

# Residential Water Consumption in Los Angeles: What are the Drivers and are Conservation Measures Working?

KRISTEN HOLDSWORTH & CELINE KUKLOWSKY

VENTURA WATER SHORTAGE TASK FORCE – AUGUST 13, 2014

DISSERTATION BY: Caroline Mini

PRINCIPAL INVESTIGATORS: Stephanie Pincetl and Terri Hogue

GRANT: NSF ULTRA-EX Program

## ABOUT THE CCSC

- The California Center for Sustainable Communities (CCSC) is a statewide collaboration that brings together leading-edge researchers to inform California's transition toward urban sustainability
- CCSC provides resources for policy makers, stakeholders and the residents of the state. Our mission is to assist the state's communities in the transition to greater sustainability on multiple fronts
- CCSC's expertise is in integrated energy analysis. We partner with utilities, cities, counties and others to provide rigorous research that informs decision-making and improves communities



# CCSC AT UCLA RESEARCH TEAM



# WATER USE IN LOS ANGELES – SINGLE FAMILY RESIDENTIAL

**Overarching goal:** *Improve understanding of residential water use dynamics and outdoor use components for targeted water conservation programs*

- What is the magnitude and variability of landscape water use in the city?
- What is the spatial distribution of urban vegetation, how does it relate to landscape water use and to sociodemographic differences?
- What are the ecosystem services supported by landscape water use and what are some of the potential costs of those services?



**NSF Behavioral and Cognitive Sciences (ULTRA-Ex)**  
**PI Stephanie Pincetl (UCLA)**

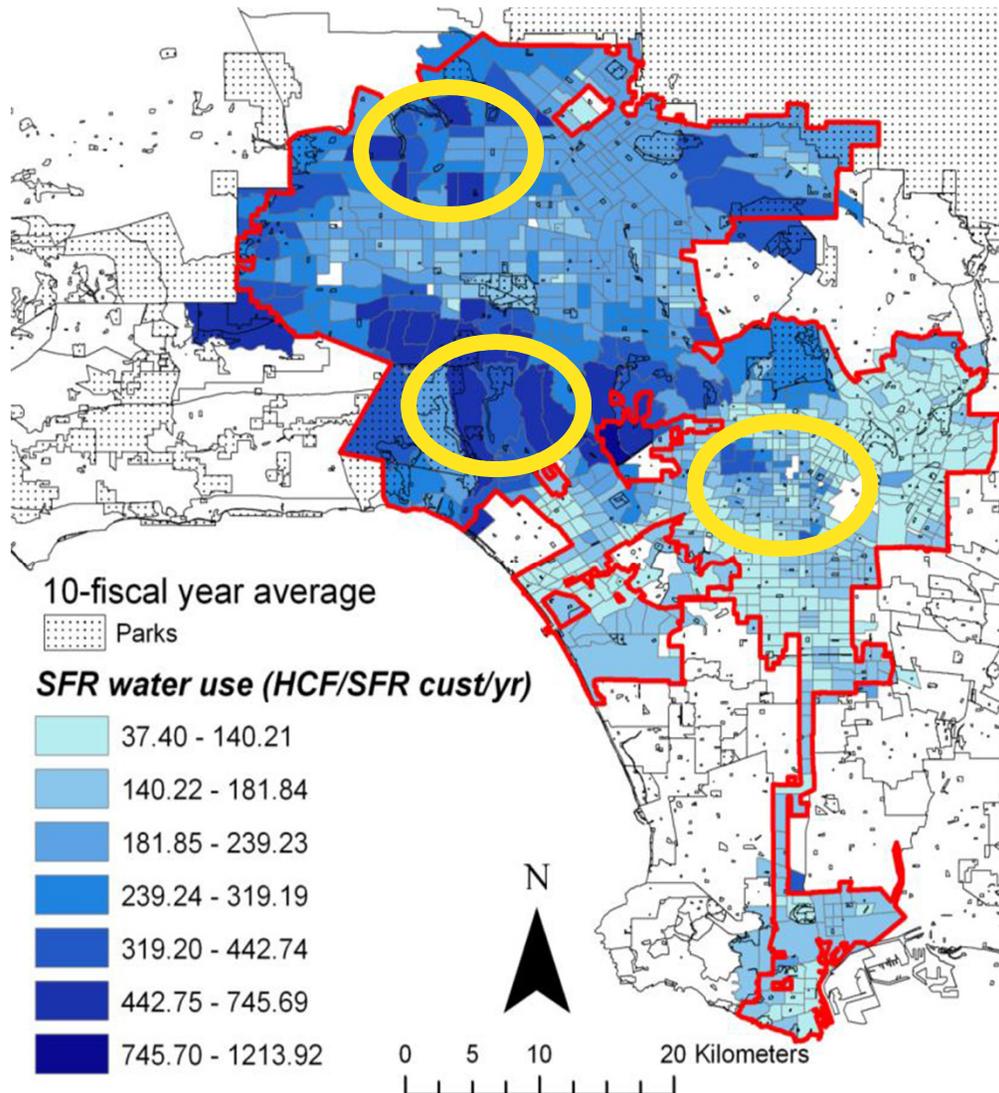
## PROJECT BACKGROUND

- Dr. Caroline Mini, PhD Dissertation of residential water consumption patterns and drivers in LA County
- Ten years of LADWP data that links water consumption with socio-economic demographics, climate information, and water prices.
- **Three components:**
  - **Part I:** Analysis of trends and determinants in single-family residential water use in Los Angeles
  - **Part II:** Evaluation of outdoor water use and landscaping irrigation modeling using remote-sensing data across Los Angeles
  - **Part III:** Evaluation of the effectiveness of water restrictions policies on single-family water use in Los Angeles

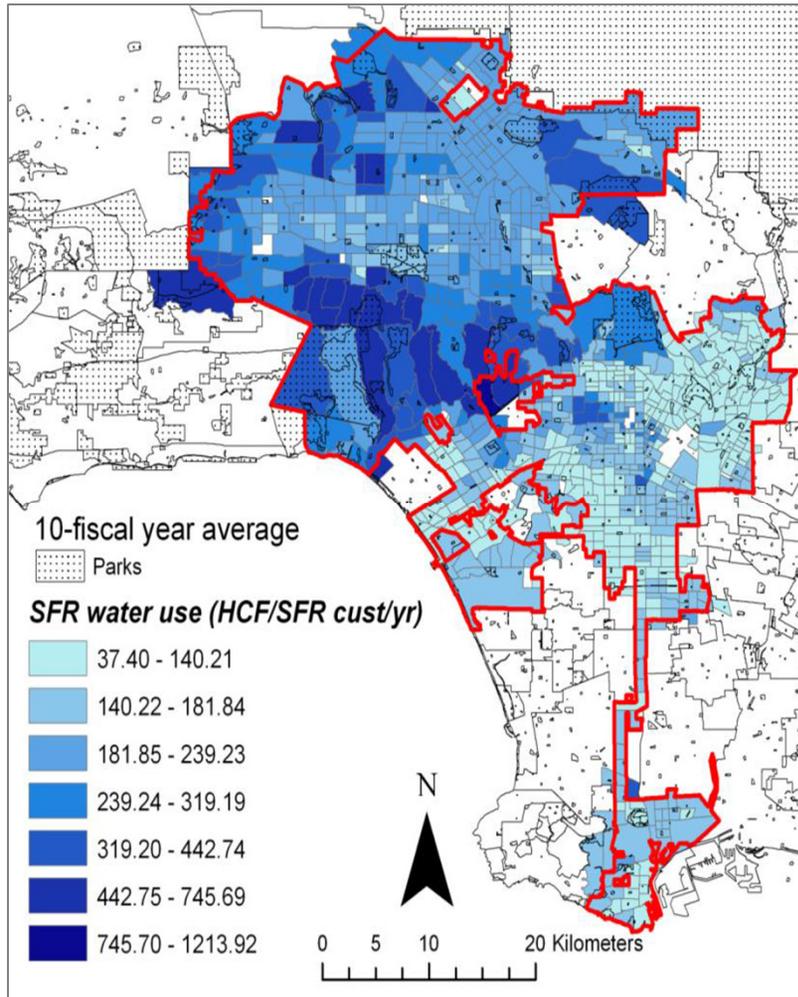
## DRIVERS OF SFR WATER USE

- Single-family residential water consumption in Los Angeles primarily driven by:
  - **Income**
  - Landscape greenness
  - Water rates
  - Household water volume allocation
- LADWP territory, the average SFR water consumption ranges:  
**37.4 HCF/SFR customer/yr - 1,214 HCF/SFR customer/year**
- Geographical clusters of water consumption: northern, coastal, downtown

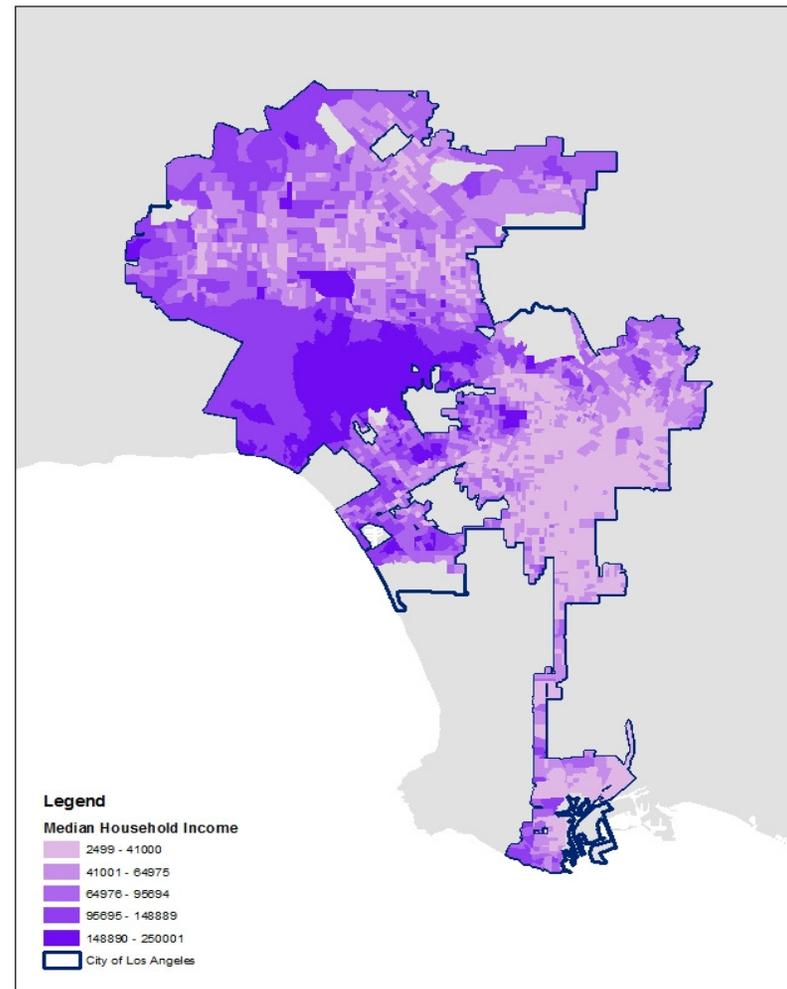
# 10 YEAR AVERAGE SFR WATER USE PER CENSUS TRACT



# Water Consumption



# Income



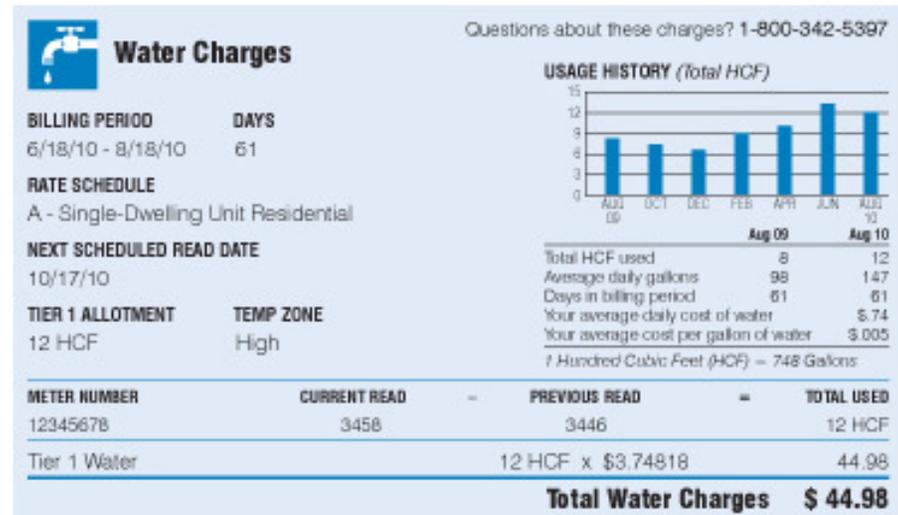
Map from: Mini, C., T.S. Hogue, and S. Pincetl, 2014: Patterns and Controlling Factors of Residential Water Use in Los Angeles, California, Water Policy, doi:10.2166/wp.2014.029

## INCOME AS PRIMARY DRIVER

- Wealthier neighborhoods consume **three times** the amount of water than less affluent neighborhoods
  - Pacific Palisades (827 m<sup>3</sup>/SFR customer/yr)
  - Downtown LA (369 m<sup>3</sup>/SFR customer/yr)
  - Playa Vista and Venice are exceptions (dense coastal)
- Income and household characteristics are tightly connected
  - Lot size, gardens, parcel and building characteristics
- \$1,000 increase in median household income increases SFR water use by about 2%

# TIER WATER RATES AND HOUSEHOLD ALLOCATION

- The **rate** and **household allocation of water** also influence SFR water consumption
- LADWP two-tiered rate system
  - Allotments set by zip code, lot size, season and temperature zone



**Your Water Usage by Tier**

Tier 1 Water Allotment \$3,748.18/HCF	Tier 2
12 HCF	More than 12 HCF

Usage is billed at 2 different rates, depending on how much you use. The graph shows how your water usage relates to these tiers, and the rate you paid in each tier. For more, visit [www.ladwp.com](http://www.ladwp.com)

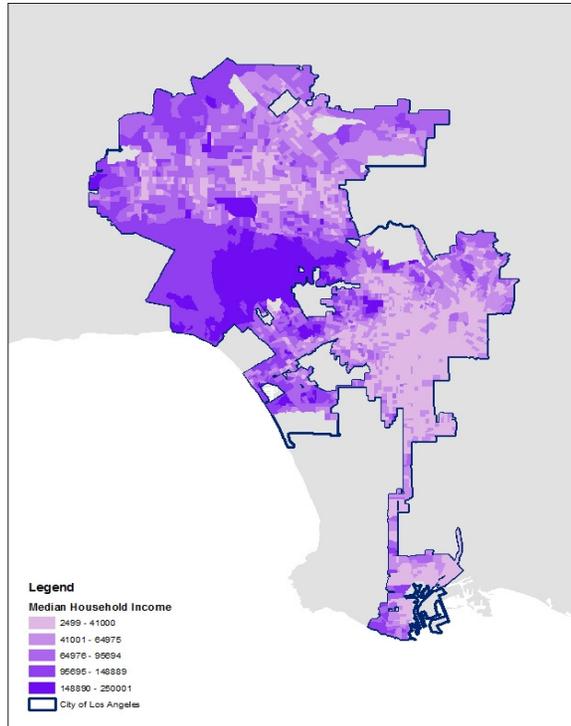
## TIER WATER RATES

- When water rates **increase**, water consumption for all households **decreases**
- Greater responses to increases in Tier 1 rates than in Tier 2 rates:
  - If Tier 1 rates were to increase by 10%, water demand would decrease by 2% for Tier 1 consumers and 0.7% for Tier 2 consumers.
  - Lower income customers more sensitive to changes in Tier 2 than higher income customers.
- Tier 2 rates not triggering their intended savings and are disproportionately affecting lower-income groups.

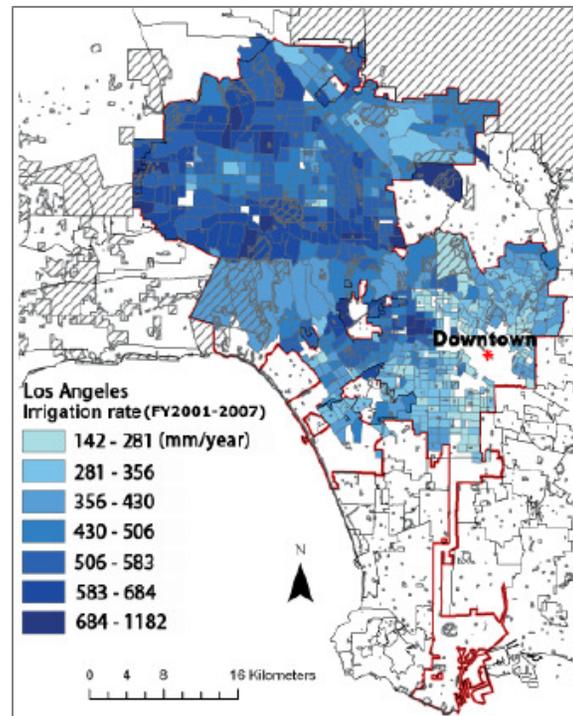
## HOUSEHOLD WATER ALLOCATION

- When water volume allocation is **increased**, SFR water consumption **rises**
- Increase in household volume allocation of 10 HCF (30% average increase) results in SFR water use increase of 9%
- Low water users are more sensitive to increases in volume allocation
- Neither price nor volume are sufficiently targeting higher water users

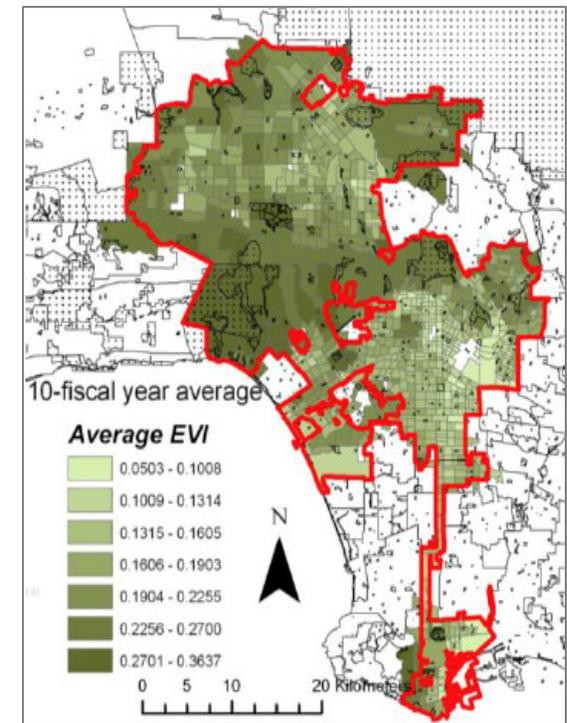
## Income



## Outdoor Landscaping Irrigation



## Green Index



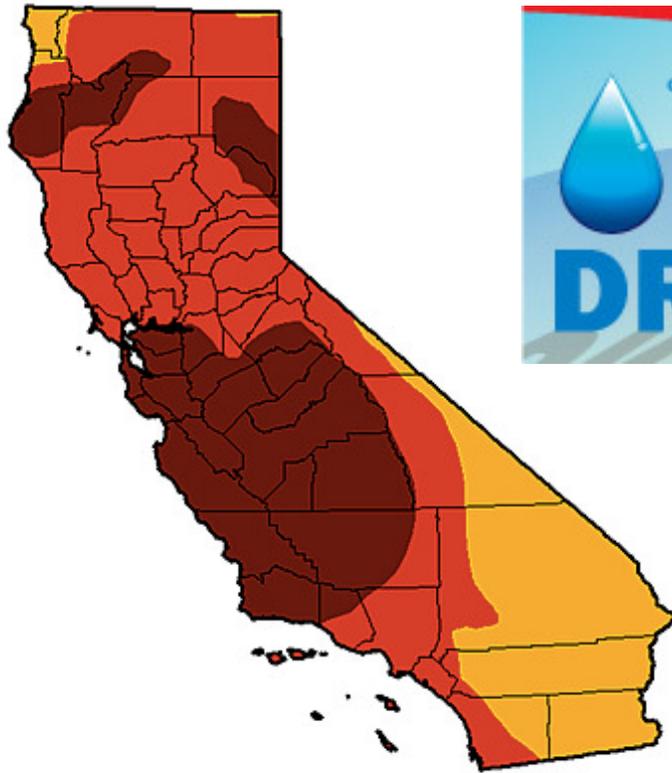
Maps from: Mini, C., T.S. Hogue, S. Pincetl, 2014: Estimation of Residential Outdoor Water Use in Los Angeles, California, *Landscape and Urban Planning*, 127, 124-135

## OUTDOOR WATER CONSUMPTION IN LA

- Challenge: distinguishing indoor vs. outdoor water use
- Outdoor water use accounts for **54%** of overall SFR water consumption



## CONSERVATION MEASURES

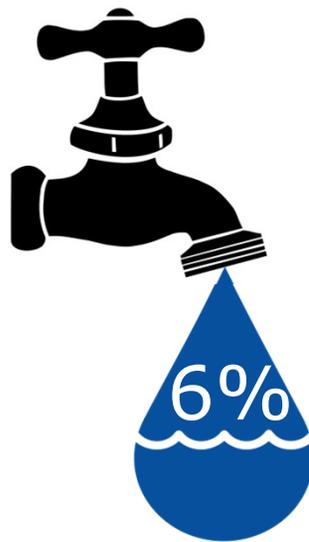


## 2007-2009 LADWP WATER RESTRICTIONS

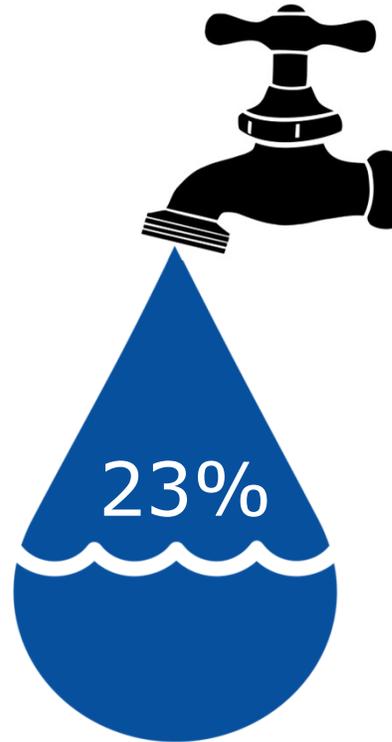
Year	Type of Restriction	Details
2007	Voluntary	Voluntary conservation called for by the mayor
2008	Mandatory (Phase I)	Limitations on: <ul style="list-style-type: none"> <li>- Daytime watering</li> <li>- Frequency and duration of outdoor irrigation depending on irrigation technique</li> <li>- Water waste practices</li> </ul>
2009	Mandatory (Phase III) + Pricing	Previous 2008 limitations <b>PLUS:</b> <ul style="list-style-type: none"> <li>- Only two days of watering allowed/week</li> <li>- Pool and spa restrictions</li> <li>- No washing of vehicles in streets</li> <li>- Increased reductions in watering times and frequency</li> </ul> Decrease in SFR allocation by 15% Increase in Tier II rate by 44%

# EFFECTIVENESS OF 2007-2009 WATER RESTRICTIONS

## Water Savings



Voluntary  
Restrictions



Mandatory  
Restrictions  
and Pricing

## RESTRICTIONS AND OUTDOOR WATER USE

- Stringent mandatory restrictions of June 2009 led to around **35% reduction in outdoor irrigation rates.**

### **Single-family residential households overwater outside areas**

Landscape **greenness** does not change significantly when there are outdoor watering restrictions...



...indicating that residents are **overwatering** when restrictions are not in place.

## SUMMARY OF WATER RESTRICTION FINDINGS

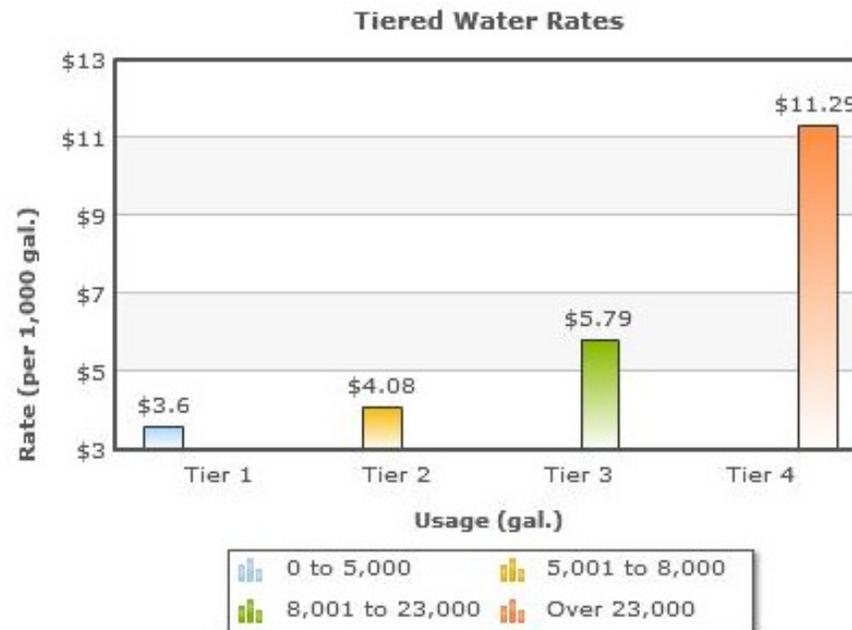
- 2009 Restrictions: Reductions across all neighborhoods
  - Annual single-family water use decreased by:
    - 17% in Pacific Palisades
    - 11% for Florence (2008-2010)
  - Low-water users reduce consumption more than higher water users when rates increase
- 2007 and 2008 restrictions: Lower income groups conserved more than higher income groups
- **Mandatory restrictions** are more effective at targeting higher income users (as opposed to voluntary measures)



## POLICY RECOMMENDATIONS

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Establish reasonable **water budgets** for households.

**Water Budget**

=

### Indoor Water Budget

- X gallons of water per person, per day
- The number of people in the household
- The number of days in the billing cycle

+

### Outdoor Water Budget

- Amount of irrigated acreage per parcel
- Daily evapotranspiration
- Plant Factor

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Differentiate between **indoor and outdoor water** use.



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**Revise** the two-tiered water pricing system to increase conservation without harming low-income consumers.

Establish reasonable **water budgets** for households.

Differentiate between **indoor and outdoor water** use.

Increase **landscape** options.









## CONTACT US

**Terri Hogue** [thogue@mines.edu](mailto:thogue@mines.edu)

Colorado School of Mines

**Stephanie Pincetl** [spincetl@ioes.ucla.edu](mailto:spincetl@ioes.ucla.edu)

California Center for Sustainable Communities at UCLA

Institute of the Environment and Sustainability

*Website:* [californiasustainablecommunities.com](http://californiasustainablecommunities.com)

*Email:* [info@californiasustainablecommunities.com](mailto:info@californiasustainablecommunities.com)

*Phone:* (310) 825-3778