

Drought Economic Impacts for Urban Water Agencies

Improving Drought Prediction at Seasonal to Inter-Annual Timescales
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NWRI Overview

- Non-profit research institute

- Fountain Valley, CA

- Members

- Water and wastewater agencies in Southern California

- Research Program

- Technologies, water quality, etc.

- Areas of interest

- Recycled water, desalination
- Science and policy

NWRI



Economic Impacts of Drought

- Safe, reliable water supply is central to the economic success of our communities
- Economics/costs of drought:
 - Cost impacts to replace the lost water (if available)
 - Economic impacts to the residences and businesses as a result of a reduction in the available water

2007-2009 Drought (Rossi et al., 2013)

- Drought (hydrologic plus restrictions)
 - State Water Project/Central Valley Project
 - Multiyear drought/restrictions
 - State emergency declared
- Impacts – including rate impacts
 - MWD declared 20% allocation in 2009
 - Reduction in revenue → pressure to raise rates
 - 19.7% increase in MWD rates 2009
 - Costs to construct more local projects

Source: Rossi et al., Potential Political Impacts in Southern California of Drought-Related Water Availability and Rate Increases, 2013 (in press)

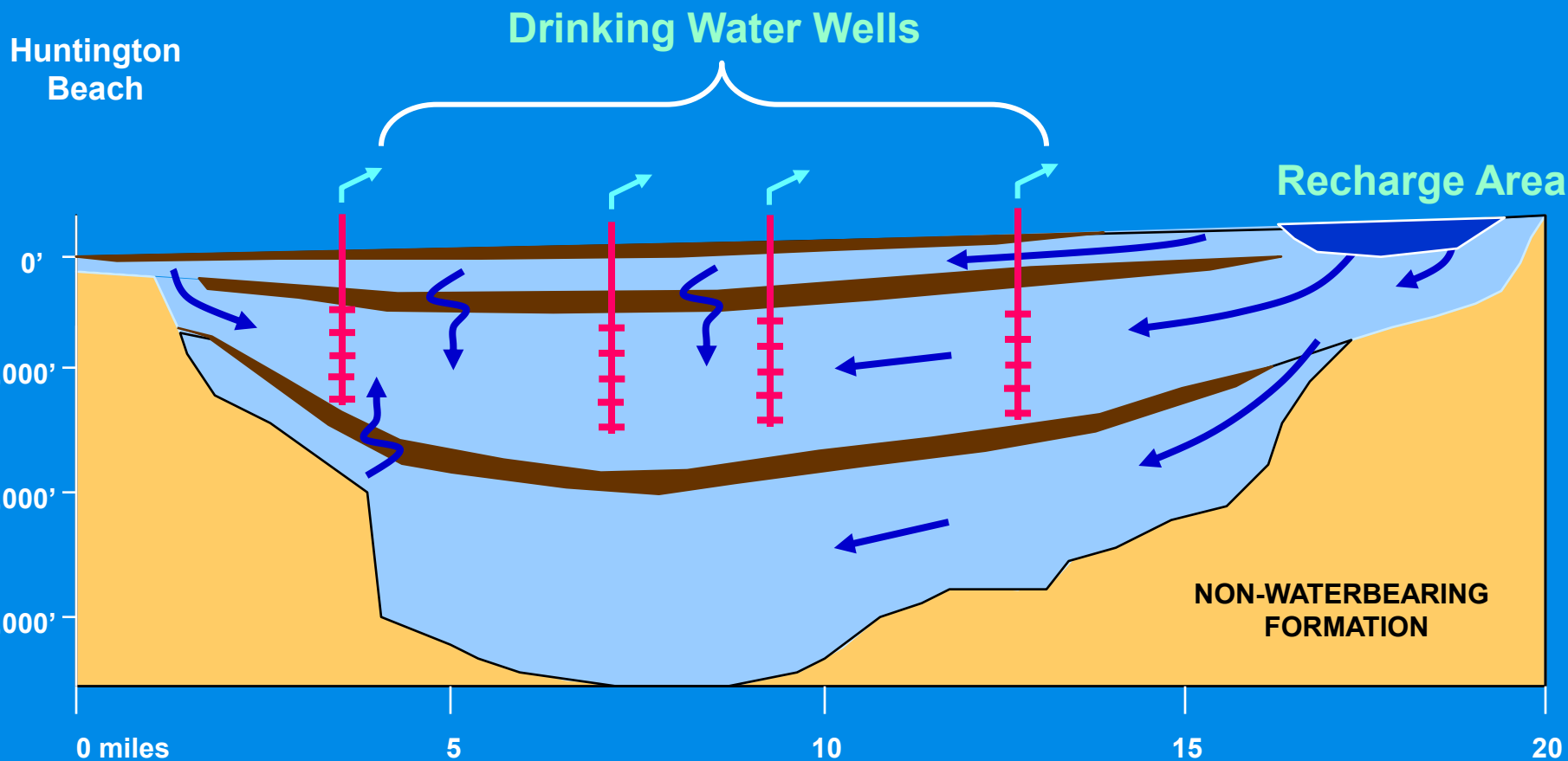
2007-9 Drought Impacts (cont)

(Rossi et al., 2013)

- **Supplies Reduced & Prices Rise**
 - Slow down in production/commercial processes
 - Ag sector – hardest hit
 - Discounted “surplus” water (5% of MWD supply) “service can be interrupted” (since 1994)
 - 30% reduction in 2008; 5-year phase out
 - Agencies consider halting economic development
 - Rancho California Water District considered a moratorium on new meters and service guarantees for new development (residential and commercial)
 - Rejected after much debate and public outcry
 - Decided that others methods would be studied (conservation and supply management)

Orange County Water District

Recharge San Ana River Water



Recharge Stormwater

- Drought conditions can result in:
 - 30,000+ af/yr decrease
- “Replacement costs”
 - Buy MWD water at \$900 af
 - Groundwater cost \$350 af
- Impact: $30,000 \times (\$900 - \$350) =$
 - \$16.5M per year

Source: Greg Woodside, OCWD, Personal Communication (2013)



Economics of Drought

- Water Supply Reliability

The ability of a water supply option to produce a given yield on a reasonably stable, continuous basis, whenever the utility wishes to tap and operate that given source

Source: Raucher et al., The Value of Water Supply Reliability in the Residential Sector, WaterReuse Research Foundation, Alexandria, VA , 2013

Dimensions of Reliability (Raucher et al., 2013)

- **Episodic, catastrophic events (earthquakes)**
 - low probability
 - high consequence risk
- **Periodic adverse events (droughts)**
 - moderate probability
 - moderate consequence risk
- **Routine inconvenient events (infrastructure repairs)**
 - moderate probability
 - low consequence risk

Business and Residential Water Supply Impacts from Catastrophic Events

- Economic losses from water supply destruction may be higher than the damage to the infrastructure itself

“San Francisco Bay Area Damages”

	Residential Losses	Business Losses
San Andreas <i>M</i> 7.9	\$279 M	\$14.4 B
Hayward <i>M</i> 7.0	\$37 M	\$9.3 B

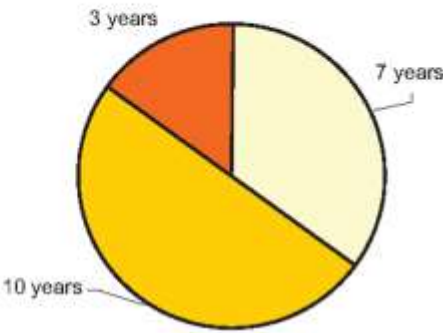
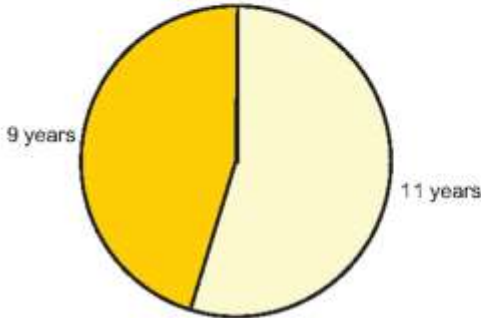
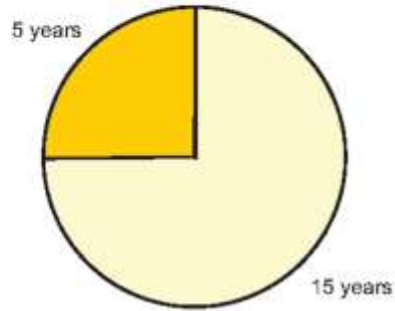
Reliability

- Traditional sources are tapped
- Demand continues to grow
- Consider non-traditional options
 - Water reuse and desalination
 - Typically more expensive
 - But provide benefits
- Need:
 - Customer valuation data to quantify these benefits

Questions

- How much are customers willing to pay to maintain or improve water supply reliability?
- What types of water supply options do customer's think their utilities should pursue?

Residential Survey (Raucher et al., 2013)

	No Additional Actions	Plan B	Plan C
Available water supply such that water use restrictions in the next 20 years will be:	 <ul style="list-style-type: none"> ■ No restrictions in 7 out of 20 years ■ Stage 1 restrictions in 10 out of 20 years ■ Stage 2 restrictions in 3 out of 20 years 	 <ul style="list-style-type: none"> ■ No restrictions in 11 out of 20 years ■ Stage 1 restrictions in 9 out of 20 years ■ Stage 2 restrictions in 0 out of 20 years 	 <ul style="list-style-type: none"> ■ No restrictions in 15 out of 20 years ■ Stage 1 restrictions in 5 out of 20 years ■ Stage 2 restrictions in 0 out of 20 years
Increase in your water cost	\$1 per month, which would be \$12 per year	\$14 per month, which would be \$170 per year	\$25 per month, which would be \$300 per year
Which plan do you prefer?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Survey Results (Raucher et al., 2013)

Table 4.1. Percentage of Time Status Quo Option Was Chosen as the Preferred Option, by City

City	Percentage of Time Status Quo Option Was Chosen (%)
Austin	45.4
Long Beach	61.7
Orlando	63.2
San Francisco	50.7
Utility X	48.3

Survey Results (Raucher et al., 2013)

Table 4.2. Most Frequently Chosen Alternative to the Status Quo, by City

City	Most Frequently Chosen Alternative	Summers with No Restrictions	Summers with Level 1 Restrictions	Summers with Level 2 Restrictions	Added Cost per Year	Percentage Chosen, %
	Status Quo	7 (8) ^a	10 (8) ^a	3 (4) ^a	\$12	
Austin	Alternative 24	10	9	1	\$65	53.8
Long Beach	Alternative 10	12	8	0	\$110	37.0
Orlando	Alternative 5	10	8	2	\$60	37.2
San Francisco	Alternative 10	12	8	0	\$110	39.6
Utility X	Alternative 2	12	6	2	\$95	47.0

^aExpected future is the same in all cities with the exception of Austin, which is shown in parentheses.

Results: Annual Household Willingness to Pay

(Raucher et al., 2013)

	Austin	Long Beach	Orlando	San Francisco
WTP to reduce Level 1 restrictions by one year				\$12.25
WTP to reduce Level 2 restrictions by one year	\$33.94	\$34.29	\$20.20	\$37.16

Other Water Supply Options

(Raucher et al. 2013)

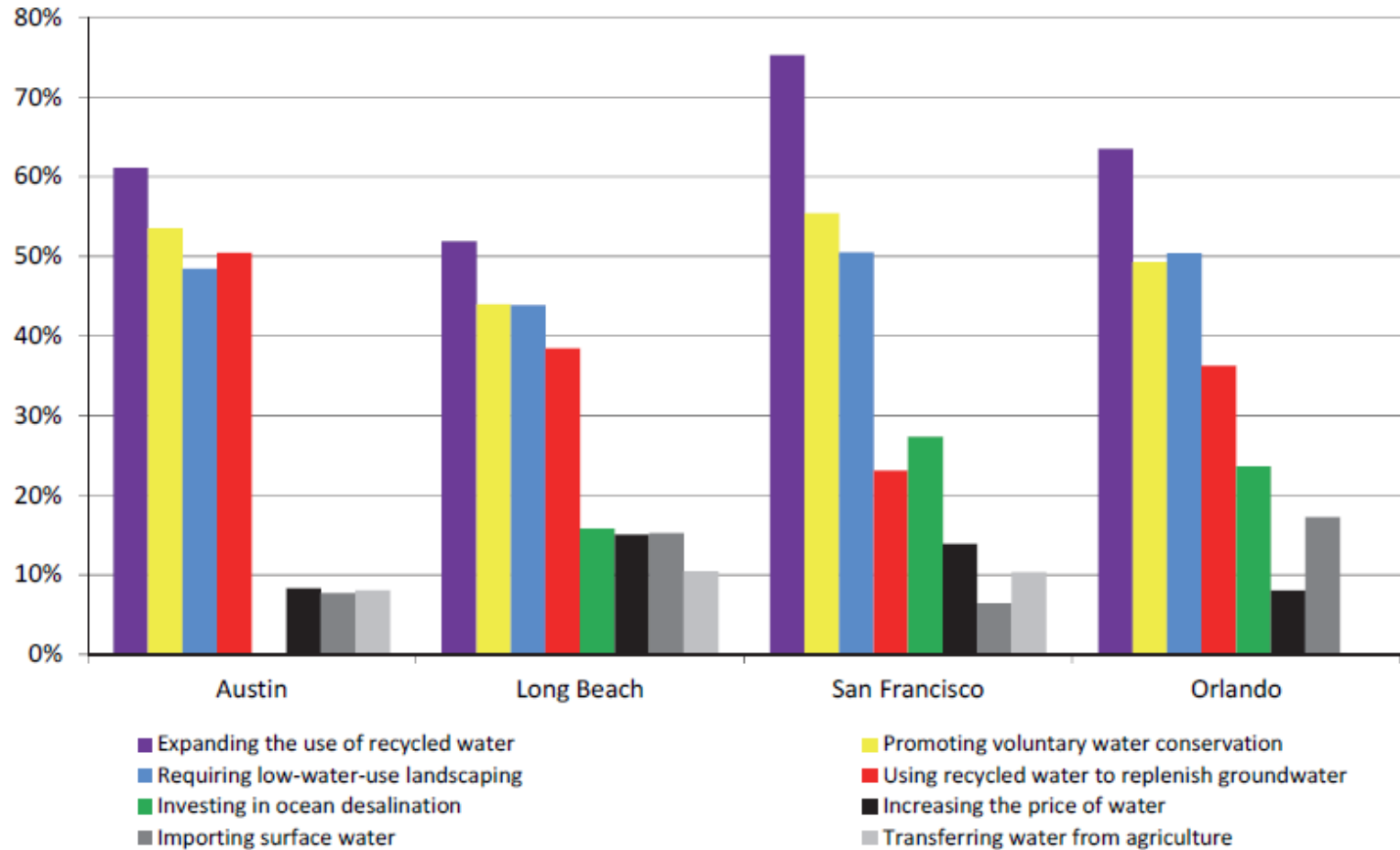


Figure 4.6. Percentage of respondents, by city, who selected a given option as one of their three most preferred options for water supply enhancement.

Least Preferred Options

(Raucher et al. 2013)

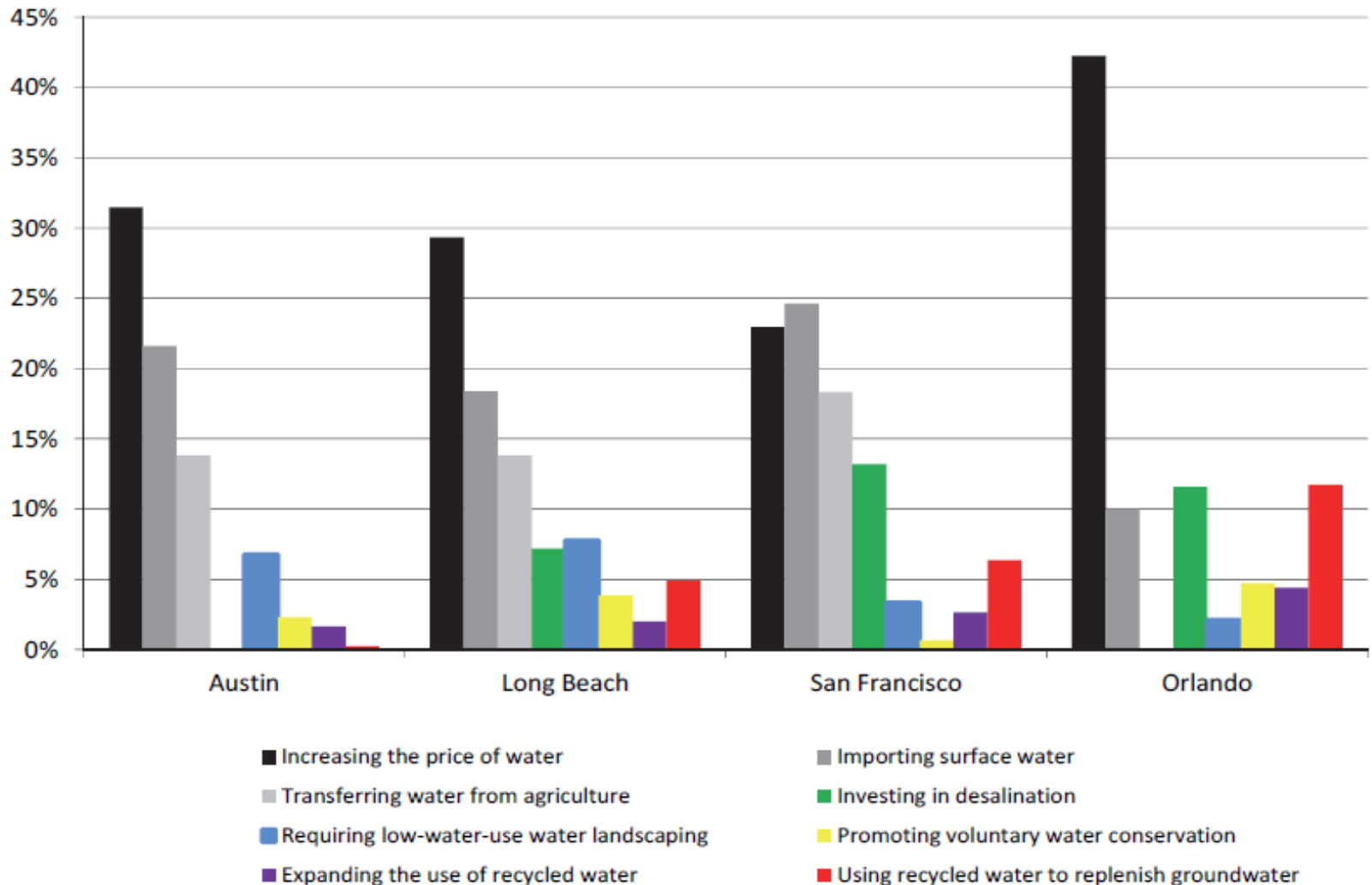


Figure 4.11. Percentage of respondents, by city, and their least preferred option rankings.

Another Perspective . . .

Interpreting WTP estimates in terms of \$/AF

Assumptions

**WTP Orlando =
\$20.20 per
household**

**Water use reduction
from Stage 1 to Stage 2
restrictions =
15%.**

**Water use for homes
with a yard =
325 gallons per day
or 36% of an AF per
year.**

Calculations

15% reduction under
Stage 2 restrictions =
5.4% of AF
(15% × 36% of an AF)

WTP of \$20.20 each year
for 20 years has a **present
value of \$250**, when
discounted at 6%

WTP to avoid losing
use of **0.054 AF** in
one future year =
\$250

Value to household
for that water use =
\$4,630 per AF
(= \$250/0.054 AF)

Summary

- General:
 - Reliable water is central to economic success
 - There are economic impacts from water scarcity
- Customers:
 - Willing to accept mild restrictions
 - Willing to pay to avoid severe restrictions
- Options:
 - Prefer conservation and recycled water
- Water agencies are good “planners”
 - Better tools for better prediction would be beneficial

Thanks

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