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RESEARCH SYMPOSIUM

MEASURING & REDUCING SOCIETAL IMPACTS

Building a Drought-Resilient Future

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The session will begin shortly.

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Ruth Langridge
UC Santa Cruz

Gina Ziervogel
University of Cape Town

Stephen Commins
UCLA

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UCLA Luskin Center for Innovation

Ruth Langridge

Senior Researcher, UC Santa Cruz

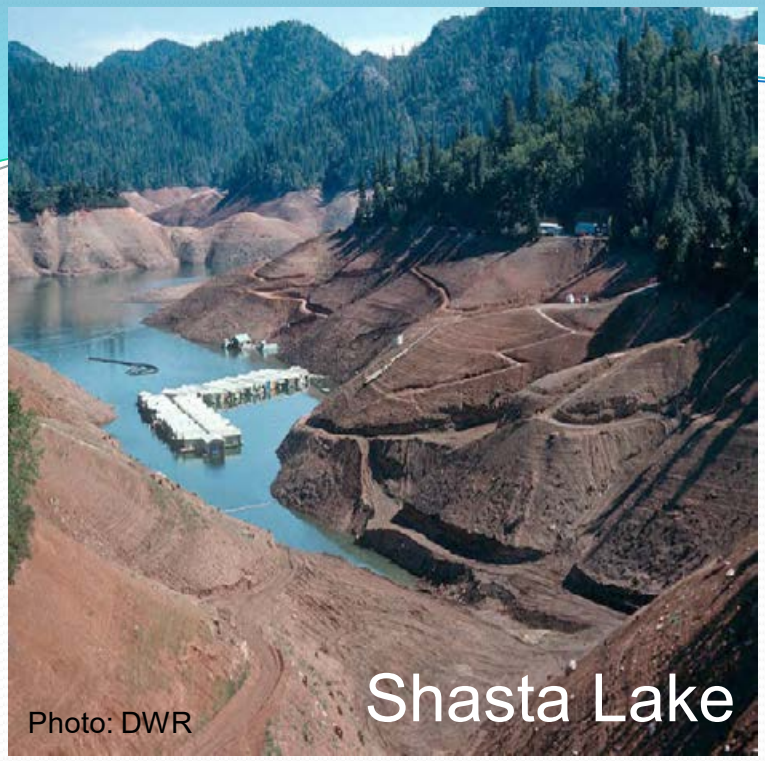
Groundwater and Drought Resilience in the Sustainable Groundwater Management Act Era

Groundwater and Drought Resilience

Water shortages and drought are Californian's biggest environmental concern PPIC 2021

Bass Lake
Photo: Vince Arrant, DWR

Ruth Langridge
University of California, Santa Cruz



The water level at Lake Shasta dropped precipitously.

Los Angeles Times

FORECAST: WORST DROUGHT EVER

SF Chronicle

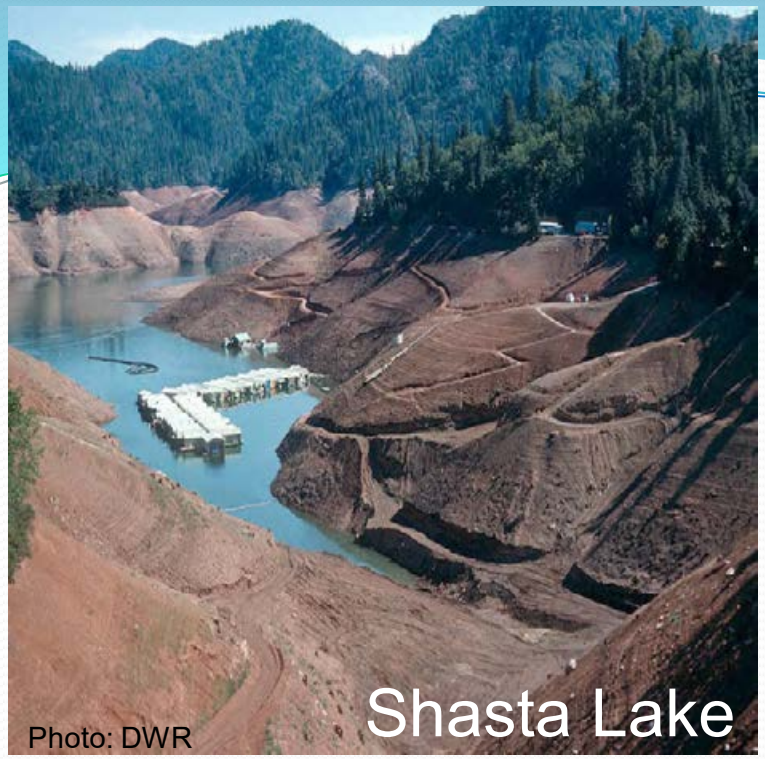
California's drought is the most severe in at least 1,200 years

The Guardian

Photo by Justin Sullivan/Getty Images

Drought worsens in Southern California…from "extreme" to "exceptional" drought conditions, *U.S. Drought Monitor Report*

1978



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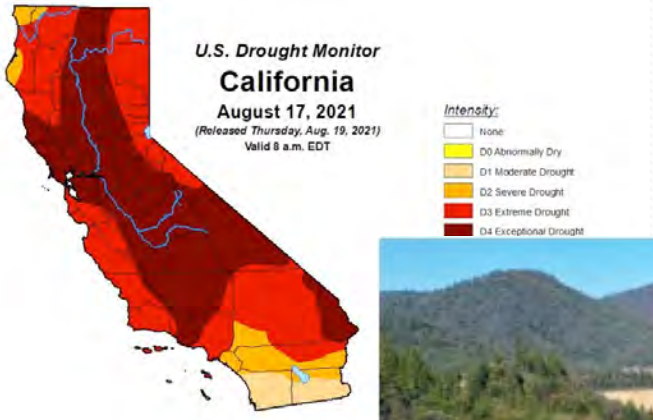
The Guardian

California Department of Water Resources

Same Old Story?

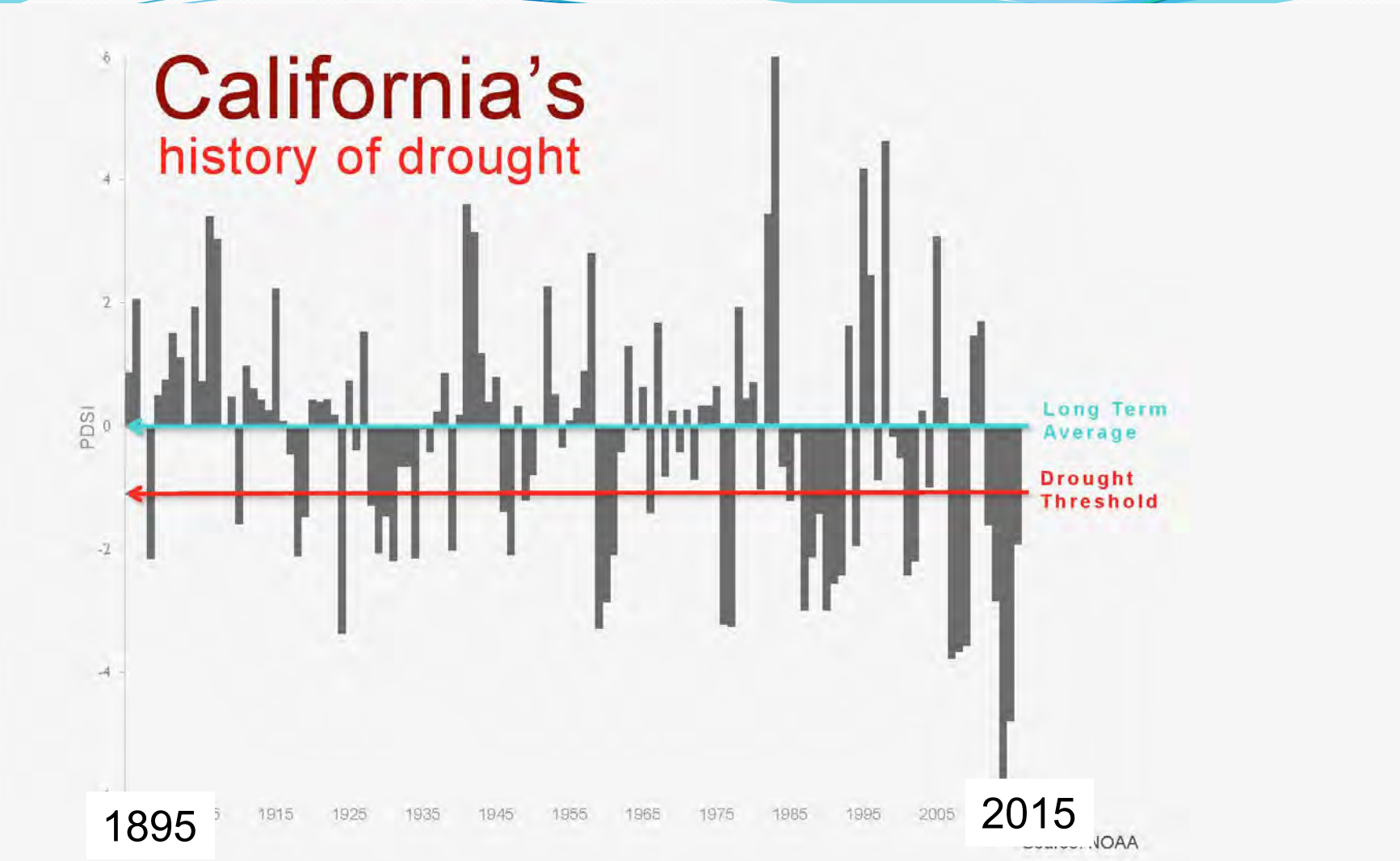


2021

Photo by Justin Sullivan/Getty Images

Drought worsens in Southern California…from "extreme" to "exceptional" drought conditions, *U.S. Drought Monitor Report*

Have we reduced our vulnerability to drought?



Source: NOAA

"And it never failed that during the dry years the people forgot about the rich years, and during the wet years they lost all memory of the dry years. It was always that way."

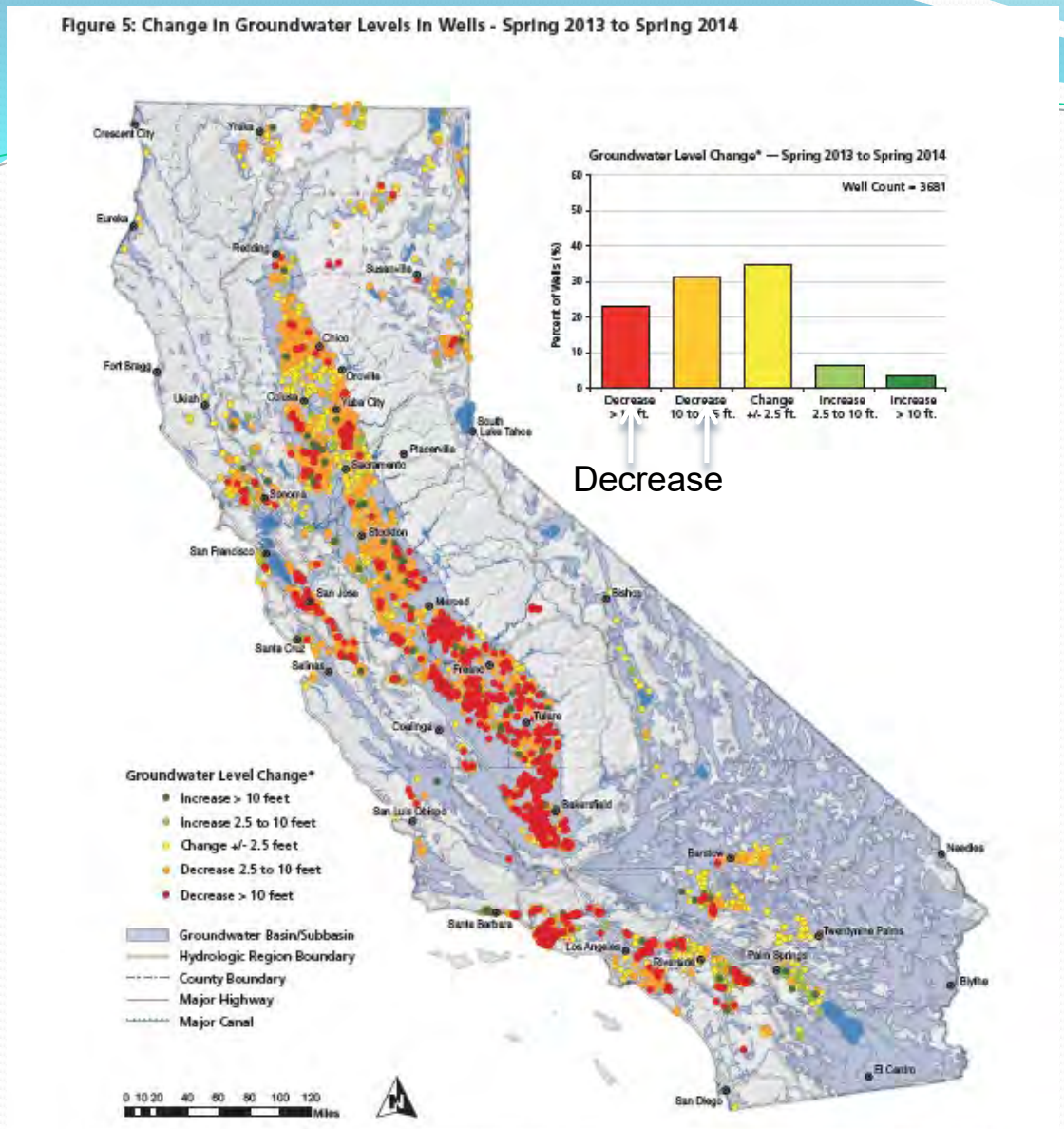
John Steinbeck, East of Eden

Why Groundwater and Drought?

Water in the aquifers continues to be the most effective strategic weapon against drought

ACE – Lessons Learned From the California Drought **(1987-1992)**

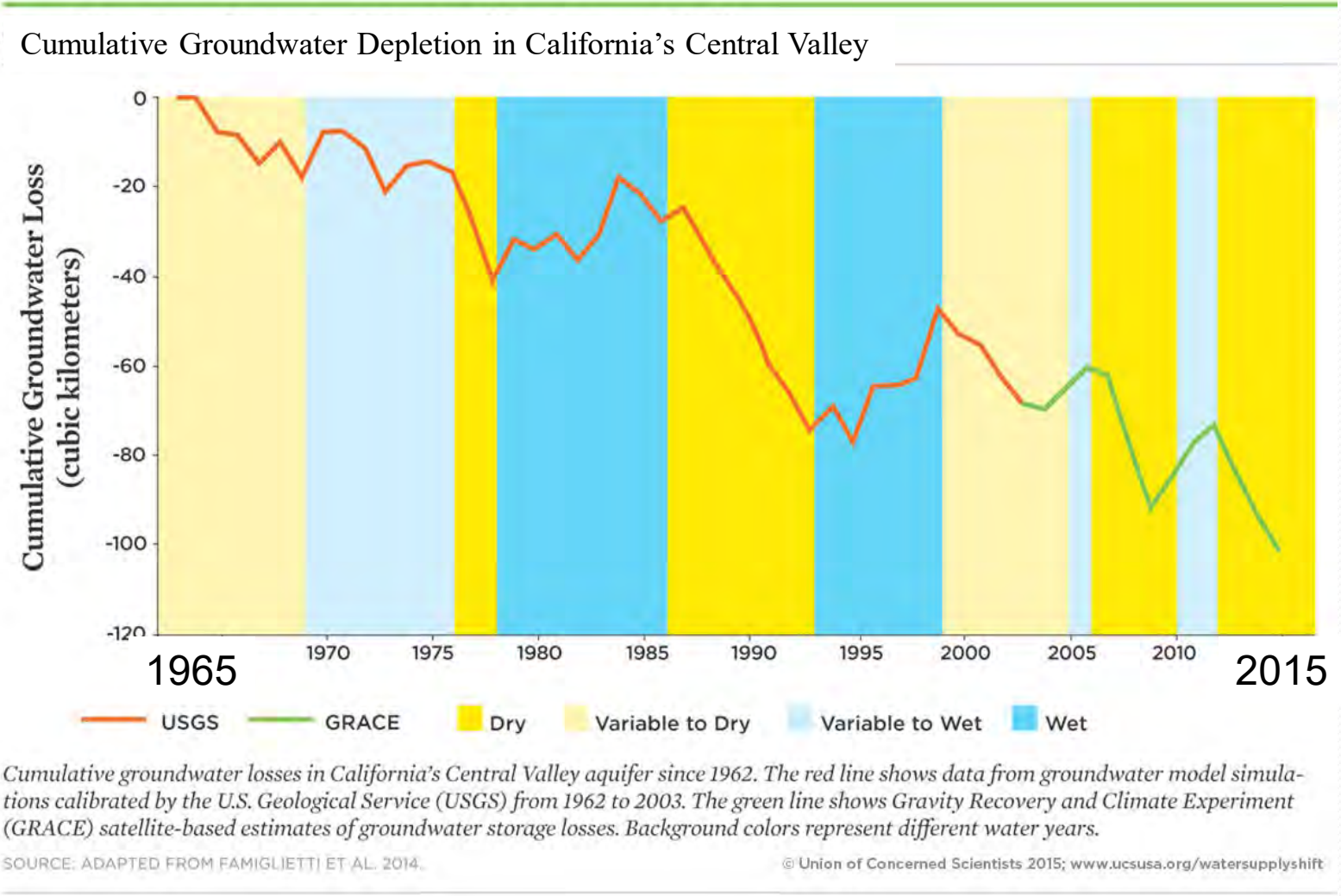
"Is it possible that much of the destruction and despair caused by floods and droughts comes down to the failure to keep water in the ground?" Ron Robie



Changes in Groundwater Levels 2013-2014

During each recent drought, groundwater levels declined in many basins

But groundwater levels did not fully recover during wet periods



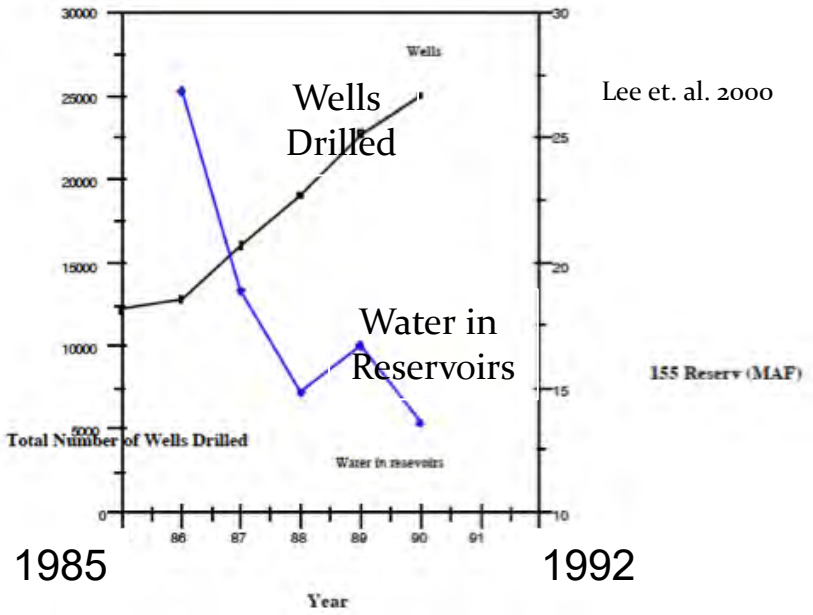
Result was cumulative groundwater depletion

California's **Typical** Past Response to Droughts and Water Shortages

Water Conservation

Mostly voluntary
Some mandates during recent droughts, but rescinded post-drought

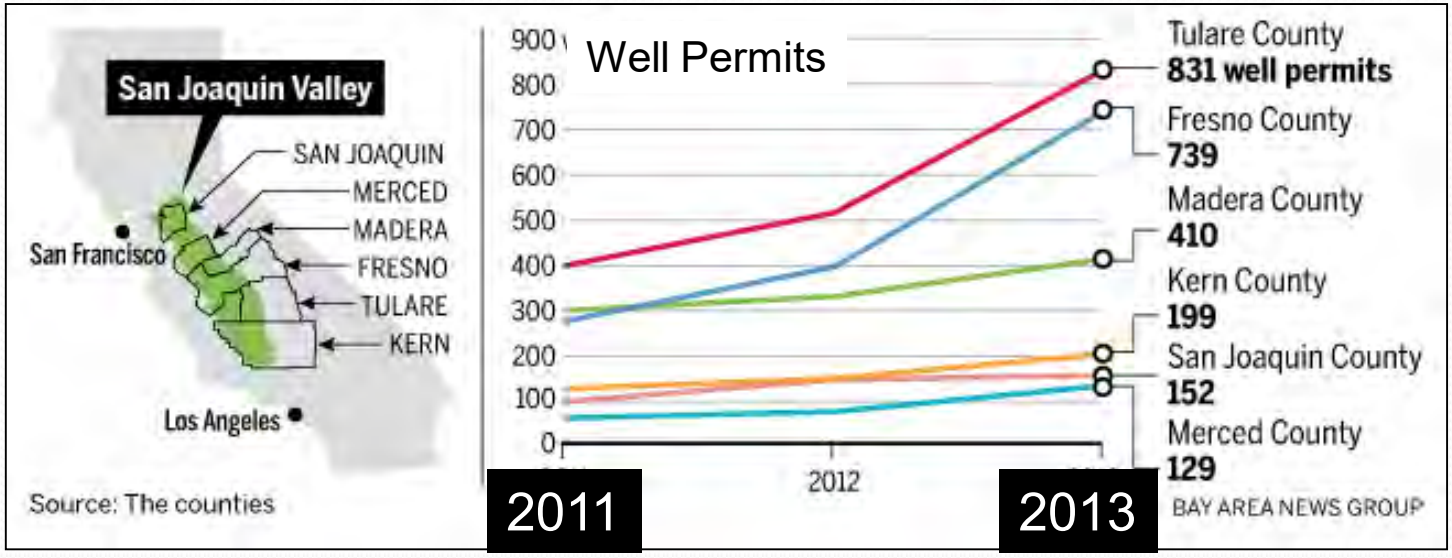
Water in reservoirs and wells drilled during the 1987-1992 drought



Lee et. al. 2000

1985 1992

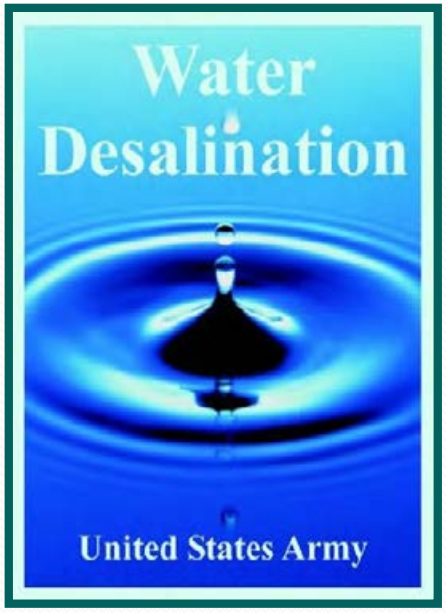
Pump More Groundwater



Develop Other Supply Side Strategies

Imported Water

Desalination

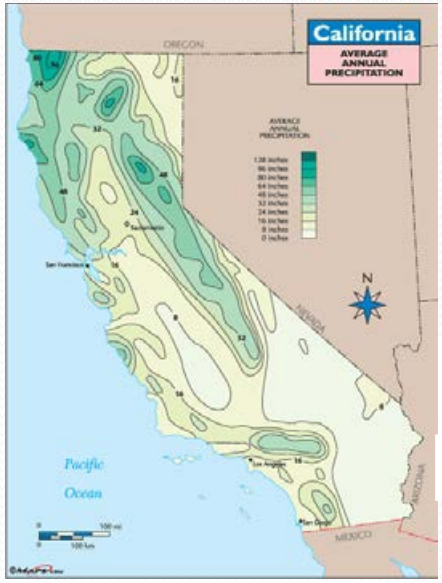


Recycled Water

Imported Water

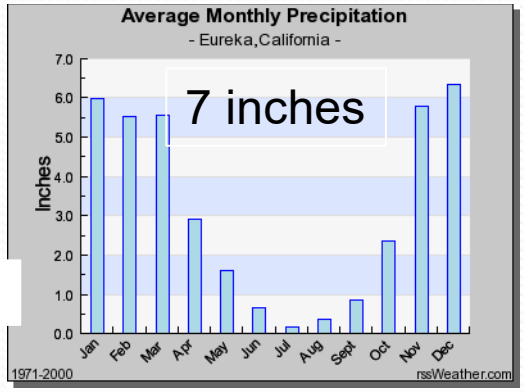
California Climate and Water

More rain in the north
Less in the south

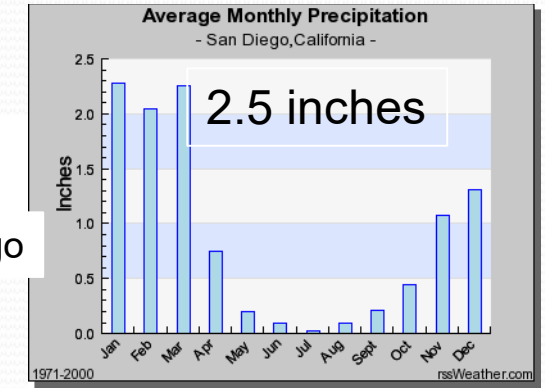


Wet in winter
Dry in summer

Eureka

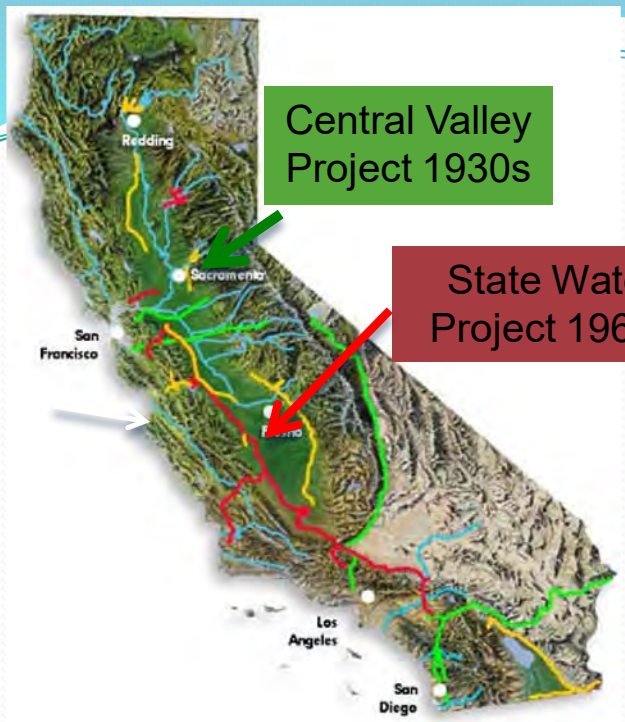


San Diego



Heavy spring run off from snow melt

Imported Water



Central Valley Project 1930s

State Water Project 1960s

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Dry in summer

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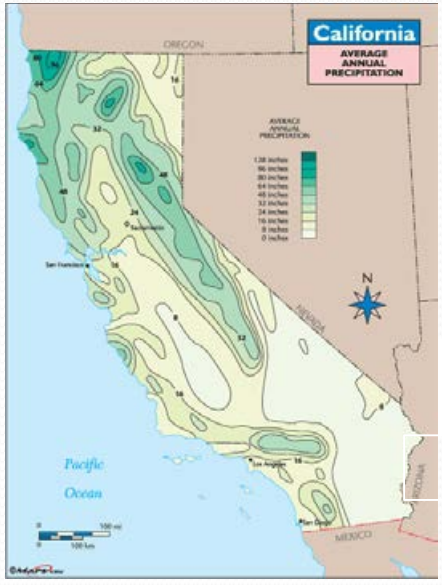

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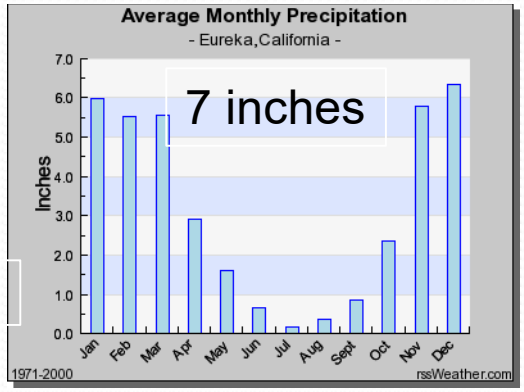

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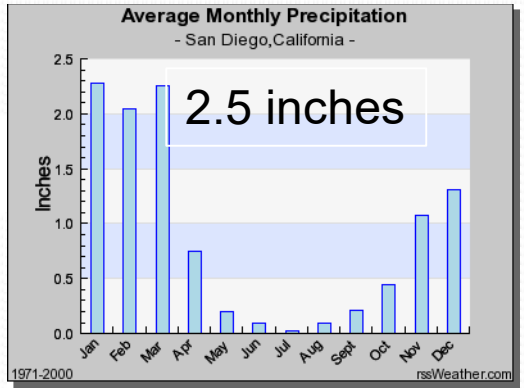
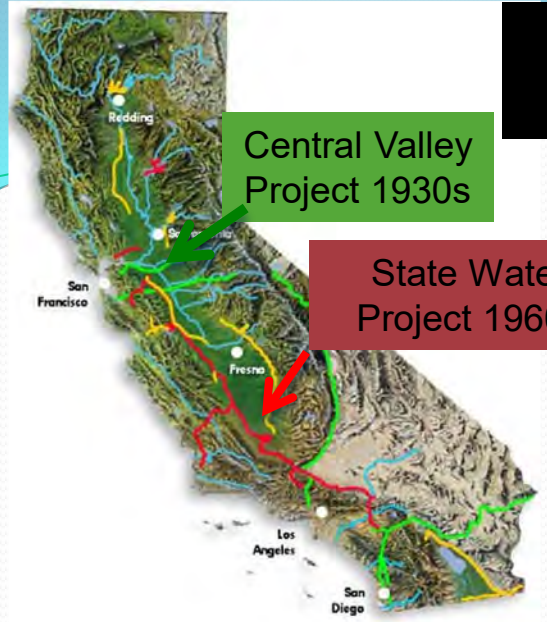


Imported Water

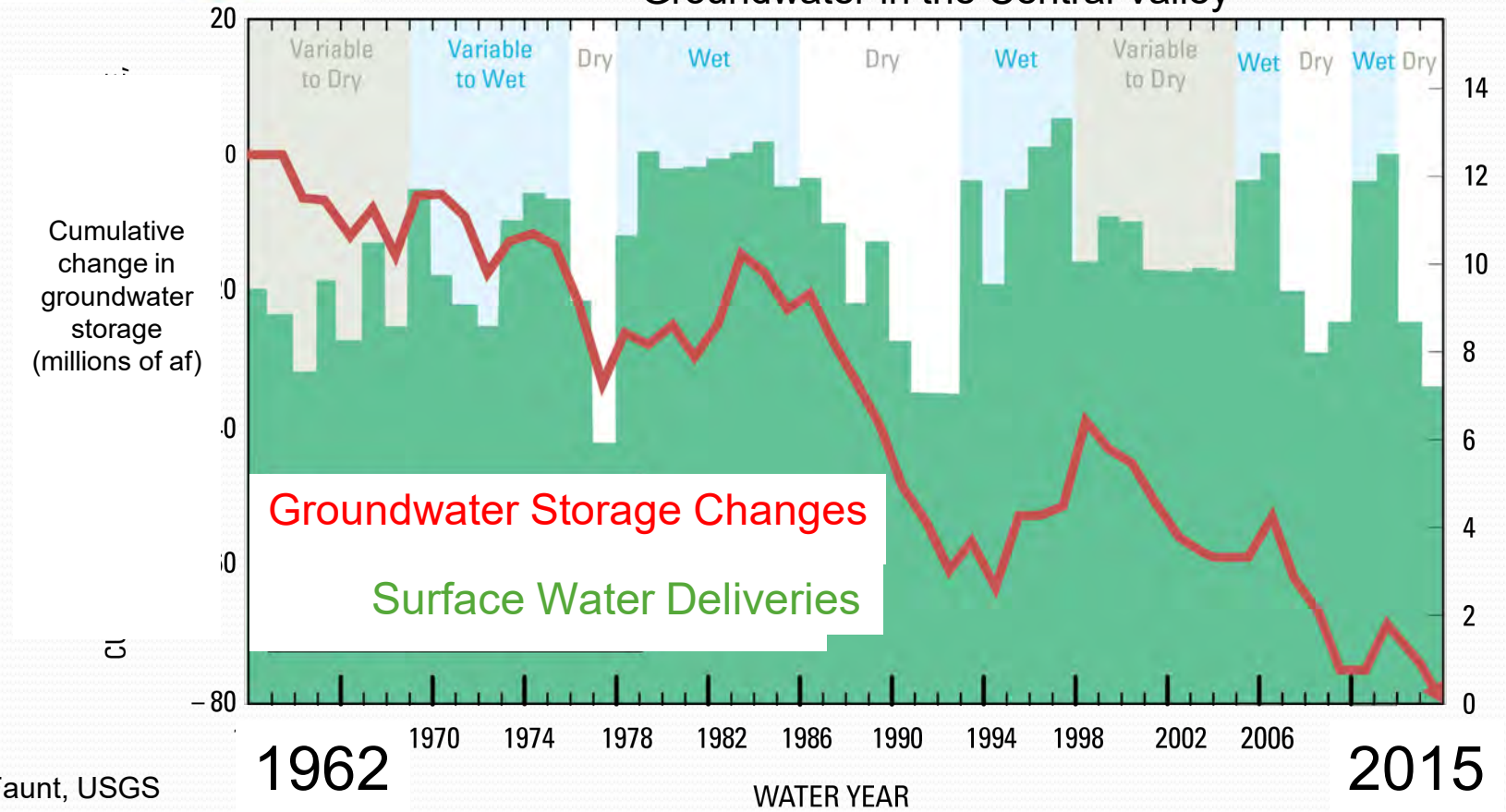


Central Valley Project 1930s

State Water Project 1960s

<u>Despite new imported water</u> from the big projects, over time, replenishment was less than withdrawals in many areas

Groundwater in the Central Valley



Claudia Faunt, USGS

Recycled Water

Table 2: Recycled Water Use in California (Pezzetti and Balgobin 2015)

Year	Recycled Water Use
1970	~175,000 AF (216 M)
1987	~ 267,000 AF (392 M)
2009	~ 669,000 AF (825 M)
2015	~714,000 AF (881 M)

State will support local and regional agencies to recycle or reuse at least 2.5 million AF a year in the next decade.

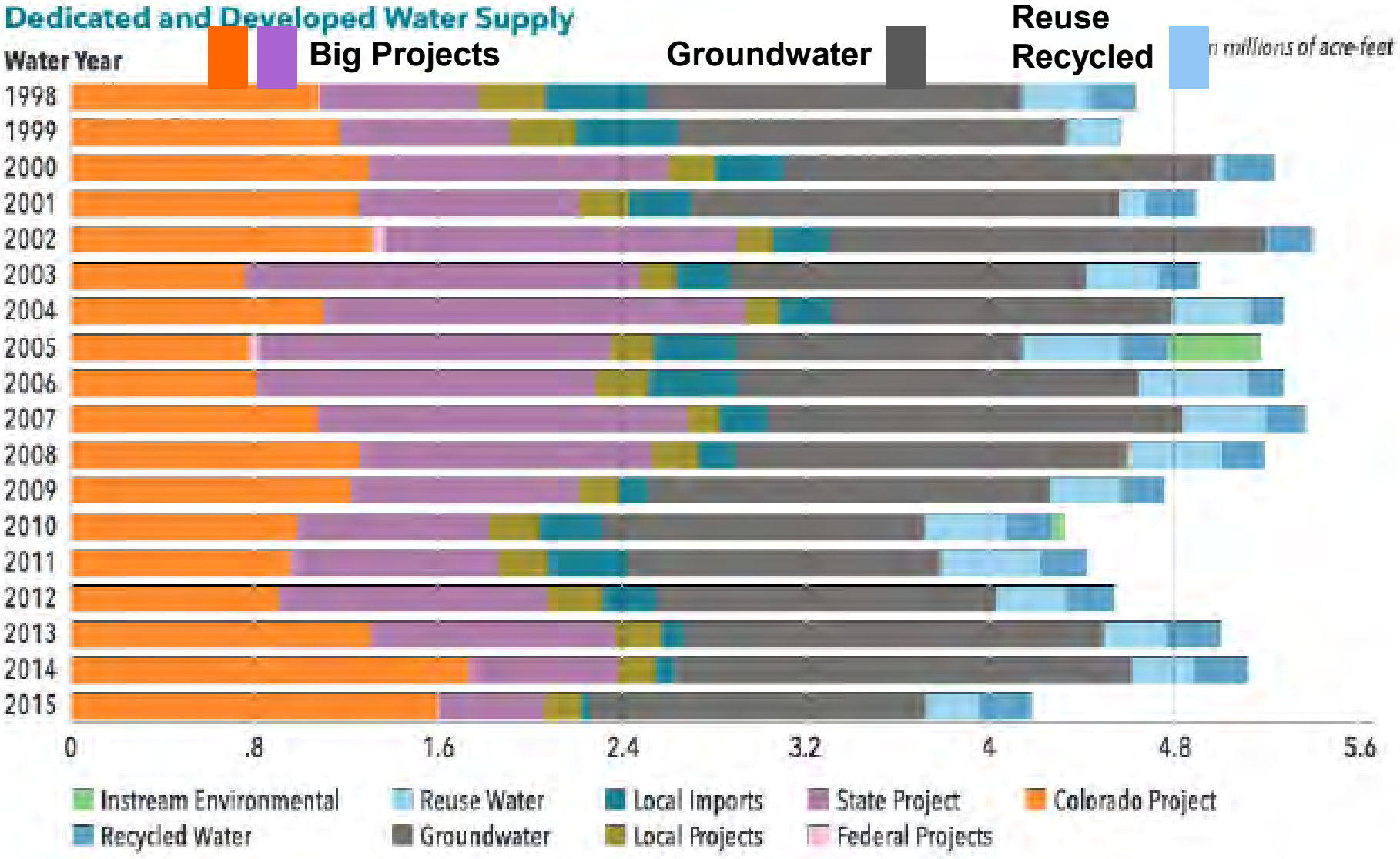
WATER RESILIENCE PORTFOLIO DRAFT, JANUARY 2020

Desalinated Water

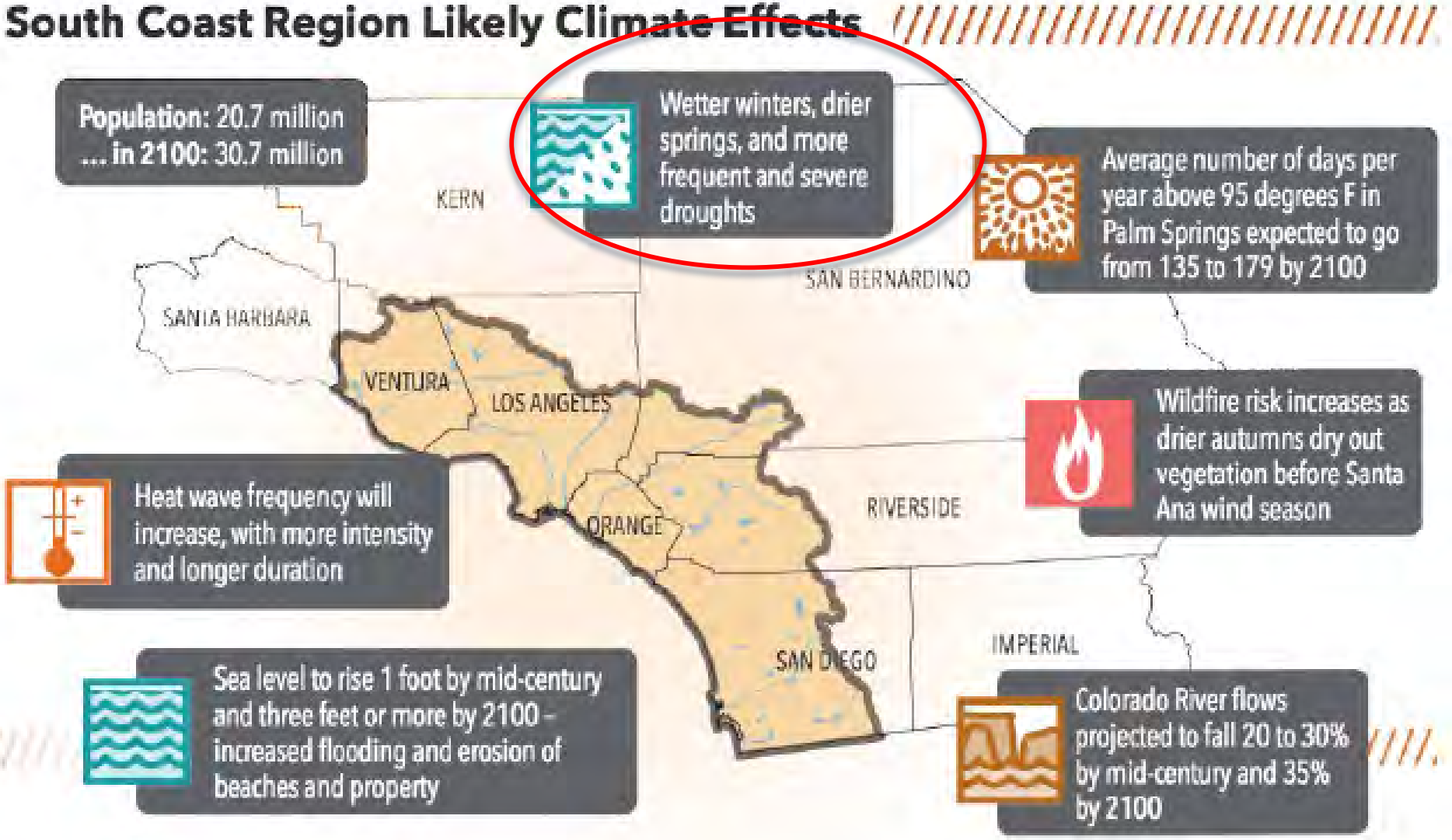
Pros – New needed water supply source Potentially a drought proof source

Cons - Decimates ocean life, expensive, big energy user, and requires disposal of brine.

California's South Coast Region



Climate Change



Water Banking and Transfers

Agriculture

↓

Cities & Water Districts

Most transfers are intra-basin among farmers, water agencies, cities & individuals

Where are we today? 2021

Most basins remain focused on conservation

And on supply side strategies

Imported water
Groundwater withdrawals
Recycled water

New in 2018 – Water Shortage Contingency Plan & Drought Risk Assessment required every 5 years by urban suppliers

New in 2019 - Water agencies have to calculate a water efficiency standard for their entire service area annually

2020 WATER RESILIENCE PORTFOLIO

RECYCLED WATER - *Support recycle or reuse*
Goal is at least 2.5 million acre-feet a year in the next decade

DESALINATION - *Enable use of desalination where cost-effective and environmentally appropriate*

STORMWATER CAPTURE - *Increase stormwater capture*

SURFACE WATER STORAGE - *Expand where it can benefit water supply and the environment*

INTERBASIN WATER TRANSFERS - *Simplify*

Water in the aquifers continues to be the most effective strategic weapon against drought

ACE – Lessons Learned From the California Drought **(1987-1992)**

Has Groundwater Management Improved?

2014 Sustainable Groundwater Management Act

GSAs **must** adopt plans to manage groundwater

"without causing undesirable results"

-***Chronic lowering of groundwater levels***

-Significant and unreasonable:

Reduction in storage

Saltwater intrusion

Degraded water quality

Subsidence

Reduced flows in surface streams

Accumulated overdraft is not required to be addressed under SGMA

ACCUMULATED OVERDRAFT

Declining storage over time due to withdrawals greater than replenishment

CONTROLLED OVERDRAFT

Intentionally withdrawing more than the safe yield – sometimes to create storage space for imported water

Are there requirements, incentives and practices to more pro-actively mitigate drought risk during the periods between droughts?

Promising Strategies

Linking Land Use and Water Supplies

Land Use Policies

Earth's Climate Future: **Extremes of Flood AND Drought**

Capture Floodwaters To Reduce Flooding AND Combat Drought

Water in Aquifers Continues to be The Most Effective Strategy Against Drought

Establish Local Drought Reserves

Promising Strategies

Linking Land Use and Water Supplies

Monterey County General Plan

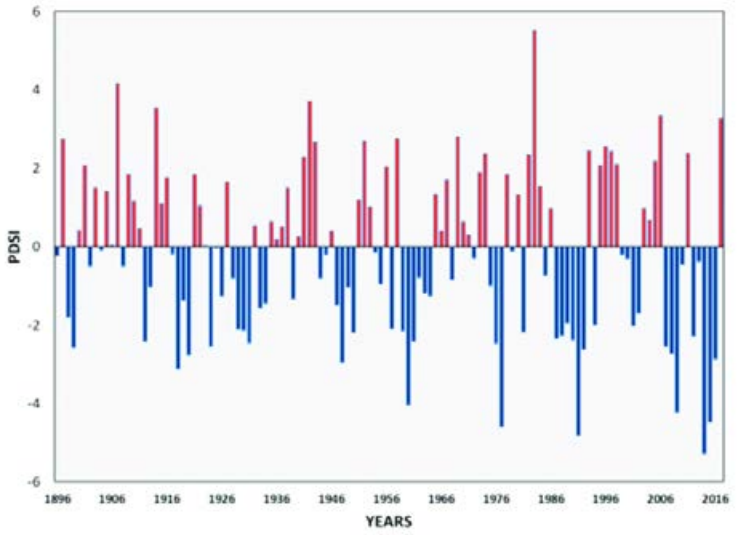
New development for which a … permit is required …shall be prohibited without proof…(of) a long-term, sustainable water supply…in quality and quantity to serve the development

City of Greenfield General Plan

Prior to project approval, new development shall demonstrate that adequate water quantity and quality can be provided.

Promising Strategies

Climate change will exacerbate swings between droughts & floods



Palmer Drought Severity Index for California for December, January, and February (1896 to 2016) Modified graph based on NOAA info (Pathak et al. 2018 Agronomy 8 (3):25)

Capturing Floodwaters Can Reduce Flooding AND Be Used to Replenish Groundwater

Chardonnay grapevines in the Russian River Valley flood on March 12, 2018, near Sebastopol, California. Credit: George Rose/Getty Images

Promising Strategies

One of the major lessons learned from the 2012-2016 drought was that urban water suppliers, small water suppliers, and rural communities must strengthen local drought resilience

Developing Local Groundwater Drought Reserves

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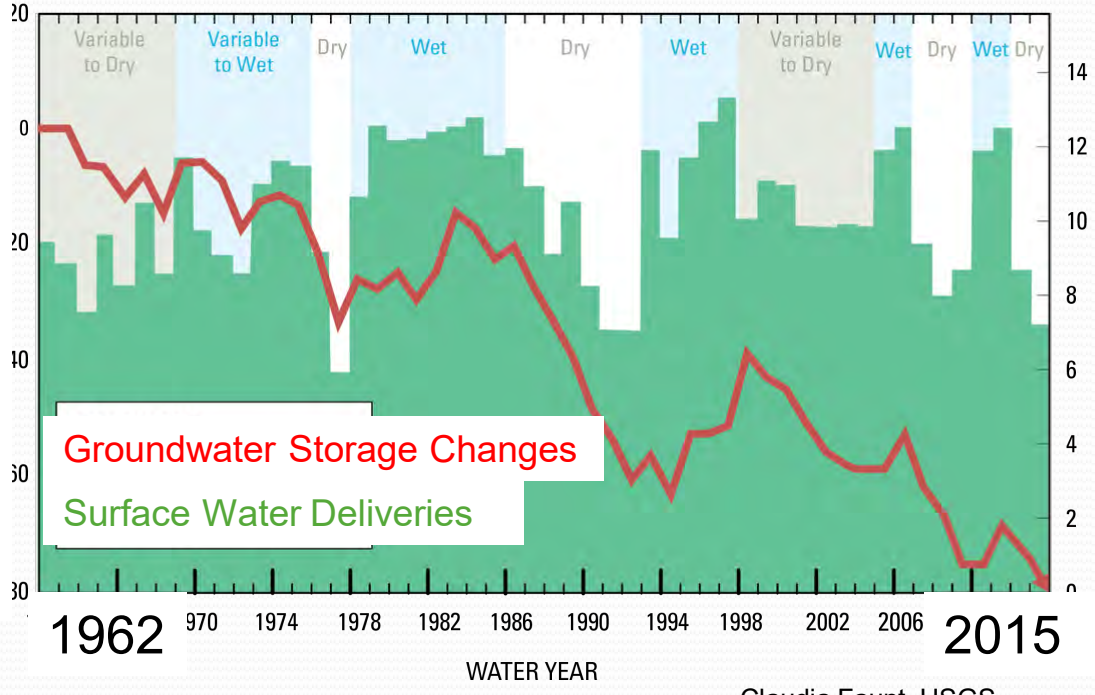
Developing Local Groundwater Drought Reserves



Cumulative change in groundwater storage (millions of af)

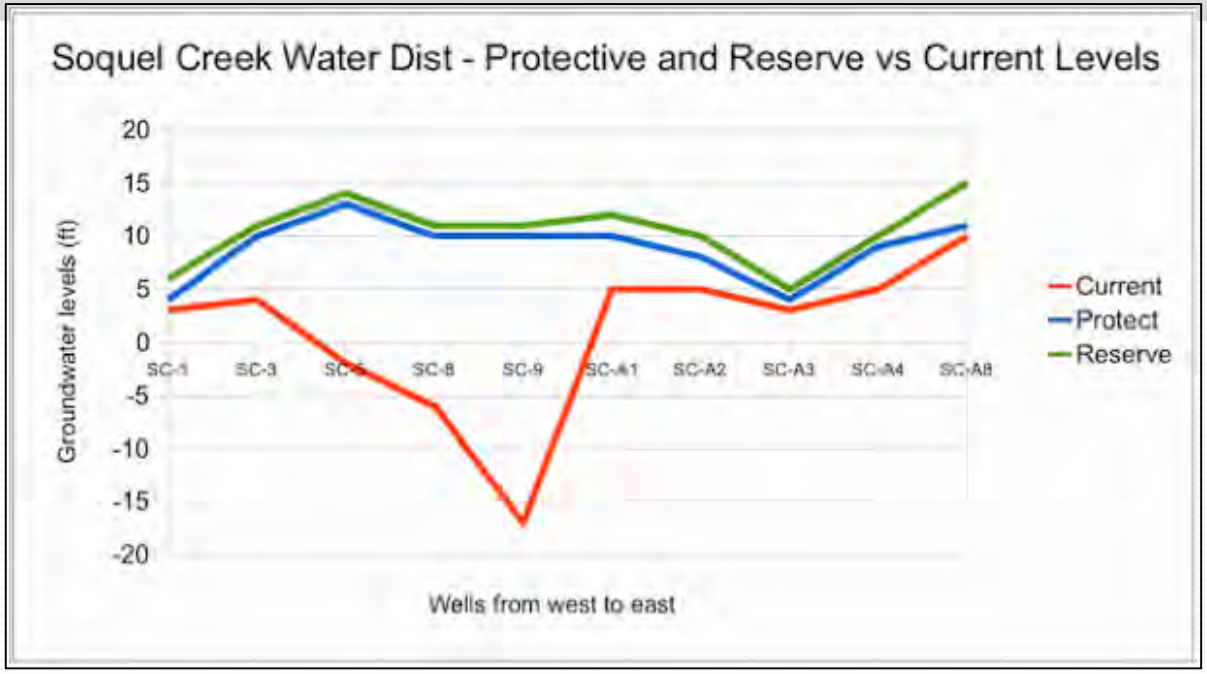
Annual surface water deliveries (millions of af)

Claudia Faunt, USGS

How does our approach differ from the large groundwater banks?

Reserves are ***Sited and Used*** Locally

Goal - Establish groundwater levels that would avoid unrecoverable declines during a drought



Achieving drought protection requires:

Estimate storage capacity of a basin

Determine groundwater levels to bring basin into hydrologic balance and to sustain a reserve

Determine criteria to access a drought reserve supply

Goleta

Central Coast Adjudicated Groundwater Basin

Santa Barbara Basin

Goleta Basin

29,000 acres - Alluvial plain

16-20” rainfall/yr

Goleta Water District

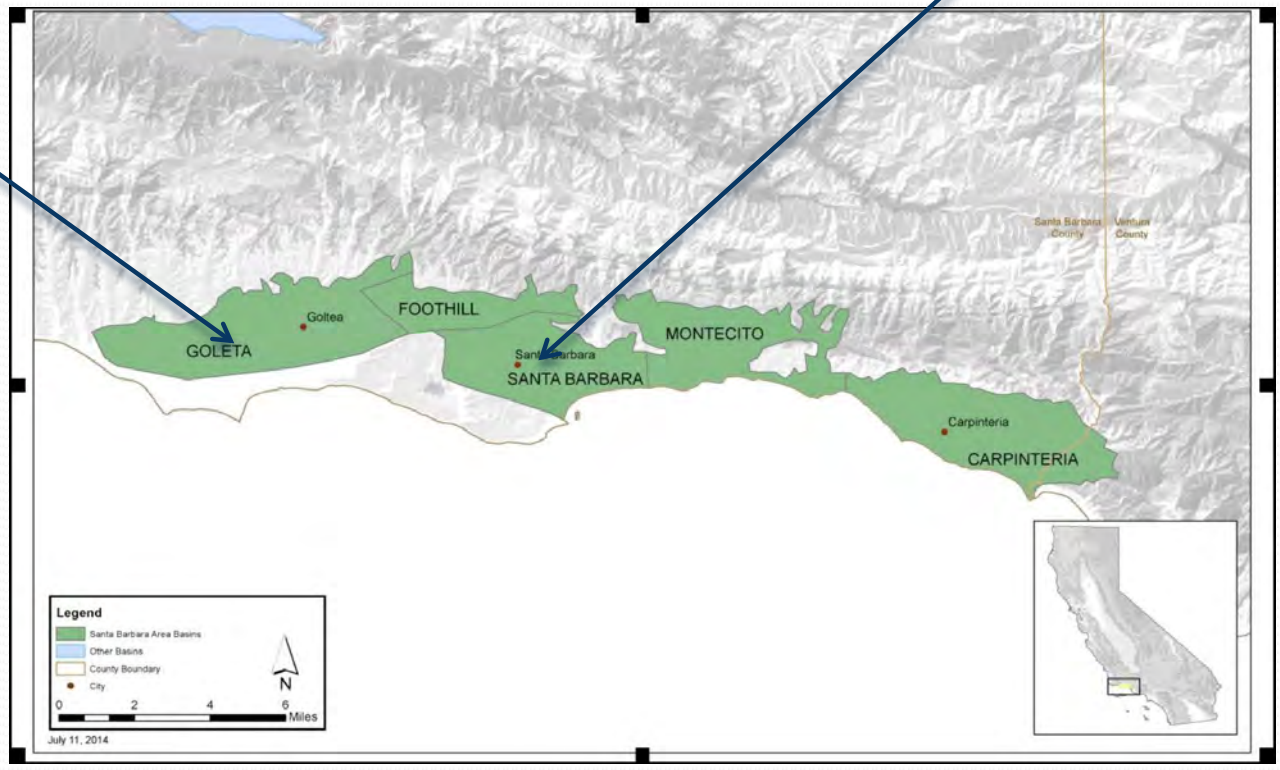
87,000 customers

Water Supply

- Surface Water

BOR Cachuma Project

- Groundwater



DROUGHT BUFFER

First recover the basin to 1972 levels
Then establish an additional drought buffer
Buffer can only be used for customers when a regional drought results in reduced deliveries from Lake Cachuma

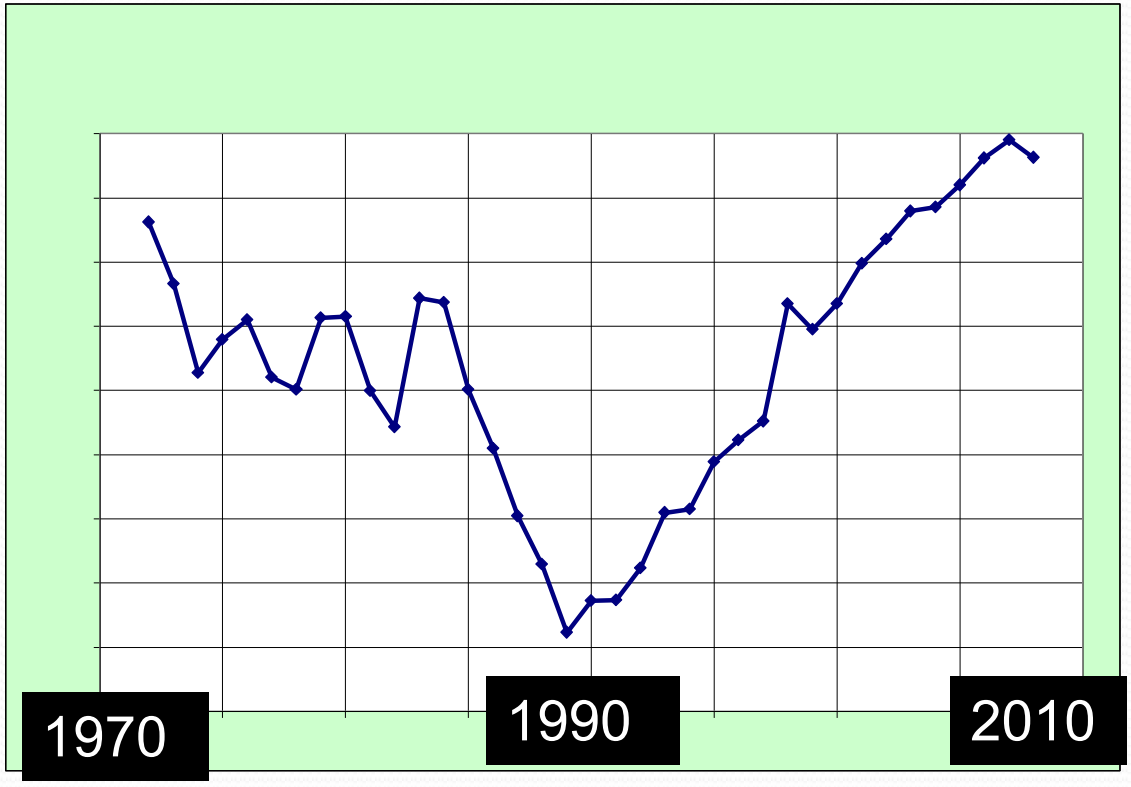
After recovery and establishment of drought buffer, and all water delivery obligations are met, GWD can provide new service connections up to 1% of total potable water supply

But when new service is connected, annual storage commitment to the drought buffer must permanently increase …..
"so that safe water supplies in times of drought shall not be endangered by any new or additional demands"

Results

1990s - Basin pumping declines
2008 - Water levels were near highest recorded in the basin

Average Groundwater Elevation



Average June groundwater elevations of 14 wells,
with missing data filled in by cross-correlation with nearby wells (**Bachman 2010)**

2012-2015 DROUGHT

GWD received no Lake Cachuma entitlement

Basin groundwater served as the primary supply source for GWD customers during this period

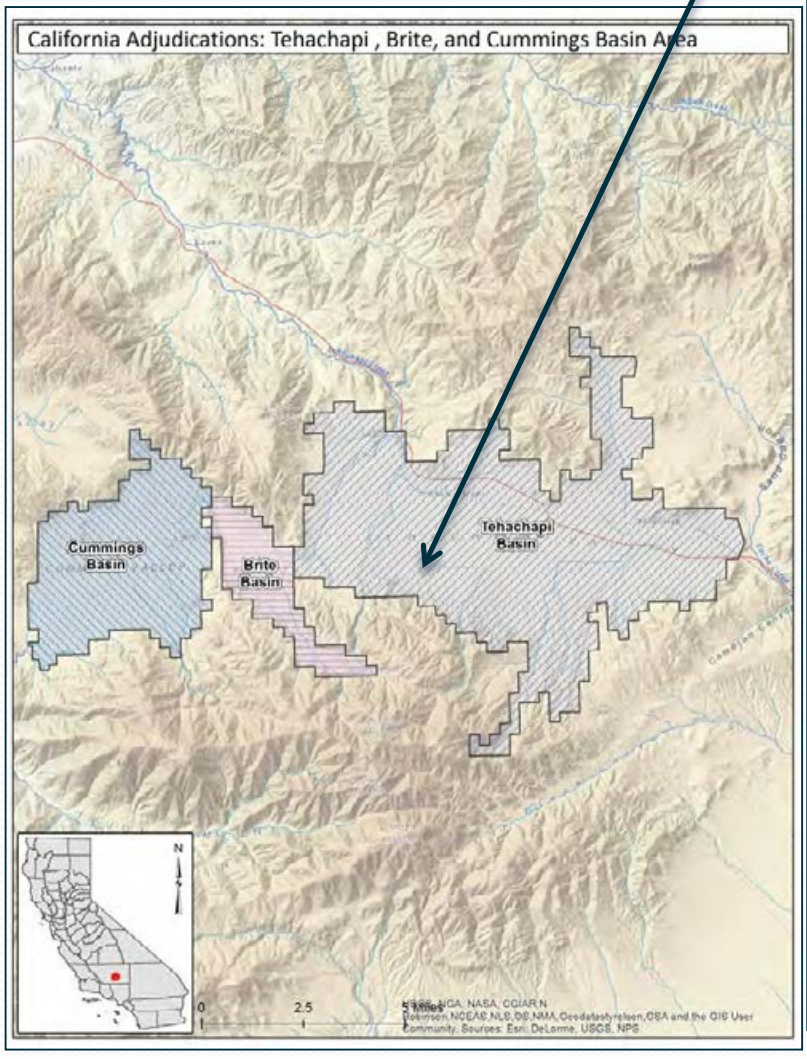
Lake Cachuma

2021

Some Lake Cachuma water still available & some carryover SWP water

Not using groundwater to enable basin to recover from 2012-2016 drought

Tehachapi
Foothill Adjudicated Basin



Drought Planning

Imported water comes with a recharge component

M & I *required* to bank a 5 year supply over 10 years as a local drought reserve

Conservation helped to provide for the injection of some imported water into bank

Ag not required, but are limited in amount of water provided by agency, which is expensive

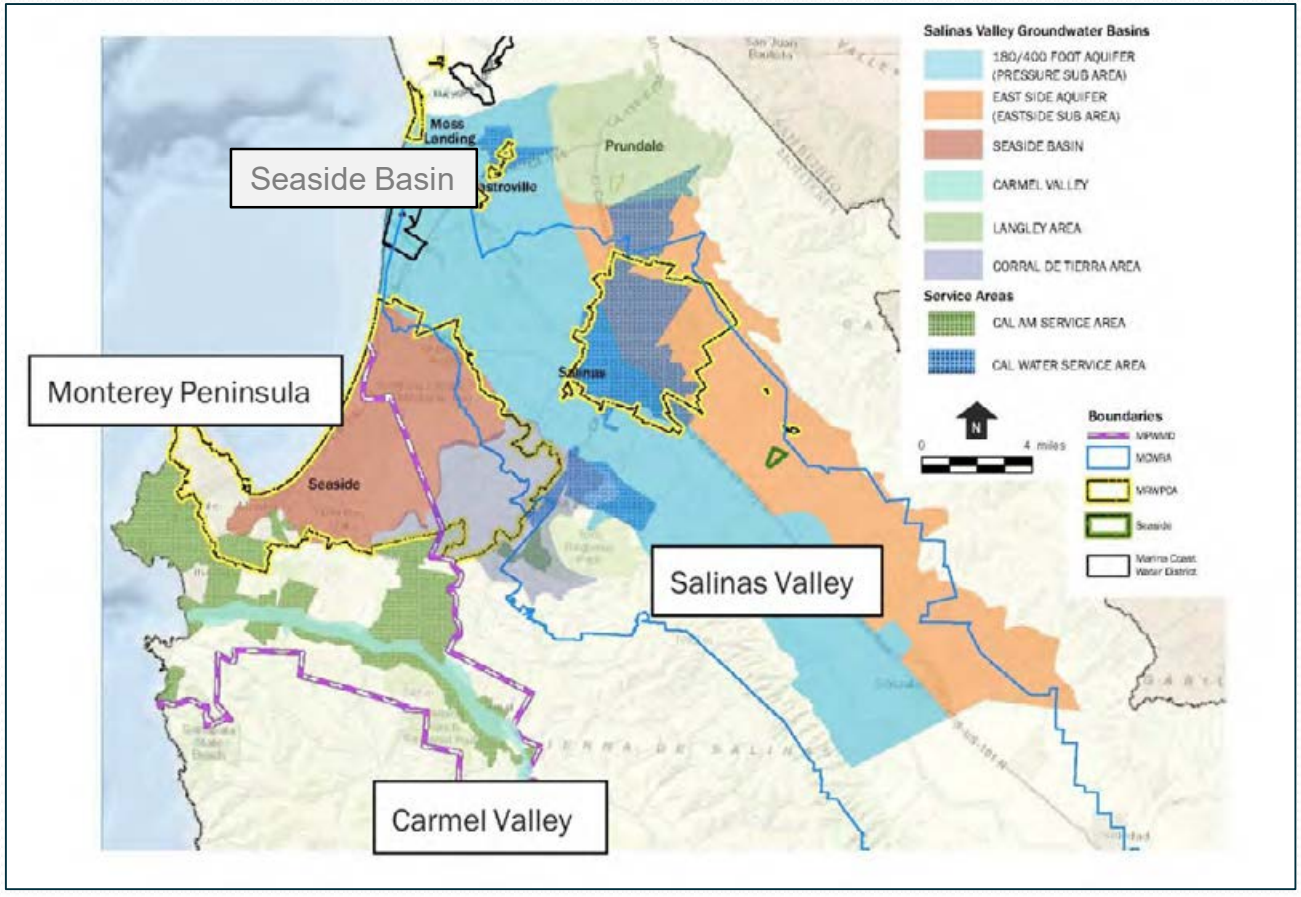
During drought water users can tap into banked water

Monterey Peninsula Water Management Agency – *Special Act District*
Seaside Basin – *Adjudicated Groundwater Basin* Salinas Valley Growers

NO state or federal project water

MPWMD traditional supply sources:
Groundwater –
Seaside Basin ~25%
Surface water – Carmel River ~70%

Seaside recharge is rainfall, percolation & excess Carmel River winter flows pumped into a distribution system & injected into Seaside



MPWMD's Pro-active Drought Reserves

Pure Water Monterey
A Groundwater Replenishment Project

-Negotiation w Salinas Valley growers

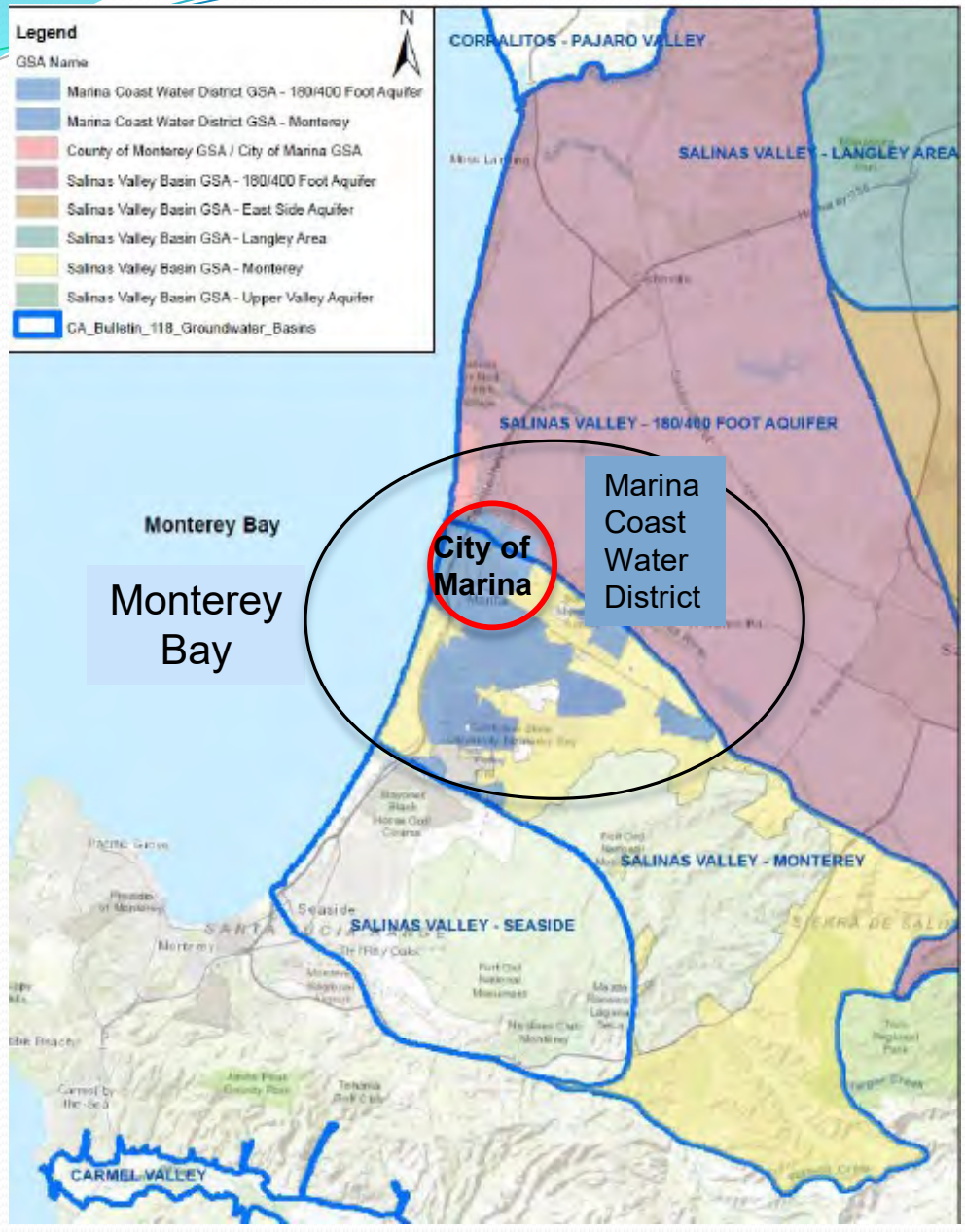
-Water from overflow ponds to be purified

-3,500 AFY recharged into Seaside basin

-In exchange - recycled water provided for the Castroville Seawater Intrusion Project's agricultural irrigation system

~ Plus 1,000 AF provided to SV growers in a dry year from a local drought reserve

Sustaining a Drought Reserve



City of Marina General Plan

A 15% *reserve* will be maintained between demand and supply.

When demand exceeds 85% of the available supply, no new development will be allowed until supplemental water sources are identified.

Summary of pre- and post-SGMA groundwater management strategies

Strategy	Pre-SGMA	Post-SGMA
Groundwater sustainability	Primarily planning with some financial incentives	Mandatory management to achieve sustainability for basins in major overdraft
Conservation	1976 Drought - Voluntary Conservation 2007-2009 Drought – Mandatory 2012-2016 Drought - Mandatory 25% reduction for urban users-rescinded 2017	2019 water agencies to limit customer's indoor water use to 55 gal/person each day & to 50 gal by 2030 2021 – Mandatory restrictions likely end of Sept

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Supply management	Heavy reliance on imported water Recycled water use grows to 669,000 AF 11 desal plants, controversial	Emphasis on diversifying supply Recycled water projected at 1,250,000 AF by 2030 Funding for new desal plants–remains controversial

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Aquifer Recharge	MAR using spreading basins & injection wells	Increased use of Flood MAR for recharge & irrigation
Large Groundwater Banks	Used to store imported water – then withdrawn & transported for use at a different site.	Continued use both seasonally & during drought for large agencies.
Local Groundwater Reserves	Goleta WD & Tehachapi-Cummings County WD establish locally sited reserves for emergency use only during drought	Increased use of local groundwater drought reserves. Approaches vary. Ex- under SGMA, development caps are set below sustainable yield to create a drought reserve Others establish a drought storage commitment

Questions?

Thank you to:
Dr. Nathan Van Schmidt, USGS

And to:
Ryan Drake,
Water Supply-Conservation Manager, GWD
Tehachapi Watermaster
Jonathan Lear, MPWMD
Bruce Daniels SqWD

rlangrid@ucsc.edu
https://droughtreserves.ucsc.edu/

Gina Ziervogel

Associate Professor, University of Cape Town
(currently visiting UC Santa Cruz)

@GinaZiervogel

Unpacking the Response to the Cape Town Drought: Lessons for Strengthening Urban Drought Governance

Unpacking the Response to the Cape Town Drought: Lessons for Strengthening Urban Drought Governance

8 September 2021

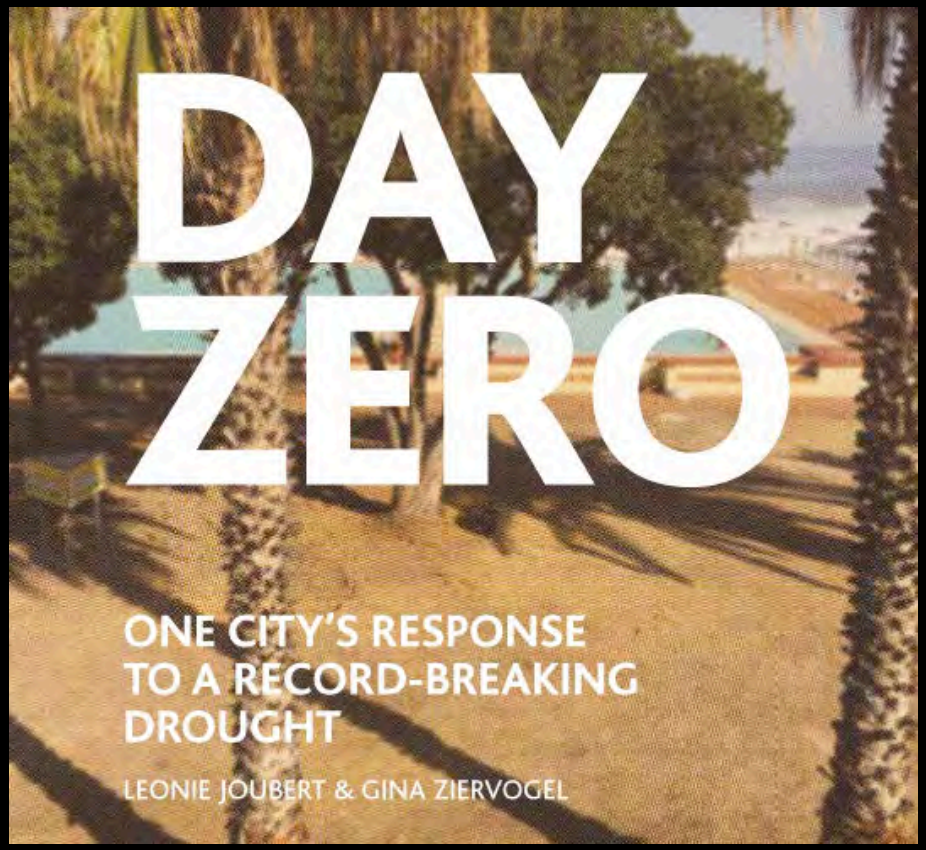
Gina Ziervogel

Associate Professor

Department of Environmental and Geographical Science, University of Cape Town

Overview

- Context (2:47 min video)
  - Drought timeline and response
- Lessons learned
- Building an adaptive city



www.dayzero.org.za

THE CAPE TOWN DROUGHT RESPONSE LEARNING INITIATIVE

https://www.africancentreforcities.net/unpacking-cape-town-drought-lessons-learned/

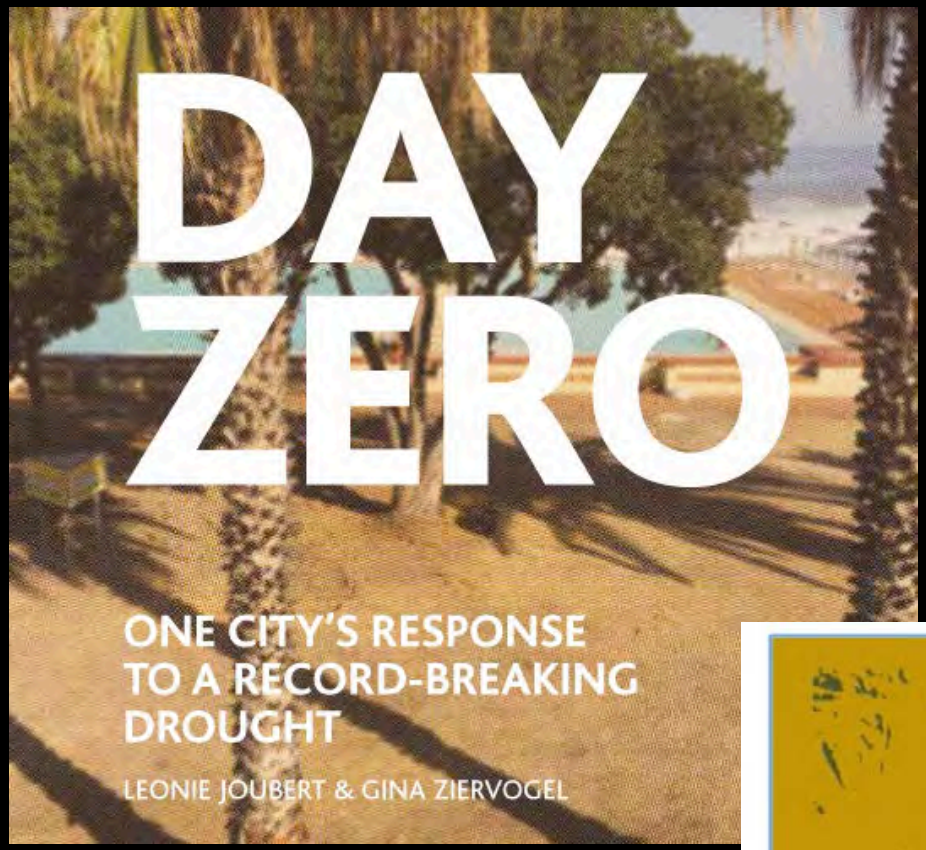
The Drought Response Film Library

https://www.drought-response-learning-initiative.org/film-library/

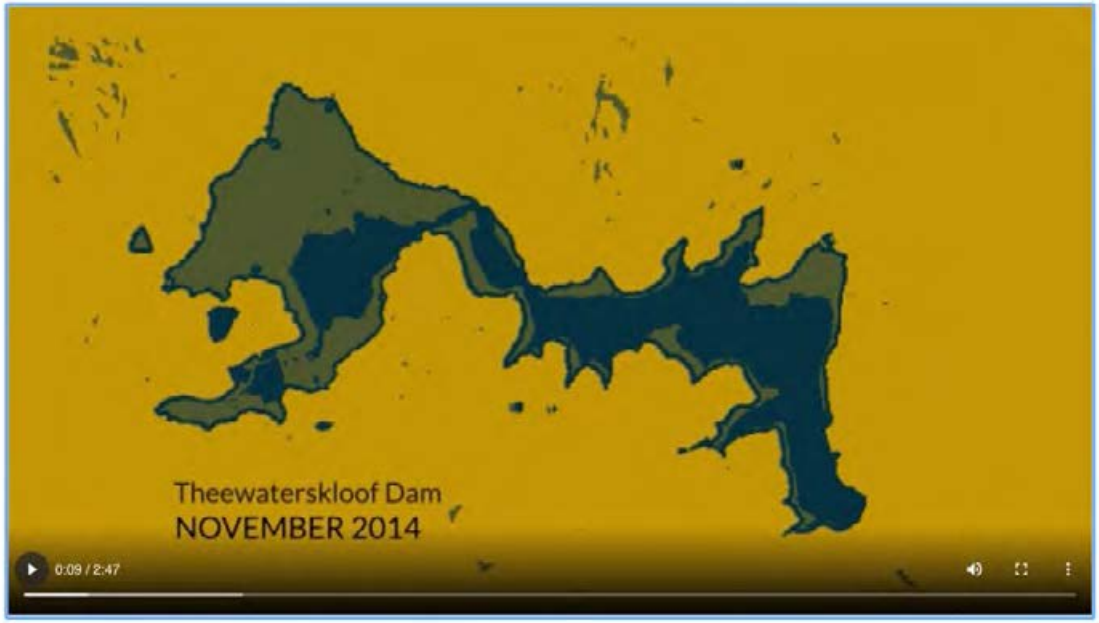
Cape Town Water Context

- 4 million citizens
  - high levels of inequality
  - industry and tourism
  - agriculture in surrounding area
- Water source
  - Winter rainfall
  - primarily from 6 dams outside the city's boundary
- Western Cape Water Supply System
  - managed with National Water Dept

Source: https://pxhere.com/en/photo/649823?utm_content=shareClip&utm_medium=referral&utm_source=pxhere (CC0 Public Domain)



www.dayzero.org.za



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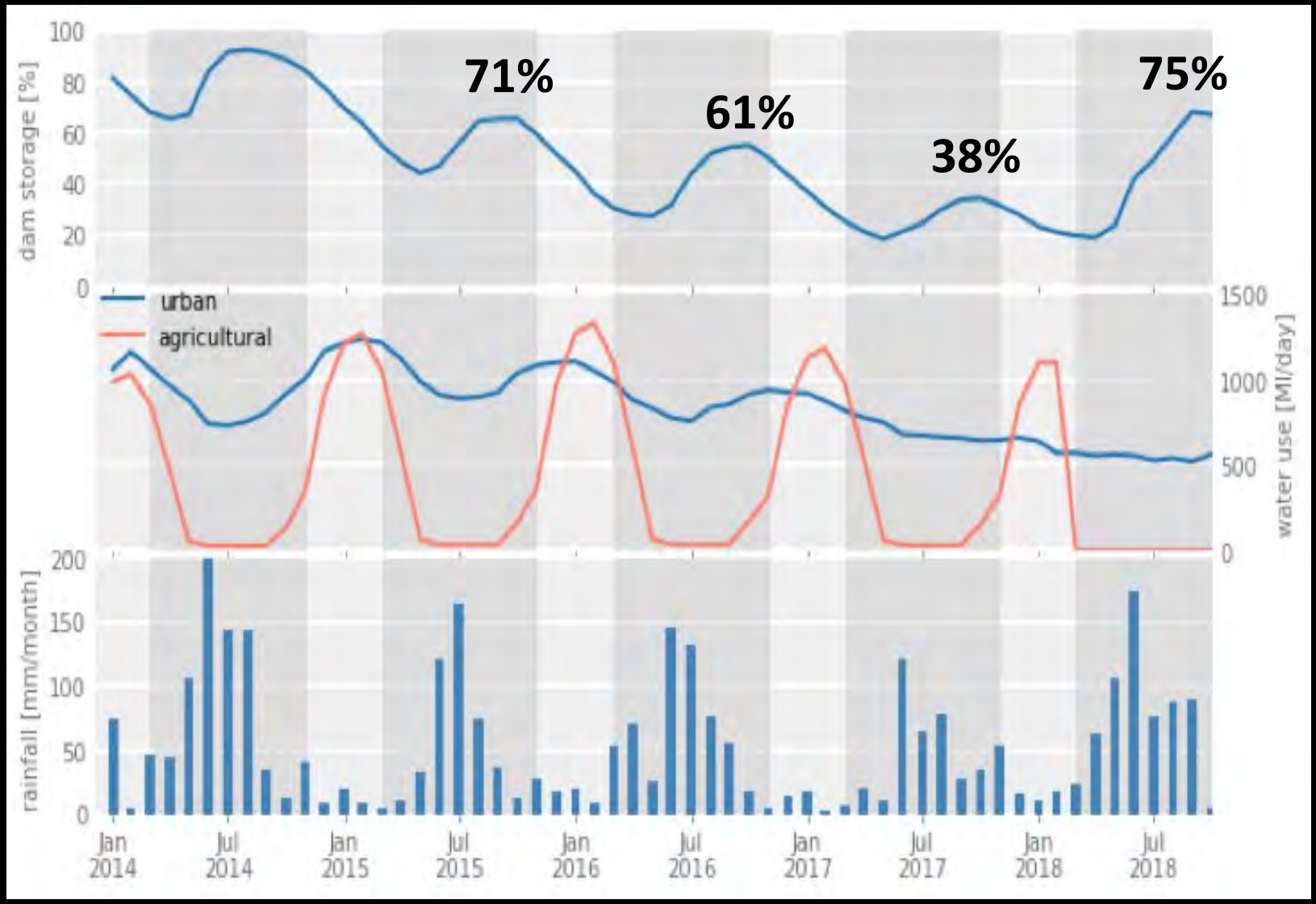
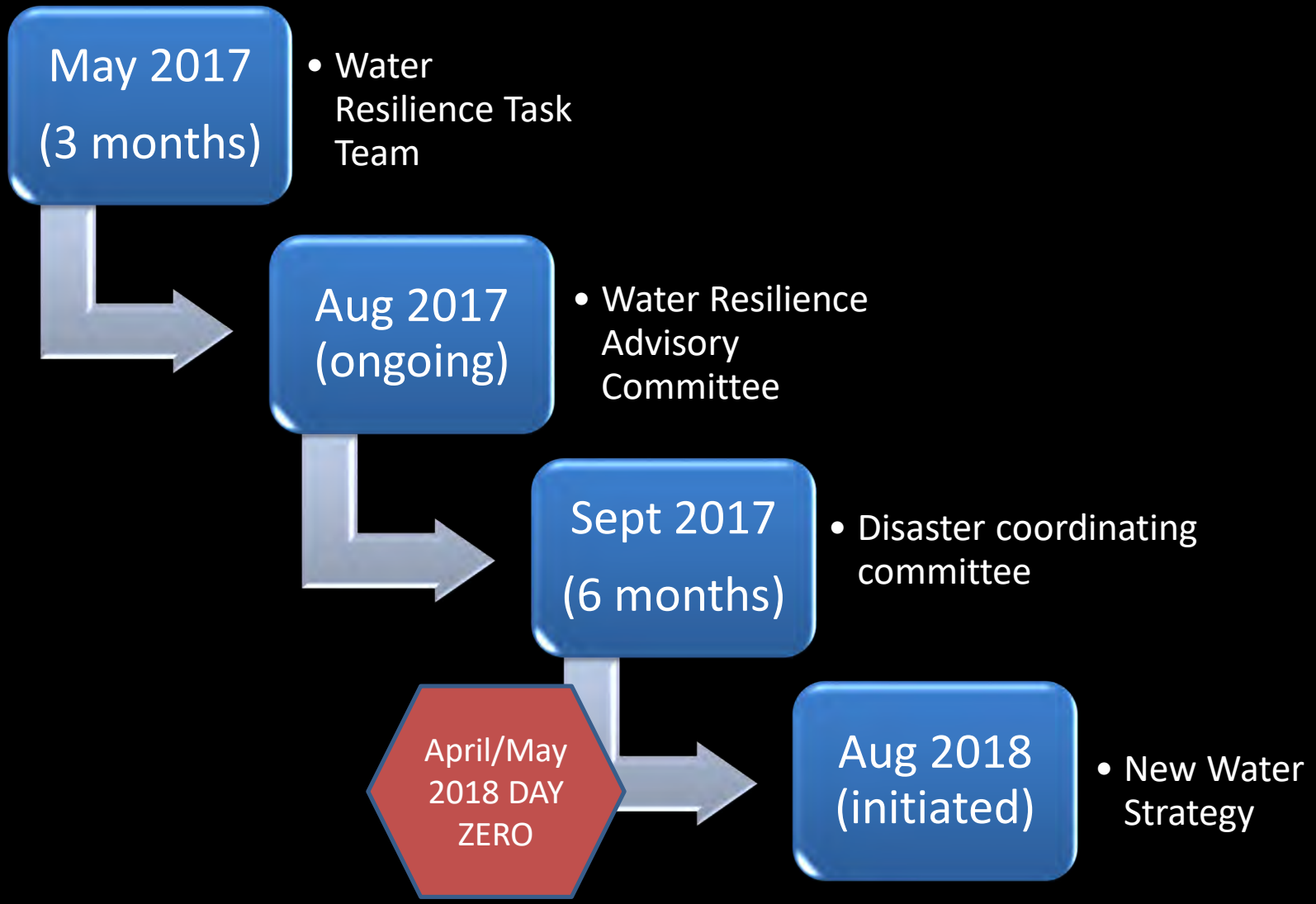


Dam levels, urban and agricultural use and rainfall in the Western Cape from 2014 to 2018 (Source: cip.csag.uct.ac.za/monitoring/bigsix.html)

Governance of the CT drought



BY THE NUMBERS

Cape Town's drought

Water available

Current average	35%
Dec 2016	53.3%
Dec 2015	63.6%
Dec 2014	91.6%

DAY ZERO

May 20, 2018

is "day zero", when the City of Cape Town expects taps to be turned off and residents will have to queue for water

87l

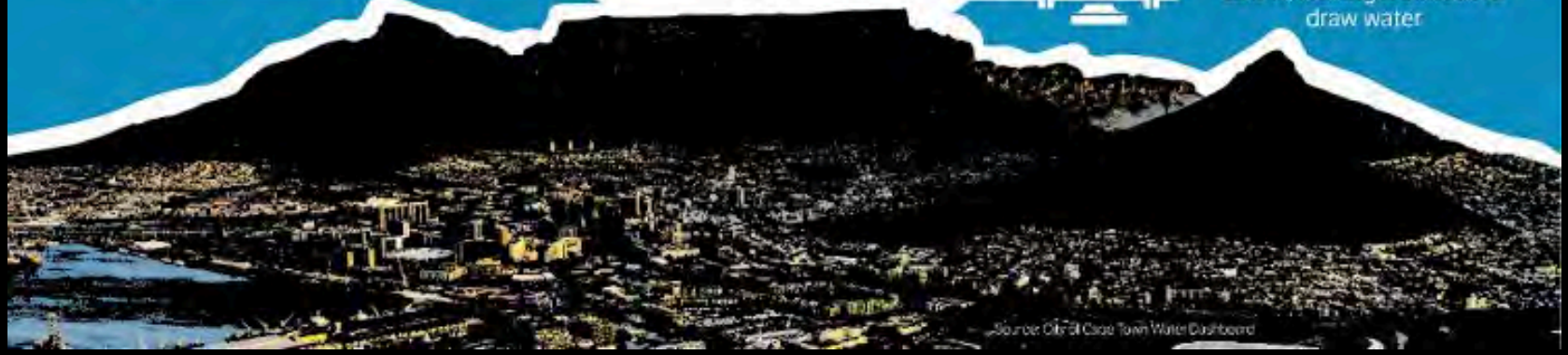
is what the city has asked residents to cap their daily usage at

At this target, consumption will drop to 500m litres/day, from 600m today

40%

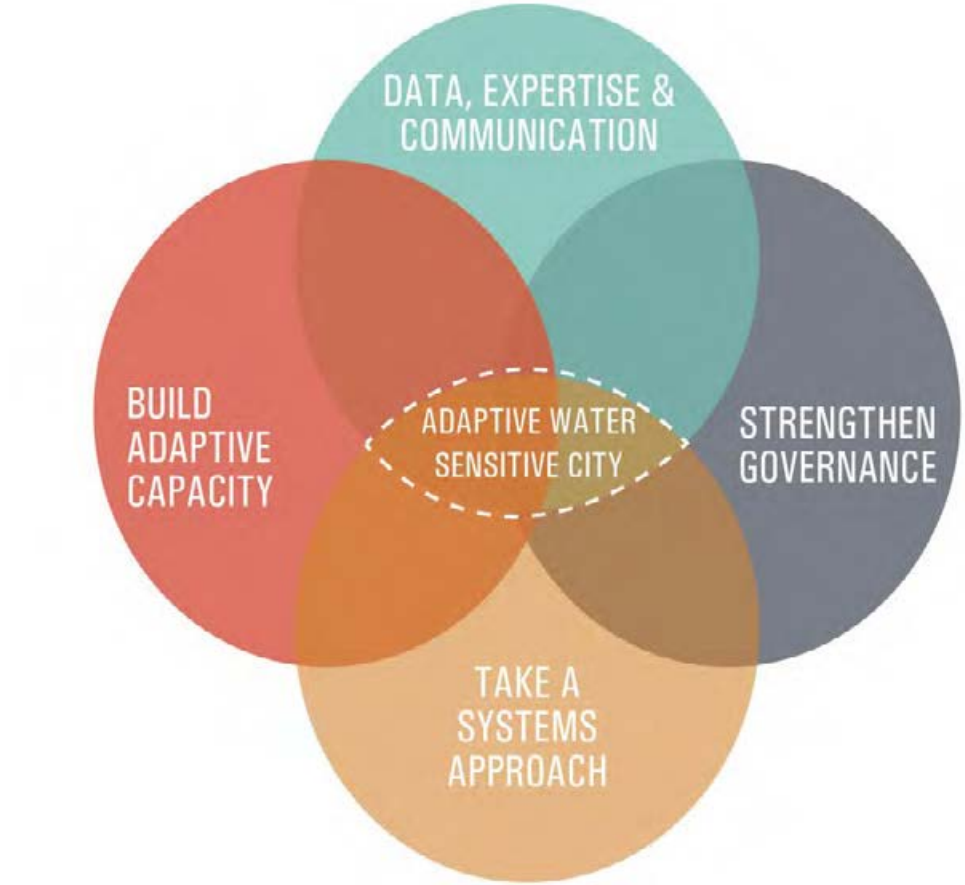
of Capetonians have dropped their usage to below 87l

May 20 is when the average water level of dams supplying the city is expected to drop to 13.5%, making it difficult to draw water



Source: City of Cape Town Water Dashboard

Lessons learned from the drought:
Building an adaptive city



Area 1: Strengthen governance

Lesson 1: Build systems and relationships of mutual accountability for effective water management between spheres of government

- Dept of Water and Sanitation (DWS)
  - Slow response to requests
    - Restrictions
  - Groundwater mandate - National
  - Alien vegetation and clearing

- Western Cape Water Supply System (WCWSS)
  - Up-to-date data was lacking
  - Enforcement of restrictions limited

Area 1: Strengthen governance

Lesson 2: Strengthen horizontal (transversal) management between and within municipal departments and entities

- Disaster management
  - Identified drought early on
- Mayor prioritised drought response before the 2017 rains
  - Moved responsibility to Directorate of Mayor
  - Moved back to Water and Sanitation Dept in 2018
- Water strategy: 2018 onwards
  - Input from across City departments and external actors

Area 1: Strengthen governance

Lesson 3: Invest in partnerships beyond the City government

- Key individuals
  - National and provincial govt
  - Disaster management

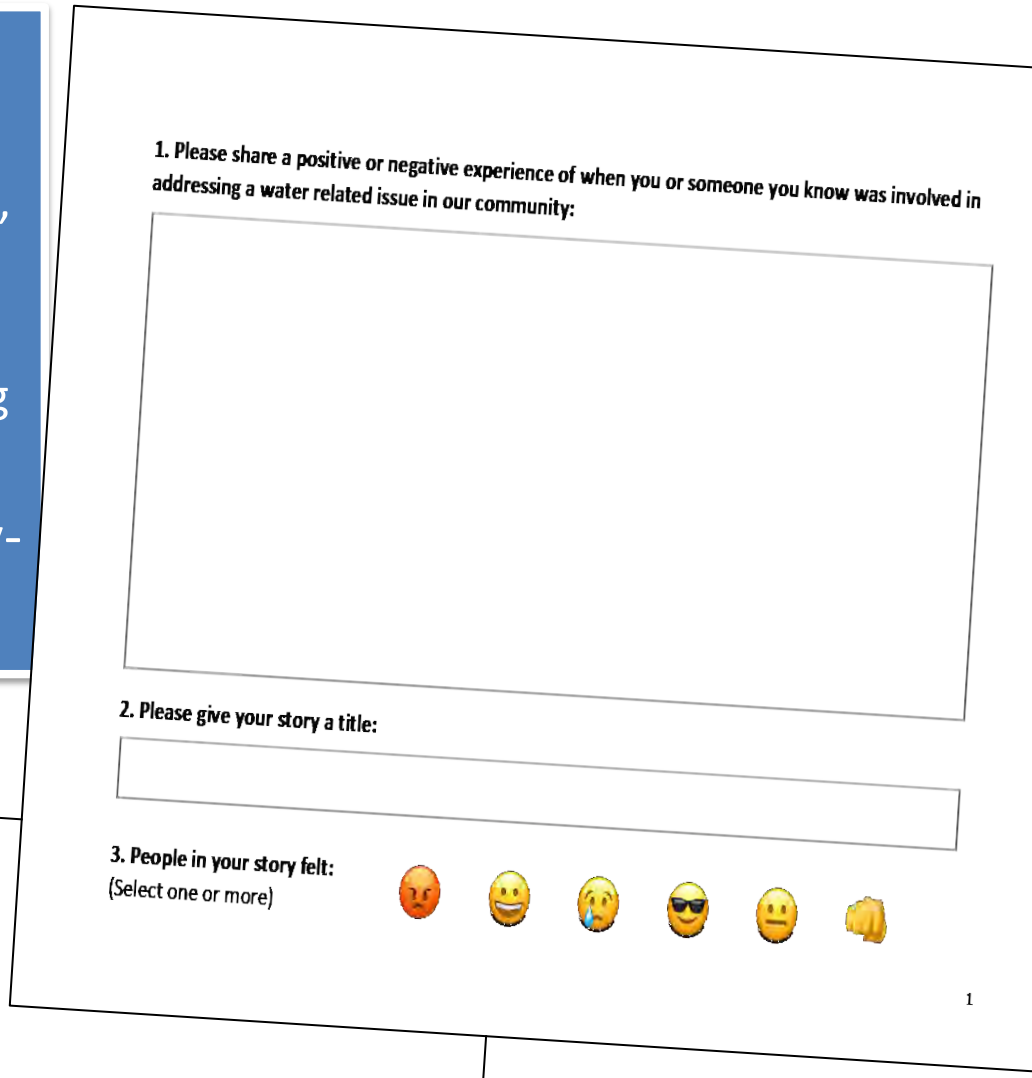
- Intermediaries
  - WWF
  - Section 80 committee
- Engagement with business and civil society
  - Initially business didn't know how to engage with City
  - Importance of involving civil society

Engagement commitments in Cape Town's Water Strategy

- **The City's commitments in the context of a whole-of-society approach:**
  - The City will adopt a collaborative approach in implementing this strategy (Pg.i)
- **Engaging citizens and civil society:**
  - The City will endeavour to create an enabling environment in order to be **responsive to citizen-led water initiatives.** The City will continue to work with social partners and collaborative intermediary organisations. (Pg 30)
- **Effective partnering:**
  - A partnering approach enables **joint problem-identification, co-design and co-implementation** of solutions, joint monitoring and evaluation, and shared learning and adaptation. (Pg 30)

Community Resilience in Cape Town (CoReCT): **SenseMaker™ methodology**

- Toolkit to study lived experiences
  - Not only what the problems are, but what it means to live with them on a daily basis
  - Collecting "stories" and allowing respondents to attach meaning
- Challenging to feed community-level data in to City

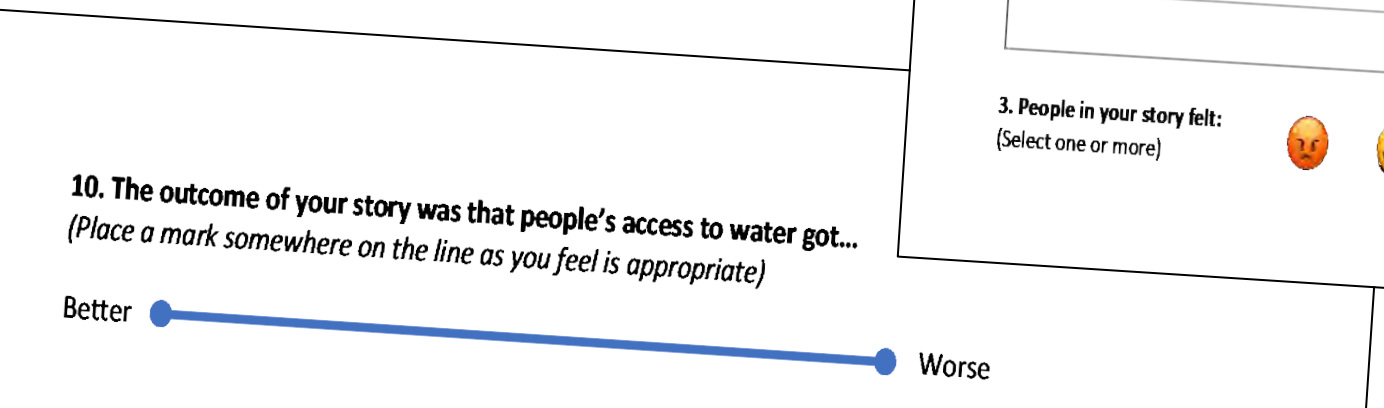


1. Please share a positive or negative experience of when you or someone you know was involved in addressing a water related issue in our community:

2. Please give your story a title:

3. People in your story felt:
(Select one or more)

1



10. The outcome of your story was that people's access to water got...
(Place a mark somewhere on the line as you feel is appropriate)

Better — Worse

Sensemaker

- Feedback to community
- Challenges with how to integrate bottom-up data in city

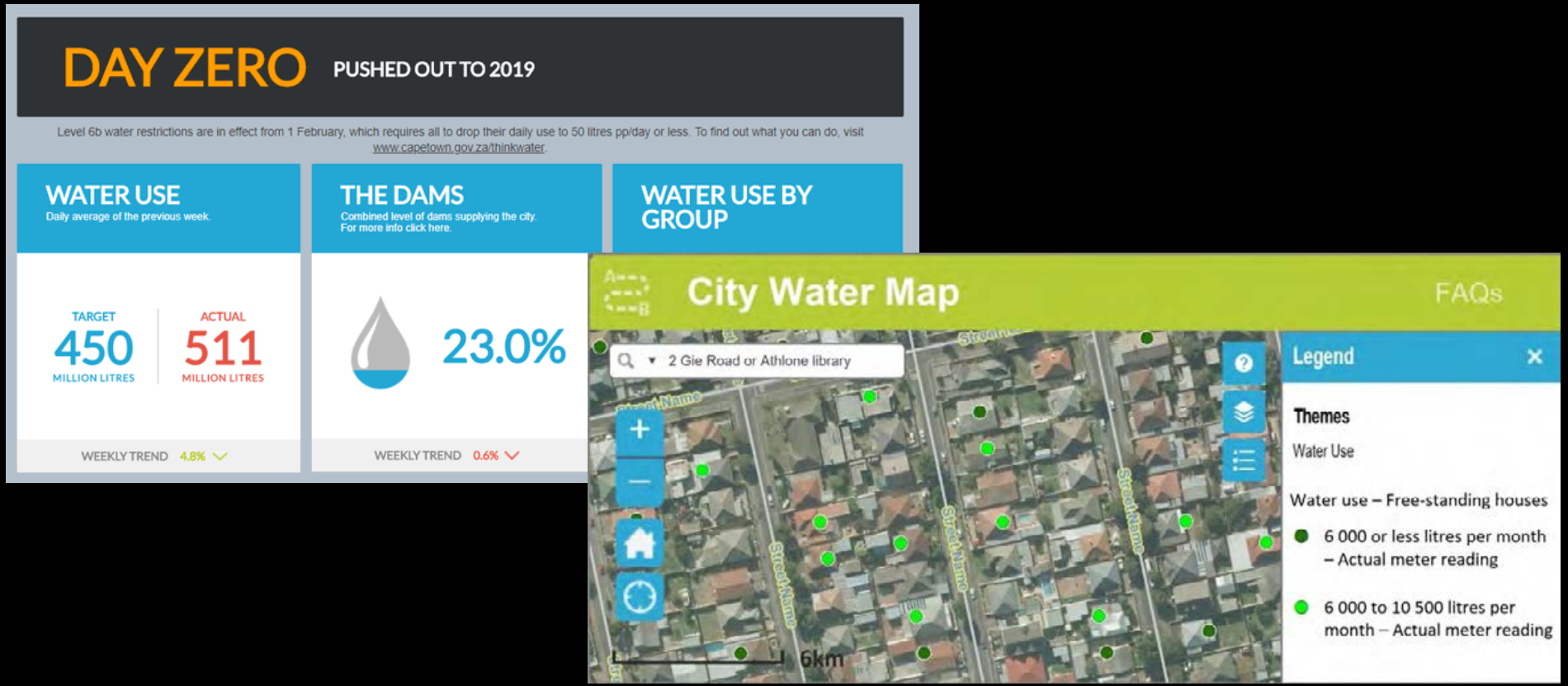
http://www.acdi.uct.ac.za/community-resilience-cape-town-corect

Area 2: Data, expertise and communication

Lesson 4: Understand the local water system

Lesson 5: Share information about the water situation to build public trust

Lesson 6: External input is important



Area 3: Take a systems approach

Lesson 7: Actively manage and integrate diverse part of the water system water

Lesson 8: Create a robust networked system of water supply

Lesson 9: Recognise the limitations of the current financial model for water

Area 4: Build adaptive capacity

Lesson 10: Develop a water sensitive city vision

Lesson 11: Integrate climate change into water planning

Lesson 12: Strengthen leadership and the capacity to enable flexible, adaptive decision-making


SOUTH AFRICA

#CapeWaterGate: 'Day Zero' is a political attack on the people, says water crisis coalition

By Leila Dougan - 29 January 2018

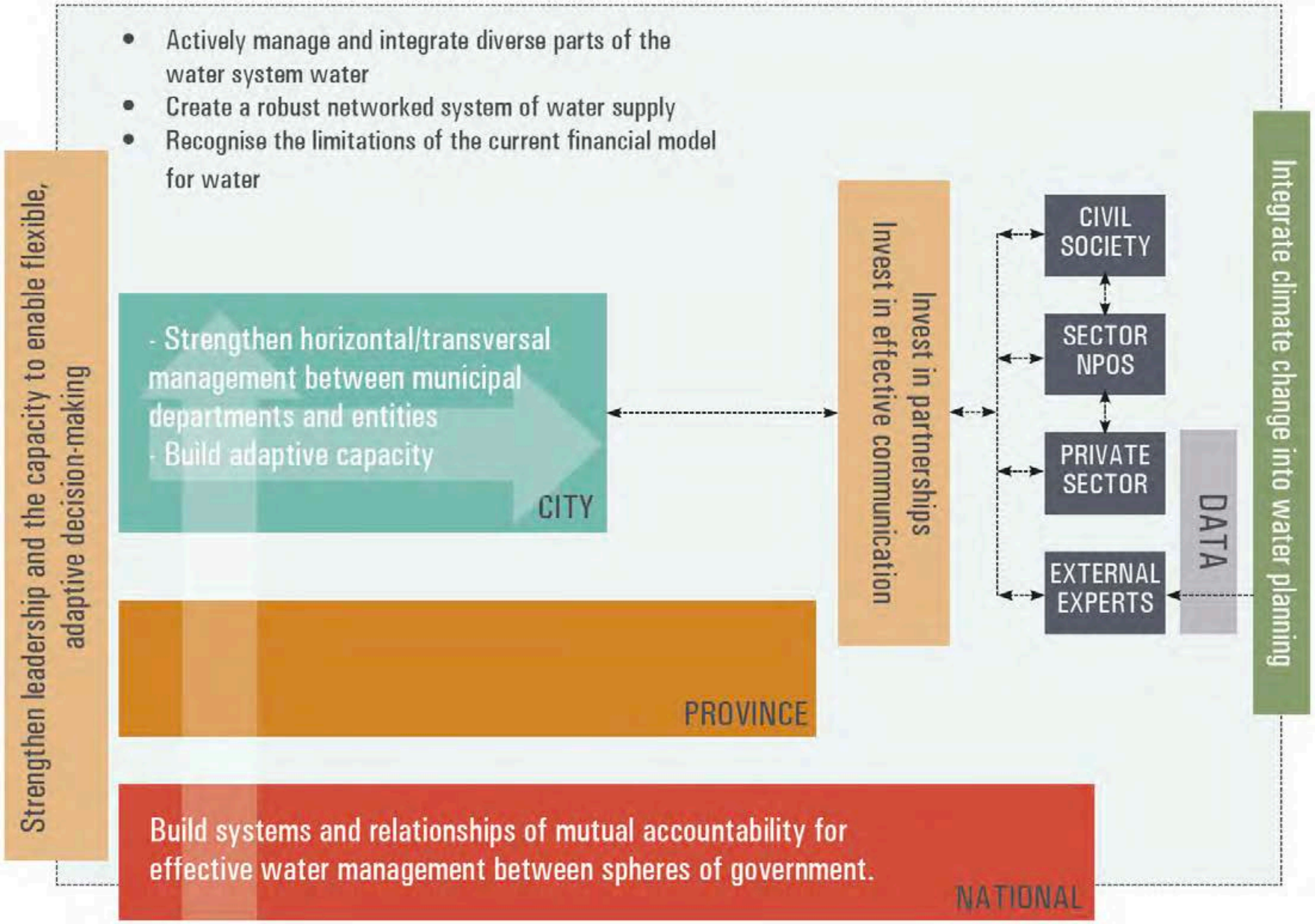

COMMISSION FOR ENVIRONMENT NOT SET UP

Zille hauled to court over water failure

Gran saved but 3 grandchildren die in Khayelitsha fire

Source: Daily Maverick 29 Jan 2018

ADAPTIVE WATER SENSITIVE CITY



What the Cape Town drought taught us

Four focus areas for local governments

STRENGTHEN GOVERNANCE

Build systems and relationships of mutual accountability

Strengthen horizontal management between municipal departments

Invest on partnerships beyond the City

DATA, EXPERTISE & COMMUNICATION

Understand the local water system

Share information about the water situation to build public trust

Actively seek external expertise and experience

TAKE A SYSTEMS APPROACH

Actively manage and integrate diverse parts of the water system

Create a robust networked system of water supply

Recognise the limitations of the current financial model for water

BUILD ADAPTIVE CAPACITY

Strengthen leadership and the capacity to enable flexible, adaptive decision-making

Develop a water sensitive city vision

Integrate climate change into water planning

MORE INFO AT HTTPS://WWW.AFRICANCENTREFORCITIES.NET/

DESIGNED BY MUOFHE PEDZAI

CAPE TOWN
Resilience Strategy

RESILIENT CAPE TOWN

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

100 RESILIENT CITIES

Resilience filter

Drought impacts multiplied by stresses

1
Compassionate, holistically-healthy city

Trauma
Poverty and inequality

2
Connected, climate-adaptive city

Climate change
Food insecurity
Rapid urbanisation

3
Capable, yet evolving city

Unemployment

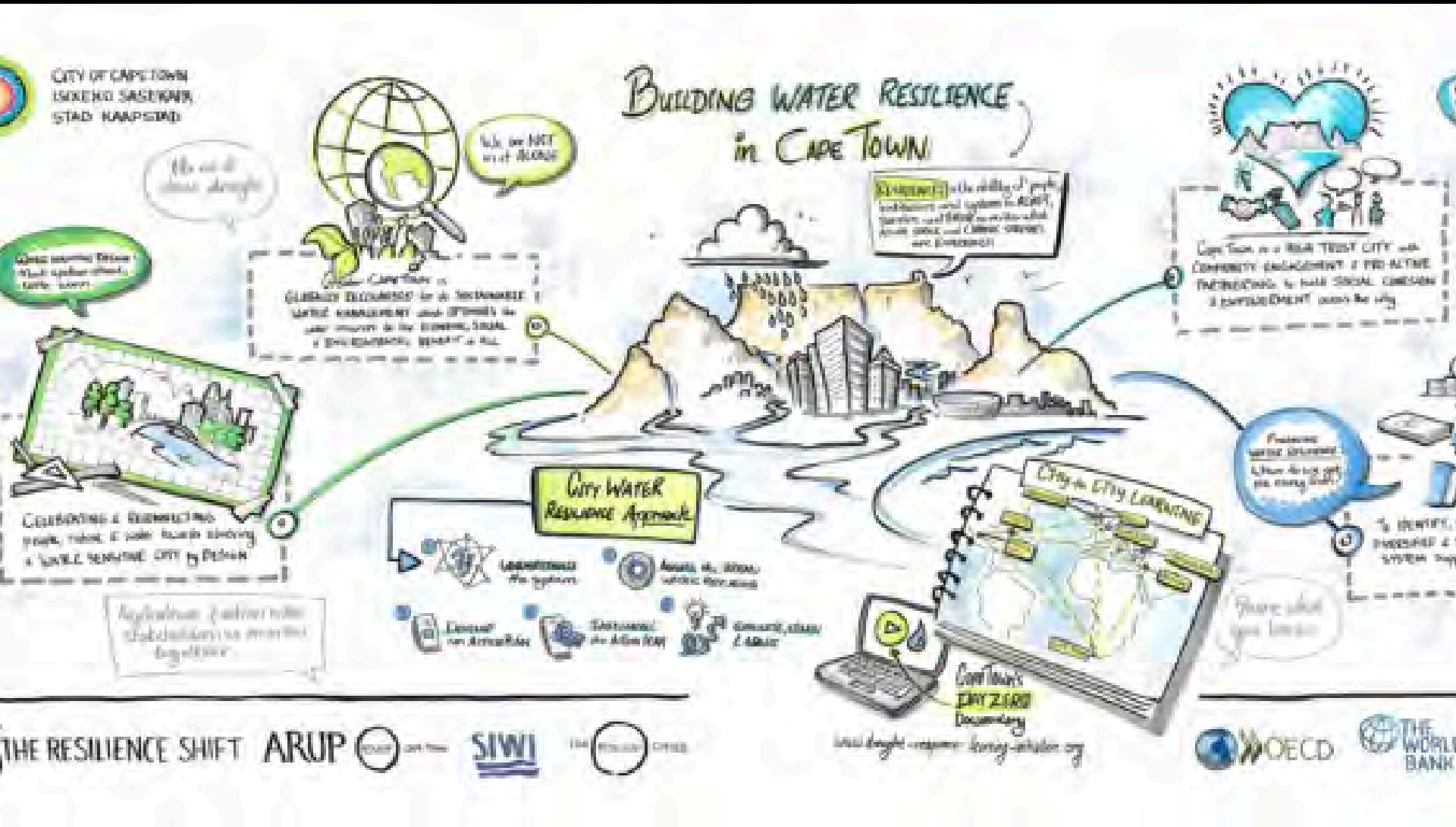
4
Collectively, shock-ready city

Lack of social cohesion

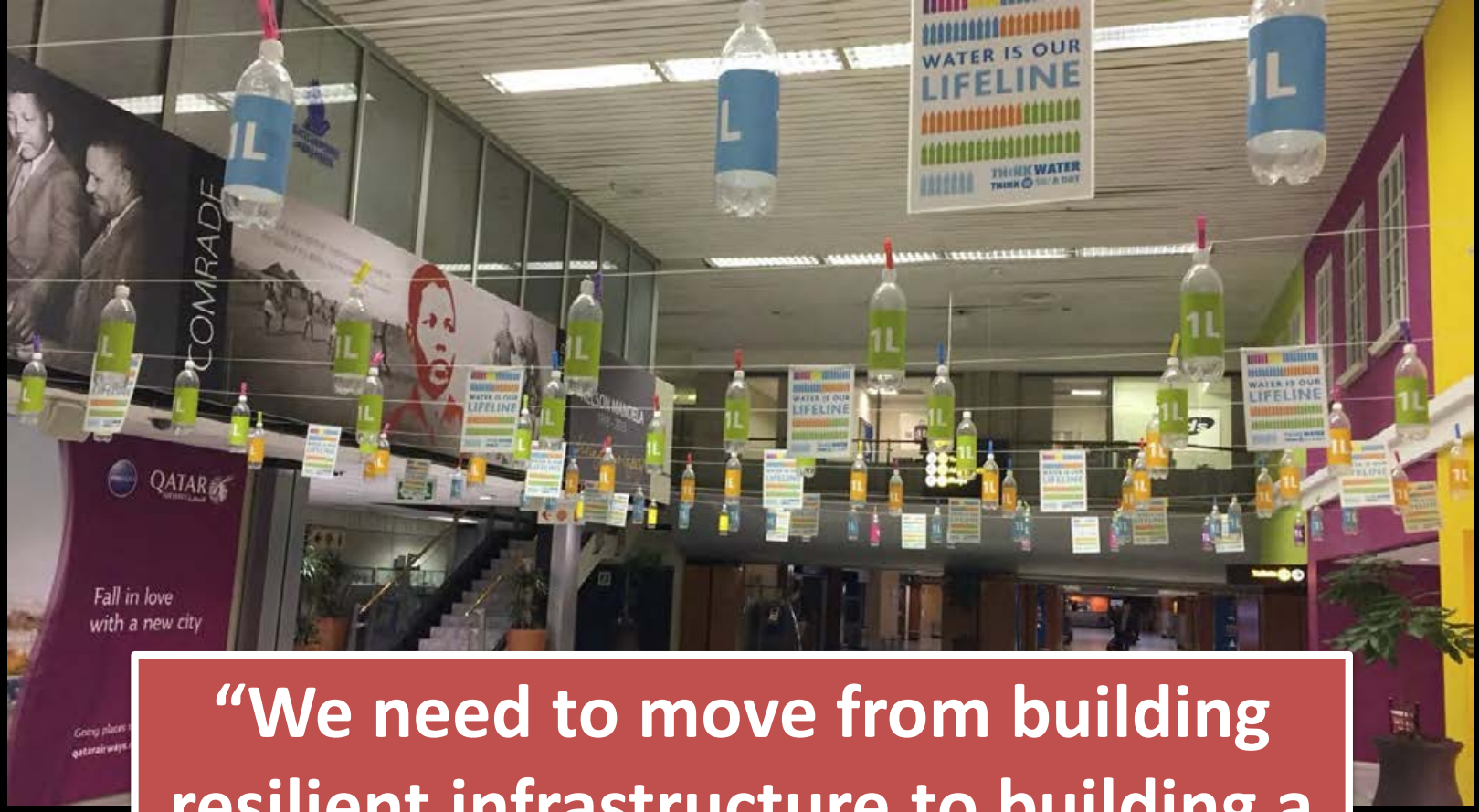
5
Collaborative, responsive city

Inadequate municipal finances

Have we built a more adaptive city?



http://www.100resilientcities.org/building-resilient-future-water/



"We need to move from building resilient infrastructure to building a resilient system"

Gina Ziervogel
gina@csag.uct.ac.za
@GinaZiervogel

Stephen Commins

Lecturer, Regional and International Development,
UCLA Luskin School of Public Affairs

The Climate, Water and Migration Nexus in the Maghreb

The Climate, Water and Migration Nexus in the Maghreb

Stephen Commins

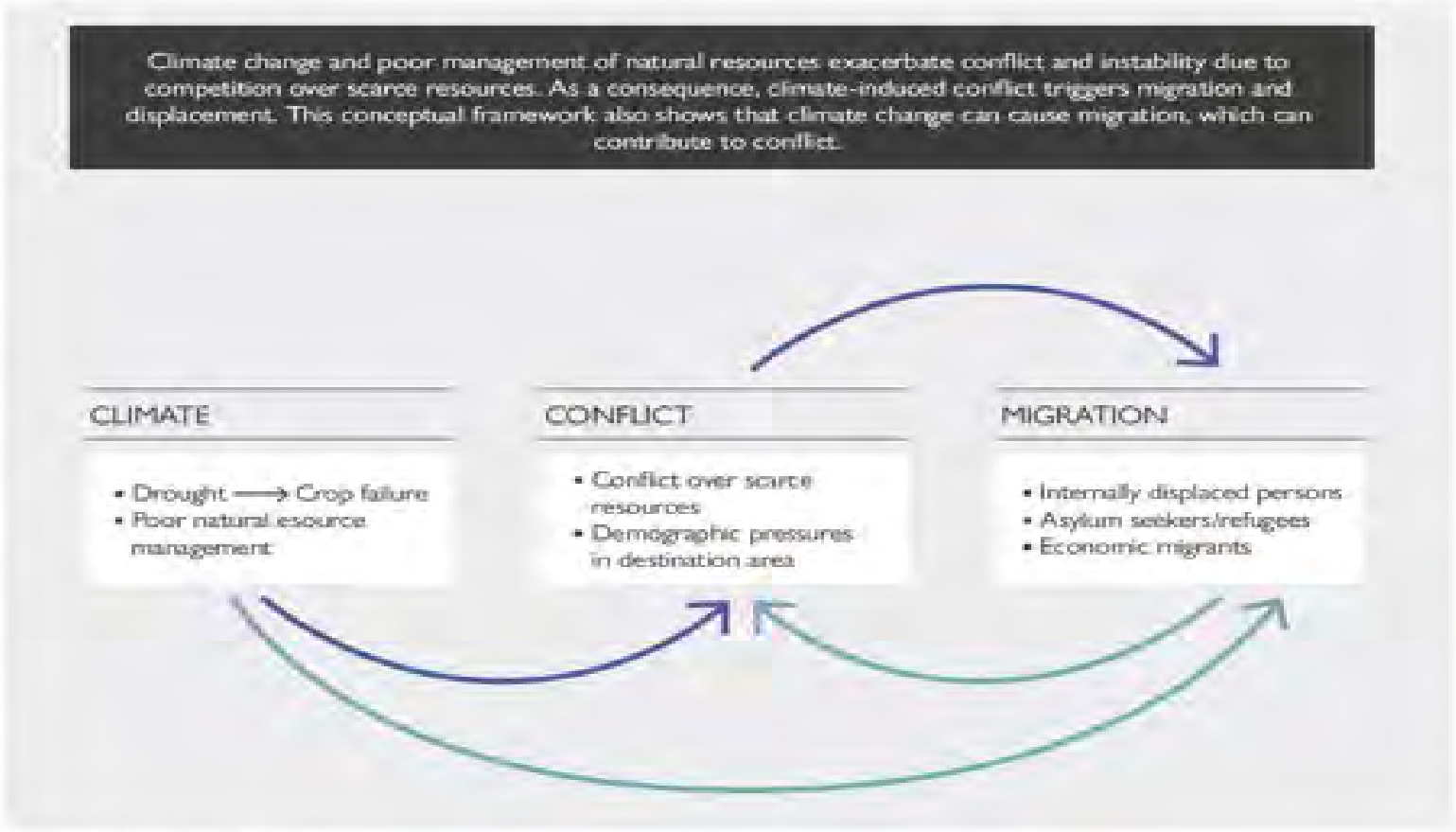
Luskin School of Public Affairs

September 8, 2021

Background

- Research through the Center for Mediterranean Integration in partnership with IWMI and CEWAS
- Focus on Morocco, Tunisia and Algeria (political situation in Libya not allowing research)
- Funding by UK government: climate, migration, water nexus
- Linked with debates about the ‘climate and conflict’ relationship

What we want to avoid…



Source: Abel et al, 2019.

1. Overly simplistic and deterministic
2. Conflicts with the evidence
3. Does not provide sound policy guidance for governments or other organizations

Towards a new framework

1. Drivers: climate / non-climate
2. **Intermediating factors**
3. Possible impacts
4. Significance of migration outcomes
5. Understanding feedback loops

Climate Change Impacts in Tunisia

Threats of desertification and drought means significant repercussions for food and water security

Desertification threatens around 52% of the land area of Tunisia suitable for agriculture, forestry and pasture farming

Depleted cereal fallows

Special attention needs to be given to natural solutions such as protecting soil from erosion and planting trees in desert areas

-

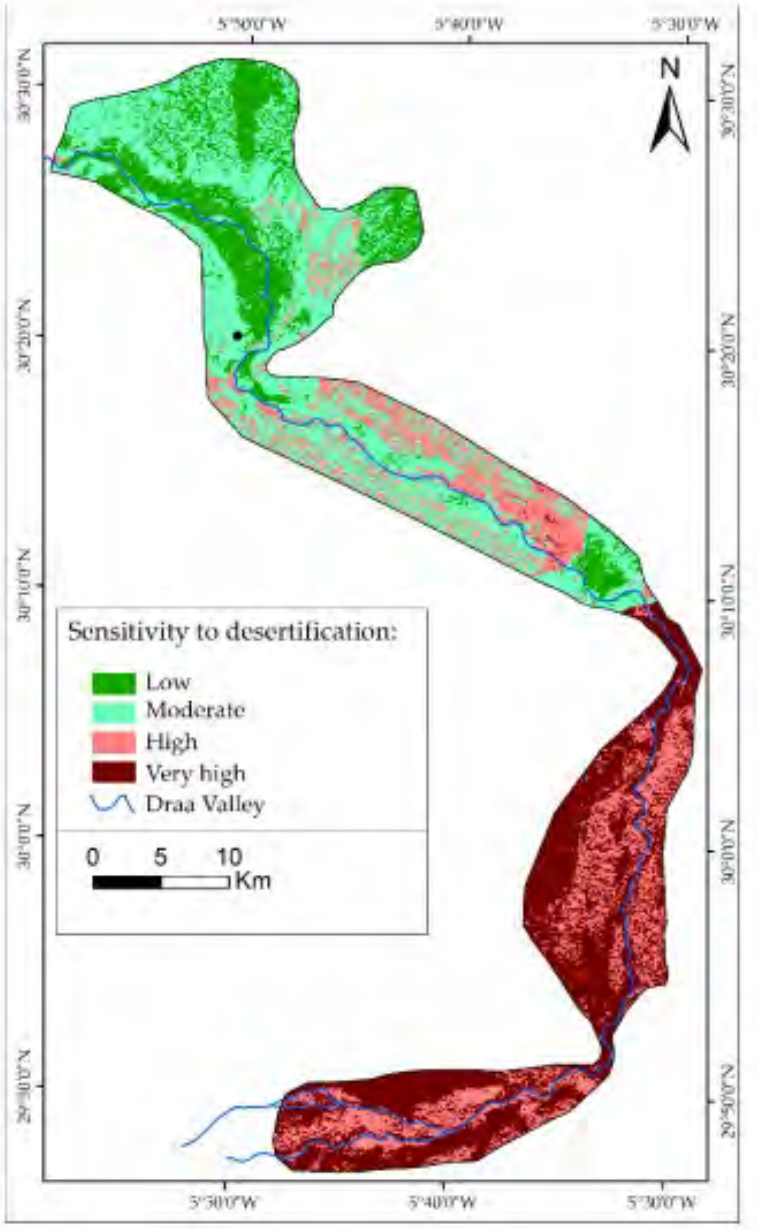
Algeria

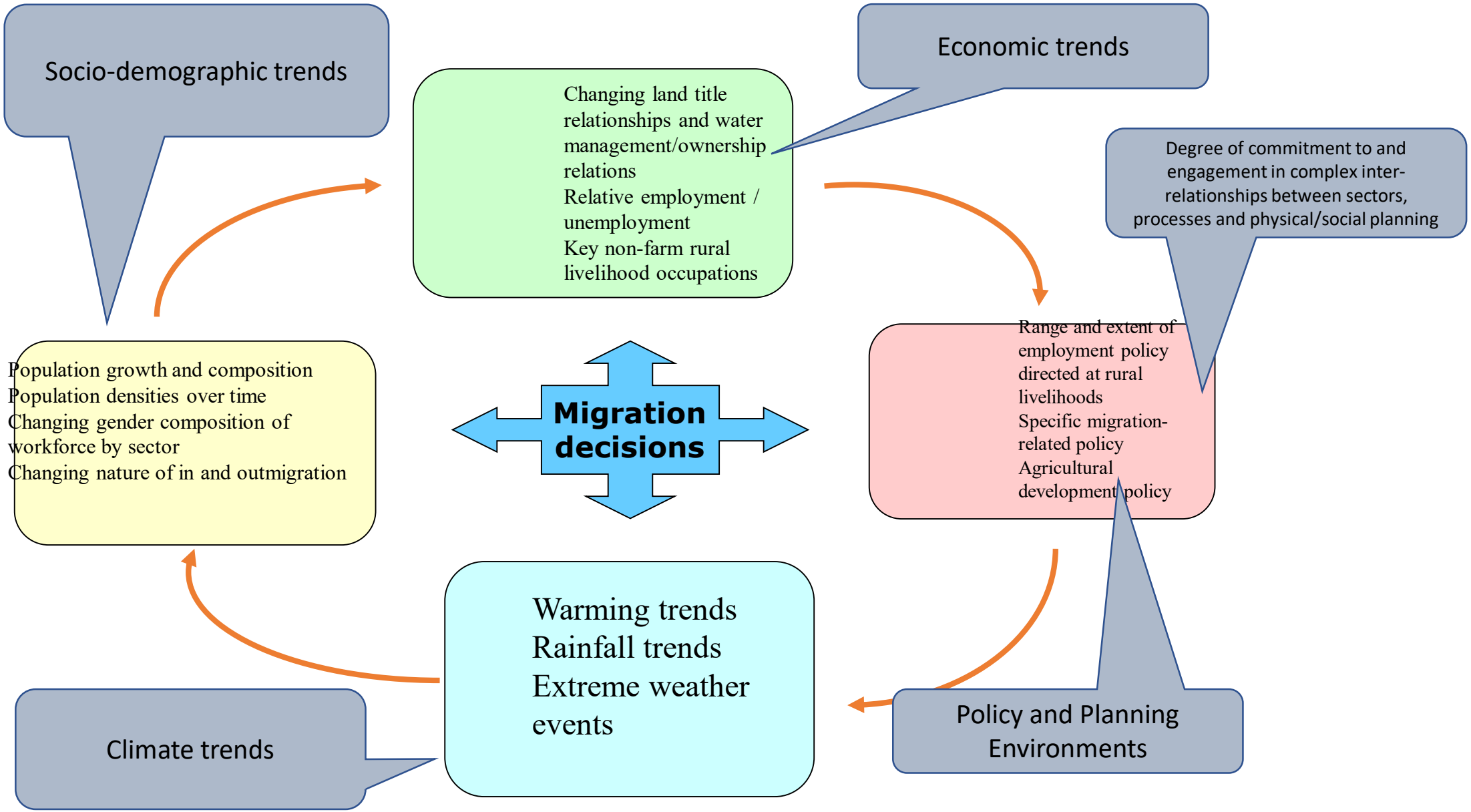
- Agricultural land and water is already under pressure from both human activity, and desertification, erosion, and vegetation loss.[
- Climate change is expected to speed up this process, weakening soil and biodiversity in farmland.
- Every part aspect of agricultural systems will be effected:
- Hirak adds complexity to decisions about resource use

Climate Change Impacts in Morocco

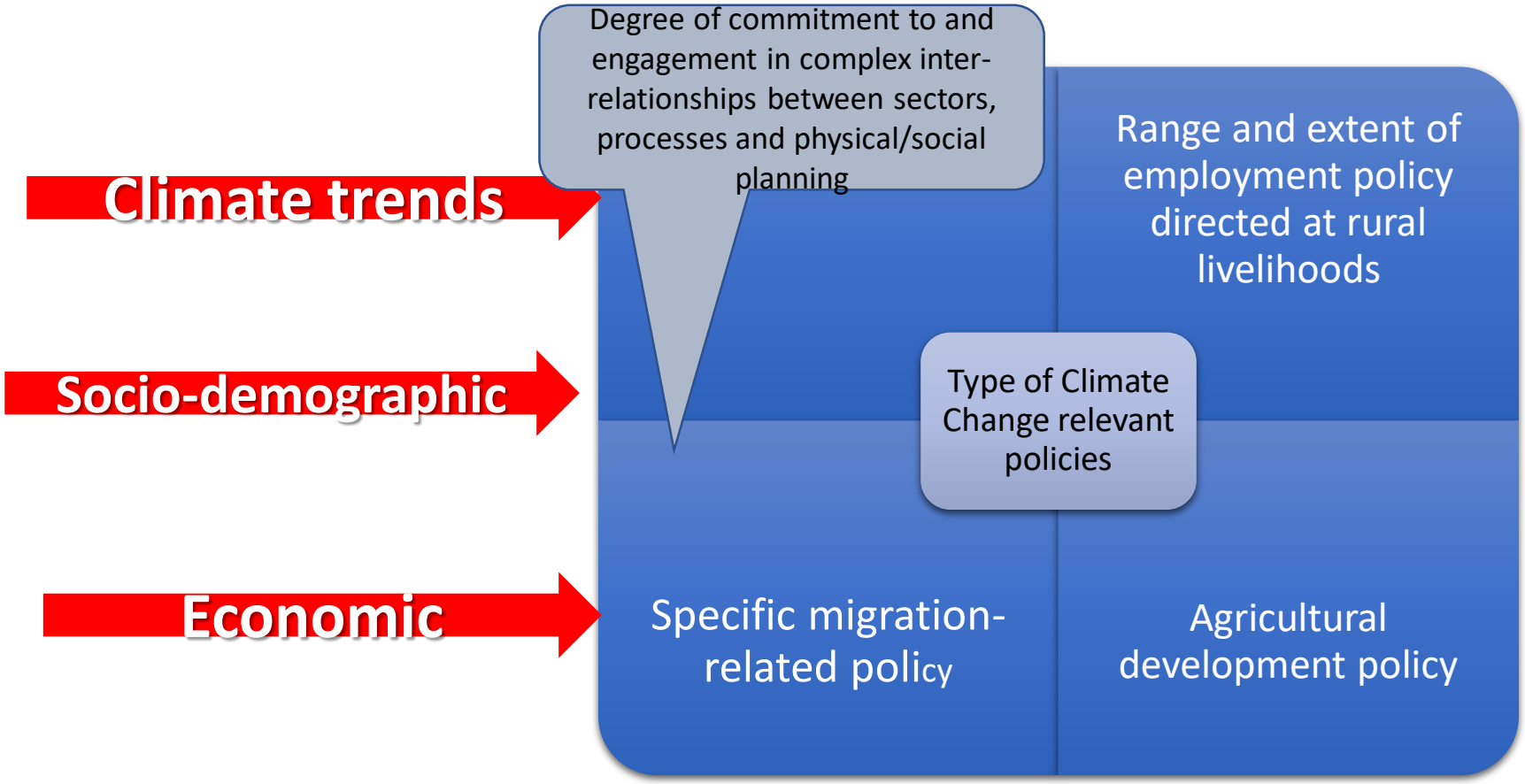
-Morocco is highly susceptible to long periods of drought
-creates volatility in agricultural production
-Morocco provides a good example of drought monitoring and assessmen
-However, still inadequate in sharing drought information
-Decreased land areas suitable for agriculture and reduced c

Morocco Green Plan




Socio-demographic trends
Economic trends
Changing land title relationships and water management/ownership relations
Relative employment / unemployment
Key non-farm rural livelihood occupations
Degree of commitment to and engagement in complex inter-relationships between sectors, processes and physical/social planning
Population growth and composition
Population densities over time
Changing gender composition of workforce by sector
Changing nature of in and outmigration
Migration decisions
Range and extent of employment policy directed at rural livelihoods
Specific migration-related policy
Agricultural development policy
Warming trends
Rainfall trends
Extreme weather events
Climate trends
Policy and Planning Environments

The impact of climate Change on Migration and related policies



Maghreb policy goals:

overarching goal: policies and funding to prepare North African countries for climate change by assisting sustainable development and building resiliency.

- **Targeted people-centered, community-led, customized solutions and delivery mechanisms for climate actions**:
- **Strengthened ability of the poorest and vulnerable to recover quickly and more effectively from climate (and other) shocks.**
- **Information systems for early warning and decision support**: Strengthened and enhanced climate information systems for early warning and decision support reaching the poorest and most vulnerable.

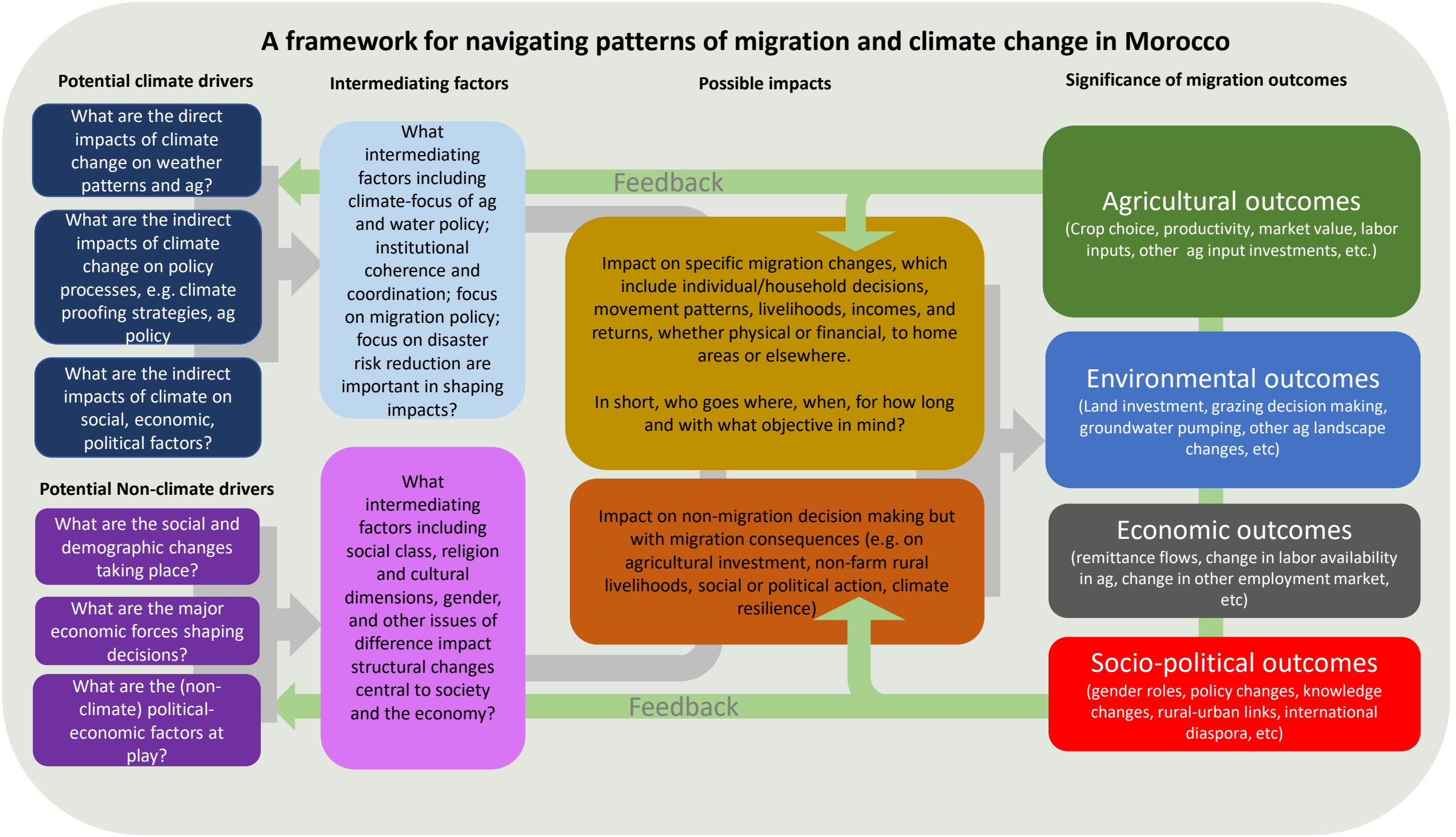
Maghreb policy goals

- **Institutional and policy response**: Improved institutional, risk financing and macro-fiscal policy to prepare and respond to climate shocks (and pandemics).
- Greater participation of local communities in climate and water decision making processes.

There is a need to distinguish carefully a typology of migration types

;

- *use a simple framework to describe this typology which helps to differentiate seasonal from international, internal to external migration;*
- *Migration decision making needs to be understood as informed by a range of sociological and economic factors, as well as ecological and resource-based signals;*
- *Wider policy on migration by governments is a key factor in how, why and where people move to (and from);*
- *The whole migration environment needs to be understood within a wider shift in political economy(ies) within North Africa and the relationship of the wider region to the EU, in particular, but also, increasingly, the relationship of Maghreb countries to their southern neighbors.*


A framework for navigating patterns of migration and climate change in Morocco
Potential climate drivers
Intermediating factors
Possible impacts
Significance of migration outcomes
What are the direct impacts of climate change on weather patterns and ag?
What are the indirect impacts of climate change on policy processes, e.g. climate proofing strategies, ag policy
What are the indirect impacts of climate on social, economic, political factors?
What intermediating factors including climate-focus of ag and water policy; institutional coherence and coordination; focus on migration policy; focus on disaster risk reduction are important in shaping impacts?
Feedback
Impact on specific migration changes, which include individual/household decisions, movement patterns, livelihoods, incomes, and returns, whether physical or financial, to home areas or elsewhere.
In short, who goes where, when, for how long and with what objective in mind?
Agricultural outcomes
(Crop choice, productivity, market value, labor inputs, other ag input investments, etc.)
Environmental outcomes
(Land investment, grazing decision making, groundwater pumping, other ag landscape changes, etc)
Economic outcomes
(remittance flows, change in labor availability in ag, change in other employment market, etc)
Socio-political outcomes
(gender roles, policy changes, knowledge changes, rural-urban links, international diaspora, etc)
Potential Non-climate drivers
What are the social and demographic changes taking place?
What are the major economic forces shaping decisions?
What are the (non-climate) political-economic factors at play?
What intermediating factors including social class, religion and cultural dimensions, gender, and other issues of difference impact structural changes central to society and the economy?
Impact on non-migration decision making but with migration consequences (e.g. on agricultural investment, non-farm rural livelihoods, social or political action, climate resilience)
Feedback

Up next – 3:30-5pm PT

SESSION 4.1

The Effects of Temperatures on Behavior

SESSION 4.2

Adaptation at Home: Consumption, Building Codes, and Insurance

SESSION 4.3

Quantifying and Minimizing Water Quality Impacts

SESSION 4.4

Integrating Climate and Transportation Planning

CLIMATE ADAPTATION
RESEARCH SYMPOSIUM

MEASURING & REDUCING SOCIETAL IMPACTS

Thanks for tuning in!

UCLA Luskin Center for Innovation