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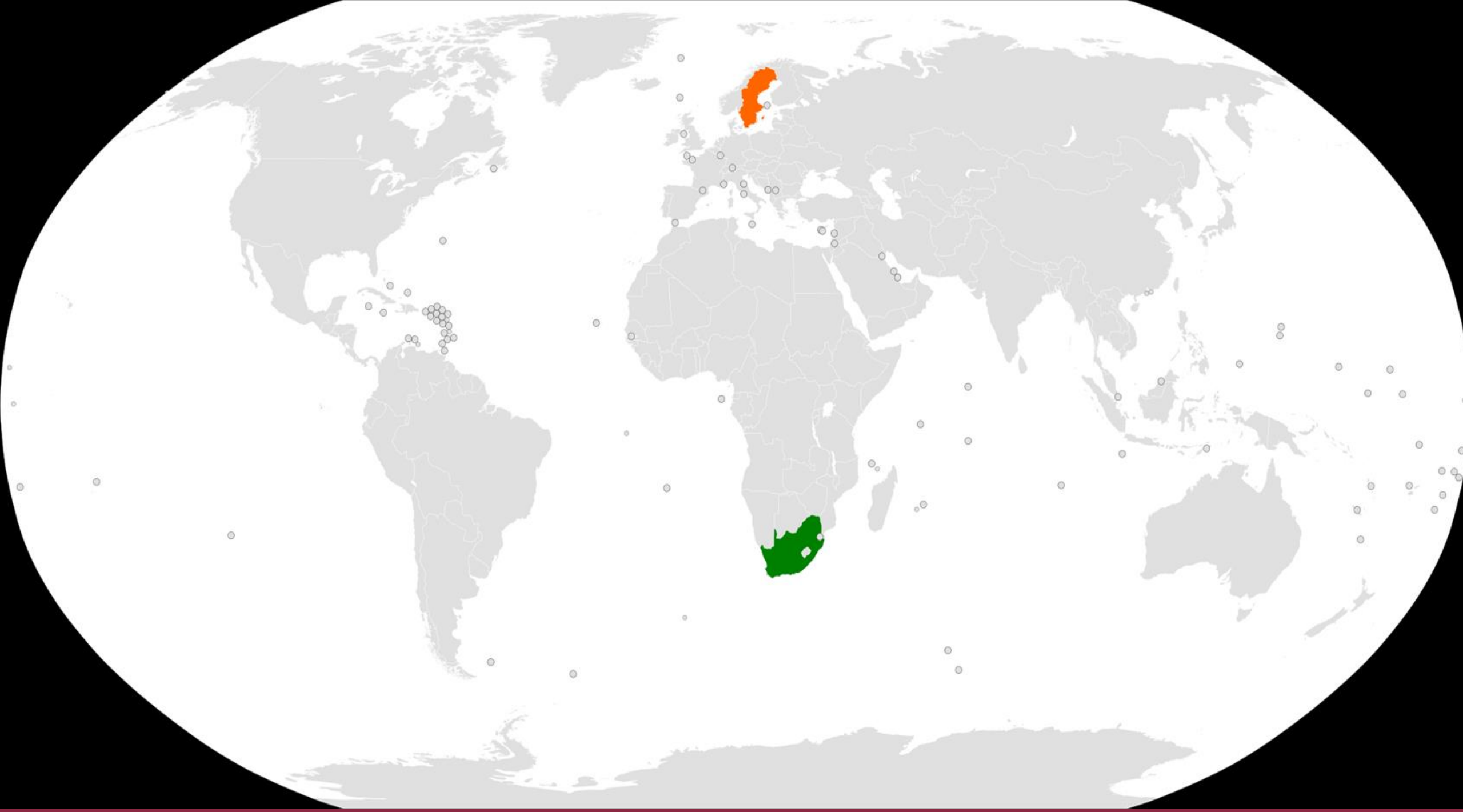
forward together · saam vorentoe · masiye phambili

Water integrity in a holistic view – A case study South Africa/Western Cape

Water and Human Rights webinar

Dr Erna Blancquaert

Date: 18 November 2020



Introduction

Colonial era and independence (1652–1948)

- Plentiful water was a key reason why the Dutch East India Company chose to settle by Table Mountain in 1652
- Racial-based conflict over access to water and 1st reservoir was established on the mountain slopes above the city to secure steady water supply in 1850
- 1927, the first larger new settlement Langa was established as a “model Native village” for black Africans who were displaced away from the city centre

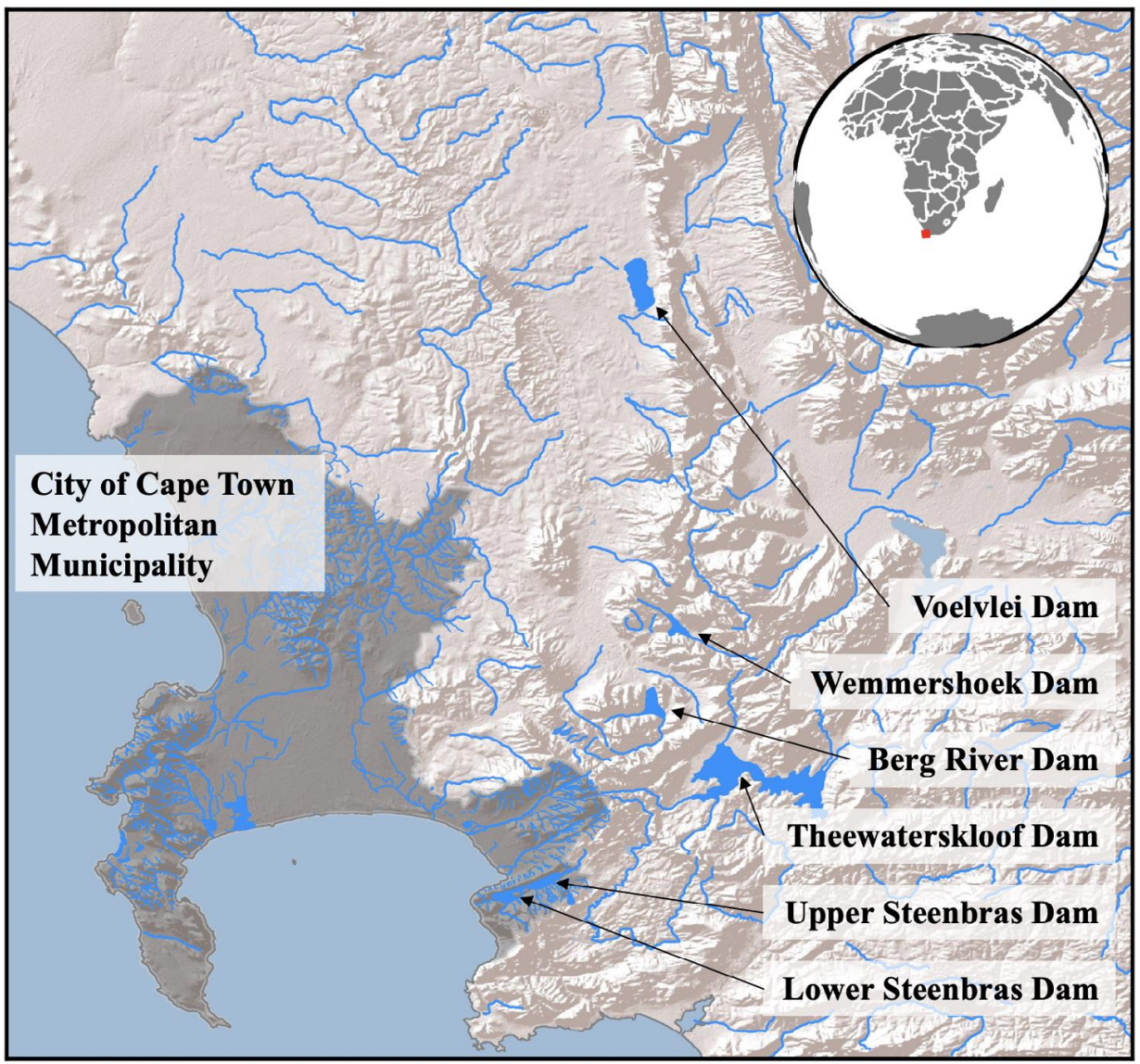
Apartheid rule and protest struggle (1948–1994)

- Expulsion of at least 150,000 people by the end of the 1960s into “colored” and “black” townships in the Cape Flats (low elevation and sandy soils is prone to flooding during winter rains)
- Migrant laborers since the rural “homelands” - scarce employment opportunities
  Western Cape Water Supply System (WCWSS)

Democratic reform (1994–present)

- South Africa was struck by a serious drought in the early 1990s
- ~ 20% of the country's population had no access to piped water at all—a figure that varied from 1 to 98% across different municipalities

Introduction



- <u>Western Cape Water Supply System (WCWSS)</u>

- Lower Steenbras Dam from 1921
- Voëlvlei Dam in 1952,
- Wemmershoek Dam in 1957,
- Upper Steenbraas Dam in 1977, and
- Theewaterskloof Dam in 1980

Enqvist & Ziervogel, 2018

Water governance

- Water use in South Africa is regulated primarily at:
  - National level through the National Water Act – Access & usage
  - Water Services Act – water related services should be provided to citizens

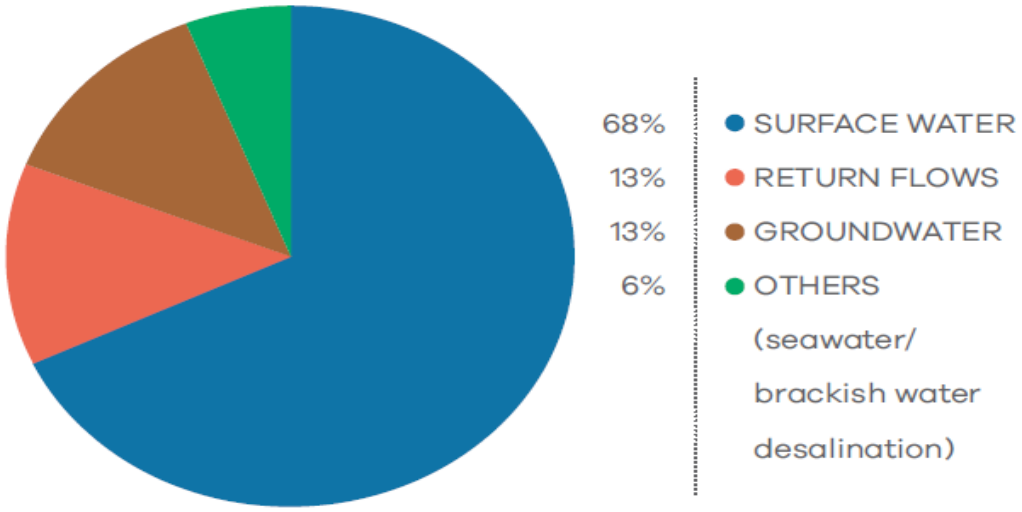
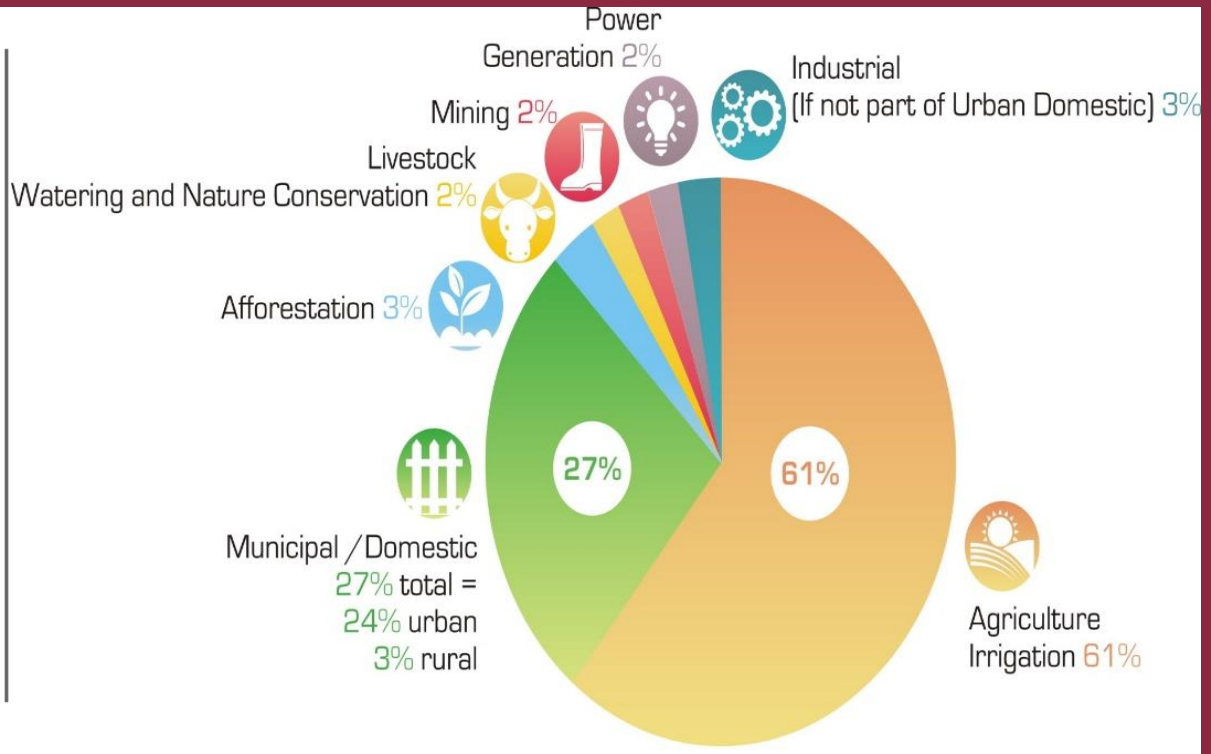


Figure 1: Water sources in South Africa

Water: Market Intelligence Report 2019

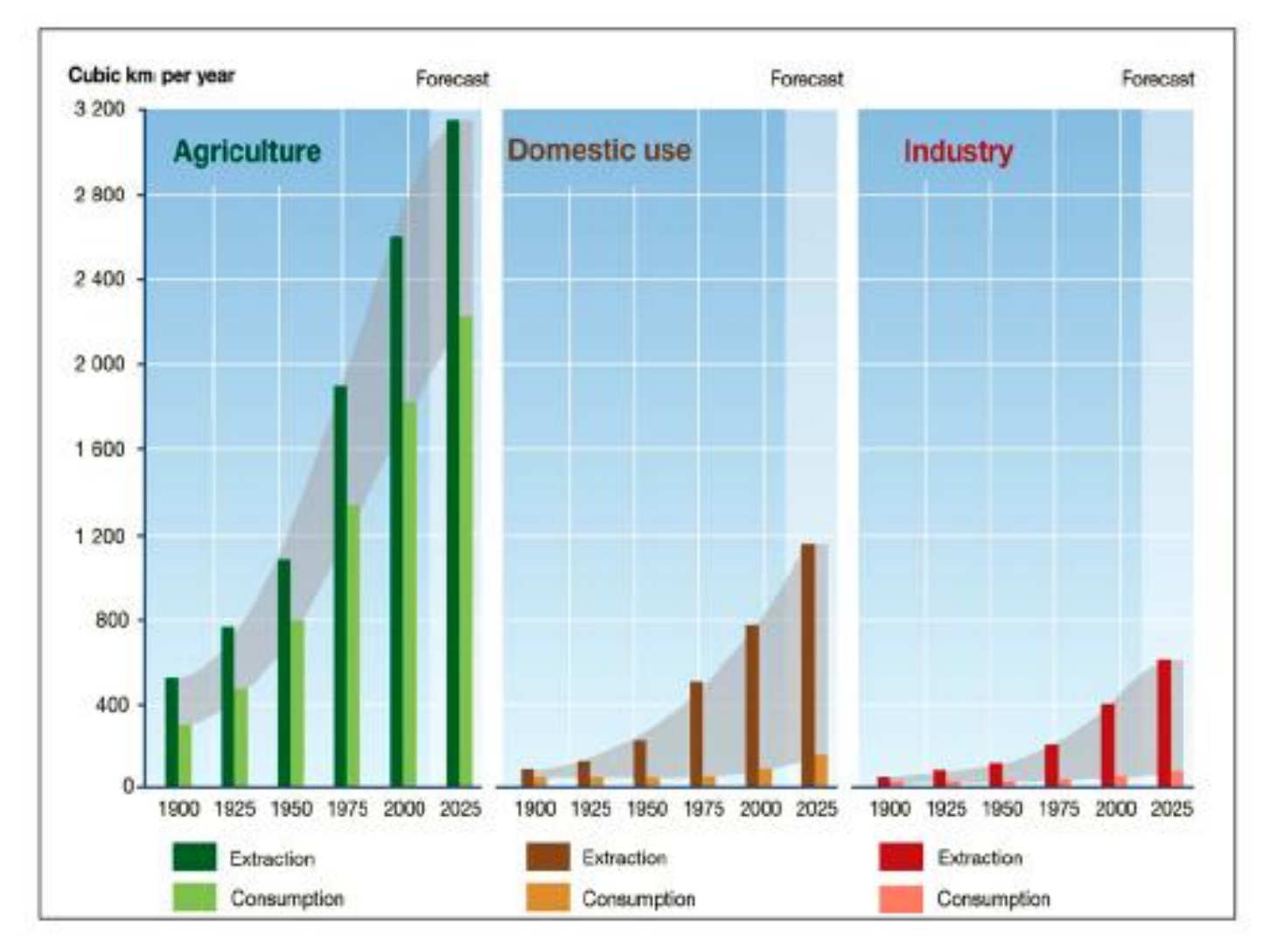


How we use our water resources in South Africa

<u>Major issue</u>:

- 3% of the water used in municipal areas is used in rural areas,
- Poor infrastructure and limited access to clean drinking water direct violation of their human rights for South Africans living in rural areas

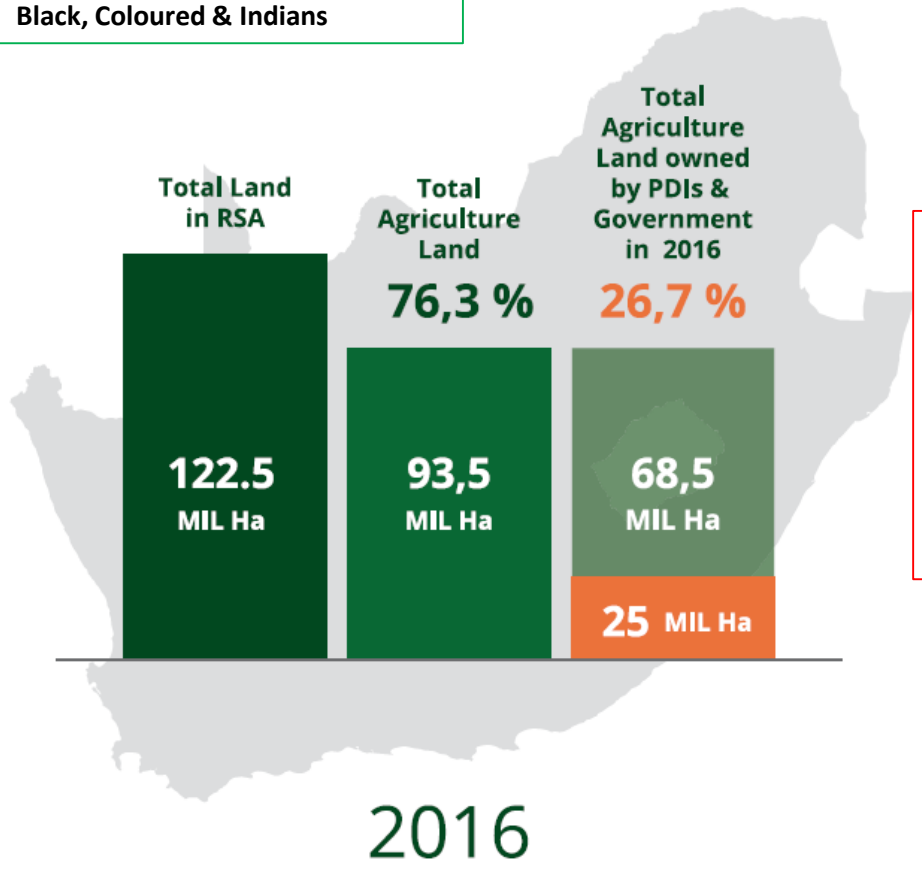
Global water use projections



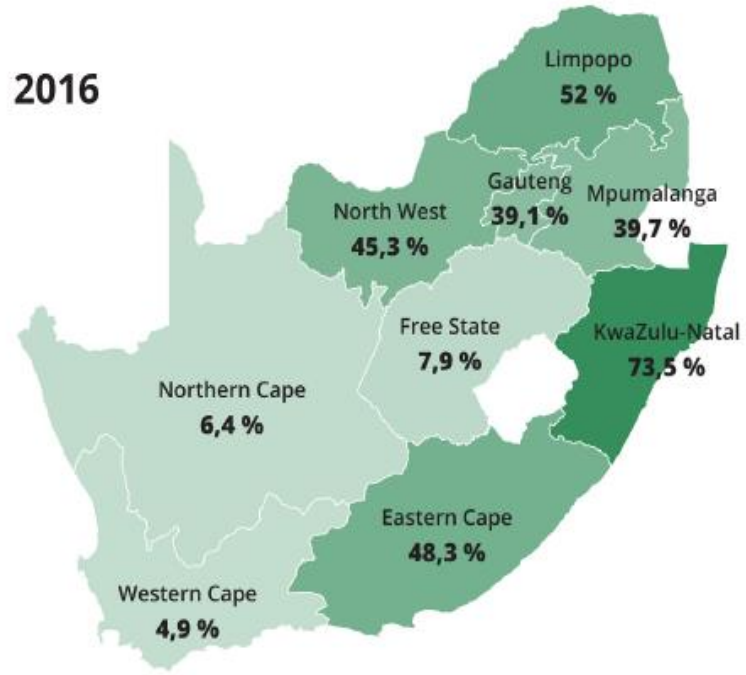
Bonamente et al., 2015

Ownership of agriculture land

Previously Disadvantaged Individual (PDI) – Black, Coloured & Indians



The country therefore grapples with a huge Human Rights issues in terms of **equitable access to clean drinking water and issues of socioeconomic mal-distribution of essential resources like water**.



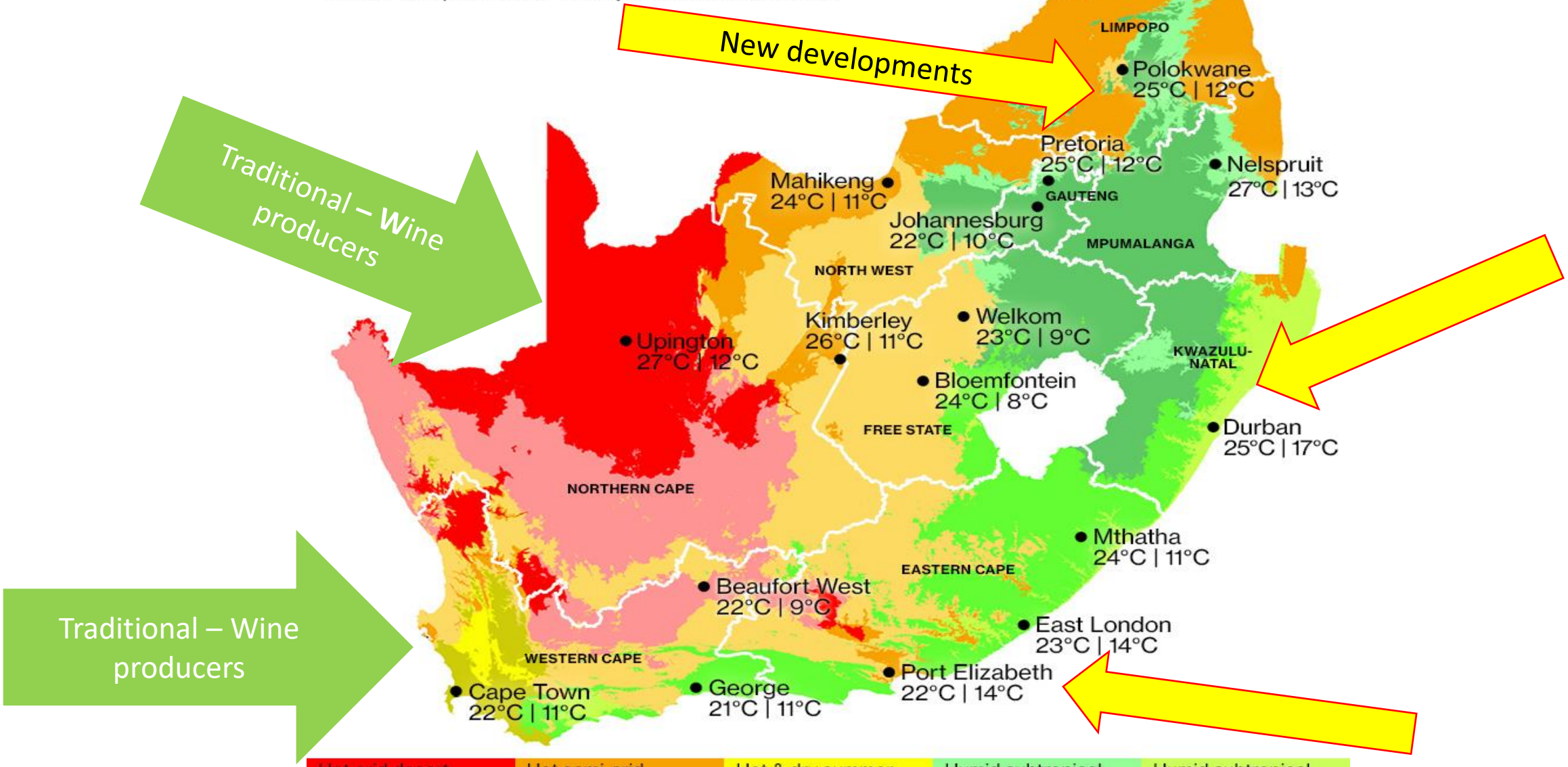
National level ownership in 2016

Provincial level of ownership by PDIs and Government in 2016

Source: AgriSA Land Audit report, 2017

South Africa's climate

Köppen climate types with average summer and winter temperatures in major cities and towns



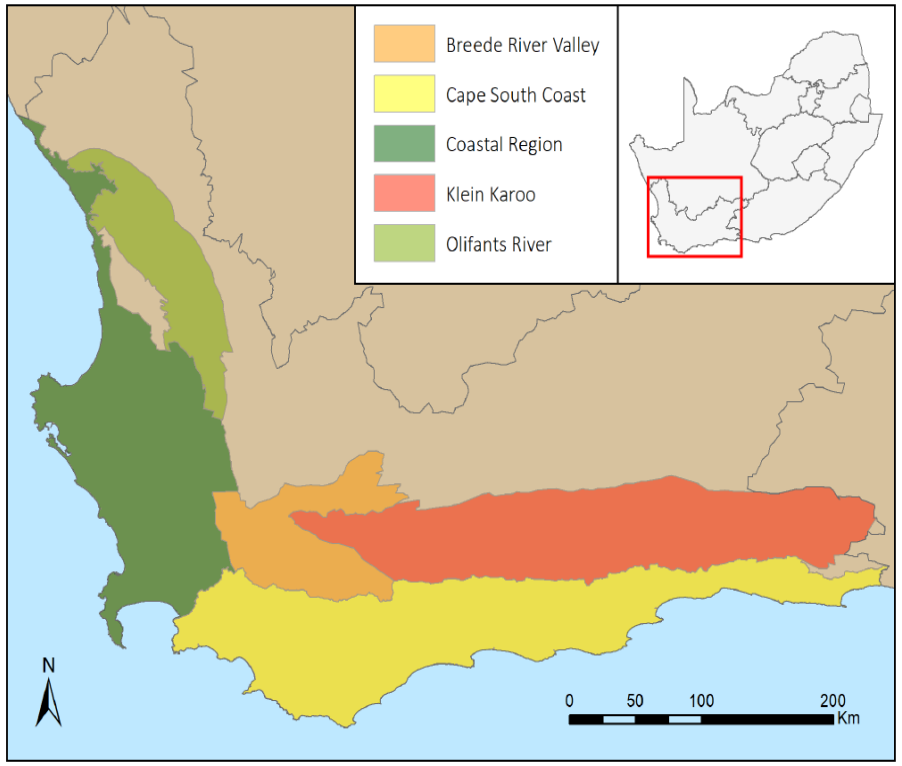
Hot arid desert	Hot semi-arid steppe	Hot & dry summer (Mediterranean)	Humid subtropical with dry winter	Humid subtropical without dry season
Cold arid desert	Cold semi-arid steppe	Warm & dry summer (Mediterranean)	Subtropical highland with dry winter	Temperate oceanic without dry season

GRAPHIC BY MARY ALEXANDER • DATA SOURCES: WIKIMEDIA COMMONS, SOUTH AFRICAN WEATHER SERVICE, WORLD BANK CLIMATE CHANGE KNOWLEDGE PORTAL

Wine Industry - Water footprint

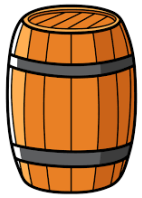
- Water Footprint as an indicator of sustainable table grape and production
- http://wrcwebsite.azurewebsites.net/wp-content/uploads/mdocs/2710%20final.pdf
  - 2017-2021
    - Review how water footprint methodologies can be applied to table and wine grape production.
    - Apply the water footprint for selected and representative grape commodities and products, and make recommendations for improvement.
    - Develop and demonstrate a procedure whereby WFA can be carried out through the utilisation of spatial datasets.
    - Propose a set of guidelines that industries or organisations can follow for implementing WFA within their organisations or industries.
    - Promote the benefits of a WFA to industries.
    - Build capacity and competence in WFA in the wine and table grape industries.
  - 2017-2019 (Revision of project)

Wine Industry - Water footprint



- **Breede River Valley**
  - Breedekloof (~13.75%),
  - Robertson (~13.55%) and Worcester (6.99%)
- **Olifants River Valley**
  - Valley of the Olifants River
- **Coastal Region**
  - Largest districts in terms of hectares are:
  - Stellenbosch (16.19%),
  - Paarl (15.87%) and Swartland (13.81%)

Wine Industry - Water footprint



Water Use

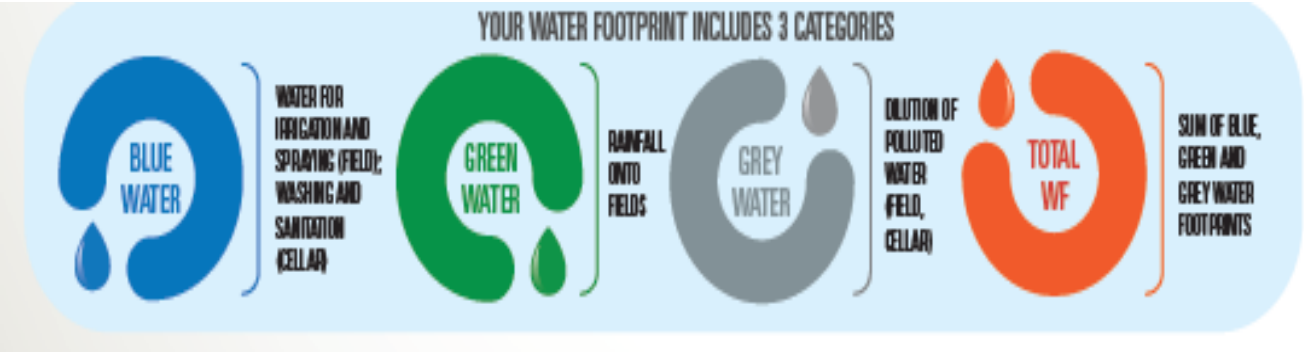
Direct
Irrigation,
fertiliser, pesticides,
herbicides

Indirect
Water for agro-chemical dilution

Direct
Before and after washing (processes of tipping, crush, juice, fermentation, winemaking, filter and cold stabilisation, waste)
Water for cooling Water for mixing chemicals,
Yeast
Sanitation

Indirect
Water for chemical dilution,
Water for waste (skins, stems, pips)

- Production: table and wine grape production, as well as wine production
- The position of fields considered in the study: field boundaries
- Field or block-specific information, e.g. block size, cultivar, rootstock, trellis system, planting date and planting density
- Crop water use: spatial evapotranspiration from various sources
- Weather data: mainly rainfall data
- Field level chemical spray and fertilizer records
- Cellar water use
- Water quality records for cellars and the environment



Wine Industry - Water footprint

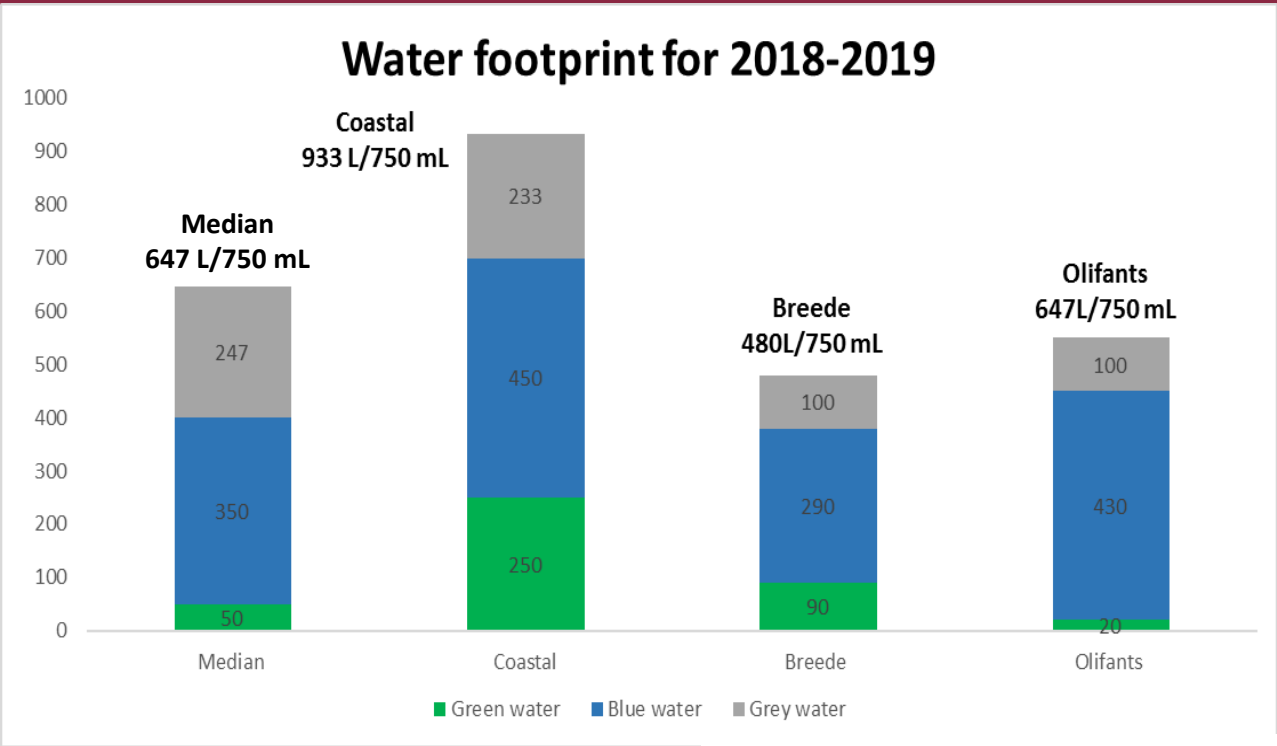


Table 5. Water footprint of a wine bottle.

	L/bottle *	L/glass **	(%)
WF green	621.4	178.1	98.3
WF blue	3.425	0.982	0.5
WF grey	7.358	2.109	1.2
WF tot	632.2	181.23	100

Note: * a wine bottle is 0.75 L. ** a wine glass is 0.215 L.

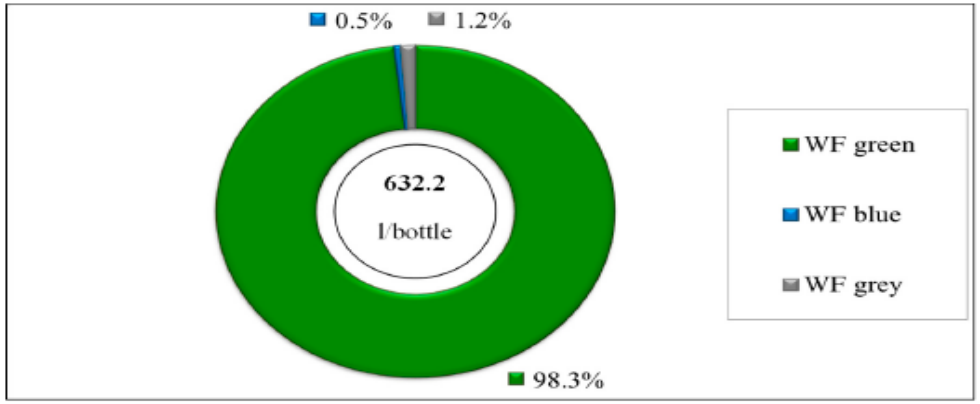


Figure 5. Water Footprint of a wine bottle.

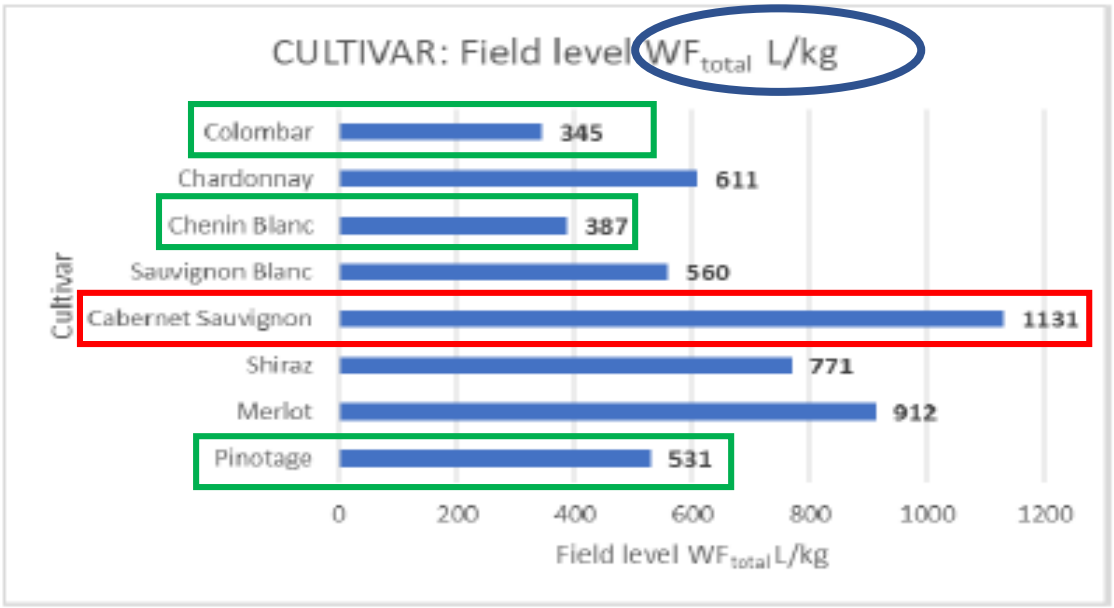
Bonamente et al., 2015

Aivazidou et al., 2020

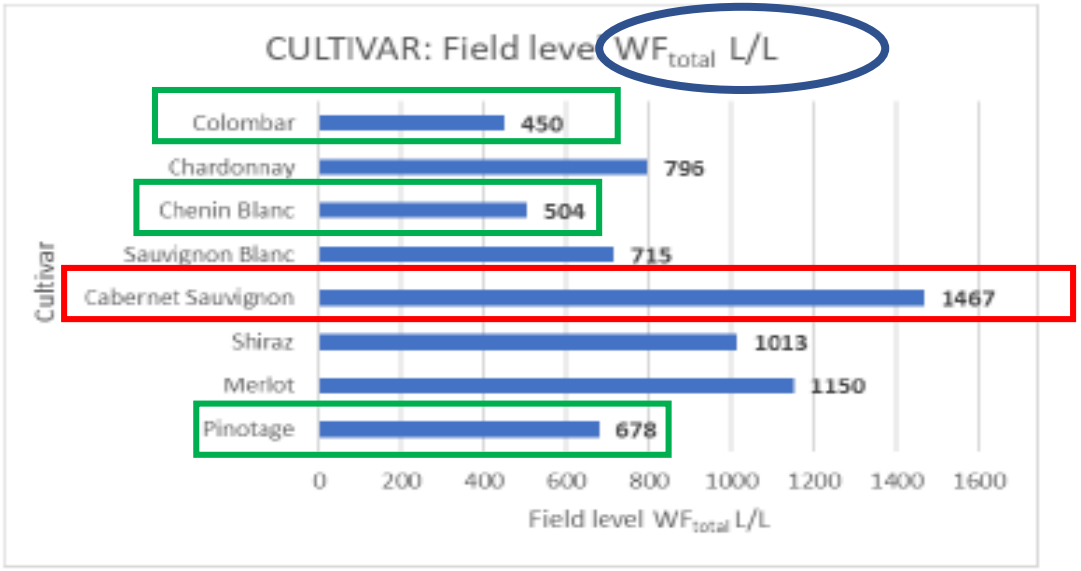
Table 1. Taxonomy of wine WF research in Italy.

Reference	Study Type	Study Period	Location	Wine Variety	Winemaking Phase	WF Assessment Method	WF Type and Volume		
							Green	Blue	Grey
Lamastra et al. [34]	Real case study	Not specified	Province of Palermo, Region of Sicily (13.49° N, 13.51° E)	Cabernet Sauvignon; Chardonnay; Nero d'Avola; White Pinot; Grecanico	Viticulture; Vinification	WF assessment manual [9]; V.I.V.A. tool [34]	694.5–902.9 (WF manual); 689.5–915.9 (V.I.VA.) L/L of wine	2.6–42.5 L/L of wine (Same for both methods)	0–228.6 (WF manual); 0–389.8 (V.I.V.A) L/L of wine
Bonamente et al. [35]	Real case study	2012	Region of Umbria	Sangiovese with small percentages of Merlot and Cabernet Sauvignon	Viticulture; Vinification	V.I.V.A. tool [34]; ISO 14046 [21] (only as a framework)	621.4 L/bottle of 0.75 L	3.4 L/bottle of 0.75 L	7.4 L/bottle of 0.75 L
Bonamente et al. [36]	Real case study	2012	Region of Umbria	Sangiovese with small percentages of Merlot and Cabernet Sauvignon	Viticulture; Vinification	ISO 14046 [21]	450.6 L/bottle of 0.75 L	7.1 L/bottle of 0.75 L	120.4 L/bottle of 0.75 L
Rinaldi et al. [37]	Real case study	2012	Region of Umbria	Red wine; white wine (specific variety not specified)	Viticulture; Vinification	ISO 14046 [21]	450.6 (red); 496.6 (white) L/bottle of 0.75 L	10 (red); 9.8 (white) L/bottle of 0.75 L	43.5 (red); 44.6 (white) L/bottle of 0.75 L

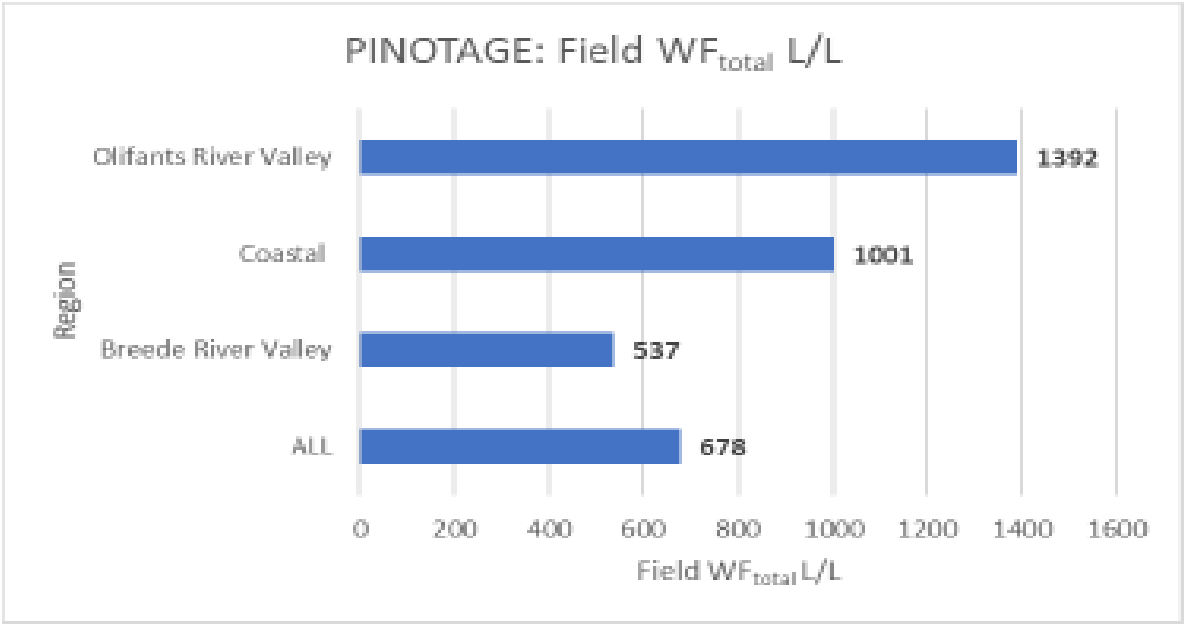
A


CULTIVAR: Field level WF$_{total}$ L/kg
Cultivar
Colombar 345
Chardonnay 611
Chenin Blanc 387
Sauvignon Blanc 560
Cabernet Sauvignon 1131
Shiraz 771
Merlot 912
Pinotage 531
0 200 400 600 800 1000 1200
Field level WF$_{total}$ L/kg

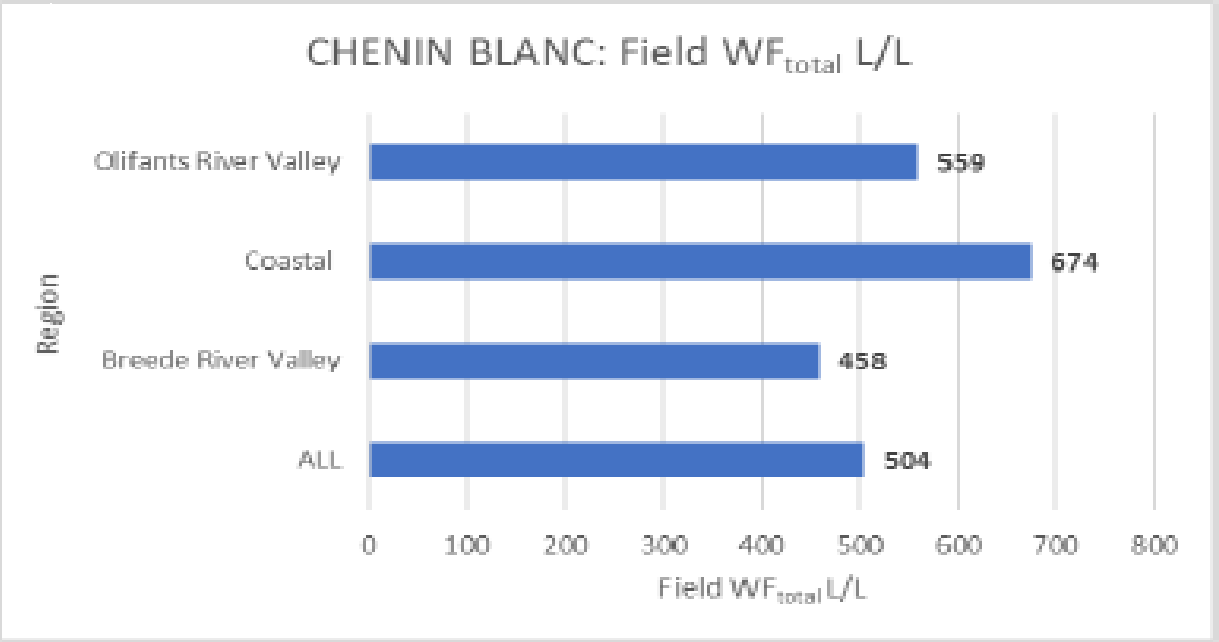
B


CULTIVAR: Field level WF$_{total}$ L/L
Cultivar
Colombar 450
Chardonnay 796
Chenin Blanc 504
Sauvignon Blanc 715
Cabernet Sauvignon 1467
Shiraz 1013
Merlot 1150
Pinotage 678
0 200 400 600 800 1000 1200 1400 1600
Field level WF$_{total}$ L/L

A


PINOTAGE: Field WF$_{total}$ L/L
Region
Olifants River Valley 1392
Coastal 1001
Breede River Valley 537
ALL 678
0 200 400 600 800 1000 1200 1400 1600
Field WF$_{total}$ L/L

B


CHENIN BLANC: Field WF$_{total}$ L/L
Region
Olifants River Valley 559
Coastal 674
Breede River Valley 458
ALL 504
0 100 200 300 400 500 600 700 800
Field WF$_{total}$ L/L

Conclusions

- **Blue water usage = highest**
- **Production**
  - 15-20 t/ha = ~ 500 L/kg water
  - 10 t/ha = ~ 850 L/kg water
  - 5 t/ha = ~ 1600 L/kg water
- **Cultivar choices/Rootstock choices** – Chenin blanc vs Sauvignon blanc vs Merlot vs Cabernet Sauvignon
- A need for better understanding of irrigation and fertilization management
- WF can be used as an indicator of sustainability (ISO 26 000 & ISO 46 000) and system resilience
- **Gaps:**
  - Economic feasibility aspects of such a project
  - More vintages should be considered
  - WF values should be put in context (People, Plant & Profit)

Future insights

Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA)
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Predictive modelling in grape berry weight during maturation process: comparison of data mining, statistical and artificial intelligence techniques

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Temperature-based grapevine sugar ripeness modelling for a wide range of *Vitis vinifera* L. cultivars

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THE 3Ps (PROFIT, PLANET, AND PEOPLE) OF SUSTAINABILITY AMIDST CLIMATE CHANGE: A SOUTH AFRICAN GRAPE AND WINE PERSPECTIVE.

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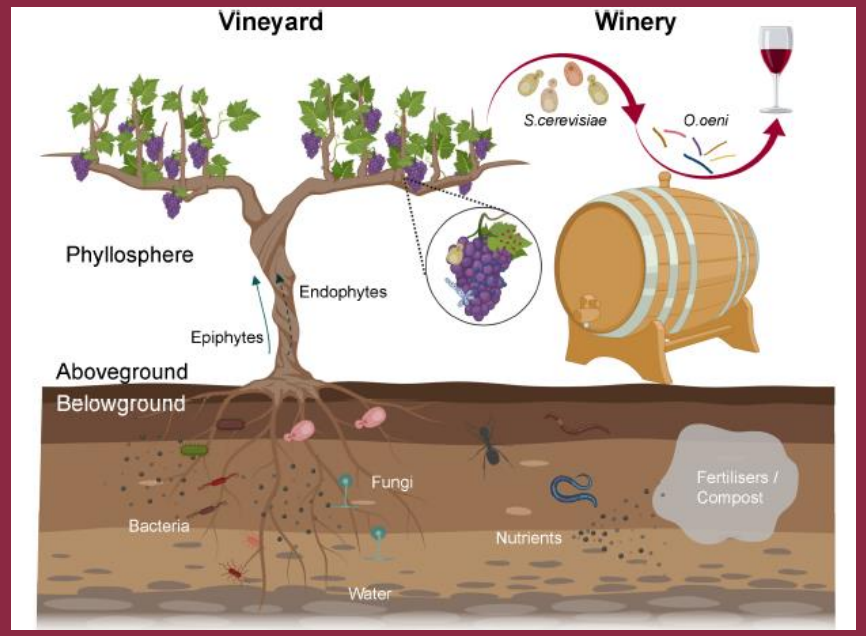
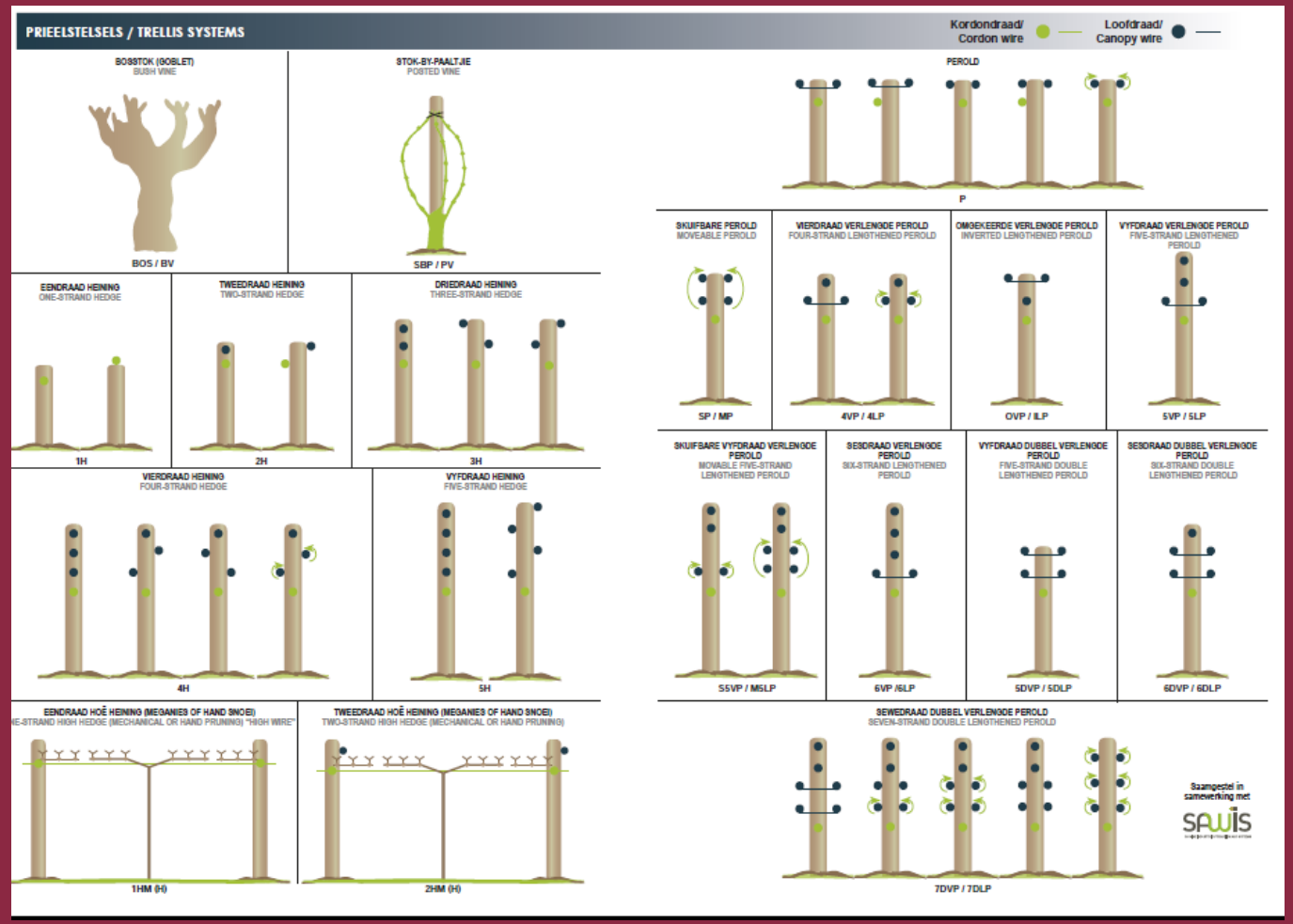
In preparation

Future insights

- **Use of drought tolerant cultivars**
  - Greek and Cypriot cultivars
  - Spanish cultivars
- **Trellis system adaptations**
- **Microbial terroir – vine – wine**



Liu et al., 2019



VinPro, 2020

Thank you / Dankie / Siyabonga/ Ngiyabonga/ Ke a leboga/ Ke a leboha haholo/ Ndo Livhuwa

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