



Western Cape
Government

FOR YOU



10TH
INTERNATIONAL
TABLE GRAPE
SYMPOSIUM

26 NOV
TO
1 DEC 2023

SOMERSET WEST
SOUTH AFRICA

Environmentally Sustainable Viticulture: From Science to Practice

Prof Stephanie Midgley

10th International Table Grape Symposium, Somerset West, South Africa
28 November 2023

Outline

- **Setting the scene globally**
- **From Science to Practice – what drives adoption of sustainable and adaptive practices?**
- **Sustainable viticulture (with examples from the Western Cape province)**
- **Concluding thoughts**



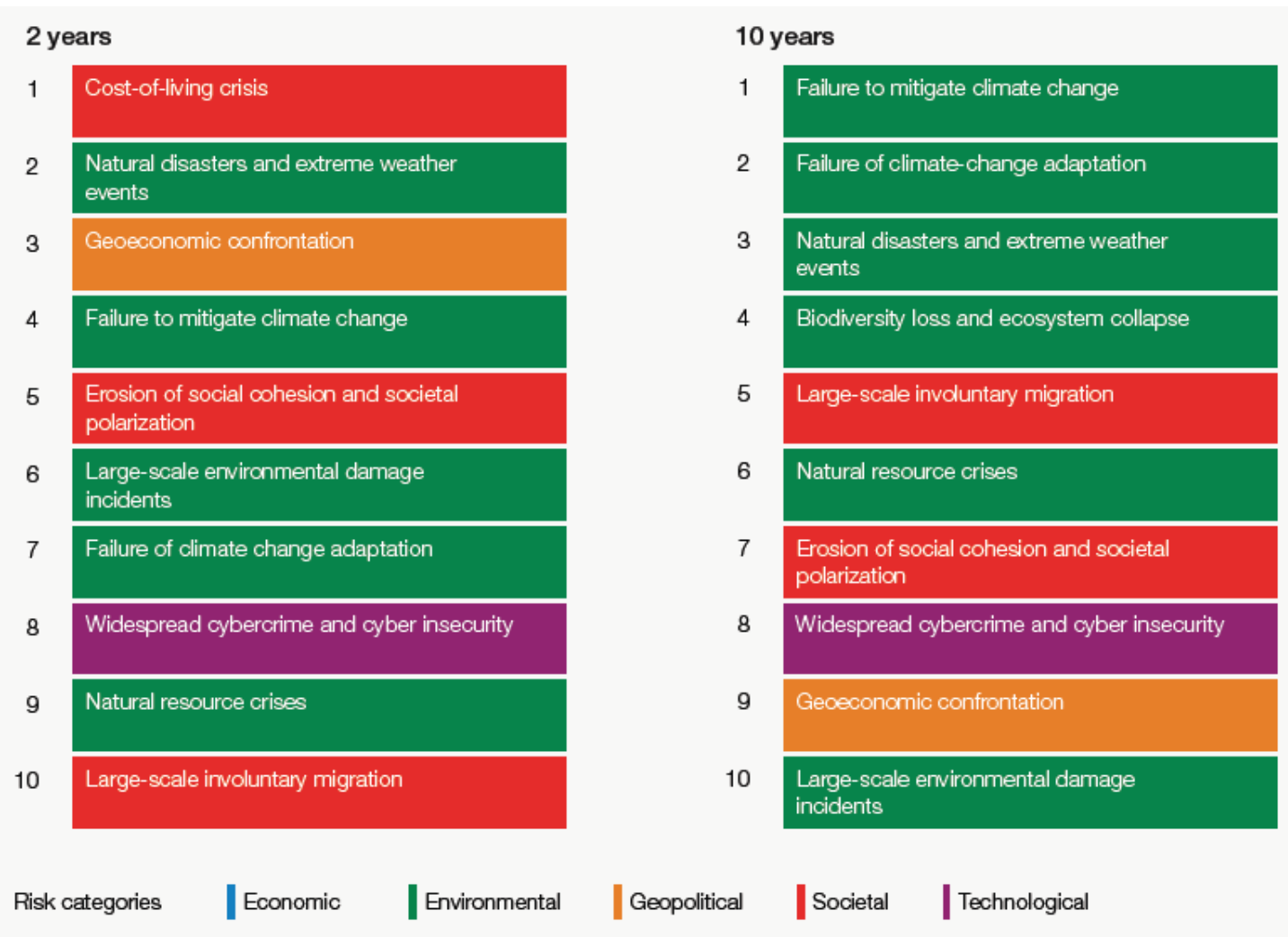
Setting the scene globally

Sustainability transitions



- 1. Nature and ecosystem function transition:**
thresholds; changes in state/function
- 2. Climate change:**
while action is proceeding, much more is needed
- 3. Energy and decarbonization transition:**
system change; just transition
- 4. Food systems, dietary & nutritional transition:**
plant-rich diets; nutritional deficiencies, hunger
- 5. Circular economy:**
volumes of waste; renewable materials
- 6. Population and human well-being transition:**
migrations partially driven by climate and nature breakdown; urbanization

WEF Global Risks (2023)



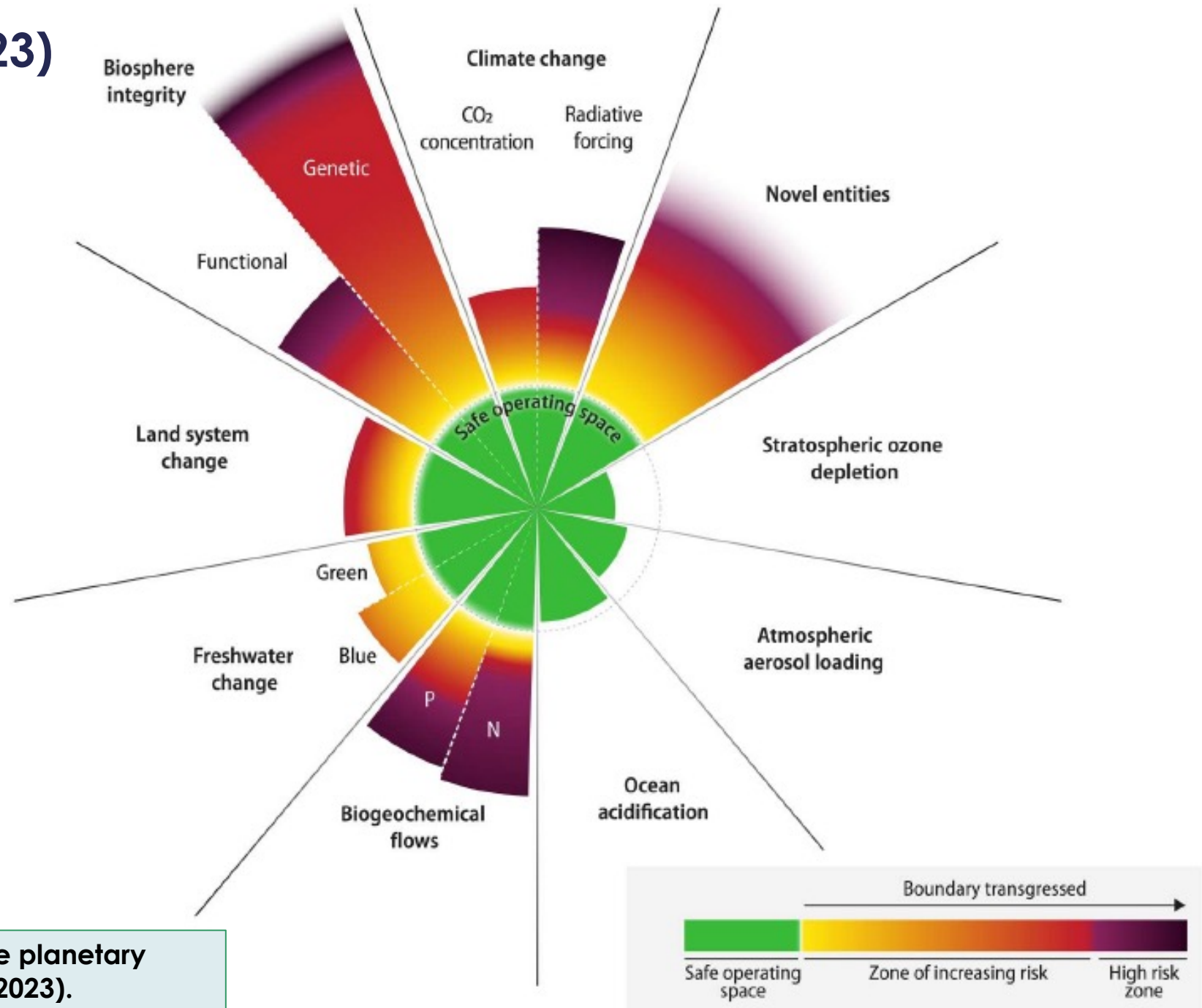
The Global Risks Report 2023 18th Edition

INSIGHT REPORT



Planetary boundaries (2023)

- Six of the nine boundaries are transgressed.
- Earth is now well outside of the **safe operating space for humanity**.
- As primary production drives Earth system biosphere functions, **human appropriation of net primary production** is proposed as a control variable for functional biosphere integrity. This boundary is also transgressed.



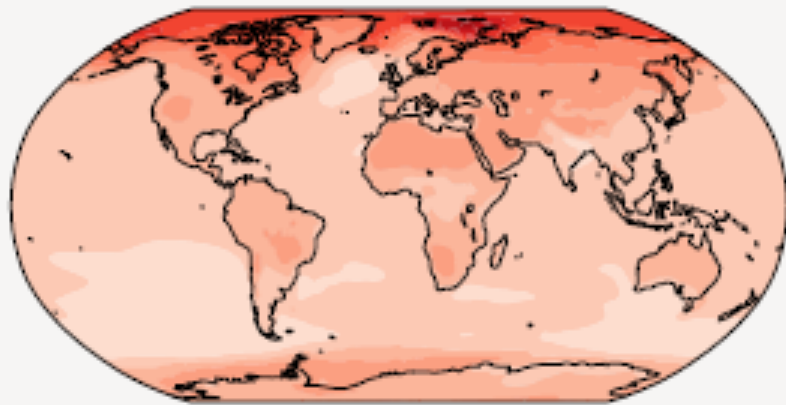
Richardson et al. 2023. Earth beyond six of nine planetary boundaries. *Science Advances* 9, eadh2458 (2023).

Projected future increases in Mean Annual Temperature

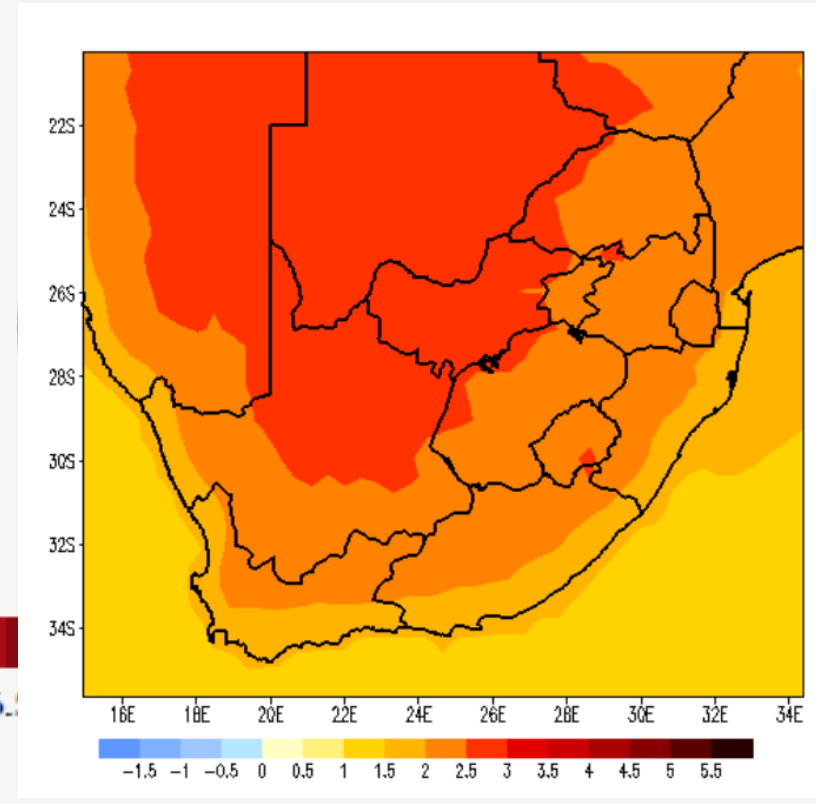
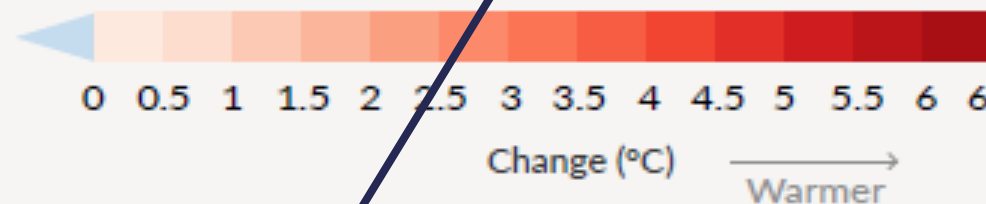
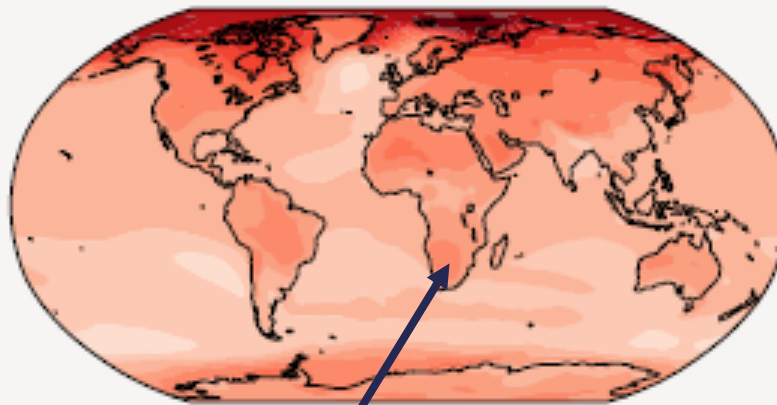
b) Annual mean temperature change (°C) relative to 1850-1900

Across warming levels, land areas warm more than oceans, and the Arctic and Antarctica warm more than the tropics.

Simulated change at 1.5 °C global warming



Simulated change at 2 °C global warming



Warming in SA > 2.5 °C when global warming increase is 2 °C

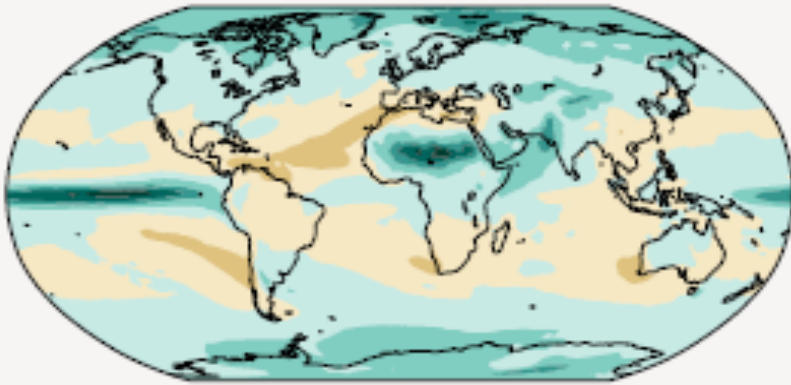
IPCC. Climate Change 2021: The Physical Science Basis. Sixth Assessment Report of the Intergovernmental Panel on Climate Change

Projected future increases in Mean Annual Precipitation

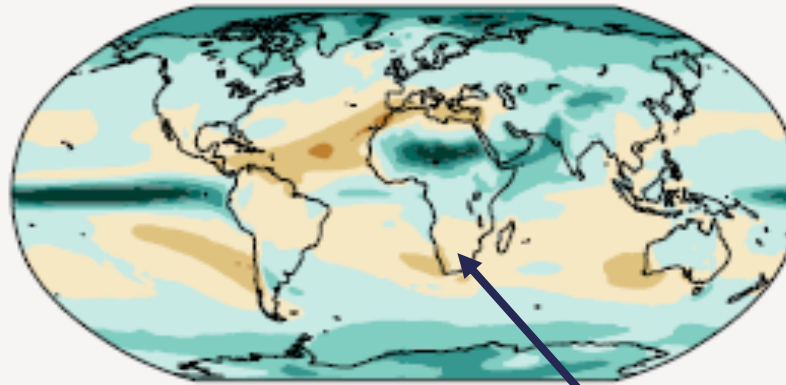
c) Annual mean precipitation change (%) relative to 1850-1900

Precipitation is projected to increase over high latitudes, the equatorial Pacific and parts of the monsoon regions, but decrease over parts of the subtropics and in limited areas of the tropics

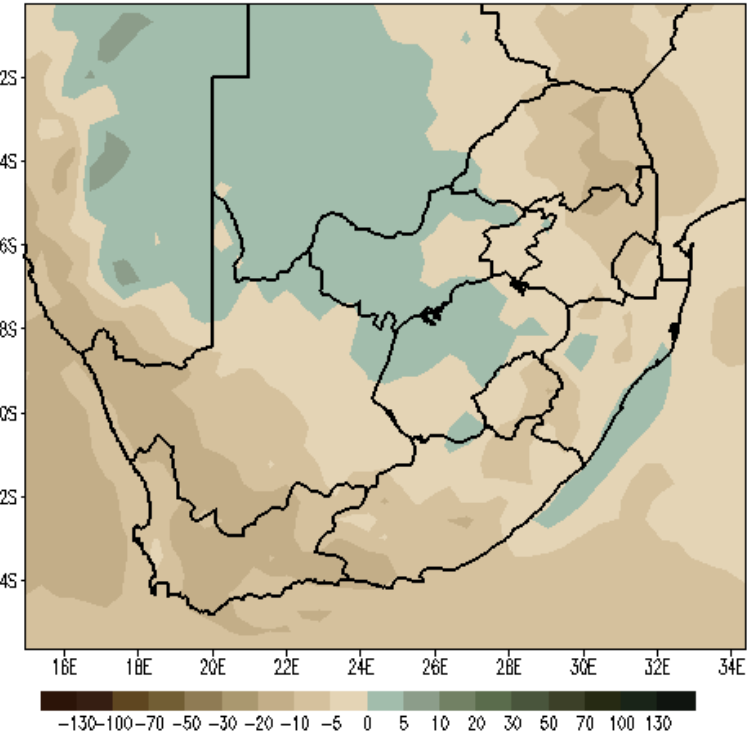
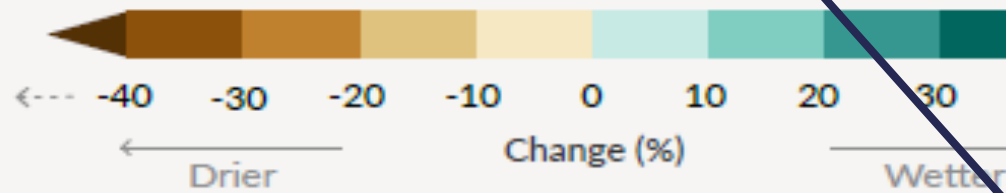
Simulated change at 1.5 °C global warming



Simulated change at 2 °C global warming



Relatively small absolute changes may appear as large % changes in regions with dry baseline conditions



IPCC. Climate Change 2021: The Physical Science Basis. Sixth Assessment Report of the Intergovernmental Panel on Climate Change

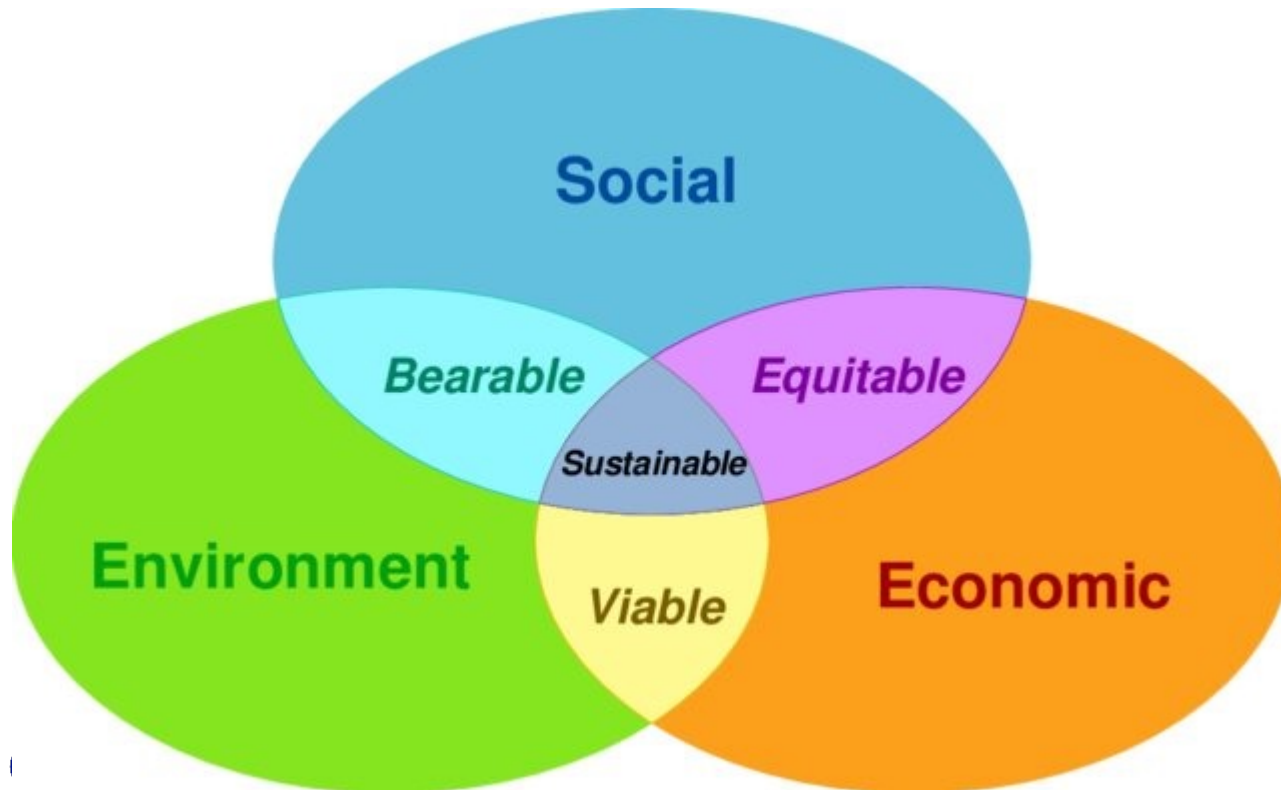
Precipitation is projected to **decrease** over parts of the subtropics, and Mediterranean climates.

Sustainability

“Meeting the needs of the present without compromising the ability of future generations to meet their own needs.”

United Nations Brundtland Commission (1987)

TRIPLE BOTTOM LINE



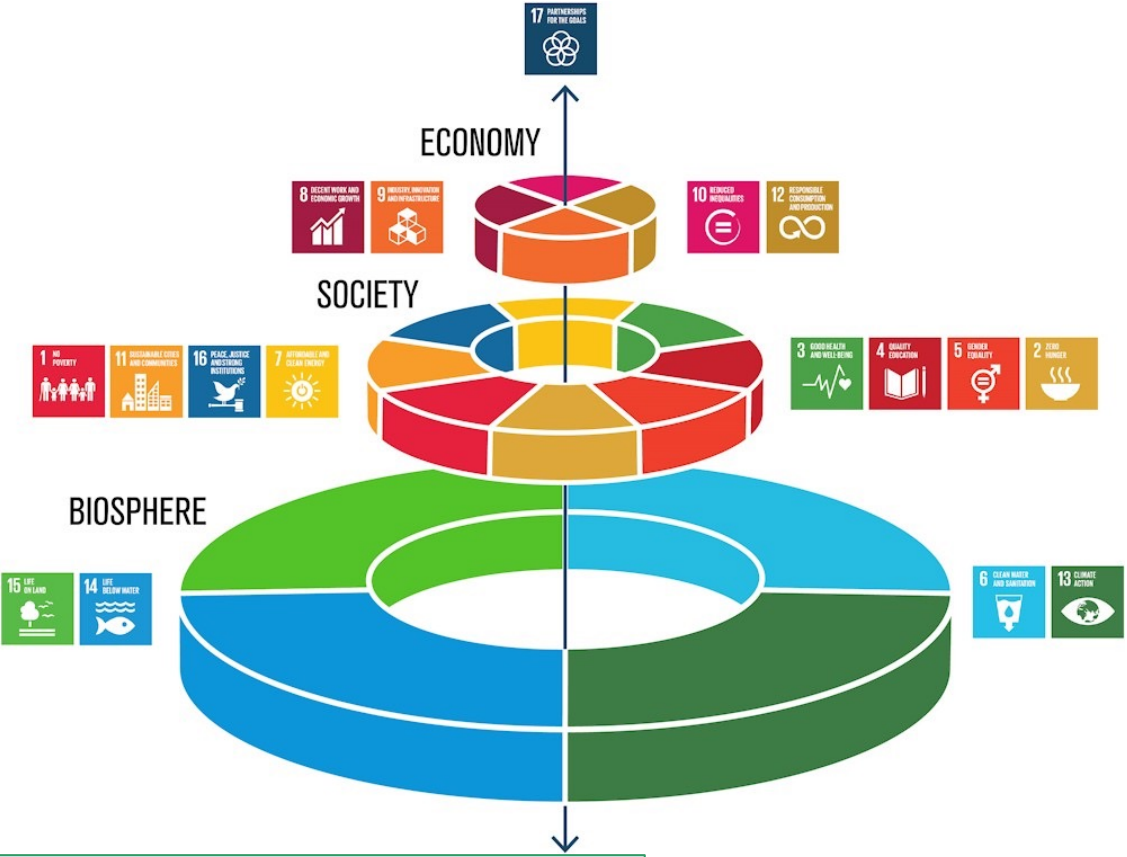
STRONG SUSTAINABILITY



Sustainability

“Meeting the needs of the present without compromising the ability of future generations to meet their own needs.”

United Nations Brundtland Commission (1987)



STRONG SUSTAINABILITY



Credit: Azote for Stockholm Resilience Centre, Stockholm University CC BY-ND 3.0

SDGs far off track

- At the half-way point toward 2030 the SDGs are **far off track**.
- **Confluence of crises:**
 - Covid-19 pandemic,
 - rising inflation and the cost-of-living crisis
 - planetary, environmental and economic distress
 - regional and national unrest, conflicts, and natural disasters
- As a result, overall **progress** towards the 2030 Agenda and the SDGs has been **severely disrupted** in the last three years.
- Actions must simultaneously be taken to destabilize, break-down, and **phase out unsustainable practices**.
- Transformation to sustainable pathways should be **rooted in science**.

CURRENT STATE OF PROGRESS TOWARD THE SUSTAINABLE DEVELOPMENT GOALS BASED ON SELECT TARGETS

GOAL	INDICATOR	DISTANCE FROM TARGET (2023) ¹	TREND OF SDG PROGRESS (2023) ¹	CHANGE IN TREND OF SDG PROGRESS BETWEEN 2020 AND 2023 ²
1	1.1.1 Eradicate extreme poverty	Very far from target	Limited or no progress	Backward
	1.3.1 Implement social protection systems	Fair progress but acceleration needed	Fair progress but acceleration needed	N/A
2	2.1.2 Achieve food security	Fair progress but acceleration needed	Deterioration	None
	2.2.1 End malnutrition (stunting)	Fair progress but acceleration needed	Fair progress but acceleration needed	None
3	3.1.2 Increase skilled birth attendance	Close to target	Fair progress but acceleration needed	Backward
	3.2.1 End preventable deaths under 5	Fair progress but acceleration needed	Fair progress but acceleration needed	Backward
	3.3.3 End malaria epidemic	Fair progress but acceleration needed	Limited or no progress	None
	3.b.1 Increase vaccine coverage	Fair progress but acceleration needed	Deterioration	Backward
4	4.1.2 Ensure primary education completion	Fair progress but acceleration needed	Limited or no progress	Backward
5	5.3.1 Eliminate child marriage	Fair progress but acceleration needed	Fair progress but acceleration needed	None
	5.5.1 Increase women in political positions	Fair progress but acceleration needed	Fair progress but acceleration needed	None
6	6.1.1 Universal safe drinking water	Fair progress but acceleration needed	Limited or no progress	None
	6.2.1 Universal safe sanitation and hygiene	Fair progress but acceleration needed	Fair progress but acceleration needed	None
7	7.1.1 Universal access to electricity	Fair progress but acceleration needed	Fair progress but acceleration needed	Backward
	7.3.1 Improve energy efficiency	Fair progress but acceleration needed	Fair progress but acceleration needed	None
8	8.1.1 Sustainable economic growth	Fair progress but acceleration needed	Deterioration	Backward
	8.5.2 Achieve full employment	Close to target	Limited or no progress	None
9	9.2.1 Sustainable and inclusive industrialization	Close to target	Limited or no progress	None
	9.5.1 Increase research and development spending	Fair progress but acceleration needed	Fair progress but acceleration needed	Forward
	9.c.1 Increase access to mobile networks	Target met or almost met	Substantial progress/on track	None
10	10.4.2 Reduce inequality within countries	Fair progress but acceleration needed	Fair progress but acceleration needed	N/A
11	11.1.1 Ensure safe and affordable housing	Fair progress but acceleration needed	Fair progress but acceleration needed	Forward
12	12.2.2 Reduce domestic material consumption	Fair progress but acceleration needed	Limited or no progress	N/A
	12.c.1 Remove fossil fuel subsidies	Fair progress but acceleration needed	Deterioration	Backward
13	13.2.2 Reduce global greenhouse gas emissions	Fair progress but acceleration needed	Deterioration	None
14	14.4.1 Ensure sustainable fish stocks	Very far from target	Deterioration	N/A
	14.5.1 Conserve marine key biodiversity areas	Fair progress but acceleration needed	Limited or no progress	N/A
15	15.1.2 Conserve terrestrial key biodiversity areas	Fair progress but acceleration needed	Limited or no progress	None
	15.4.1 Conserve mountain key biodiversity areas	Fair progress but acceleration needed	Limited or no progress	N/A
	15.5.1 Prevent extinction of species	Fair progress but acceleration needed	Deterioration	None
16	16.1.1 Reduce homicide rates	Fair progress but acceleration needed	Limited or no progress	Backward
	16.3.2 Reduce unsentenced detainees	Fair progress but acceleration needed	Deterioration	None
	16.a.1 Increase national human rights institutions	Fair progress but acceleration needed	Fair progress but acceleration needed	None
17	17.2.1 Implement all development assistance commitments	Fair progress but acceleration needed	Fair progress but acceleration needed	Forward
	17.8.1 Increase internet use	Close to target	Substantial progress/on track	None
	17.18.3 Enhance statistical capacity	Fair progress but acceleration needed	Limited or no progress	None

From Science to Practice – what drives adoption of sustainable and adaptive practices?

From science to practice

WHAT DRIVES ADOPTION?

Producer/advisor/business networks / trust relationships: "social capital"

Locally contextualized knowledge ("human capital")

**Practice
(producers,
value chain)**

Researcher-producer-industry interface, tech transfer, trust relationships

In-field demonstration, producer days, knowledge management

Government-producer-business interface and relationships

Supportive integrated policy and planning

Red tape

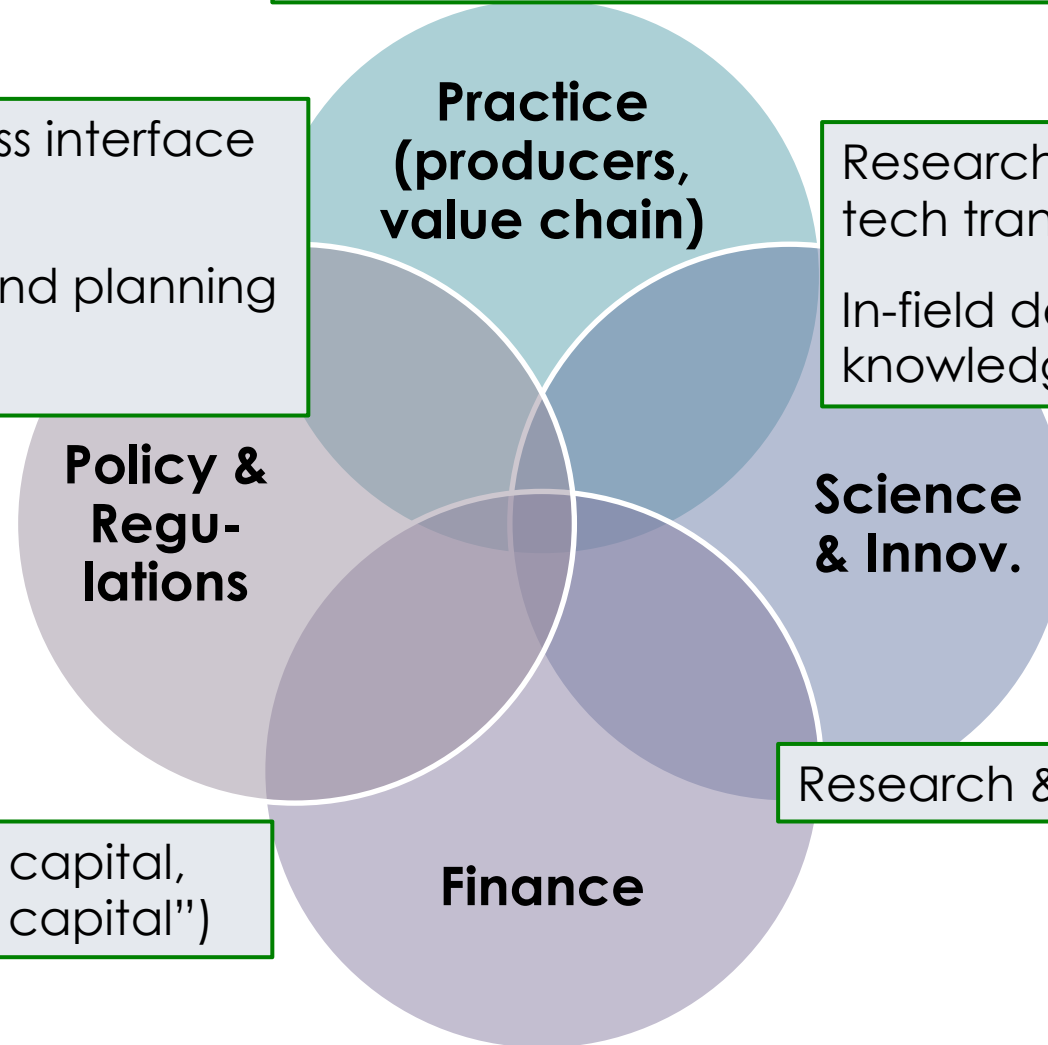
**Policy &
Regu-
lations**

**Science
& Innov.**

Research & Innovation funding

Risk perception, profit, capital, other crises ("financial capital")

Finance



Sustainable Viticulture

With examples from the Western Cape province

Sustainable Viticulture

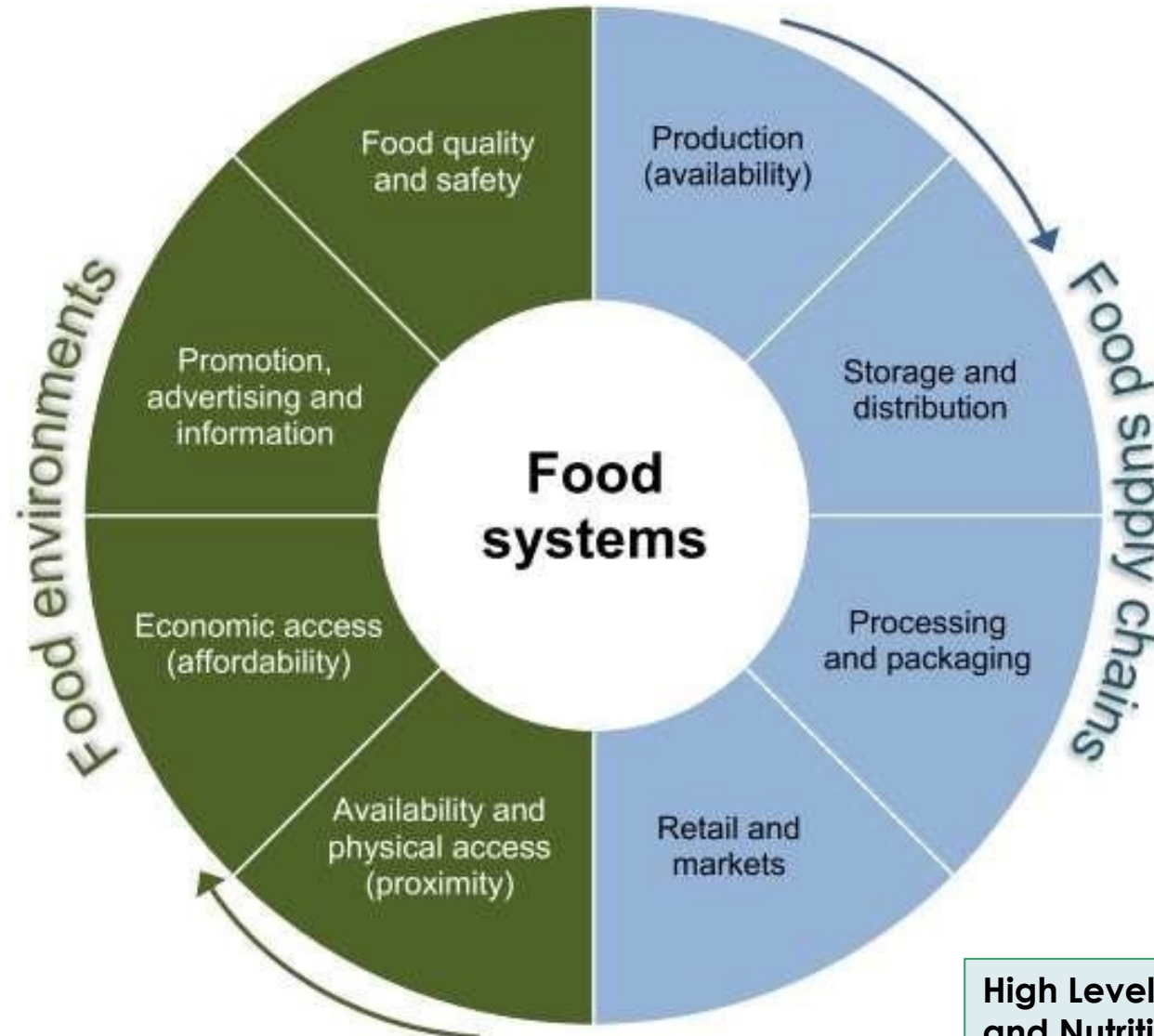
“Global strategy on the scale of the grape production and processing systems, incorporating at the same time the **economic sustainability** of structures and territories, producing **quality products**, considering requirements of **precision** in sustainable viticulture, **risks to the environment**, products **safety** and consumer health and valuing of **heritage, historical, cultural, ecological and landscape** aspects.”



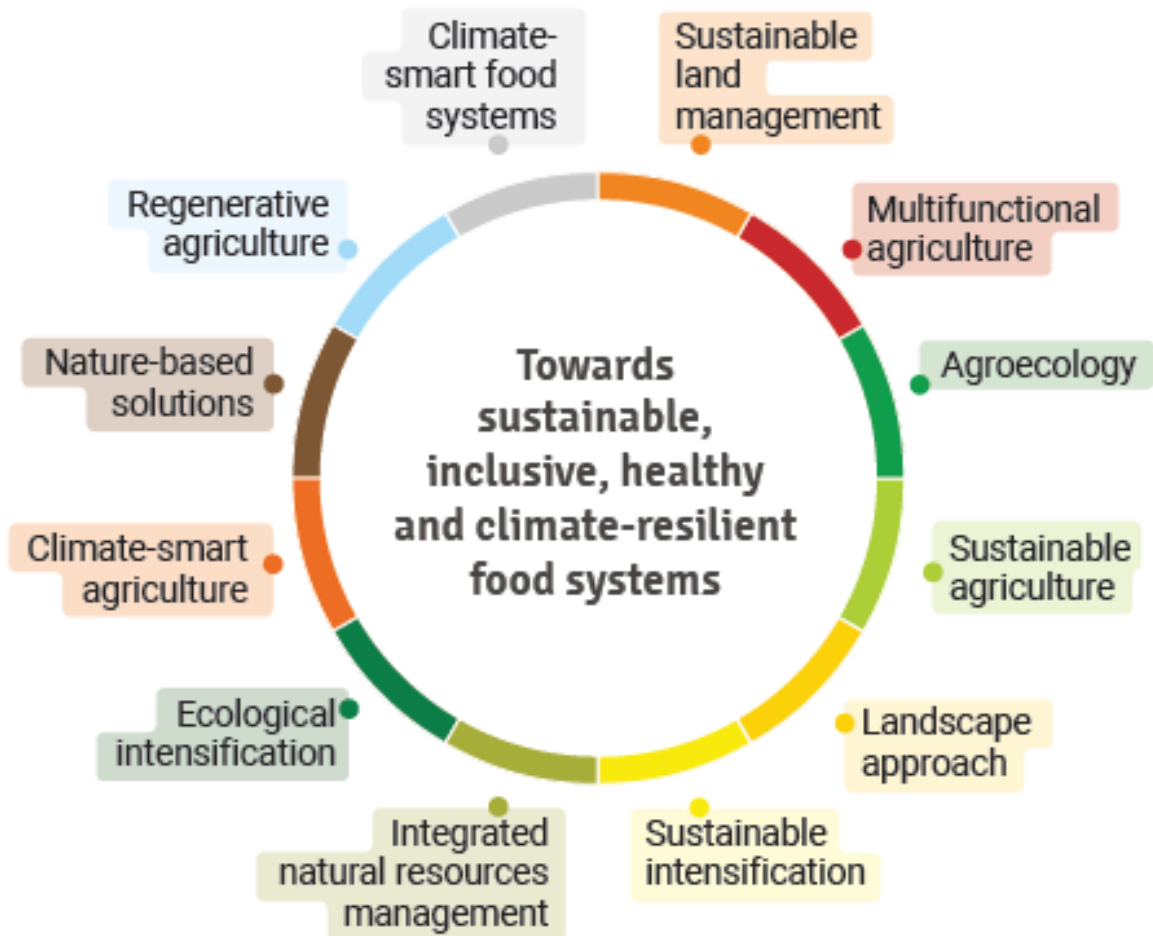
International Organisation
of Vine and Wine
Intergovernmental Organisation

RESOLUTION CST 1/2004

Sustainability must be integrated across value chains & food systems



Approaches for transforming food systems



Approaches – Western Cape/South Africa

Conservation Agriculture (CA)

Agro-ecology

Climate-Smart Agriculture (CSA)

Regenerative Agriculture (RA)

Nature-Based Solutions (NBS)

Integrated Pest Management (IPM)

Integrated Water Resources Management (IWRM)

Precision Agriculture

Organic Agriculture

EVIDENCE? SCALE? ECONOMICS?

Build soil health

- **Structure**
- **Water**
- **Nutrients**
- **Functional biodiversity**
- **GHG emissions**
- **Carbon removal**

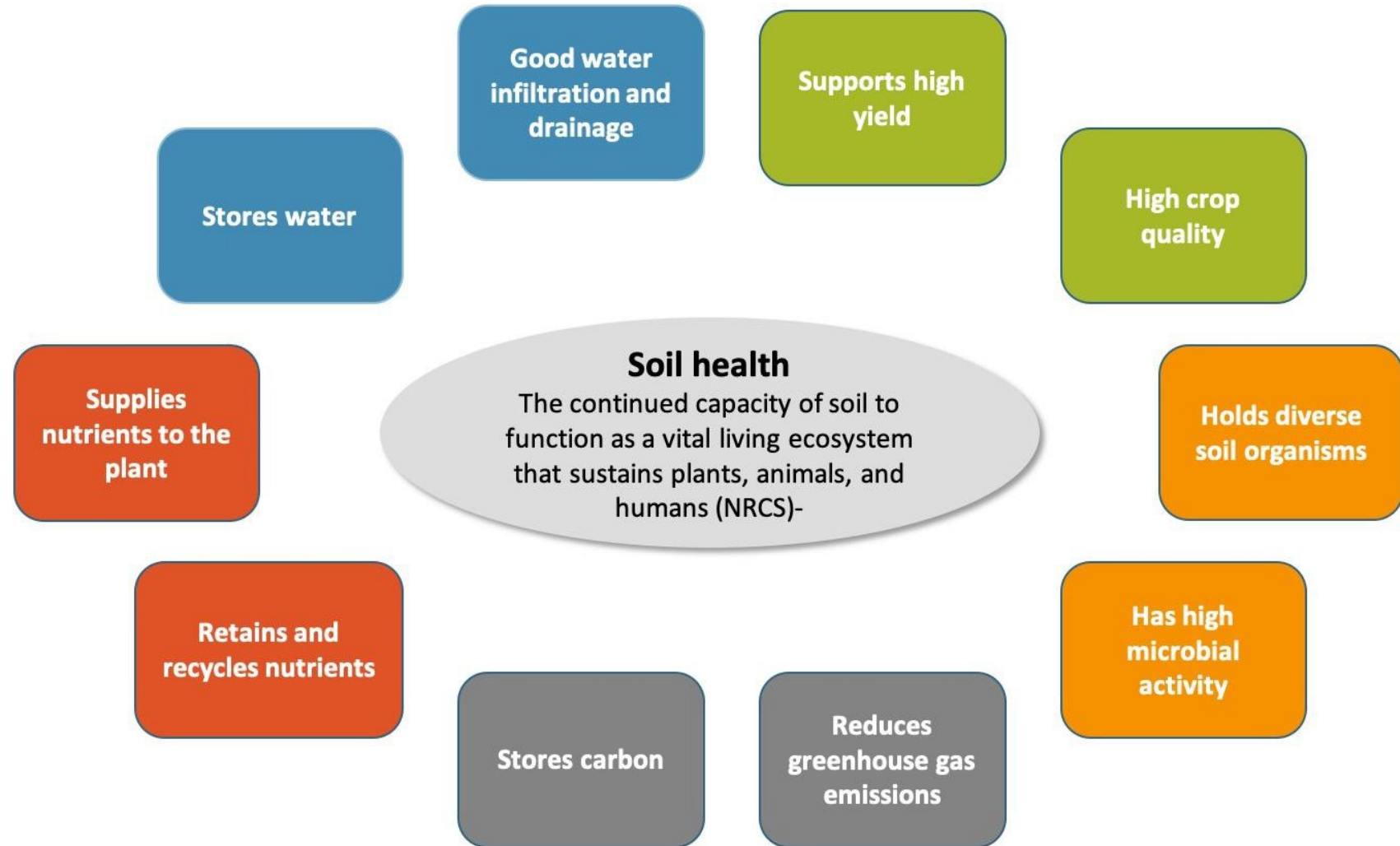
Cover crops

Mulch, compost

Soil amendments



Photo: Wineland Media



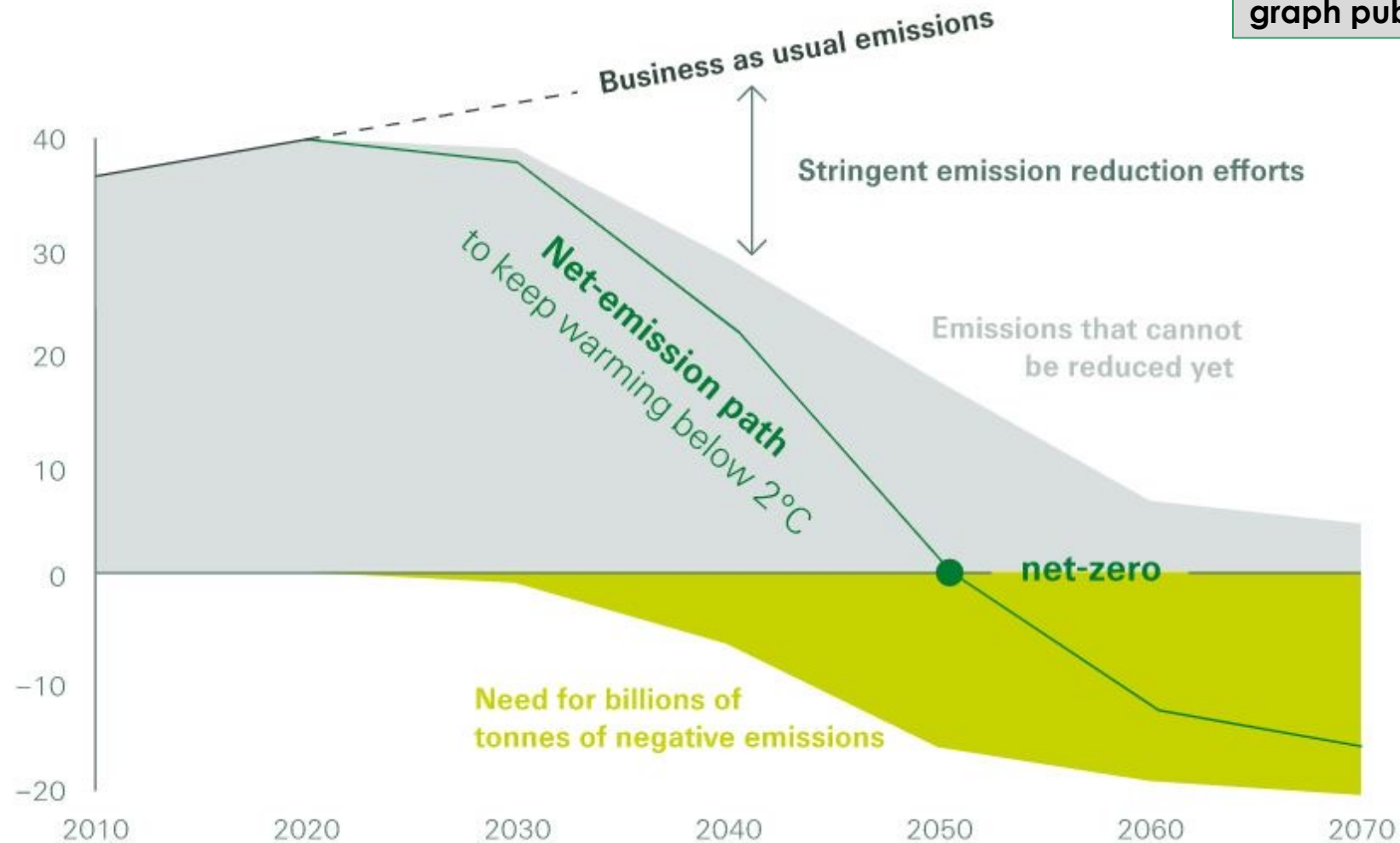
Graphic: Lazcano et al. (2020) Front. Environ. Sci. Vol. 8

Need for “negative GHG emissions” – carbon removal

Global CO₂ emissions

Billion tonnes per year

Source: Swiss Re, based on a graph published by the IPCC



SOIL PREPARATION

FOR SUSTAINABLE WINE AND TABLE GRAPE VINEYARDS



L. VAN ZYL

FERTILISATION GUIDELINES FOR THE TABLE GRAPE INDUSTRY

KOBUS CONRADIE • PIETER RAATH
DAWID SAAYMAN • BENNIE DIEDERICKS • KOBUS LOUW



COVER CROPS

IN SOUTH AFRICAN VINEYARDS

J. FOURIE



Cover crops offer many benefits to grape producers, having been shown to suppress weeds; reduce soil compaction and erosion; improve water infiltration and retention; and boost soil fertility.

Integrated crop-livestock systems

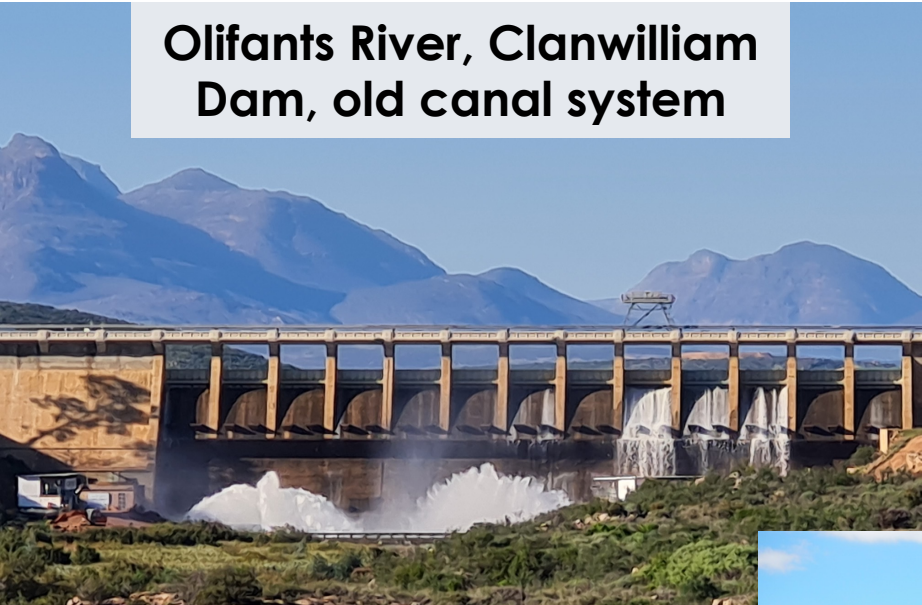
Example from Langgewens Experimental Farm, Swartland region of Western Cape – winter rainfall dryland cropping systems research.

Exploration of concept in vineyards and orchards.



Sustainable water use and management – Irrigation water / infrastructure

Olifants River, Clanwilliam Dam, old canal system



Producers sit on Irrigation Boards / Water User Associations

Orange River



Berg River, Berg Dam

Sustainable water use and management – Irrigation efficiency

Micro-sprinklers

Industry standard

Drip

Has allowed table grape production to expand into arid areas

Low-Flow Drip

Is an effective tool in sandy and rocky soils

Ultra-Low-Flow Drip

Early adoption for citrus. Needs research for table grapes.

- Variation between and within different vineyards – where is the water going?
- Measure!
- Sensor-based continuous soil moisture measurement – capacitance probes
- Physiologically-based irrigation scheduling
- Producers combining capacitance probes with data from weather stations – towards greater precision
- Remote sensing tools e.g. FruitLook
- Producers can manage with less water (experiences from the last years: drought, electricity blackouts, research)

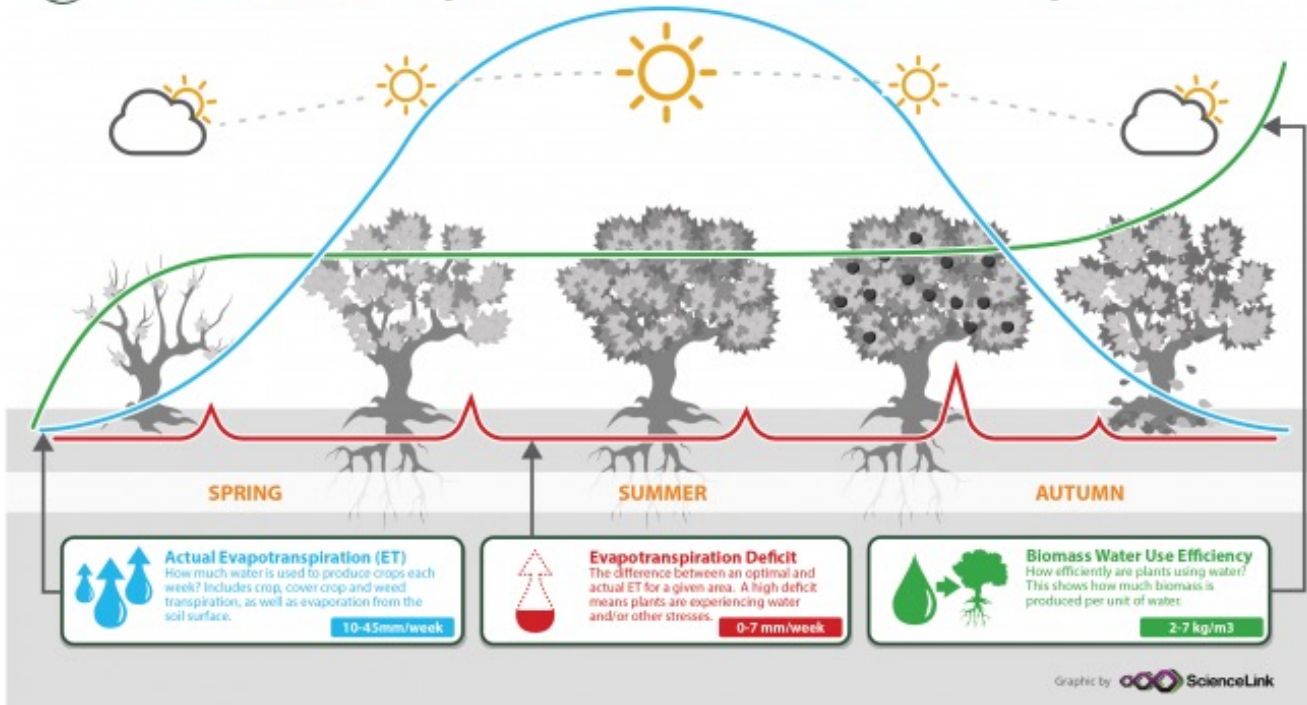
FruitLook: web-based remote sensing tool to track growth, water use, N use

Assists growers in optimising in-field water use through satellite-based data and data products

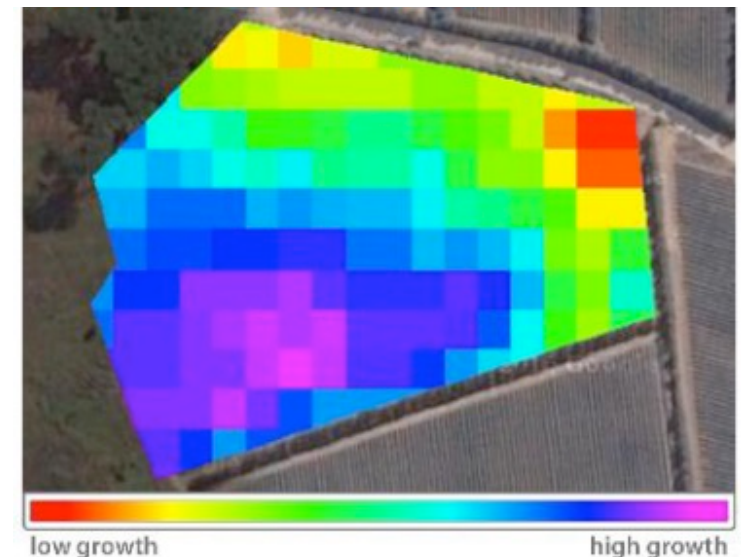
Pixel maps at a resolution of 20 x 20m

Water use savings: 11-20% (grapes, pome); 21-30% (stone)

 fruitlook.co.za helps farmers understand their crops' water use



- Data since 2011
- FruitLook now covers **9.5 million hectares** in the Western Cape

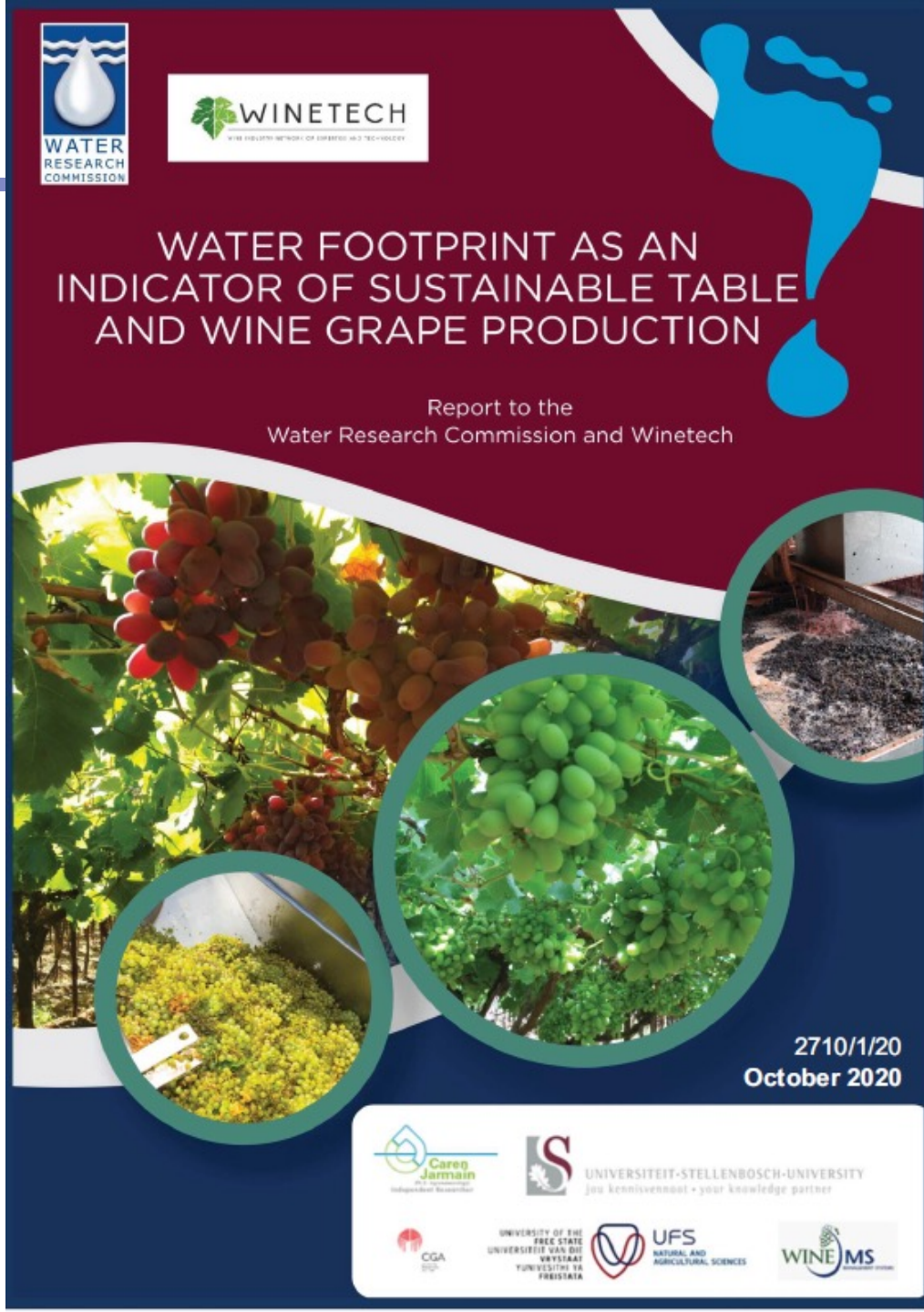


Applications: identify under-irrigation, identify over-irrigation and probe placement

Water Footprint study – Western Cape table grapes

- 200 cases representing a wide range of production conditions typical of the Western Cape (2018/19).
- Small/negligible contribution of the WF_{blue} from the packhouse (under 1% or 0.76 ℓ/kg) to the WF_{total} ; field-level WF_{total} contributing to 99% of the estimates.
- **The WF_{total} ranged between 500 and 714 ℓ/kg , with a median value of 619 ℓ/kg .**
- Variation in the WF_{total} was observed between cultivars.
- For all areas studied, the WF_{blue} (field level plus packhouse) contributed more than 70% to the WF_{total} .
- WF_{grey} contributed to about 20% of the WF_{total} .

Jarmaine et al. 2020. Report to the Water Research Commission and Winetech



Physical crop water productivity

$$WP_p = \frac{\textit{Yield}}{\textit{Total Water Use}}$$

Making every drop count

1. Higher yield with less water
2. Higher yield with the same amount of water
3. Same yield with less water

Economic crop water productivity

$$WP_e = \frac{\textit{Gross Value}}{\textit{Total Water Use}}$$

Making every drop count

1. Higher value with less water
2. Higher value with the same amount of water
3. Same value with less water

Fernández et al. 2020, Agric Water Mgt 237,
1 July 2020, 106074

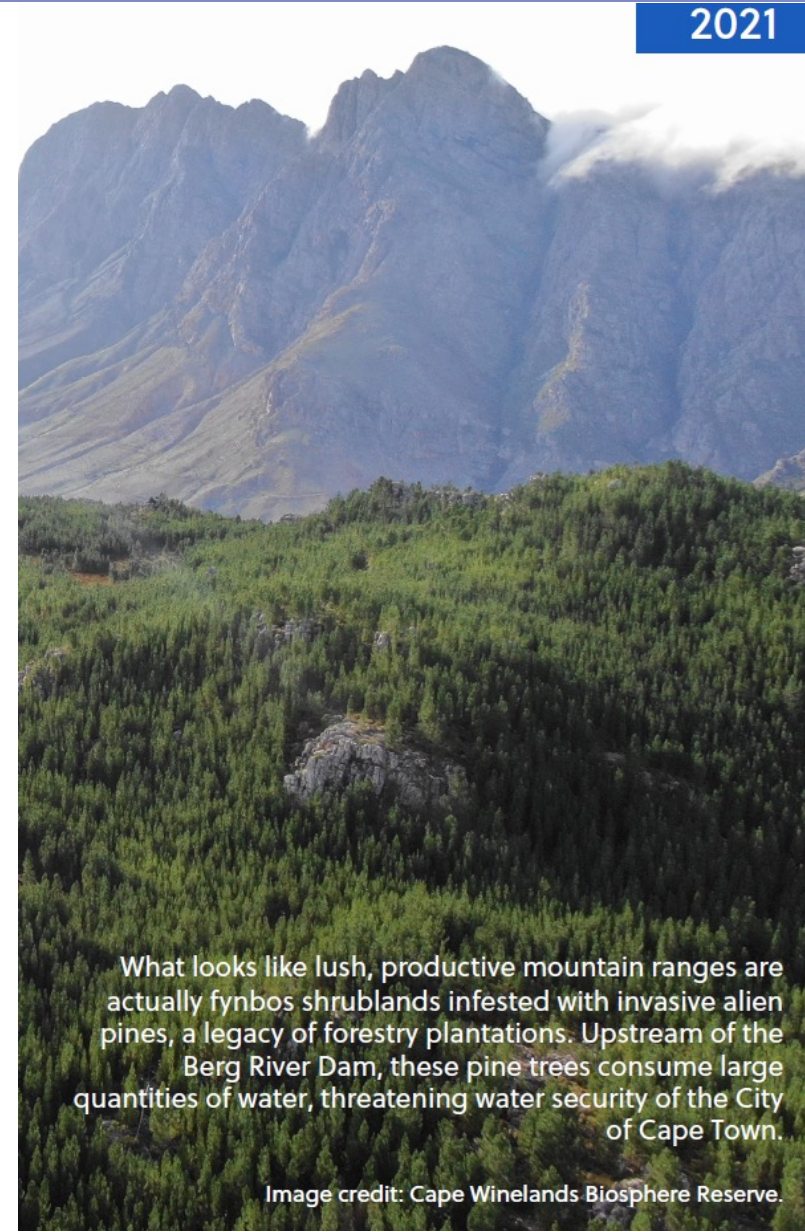
Landscape-catchment integrity and function: Nature-Based Solutions

Clearing of infestations of invasive alien trees (e.g. pines) from naturally tree-less catchments **increases available water resources by 15 – 29 %** (Rebelo et al., 2022).

Increases water base flows, flow regulation, improved water quality, fire risk reduction, significant job creation (Olesen et al. 2021).

Reduces the impact of climate change on hydrological drought severity (Holden et al. 2022).

Public programme, but **works best in partnership with landowners** (Midgley et al., 2021).



What looks like lush, productive mountain ranges are actually fynbos shrublands infested with invasive alien pines, a legacy of forestry plantations. Upstream of the Berg River Dam, these pine trees consume large quantities of water, threatening water security of the City of Cape Town.

Image credit: Cape Winelands Biosphere Reserve.



Image credit: Anaya Katlego, Unsplash

Landscape-catchment integrity and function: Dept Agriculture/LandCare

Integrated Catchment Management: Remove invasive alien plants to increase stream flows; erosion prevention and river protection; maintain and develop agricultural water infrastructure.

The WC DoA, with the support of DEA&DP, has completed almost 1500 km of River Maintenance Management Plans over the past 10 years, involving more than 1200 farms.



Witrivier as it comes out of Bainskloof to Breede River.

45 ha wetland that was 100% dense of invasive aliens.

It has now been cleared of aliens for 5 years and the wetland is recovering well.

DoA invested initial project funds and landowners contributed.

Now the Bains Home Owners Association is 100% responsible for follow up and they have taking full ownership to maintain the restoration work.

Landscape-catchment integrity and function: Dept Agriculture/LandCare



Image credit: Rudolph Röscher

Holsloot river below Stettynskloof dam, before (left) and after (right) clearing of invasive alien plants.

DoA invested initial project funds but in agreement with the **Irrigation Board** that they will **co-fund and charge an additional levy on their water allocations to each farmer.**

That fund is then used to maintain the gain.

June 2023 and September 2023 flooding

- Damages to production (crop losses, sediment), natural resources (river banks/ systems, soil) and infrastructure (irrigation equipment, fencing, roads)
- **June: total damages > ZAR 1 billion**
- **September: total damages > ZAR 1.4 billion**



Photo: Supplied to Financial Mail



Photo: Supplied to Daily Maverick

DoA Incorporating climate change into disaster risk reduction

Integrating Climate Change into Disaster Risk Reduction Community (Farmer) Risk Assessment Engagements

Multi-stakeholder Dialogue on Climate Disaster Solutions, 24-25 April 2023



PRIORITY INTERVENTIONS (lessons from 2015-2018 drought):

Financial support and instruments

Management of water infrastructure and irrigation systems

Laws and regulations that impede disaster management

Scale up more efficient water use and irrigation

Scale up adaptive technology and innovation

Scale up adaptive production methods

Scale up weather data, forecasting and early warning

Other elements of sustainability in table grapes

Cultivar development & crop diversity



Sustainable nutrition



Canopy management



Protecting biodiversity



Sustainable plant protection



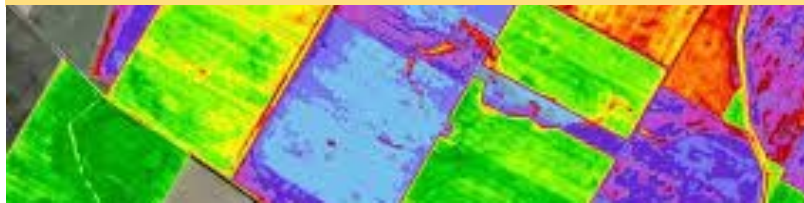
Transition to biological options



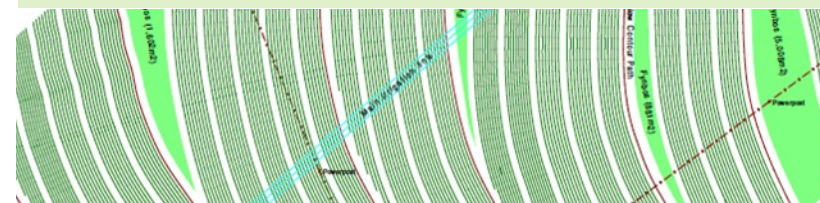
Smart use of weather data



Sensor technology & remote sensing



Vineyard layout and design



Renewable energy



Energy efficiency

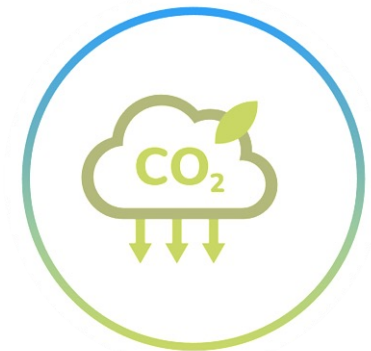


Waste mgt & circular economy



An online carbon footprint calculator developed to equip the South African fruit & wine industries to:

1. **Assess and reduce** their greenhouse gas emissions
2. **Proactively respond** to the demands associated with climate change and carbon emissions



2008

Project
Initiated

2012



Online
calculator

TODAY

Over 10 years of
carbon footprinting

 Farm CO₂e Benchmark

 Cold Store CO₂e Benchmark

 Packhouse CO₂e Benchmark

Carbon reductions can be made by focusing in reducing electricity by optimizing irrigation needs through **precision irrigation** and switching to **renewable energy** sources. There should also be a focus on soil health to **reduce external inputs**.

Carbon Heroes – gives recognition to users with graded carbon footprints (www.carbonheroes.co.za)



Measure the carbon footprint of the farm or business entity

Identify 'carbon hotspots' across the farm or business entity

Develop creative solutions to reduce CO₂e emissions

Manage the perceptions of buyers and policy makers

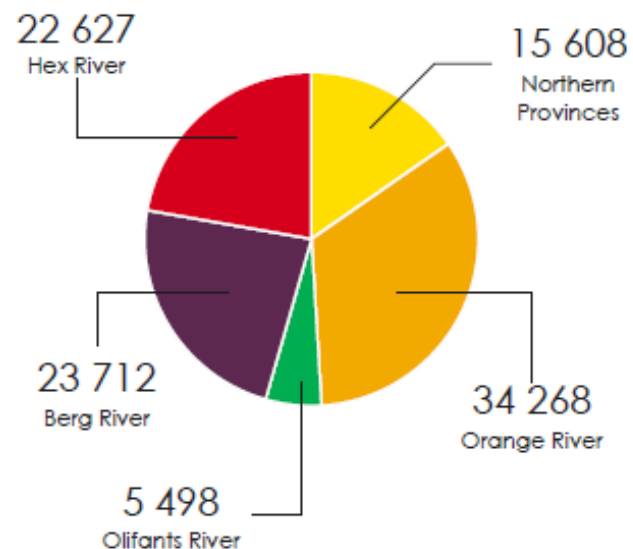
2022/2023 TOTAL NUMBER OF EMPLOYEES PER REGION



NORTHERN PROVINCES	ORANGE RIVER	OLIFANTS RIVER	BERG RIVER	HEX RIVER
Seasonal: 13 391	Seasonal: 30 590	Seasonal: 4 761	Seasonal: 20 427	Seasonal: 17 701
Permanent: 2 217	Permanent: 3 678	Permanent: 737	Permanent: 3 285	Permanent: 4 926
Total: 15 608	Total: 34 268	Total: 5 498	Total: 23 712	Total: 22 627

SOURCE: SATI AND AGRIHUB 2021/2022

TOTAL EMPLOYMENT PER REGION



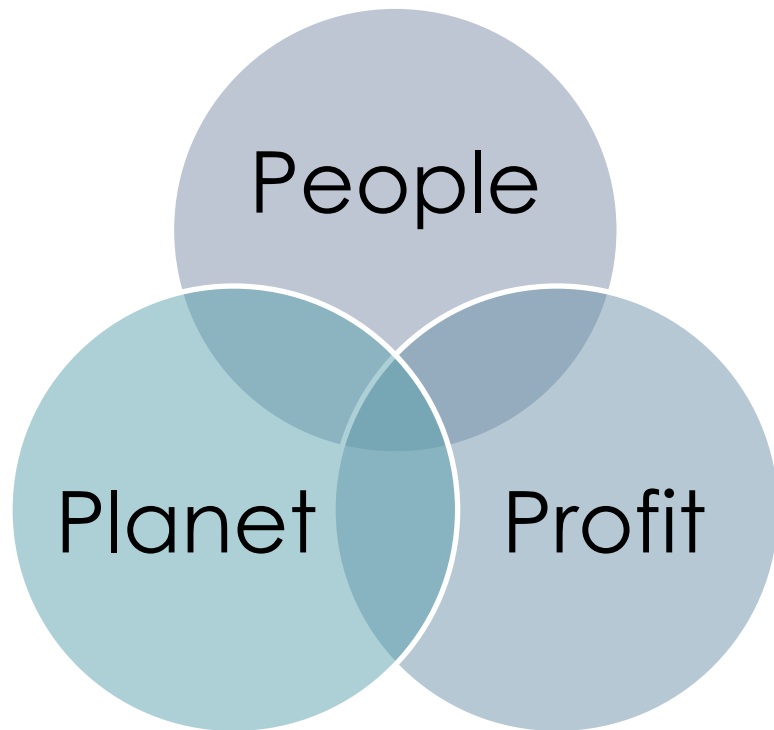
Social considerations

Producers and workers – health and safety

Fair remuneration and HR practices

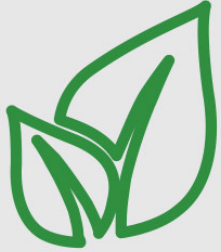
Consumer demand, preferences

Consumer health and safety



- Membership-based; >4000 members
- Assists producers with **ethical labour compliance** and **environmental assurance** whilst **minimizing costs**.
- Encourages **continuous improvement in practices over time** in excess of the minimum legal requirements.
- Adopts a **single South African standard and audit** process and methodology that is aligned to local law and international standards.
- **Global platforms:** SIZA offers producers the functionality to make their audit data available through platform such as Sedex and GLOBALG.A.P.
- **One audit** no matter which market is supplied. Alleviates certification burdens on producers.

Global: Corporate sustainability / accountability - ESG



Environmental

- Renewable fuels
- Greenhouse gas (GHG) emissions
- Energy efficiency
- Climate risk
- Water management
- Recycling processes
- Emergency preparedness



Social

- Health and safety
- Working conditions
- Employee benefits
- Diversity and inclusion
- Human rights
- Impact on local communities



Governance

- Ethical standards
- Board diversity and governance
- Stakeholder engagement
- Shareholder rights
- Pay for performance

Set of standards that socially and environmentally conscious investors use to evaluate the ESG performance of companies or organizations.

Integrate ESG considerations into investment and innovation decisions.

Support sustainable and responsible business practices whilst seeking financial returns.

Global: Science Based Targets initiative (SBTi)

<https://sciencebasedtargets.org>

Science-based targets show organizations how much and how quickly they need to reduce their greenhouse gas (GHG) emissions to prevent the worst effects of climate change.



SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

3961
with science-based targets

6652
companies taking action

2590
net-zero commitments



COMMIT

Submit a letter establishing your intent to set a science-based target



DEVELOP

Work on an emissions reduction target in line with the SBTi's criteria



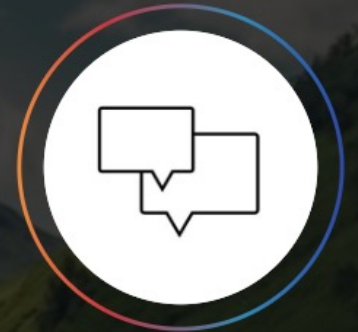
SUBMIT

Present your target to the SBTi for official validation



COMMUNICATE

Announce your target and inform your stakeholders



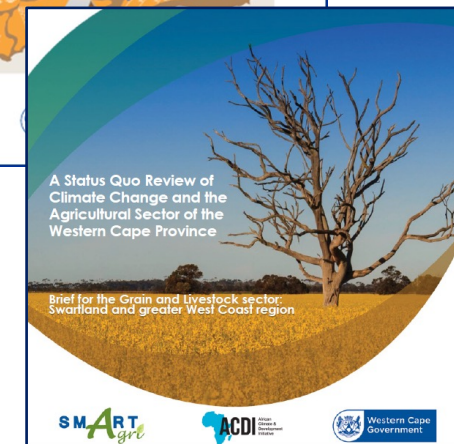
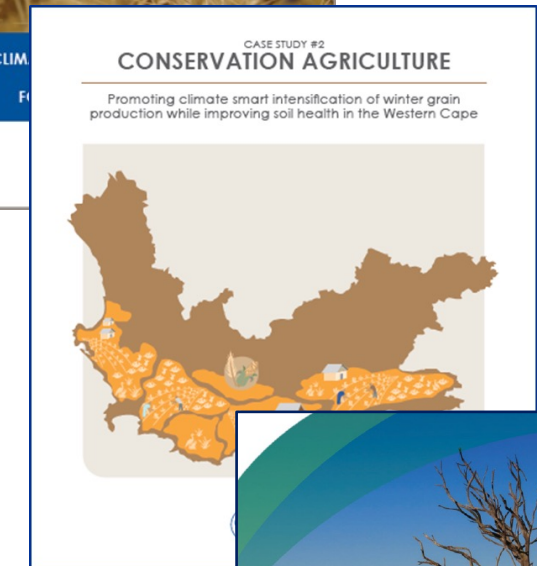
DISCLOSE

Report company-wide emissions and progress against targets on an annual basis

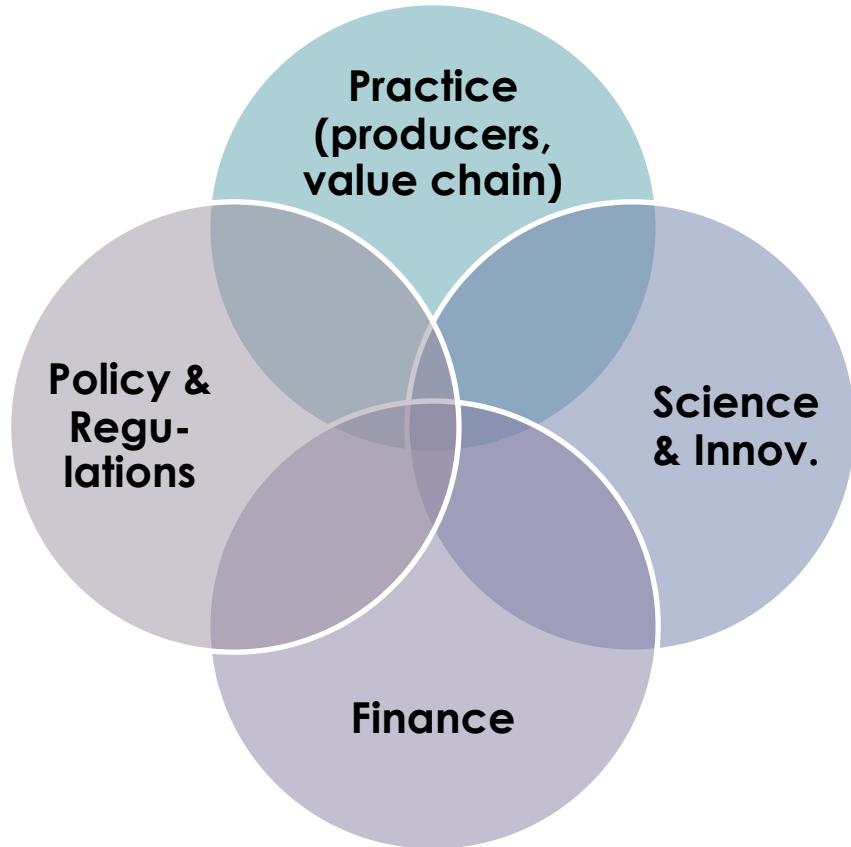
Supportive Integrated Planning: SmartAgri Plan

Western Cape Climate Change Response Framework and Implementation Plan for the Agricultural Sector (2016)

- Joint project of the Dept Agriculture (DoA) and the Dept Environmental Affairs & Development Planning (DEA&DP)
- Provides a “roadmap” to ensure a low-carbon, climate-resilient agricultural sector in the WC



Concluding thoughts



- Collaborations and partnerships can work and are becoming increasingly essential for real impact
- Transformative action now is cheaper in the long run than responding to a full blown crisis; WC drought taught us some valuable lessons
- Long-term returns on investment for research, tech and innovation
- The “Green Train” is unstoppable because the ecological and climate crisis must be stopped
- Good policy and regulation is not the enemy; build relationships and influence to ensure sensible, effective and affordable pathways
- The whole value chain must work together and share/reduce the burden, and unlock the opportunities



10TH
INTERNATIONAL
TABLE GRAPE
SYMPOSIUM

26 NOV
TO
1 DEC 2023

SOMERSET WEST
SOUTH AFRICA

Thank you

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