

Phase 1 – Analysis of Published Research

# AWE Outdoor Water Savings Research Initiative

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Goal: To provide relevant, statistically validated, and **peer reviewed** information on water savings and costs from different outdoor measures and programs, regional differences, and evaluation methods, and to provide key inputs for the AWE Conservation Tracking Tool and other demand forecasting models.

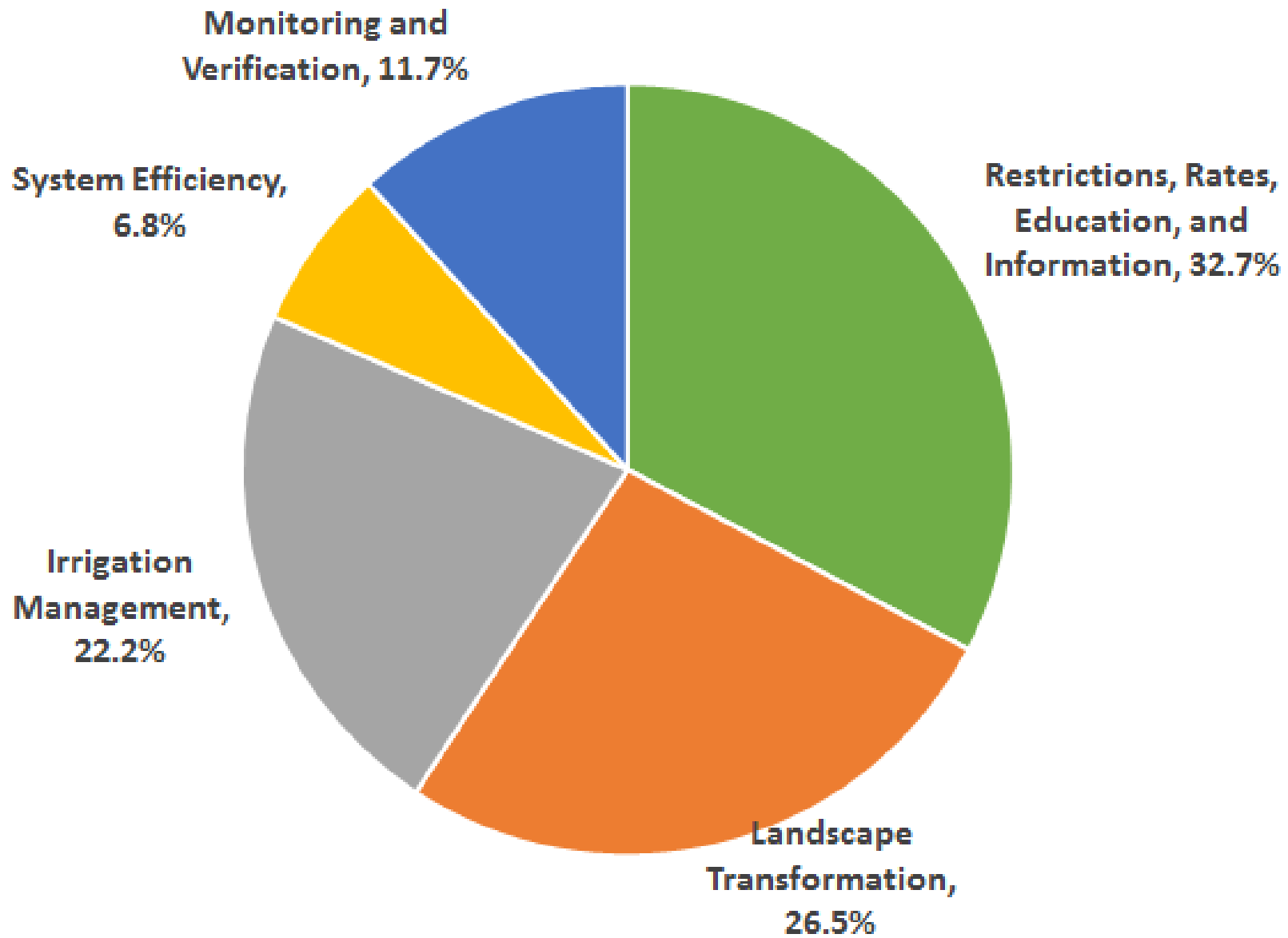


# Phase 1

A review, analysis, and synthesis of published and pending research on outdoor water use and water savings.



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% of articles found in each topic area *n~170 studies, articles, reports, etc.*

# Key Findings

- Outdoor water savings are achievable and can be significant.
- Quantifying water savings from outdoor programs and measures is challenging.
- Reporting of outdoor water savings in research varies and there is a lack of geographic and climate variability in the research.
- Cost savings are rarely documented.
- Standardized approaches and methods for measuring and evaluating outdoor water efficiency programs are needed.



# Areas of Greatest Need for Future Research - 1

- Impact of native, water-wise, and xeric landscapes vs. turf on water use and cost.
- Impact of water rates, rate structures, and billing information on demand.
- Impact of drought restrictions.
- Water requirements and drought tolerance of landscape turfs and plants under different climate and drought conditions.  
*Water requirement should be based on acceptable appearance rather than maximum growth.*



# Areas of Greatest Need for Future Research - 2

- Impact of landscape contractor training, education, and certification.
- The human element of landscape water management – how people manage and interact with the entire irrigation system and the installed landscape.
- Impact of improving system efficiency through audits, tune ups, sprinkler-head retrofits, and other measures.
- Reasons and rationale for customer landscape choices.



# Areas of Greatest Need for Future Research - 3

- Cost-effectiveness and cost savings of various outdoor water saving programs.
- Impact of regional variability (climate, soils, demographics, etc.) on outdoor water demand and savings, with a standard measure for comparison across regions.
- Standard methods for monitoring and verifying water savings.
- Long-term reliability and projected lifetime of outdoor water savings.





# Areas of Less Need for Research

- Impact of water budget-based rates.
- Irrigation control technology including weather-based controllers and soil moisture sensors.



# Summary of Water Savings by Measure -1

Measure	Lower Bound of Water Savings	Higher Bound of Water Savings	Best Available Estimate of Water Savings*
Water budget-based rates	10 %	20%	18% (Barenklau et. al. 2013)
Mandatory drought irrigation restrictions	18%	56%	Varies by severity of restriction. More severe = more savings.
Voluntary drought irrigation restrictions	4%	12%	Varies.
Customized mailed home water use reports		5%	5% (Mitchell et. al. 2013)
Conservation education programs	2%	12%	Varies.

Savings ~ % of total annual water use

# Summary of Water Savings by Measure -2

Measure	Lower Bound of Water Savings	Higher Bound of Water Savings	Best Available Estimate of Water Savings*
Florida-Friendly Landscaping	50%*	76%*	50% (Boyer, et. al. 2014)
Xeriscape rebates (NM)		33%*	Varies (Price, et. al. 2014)
Xeriscape conversion (NV)	34 gpsf	60+ gpsf	55.8 gpsf savings (Sovocool, et. al. 2005)
Urban densification (MA)		5%**	5% (Runfola, et. al.)
Natural and manufactured shade (Israel)		50%*	50% (Shashua-Bar, et. al. 2009)

\*Savings ~ % of outdoor annual water use

\*\*Savings ~ % of total annual water use

# Summary of Water Savings by Measure -3

Measure	Lower Bound of Water Savings	Higher Bound of Water Savings	Best Available Estimate of Water Savings*
Soil moisture sensor-based control (FL)	24%	<b>92%</b>	<b>65%</b> (Haley, et. al. 2012)
Residential weather-based control (CA)	6%	14.9%	9.4% (MWD OC 2011)
Commercial weather-based control (CA)	8%	27.5%	27.5% (MWD OC 2011)
ET signal-based control (FL)	23%	34%	Varies. (Davis, et. al. 2014)
Rain switch and pause (FL)	25%	41%	Varies. (Rutland et. al. 2012)

Savings ~ % of outdoor annual water use

# Summary of Water Savings by Measure - 4

Measure	Lower Bound of Water Savings	Higher Bound of Water Savings	Best Available Estimate of Water Savings*
Weather-based control (NM)	34%	54%	Varies. (Al-Ajlouni, et. al. 2012)
Weather-based control (NV)	4.6%	68%	Varies. (Devitt, et. al. 2008)
Rotating sprinkler heads	0 or negative	31% (hypothetical)	Unknown

Savings ~ % of outdoor annual water use

# On to Phase 2



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WATER  
SAVINGS**

