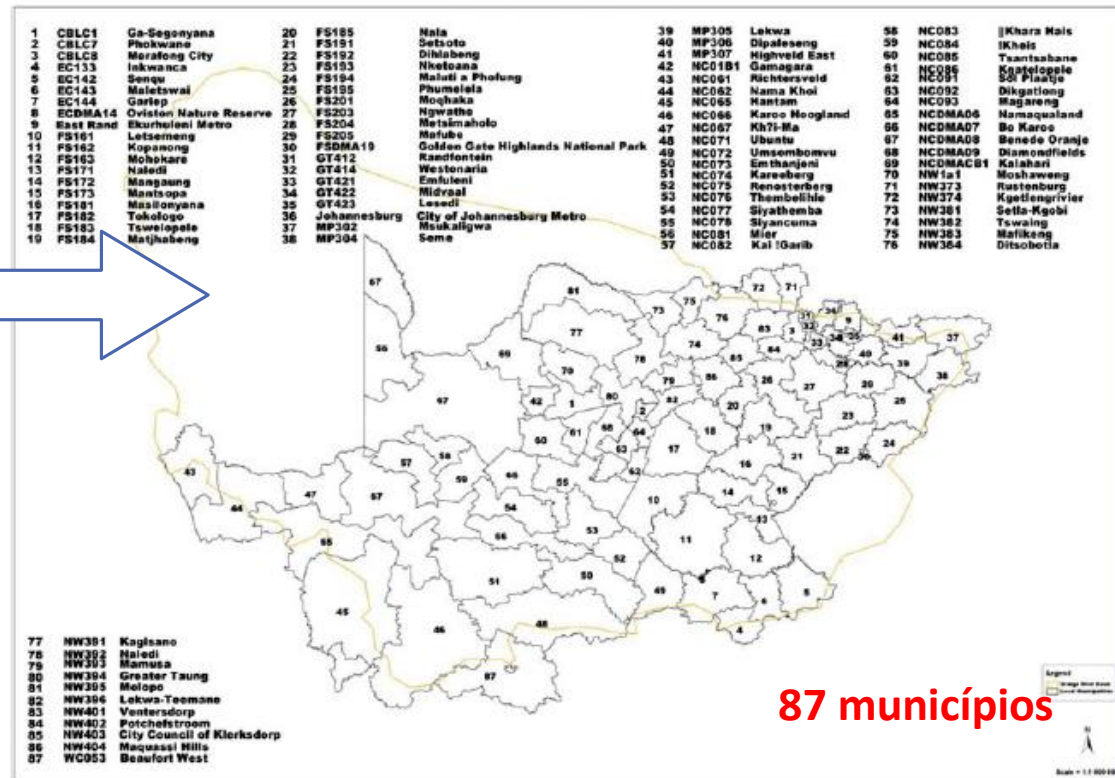
$$WVI = \frac{\sum_{i=1}^N r_i X_i}{\sum_{i=1}^N r_i}$$



Quanto mais provável levar uma condição vulnerável, maior o peso L-M-H (especialistas)

# Área de estudo

Municípios de outros países não foram analisados por falta e inconsistência de dados



87 municípios

Fig. 4 Cases used as pilot tests for the WVI. Eighty seven local municipalities in the South African portion of the Orange River Basin. *Source:* Diederichs et al. (2008)

# Resultados

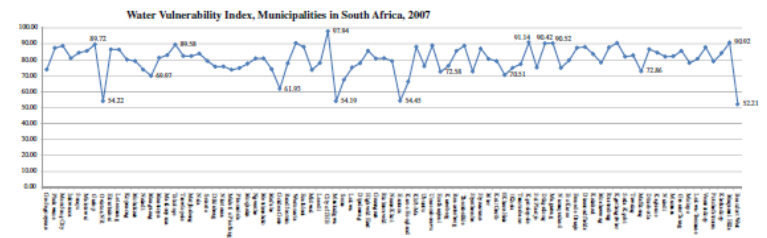
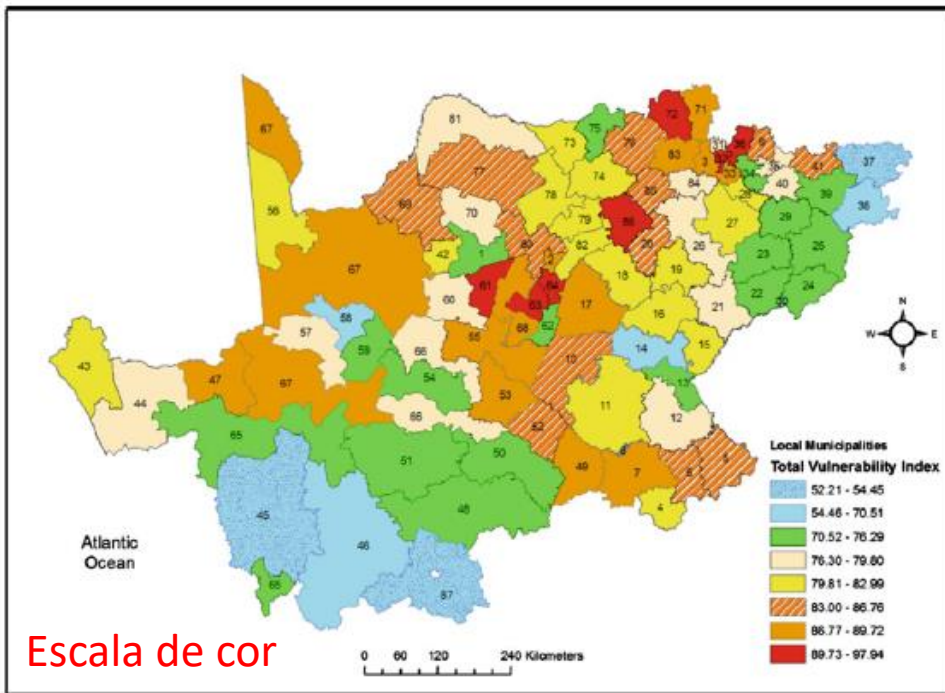


Fig. 6 WVI scores for South African municipalities in the Orange Basin

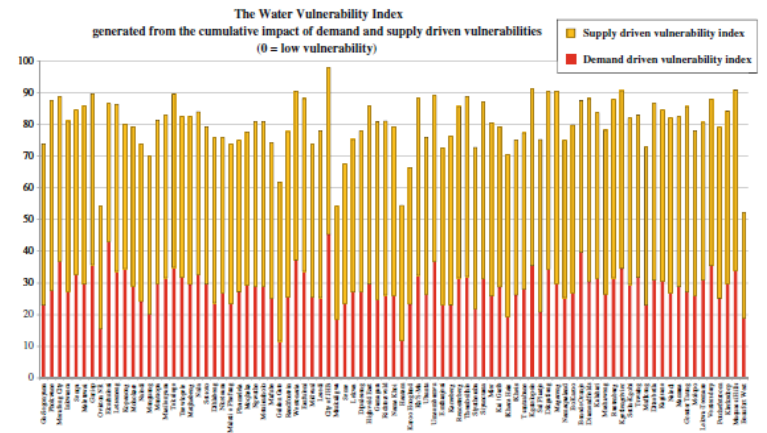
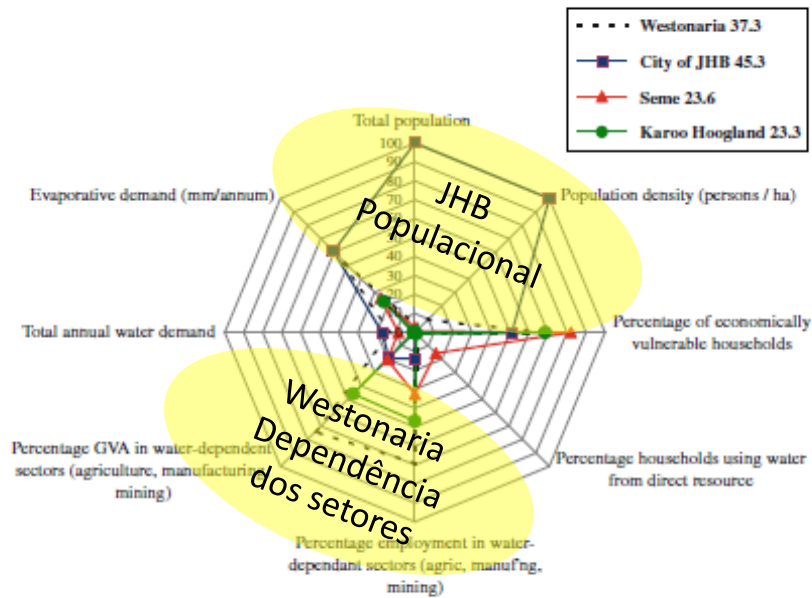


Fig. 7 WVI: combined demand and supply driver values

# Resultados

Comparing Demand Driven Vulnerability of four municipalities



Comparing Supply Driven Vulnerability of four municipalities

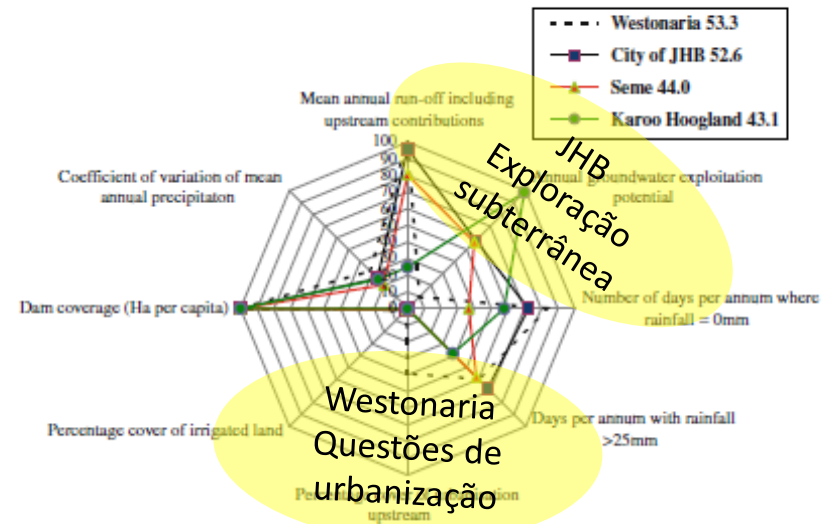


Fig. 10 Illustrating supply-driven water vulnerability

# Cenários

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**Table 5** Comparing vulnerability profiles over time (hypothetical scenario)

	Westonaria	City of JHB	Seme	Karoo Hoogland
Original total WVI	90.6	97.9	67.6	66.4
Demand driven water vulnerability +20%	44.8	54.4	28.3	28.0
Supply driven water vulnerability – 10%	47.9	47.3	39.6	38.8
Total new WVI, under climate change	92.7	101.7	67.9	66.8

# Referências

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Cerca de 24%

# Agenda



## Target 7.C:

**Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation**

- ∴ The world has met the target of halving the proportion of people without access to improved sources of water, five years ahead of schedule.
- ∴ Between 1990 and 2015, 2.6 billion people gained access to improved drinking water sources.
- ∴ Worldwide 2.1 billion people have gained access to improved sanitation. Despite progress, 2.4 billion are still using unimproved sanitation facilities, including 946 million people who are still practicing open defecation.





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# Agenda

## Central concepts: the IWRM approach

### IWRM approach<sup>9</sup>

IWRM is defined as a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

This approach promotes more coordinated development and management of:

- land and water,
- surface water and groundwater,
- the river basin
- upstream and

IWRM is also about the benefits from the approach that:

- water development
- people's water needs
- stakeholders and
- securing the investment
- policies and practices
- between macroeconomic
- water-related conflicts
- conflict with, the
- water planning
- goals.

Global Water Partnership



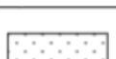

## Setting the stage for change

Second informal survey by the GWP network giving the status of the 2005 WSSD target on national integrated water resources management and water efficiency plans

February 2006

## Southern Africa

### Status IWRM & WE plans development process

	Countries that have plans/strategies in place, or a process well underway, and that incorporate the main elements of an IWRM approach.
	Countries that are in the process of preparing national strategies or plans but require further work to live up to the requirements of an IWRM approach.
	Countries that have taken only initial steps in the process towards preparing national strategies or plans and have not yet fully embraced the requirements of an IWRM approach.
	Countries that have not submitted a survey reply, or been included in the survey.

### SOUTHERN AFRICA





# Conceito Mediador

Vulnerabilidade hídrica

Vulnerabilidade abastecimento de água

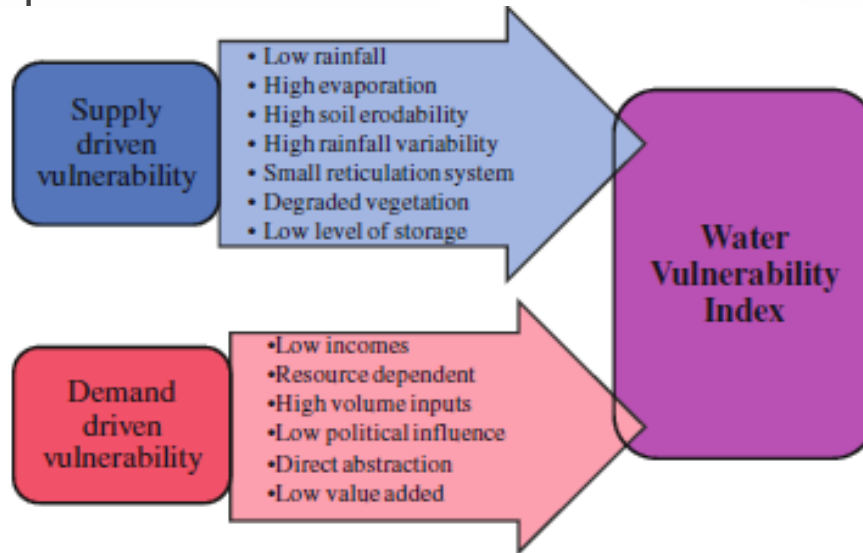
Vulnerabilidade (UNEP, 2002):

- “interface entre exposição e ameaças físicas ao bem estar humano e a capacidade das pessoas e comunidades em lidar com elas. Ameaças derivam da combinação de processos sociais e físicos. Vulnerabilidade humana integra várias questões ambientais.”

Vulnerabilidade população quanto ao abastecimento de água?

# Objeto Mediador

Indicadores selecionados com base em percepções locais, entrevistas, workshops, disponibilidade de dados e opinião de especialistas



Validade  
Especificidade  
???

Fig. 3 Characteristics of supply-driven water vulnerability (water systems) and DDWV (water users)

# Artigo de Apoio

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Plummer *et al.* (2012)

## **A Systematic Review of Water Vulnerability Assessment Tools**

*Water Resour. Manag.*, v. 26, n. 15, p. 4327-4346

Grosbois e Plummer (2015)

## **Problematizing Water Vulnerability Indices at a Local Level: a Critical Review and Proposed Solution**

*Water Resour. Manag.*, v. 29, p. 5015-5035

Revisão de 7 índices de vulnerabilidade hídrica e proposição de modelo de 7 etapas para elaboração

# Análise Comparativa

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## Modelo Conceitual e de medição

- Revisão de literatura e envolvimento dos *Stakeholders*

## Fonte de Dados, Coleta de Dados e Dados Faltantes

- Dados primários e secundários

## Escalas e normalização

## Pesos e Agregação de Dados

- Importância relativa

## Análise de Sensibilidade e Apresentação dos Resultados

- Mudanças dos resultados com alterações das premissas

## Aplicabilidade e Transferibilidade

Obrigada!!!

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