



# Water Resource Consumption at the Neighborhood-Level: Perceived Versus Actual Water Scarcity Risks in Phoenix, Arizona

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## Project Goals & Approach:

Disconnects between people's thoughts and actions have implications for mitigating environmental risks and associated losses. Understanding those discrepancies is a key concern among risk perception scholars and environmental social scientists. The identification of areas with high water demand and low concern about water scarcity, for example, represent areas that could be targeted for conservation or further research. In this presentation, we explore the following question in the study area of Phoenix, Arizona: **How do residents' concerns and perceptions about water consumption correspond to actual residential water demand in neighborhoods, and where and why do these human judgments deviate from actual demand estimates?** We focus on the neighborhood-level due to the "hyperopia effect," which is the tendency for people to exhibit diminished concern about risks at the local scale of human-environment interactions (compared to broader geographic scales). The hyperopia effect is important because it may lead to a reduced sense of personal efficacy and responsibility for mitigating water scarcity, thereby complicating water conservation efforts. Moreover, identification of neighborhoods with high water use rates, yet low concern and perceived water use, offer potential for targeted demand management programs to enhance water use efficiency. In this poster, we present preliminary findings on the locations of low to high water demand relative to concern and perceived use. Metered water use data for the City of Phoenix are combined with Phoenix Area Social Survey (PASS) data capturing concern and perceptions about water use rates throughout the metropolitan area.

## Data and Methods: GIS & Statistical Analysis

Utilizing multiple analytical methods, we statistically analyzing the data then mapped the spatial patterns of matches and mismatches in concern and perceived use versus actual water demand.

### Municipal Data: Metered Water Demand

**ACTUAL WATER DEMAND** Data by census tract (n=305) was obtained from the City of Phoenix. The numbers represent 2004 water consumption (in millions of liters) for single-family home dwellers by census tract. Water use is aggregated at the census tract level by the City of Phoenix to protect the privacy of residents. Levels of demand were categorized using standard deviation units (sd), where *low demand* =  $- < -0.5$  sd, *average demand* =  $-0.49$ - $0.5$  sd, *above average demand* =  $0.51$ - $1.5$  sd, *high demand* =  $1.51$ - $2.5$  sd, and *highest demand* =  $> 2.51$  sd.

### Social Survey: Household Data on Perceptions of Water Scarcity

Respondents of the Phoenix Area Social Survey (n=808) reflect varied socioeconomic conditions from 40 representative neighborhoods around the Valley. Survey questions used in the analysis for risk perceptions included:

#### ECOLOGICAL CONCERN

Thinking only about your neighborhood, are you very, somewhat, not too or not at all concerned about...

The amount of water being used by your neighbors?

- 1 - Very concerned, 2 - Somewhat concerned, 3 - Not too concerned, 4 - Not at all concerned
- 5 - Don't know, 6 - Refuse to answer

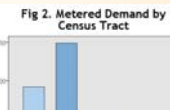
#### PERCEIVED CONDITIONS

How much water do you think your household uses compared to other similar households in the Valley?

- 1 - Much less water, 2 - A little less water, 3 - About the same amount of water
- 4 - A little more water, 5 - Much more water, 6 - Don't know, 7 - Refuse to answer

## Findings: Metered Water Demand

- Demand frequencies show a high number of very low users and then follows a positively skewed bell curve (Fig 1). Two outliers were removed (demand levels: 2994 and 4779 million liters per day).
- Overall, 49.2% of census tracts use an average amount of water, while 20.4% use above average to highest amounts, and 30.4% use below average amounts (Fig 2).

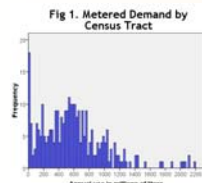


**Table 1. Metered demand by census tract (n=303)\***

Mean	587.90
Median	543.44
SD	419.78
Skewness	1.18
Min	0.12
Max	2,186.94

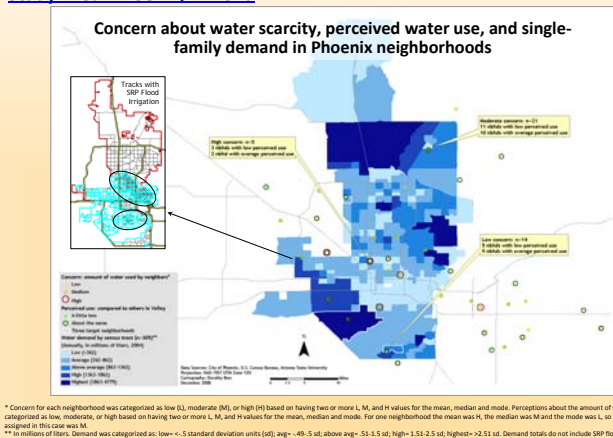
\*in millions of liters annually

Level of demand (% of tracts)  
 Low demand: 362 (36.4%)  
 Average demand: 362 (36.4%)  
 Above avg demand: 863 (1362) (15.8%)  
 High demand: 3363 (1362) (2.3%)  
 Highest demand: 1863 (2187) (2.3%)  
 \*in millions of liters annually



- Above average demand (n=62):** High demand neighborhoods are located in north, central, and southwest Phoenix. Based on previous research, we expect high demand neighborhoods will exhibit some combination of the following characteristics: pools, mesic landscaping, large lots and household sizes, higher incomes and property values.
- Average demand (n=149):** About half the census tracts had average demand rates. Many of these were located along the urban fringe, where new homes may use less water due to more efficient plumbing and fixtures.
- Below average demand (n=92):** Many tracts in the urban core and some along the fringe have abnormally low water use. Lower demand is likely partly due to flood irrigation (which is not reflected in the City of Phoenix water data) and may also be linked to lower income and smaller households.

## Study Area: Phoenix, Arizona



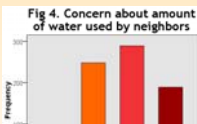
## Findings: Individual Perceptions from Survey Responses (n=808)

### ECOLOGICAL CONCERN (Fig 4)

- Over 60% of respondents were somewhat or very concerned about the amount of water used by their neighbors, while 8% were not at all concerned.
- This result reveals a high level of concern by residents about water scarcity in the Valley.

**Table 2. Individual responses: Descriptive statistics**

	Concern (n=778)	Perceived Use (n=788)
Mean	2.17	2.57
Median	3.0	2.0
SD	0.81	0.89
Skewness	-0.17	0.27
Min	1	1
Max	5	5

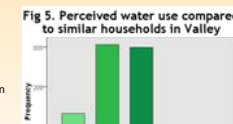


**Table 3. Individual response cross-tabulation: Concern and perceived use (n=781)**

		Perceived water use compared to similar households in Valley				
		Much less water	A little less water	About the same	A little more water	Much more water
Concern about amount of water used by neighbors	Not at all	Count: 1	Count: 0	Count: 0	Count: 0	Count: 0
	Very concerned	Count: 1	Count: 1	Count: 1	Count: 1	Count: 1
Total	Count: 2	Count: 1	Count: 1	Count: 1	Count: 1	
	% of Total	100%	50%	50%	50%	50%

### PERCEIVED CONDITIONS (Fig 5)

- Most respondents (92.5%) perceived their water use to be either the about the same as or less than others in the Valley.
- Fewer than 10% of respondents perceived their water use to be higher than other Valley homeowners.
- This finding indicates people tend not to see themselves as using more water compared to other residents of the region.



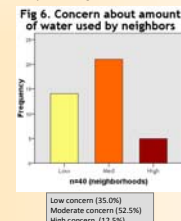
**Table 4. Neighborhood-level cross-tabulation: Concern and perceived use (n=40)**

		Perceived water use compared to similar households in Valley				
		A little less water	About the same	Total	Mean	SD
Concern about amount of water used by neighbors	Low	Count: 5	Count: 9	Count: 14	2.77	2.38
	Moderate	Count: 11	Count: 21	Count: 32	3.0	3
High	Count: 2	Count: 2	Count: 4	3	—	
Total	Count: 18	Count: 32	Count: 50	3	2	
	% of Total	47.5%	52.5%	100%	—	—

## Preliminary Findings: Neighborhood-Level (n=40)

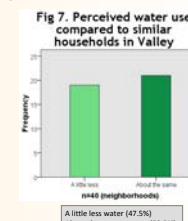
### ECOLOGICAL CONCERN (Fig 6)

Aggregated concern data reveals that most neighborhoods (65%) are concerned about the amount of water used by their neighbors.



### PERCEIVED CONDITIONS (Fig 7)

For both the mode and the median, zero neighborhoods perceived their water use to be more than that of others in the Valley.



## CONCERN & PERCEPTION (Table 5)

- Of the 4 neighborhoods that reported low concern, 3 used above average to very high amounts of water relative to others in the Valley though they perceived their use to be average.
- This may indicate that low concern for water scarcity leads to increased demand, especially when perceived use is lower than actual use.

**Table 5. Neighborhood-level cross-tabulation: Concern and perceived use (n=40)**

		Perceived water use compared to similar households in Valley			Table 4. Neighborhood-level: Descriptive statistics	
		A little less water	About the same	Total	Concern (n=40)	Perceived Use (n=40)
Concern about amount of water used by neighbors	Low	Count: 5	Count: 9	Count: 14	2.77	2.38
	Moderate	Count: 11	Count: 21	Count: 32	3.0	3
High	Count: 2	Count: 2	Count: 4	3	—	
Total	Count: 18	Count: 32	Count: 50	3	2	
	% of Total	47.5%	52.5%	100%	—	—

## DEMAND, CONCERN, & PERCEPTIONS

All 15 neighborhoods within the metered water data boundary perceived their water use to be average or low while metered demand reflects that only about half these neighborhoods actually had average to low demand.

- Above average demand (n=7):** Five of the high demand neighborhoods perceived their water use to be average as compared to similar households in the Valley, and two perceived their water use to be less. Concern regarding water scarcity in these neighborhoods was moderate (n=4) or low (n=3). This finding suggests a disconnect between actual and perceived use, especially in areas with low to moderate concern.
- Average demand (n=5):** all neighborhoods with average demand perceived their water use to be less than others in the Valley, and concern ranged from high (n=1), to moderate (n=3), to low (n=1).
- Low demand (n=3):** neighborhoods with low demand had perceived average (n=2) to low (n=1) water use rates and high (n=2) to moderate (n=1) concern. This seems to indicate that higher concern is correlated with lower demand and lower perceived use.

## Concluding Thoughts & Next Steps:

Preliminary results reveal a disconnect between residents' concern about water scarcity, perceived use, and actual demand levels. Findings suggest low water use may be linked to higher concern and average to low perceived use, whereas higher demand seems to be correlated with lower concern and lower perceived use rates.

This study has identified three neighborhoods that might be targeted for further research and analysis as well as conservation programming (see map). These are areas were concern and perceived use do not correlate with actual water scarcity risks, as they show low concern, low to moderate perceived use, and above average to highest levels of demand.

Next steps for this research include further exploring the characteristics of these three neighborhoods, obtaining simulated water data for surrounding municipalities, and characterizing/analyzing the remaining Valley neighborhoods that exhibit mismatches between concern, perceived use and demand to determine additional target areas.



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