Working With People To Promote Landscape Water Conservation

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Quinney College of Natural Resources

Utah State University

Logan, Utah

WaterMAPS™ Water Management Analysis and Planning Software

UtahState University

To Get Started….

- … think about plants
- … think about people

What do they have in common ?

People are a lot like plants….

- They come in an array of different shapes, sizes, colors, and smells.
- They call different places “home.”
- Sometimes they grow up one place and then are transplanted somewhere else.
- They have to adapt to their new homes, to the weather, to things people do to them.

People are a lot like plants….

- Their needs differ.
- Some of them are tricky to raise.
- Certain ones are particularly temperamental.
- They do well in different settings.
- They have different habits.

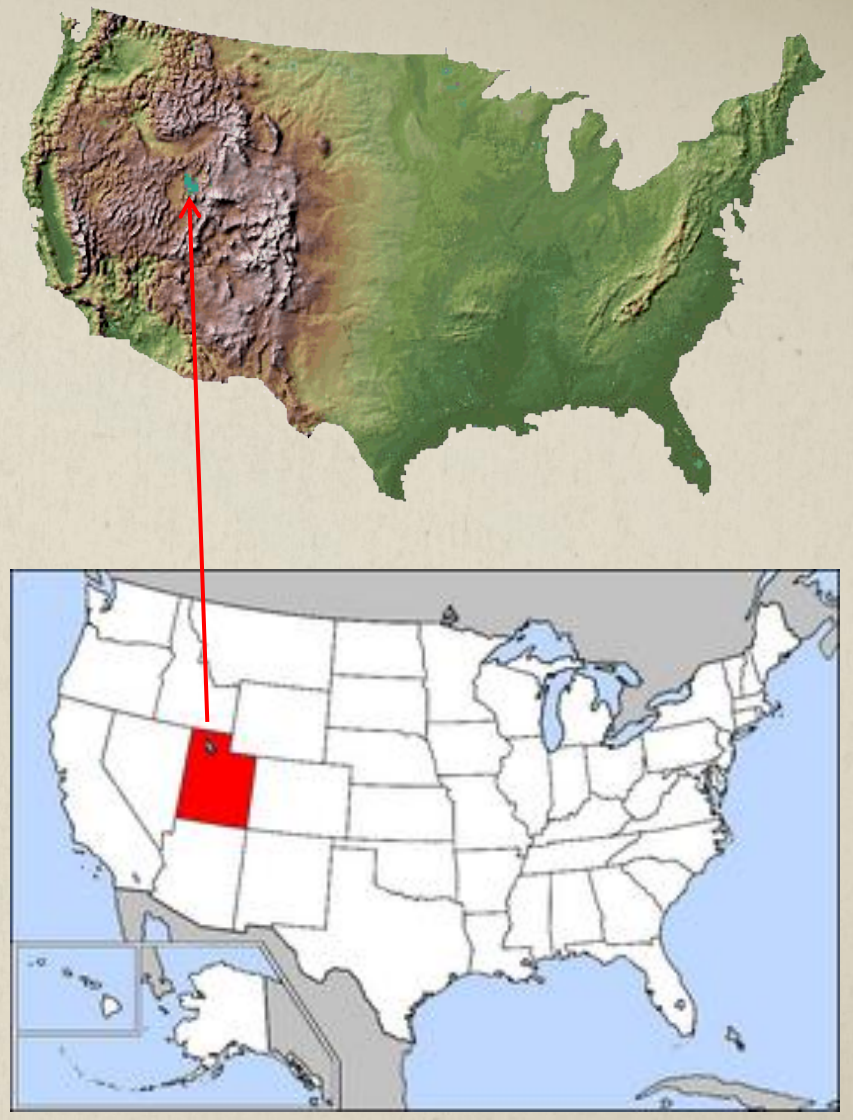
➔ **So, you need to get to know them.**

Presentation Overview

- Context and need for landscape water conservation
- Many people, many decisions
- USU WaterMAPS: software application for assessing urban landscape water use and providing information feedback to users
- Water conservation research: examples and findings
- Summary observations

CONTEXT:

need for urban landscape water conservation, especially in the U.S. West



Utah is 2nd driest state in the United States

Dimensions of Western Urban Water Context

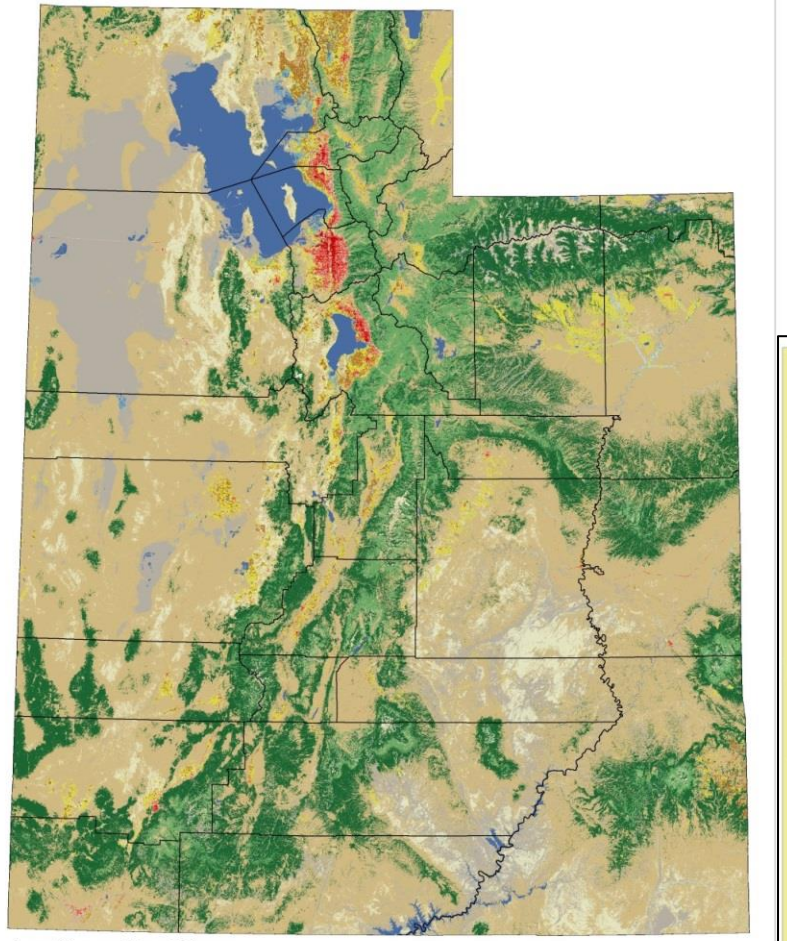
Temporal:

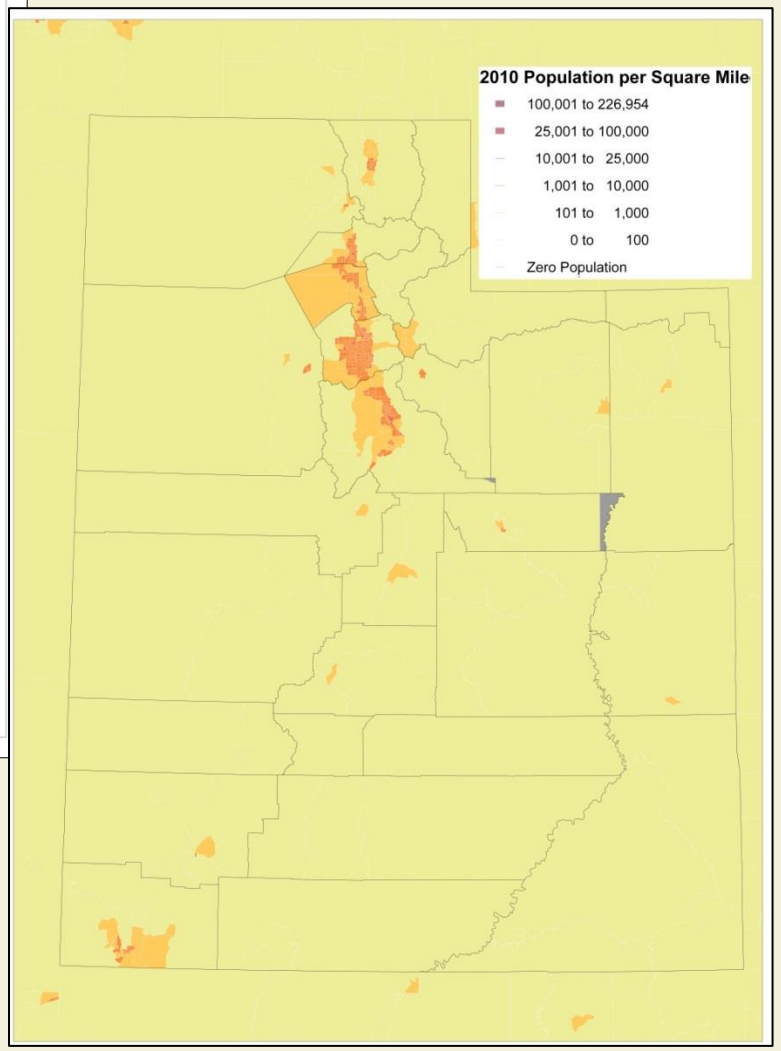
- Forgotten past ~ ~ paleo-climatic record
- Ignored present ~ ~ aridity and drought
- Uncertain future ~ ~ climate change

http://pics4.city-data.com/cpicc/cfiles7647.jpg

Spatial:

- Dynamic urban environments ~ ~ many sources of change
- High variability ~ ~ across urban landscapes; among users
- "Situational Waste" ~ ~ site-specific constraints to efficiency

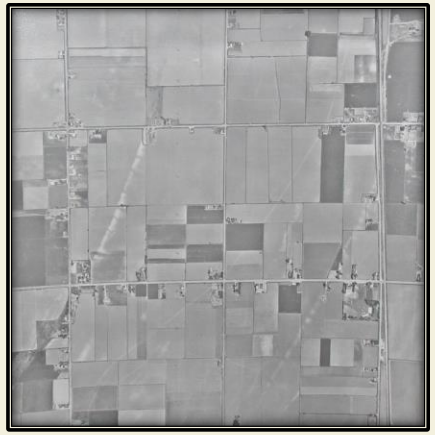




Maps compliments of Shujuan Li, LAEP at USU

UTAH CONTEXT:
Growth

- Rapid population increase
- Economic development
- Concentrated urbanization

	1958		2012
CLINTON UTAH		→	
SYRACUSE UTAH		→	
LAYTON UTAH		→	

CONTEXT:
Changing uses and needs

Transfers of land and water from agriculture to municipal and industrial uses

- About 60-70% of residential water is used to irrigate landscapes
- Urban irrigation systems often are not well designed, maintained, or operated
- Conservation of water used on urban landscapes has the greatest potential to contribute to urban water demand management

WATER ISSUES:

opportunities to increase urban irrigation efficiency

Many People,

Many Decisions

Many People Influence Landscape Decisions

- Property…
  - … owners
  - … managers
  - … renters
- Home Owner Associations (HOAs)
- Landscape architects and designers
- Landscape maintenance firms
- Growers, Nurseries
- Government officials (politicians, planners, employees)
- etc…….

Many Decisions Affect Landscape Water Use

- Decisions …
  - … big and small
  - … made frequently or occasionally
  - … made in consultation with others or alone

- Decisions related to….
  - … sites where landscapes are established
  - … soil preparation
  - … plant selection
  - … irrigation system design and installation
  - … irrigation system operated and maintenance
  - … social pressure people feel to maintain certain types of landscapes

PEOPLE-ENVIRONMENT INTERACTIONS

CONCEPTUAL SYSTEMS

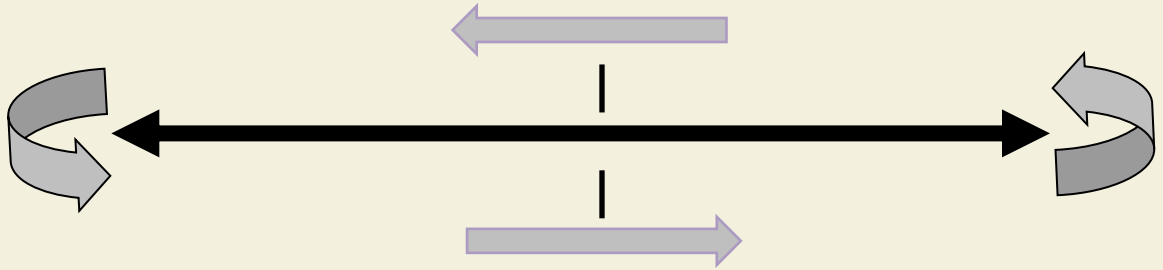
Beliefs, Perceptions, Values, Cosmology

BEHAVIORAL SYSTEMS

Economic, Political, Social, Cultural

TOOLS

Science, Technology, Language

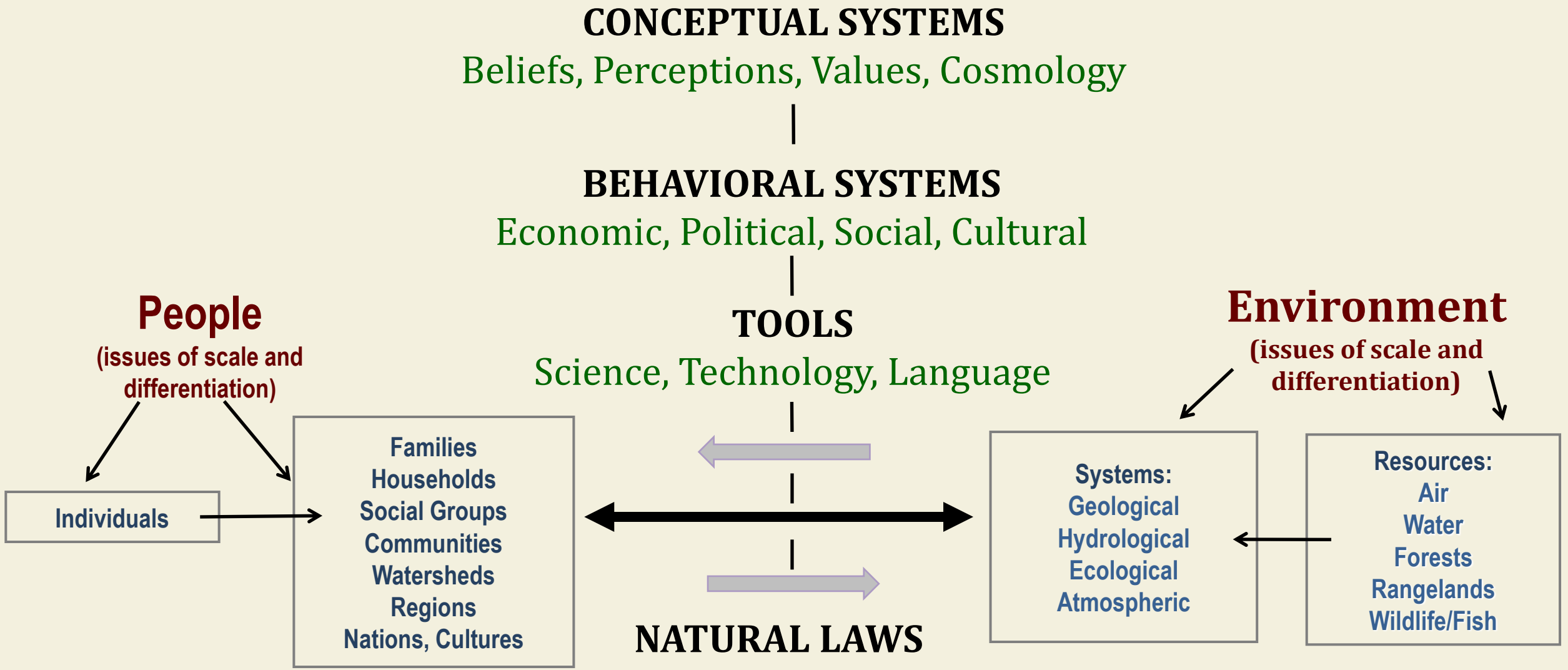


People **Environment**

NATURAL LAWS

Adapted from Endter-Wada, CEEM (Continuing Education in Ecosystem Management)

PEOPLE-ENVIRONMENT INTERACTIONS



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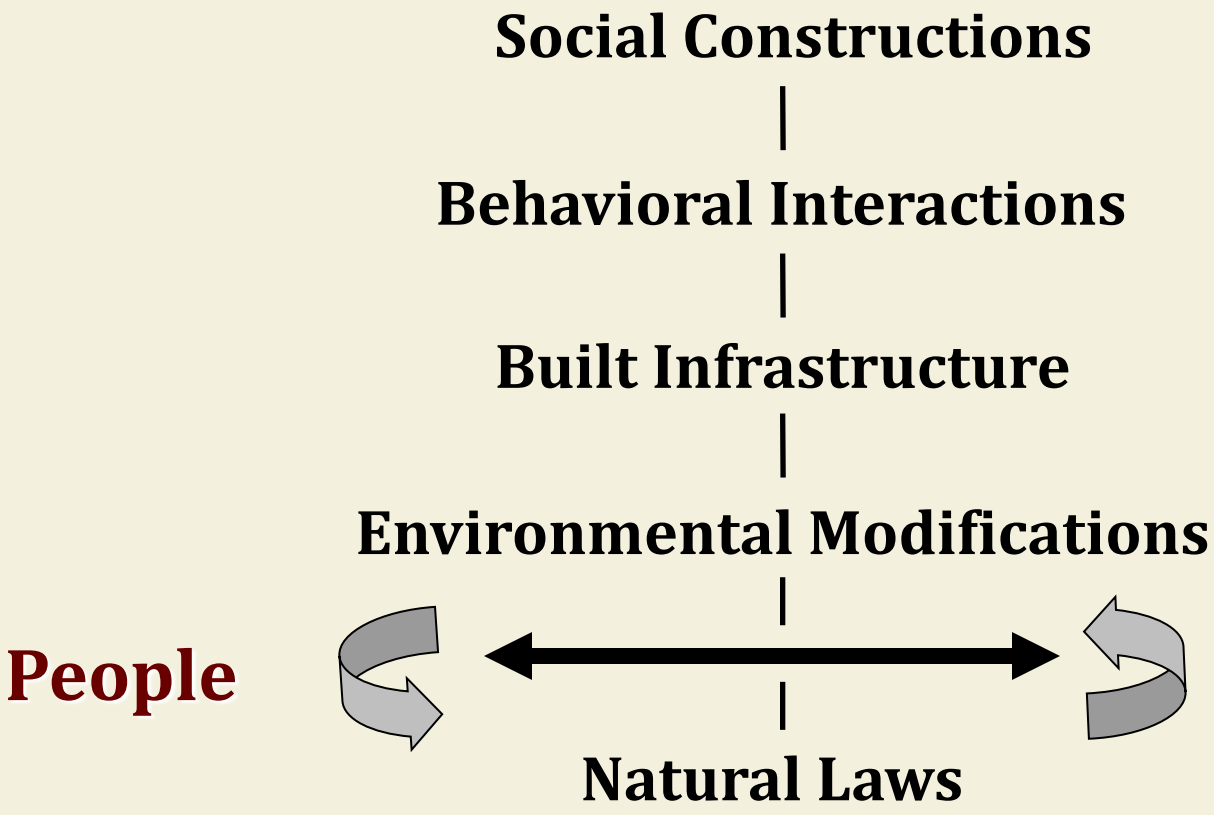
PEOPLE-ENVIRONMENT INTERACTIONS



People act in the world based on "ways of knowing" it, i.e. how it is, how they perceive it to be, and how they want it to be.

Path Dependencies

Historical legacies of past decisions

TIME

Visions, Plans, Models of the Future

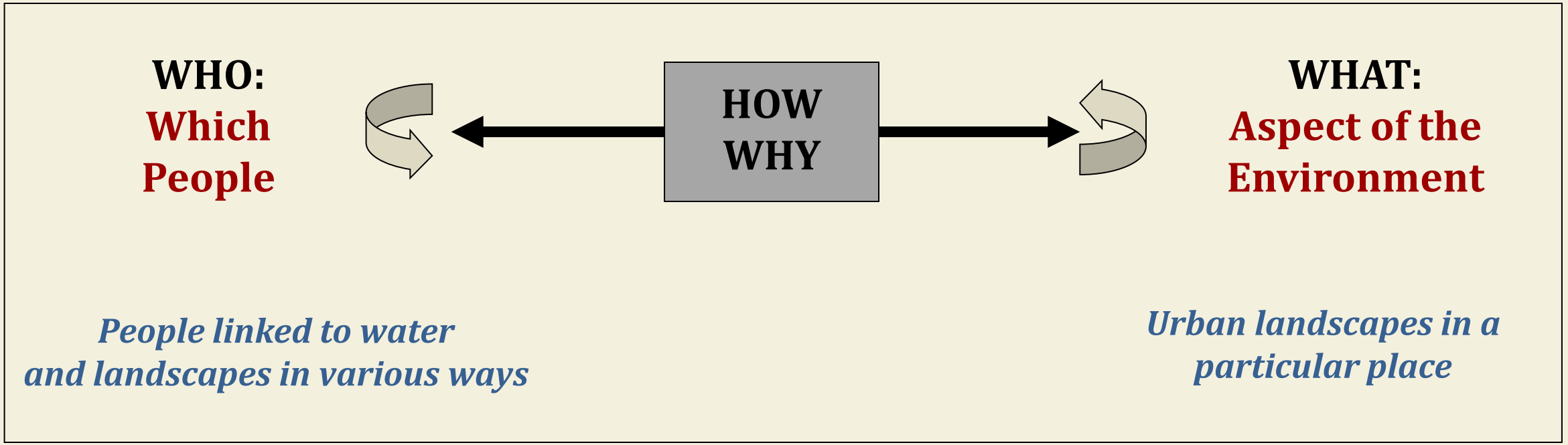
this world ***afterlife***

CONTEXTUALIZING PEOPLE-ENVIRONMENT INTERACTIONS

Context:

WHEN (location in time)

WHERE (location in space)



Endter-Wada and Blahna, 2011

USU WaterMAPS™

Water Management Analysis and Planning Software

- **Joanna Endter-Wada, Ph.D.**
  - *Dept. of Environment and Society*
  - Water Law and Policy; Human Dimensions of Natural Resources
- **Christopher M.U. Neale, Ph.D.**
  - *Division of Irrigation Engineering, Dept. of Civil and Environmental Engineering*
  - Remote Sensing; Irrigation Engineering
- **Roger Kjelgren, Ph.D.**
  - *Dept. of Plants, Soils and Climate*
  - Plant Science; Native Plants; Water Efficient Landscaping
- **Diana Glenn, M.S.**
  - *Urban Water Conservation Research Lab*
- **Clay Lewis, M.E.**
  - *Ph.D. Student, Civil and Environmental Engineering; Remote Sensing Laboratory*

WaterMAPS™
Water Management Analysis and Planning Software

UtahState University

Landscape Water Use Efficiency through Contextualized Systems Thinking

Plant Material
- Landscape Area
- Plants Choices
- Appropriate hydrozones

Site Condition
- Location
- Slope/Aspect
- Soil
- Lot size

Human Behavior
- Awareness
- Commitment
- Practices
- Habits

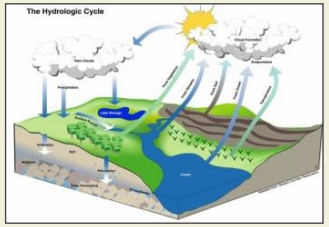
Irrigation Technology
- Type and Age
- Design / Maintenance
- Operation of System

EFFICIENCY

Outcomes to avoid

Utah State University

METHODS – BASIC STEPS



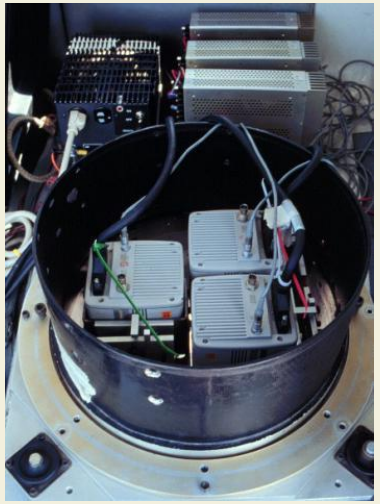
1. Identify landscape type and area (from overflights) for urban parcels/lots

2. Integrate with reference ET_o to estimate landscape water need

3. Use meter data to compare actual landscape water use with landscape water need, then categorize appropriateness of use

4. Interview/interact with water users to understand water use patterns and design appropriate water conservation programs

Airborne Multispectral Remote Sensing



USU
Remote Sensing
Aircraft & Lab

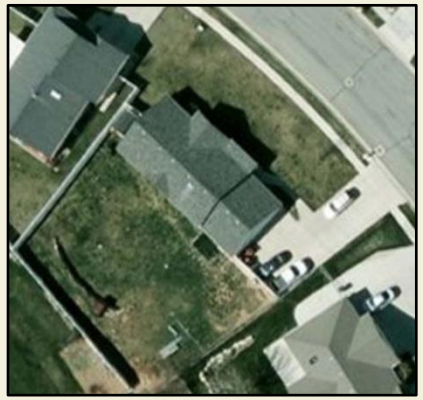
Obtains and classifies imagery for urban areas

Defining Appropriateness

of urban landscape irrigation relative to plant water needs

Beneficial Use without waste

Recognizing different water needs of turf vs. trees and shrubs



Can transition to native or low-water use landscapes

Based on a standard of ecologically appropriate water use given variations in urban lots, people's choice of landscape type(s) and local climate estimates (ET)

multispectral imagery

classified imagery

- Determines water need for existing landscapes
- Includes parking strips as part of landscapes people water (even though not within their property boundaries)

WaterMAPS™
Water Management Analysis and Planning Software

overlay of parcel boundaries

adjusted to include landscape in parking strips

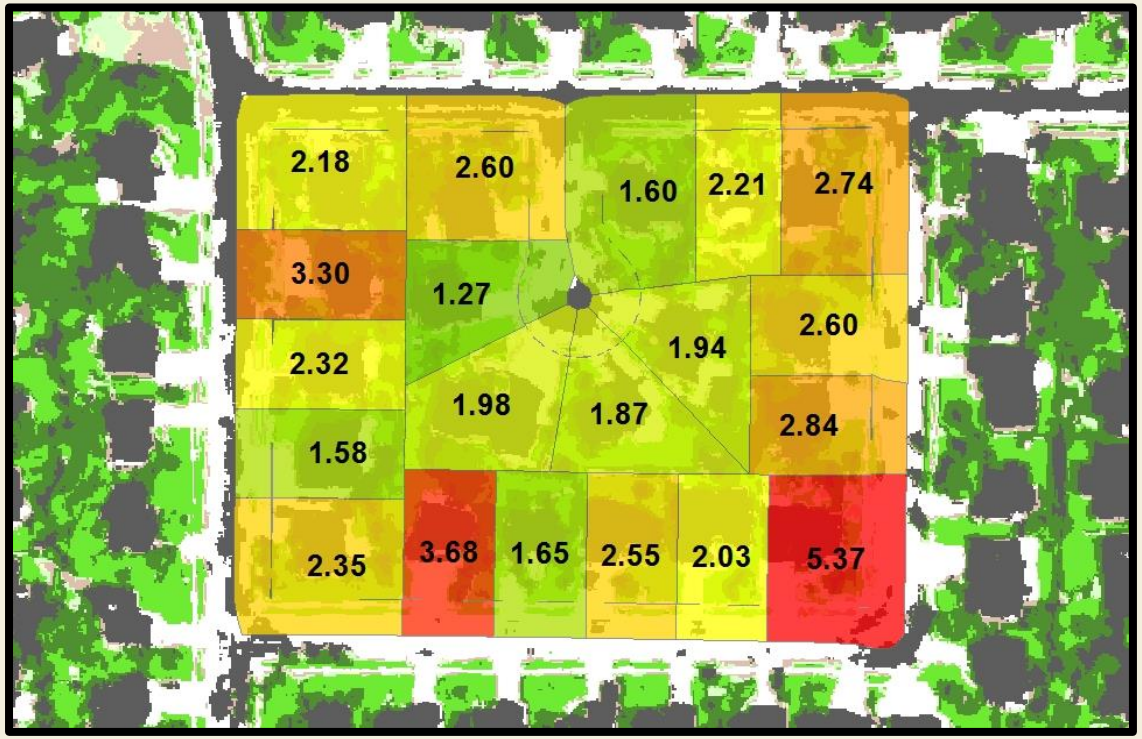
IDENTIFYING CAPACITY TO CONSERVE
utilizing Landscape Irrigation Ratios (LIR)

$$LIR = \frac{\textbf{Landscape Water Use } \textit{estimated}}{\textbf{Landscape Water Need } \textit{estimated}}$$

Landscape Water Use *estimated*
(derived from analysis of municipal or water provider meter data)

Landscape Water Need *estimated*
(derived from the classification of remotely-sensed airborne multispectral imagery and localized reference ET_o rates modified by relevant landscape correction factors and irrigation system inefficiencies)

(per unit of landscaped area)



LIR less than 1	=	**Efficient**
Between 1 and 2	=	**Acceptable**
Between 2 and 3	=	**Inefficient**
Greater than 3	=	**Excessive**

WaterMAPS™
Water Management Analysis
and Planning Software

- Allows user to make different assumptions or choices for calculating LIR
- Automates analytic process
- Provides a software graphical user interface to run within the ArcGIS environment
- Facilitates the mining of water meter data
- Estimates water use and water need (with flexible assumptions)
- Provides spatial results and allows additional analyses

Water Conservation Research:

examples and findings

CONNECTING SOCIAL SCIENCE AND POLICY

- **Conservation psychology** and insights into "multiple motivations"
- **Behavioral approach** looking at actions related to the resource domain of urban water
- **Policy contexts and structures** and the dynamics of framing, designing, and translating policies

RESEARCH METHODS

- **Observational Studies**: seeking to explain urban landscape water use patterns (utilizing interviews, focus groups, surveys, water diaries)
- **Intervention Studies:** experiments in trying to alter landscape water use and assess effectiveness of various conservation approaches (interventions)

Multiple Motivations for Water Conservation

Household respondents' willingness to conserve water for various purposes		
Hypothetical uses of conserved water	Mean	SD
To increase residential development in the Layton area	2.74	2.64
To increase commercial development in the Layton area	2.60	2.41
To maintain or improve habitat for fish and other aquatic wildlife	6.18	2.95
To reduce your water bill	7.17	2.77
To improve stream and river levels for fishing, rafting and other instream recreation	5.60	3.08
To improve reservoir and lake levels for boating, water skiing and other open water recreation	4.66	3.18
To improve municipal parks, golf courses, ball fields and other urban recreation areas	4.72	2.96
To maintain visually pleasing, non-recreational open spaces and green spaces	5.10	2.89
To ensure adequate future water supplies for yourself and your household	7.85	2.33
To ensure adequate water supplies for future generations	7.81	2.40
To reduce pressure for converting agricultural lands to residential/commercial uses	5.20	3.17
To reduce the volume of water, and therefore the costs, at waste treatment facilities	5.77	2.79
To reduce impacts on rural areas that would result from diverting water to the Wasatch Front	5.84	2.73
To prevent the need for additional infrastructure costs to provide more water for the Wasatch Front	6.09	2.64

Total n = 296; valid n for these survey questions ranged from 280 to 292.

All variables were measured on an 11-point scale where 0 = "not at all willing to conserve water" and 10 = "very willing to conserve water." Survey questions are listed in the order in which they appeared in the survey instrument.

Multiple Motivations for Water Conservation

Commercial managers' motivations for conserving water		
Hypothetical motivations	Mean	SD
Receiving educational information on the importance of conserving water on your landscape	5.31	3.10
Receiving educational information on how to conserve water on your landscape	6.04	3.10
If you made a written commitment to the city of Layton to conserve water	5.27	3.47
An increase in your water bill of 25%	6.94	3.02
An increase in your water bill of 100%	8.44	3.17
If the cost of water was no longer a tax-deductible expense for your business	6.33	3.56
If you knew the city of Layton was running out of water and needed everybody to conserve	8.86	1.84
If you knew all types of water customers in Layton were being asked to reduce water use on their landscapes	8.22	2.17
If you knew most other businesses in Layton had agreed to reduce water use on their landscapes	7.99	2.53
If you received a formal written request from the city of Layton asking you to voluntarily reduce the amount of water used on your landscape	8.18	2.15
If you received pressure from your customers to conserve water	7.70	2.80
A rebate offer to help offset the cost of installing water conserving devices	7.24	3.21
A city watering restriction that limited the amount of water you could use	8.07	2.77
A city landscape ordinance that mandated you to replace high water use landscapes with low water use landscapes	7.04	3.21

Total n = 95, valid ns for these survey questions ranged from 92 to 95.

All variables were measured on an 11-point scale where 0 = "not at all willing" and 10 = "very willing." Survey questions are listed in the order in which they appeared in the survey instrument .

"Water waste"...

a) is not widespread

b) is related to irrigation systems

Table 4: Range of Water Use by Automation of Watering System, All Cases

Water use range relative to plant need:	Level of automation of watering system [a] (percentages within each category) Low (manual hose watering)	Medium (manual start sprinkler)	High (programmed sprinkler)	All cases
Low (conserving use)	62.7	29.4	17.5	37.0
Medium (acceptable use)	22.9	17.6	25.9	23.9
High (wasteful use)	14.4	52.9	56.6	39.1
Column percentage totals	100.0	99.9	100.0	100.0
Number of total cases	153	34	189	376
Percentage of total cases	40.7	9.0	50.3	100.0

Descriptive statistics:

Pearson's chi-square = 88.84 ($p < 0.001$)

Gamma correlation coefficient = 0.63

Endter-Wada et al., 2008, JAWRA

UtahState University

c) … and human interface with that technology

Irrigation system design, maintenance, operation and the type of controller or timer have a significant influence on landscape water use.

LOGAN STUDY:
Baseline Landscape Irrigation Ratio (LIR) by Controller Type

	Controller Type[a]				
Baseline LIR Category	**Manual**	**Mechanical**	**Combo**	**Digital**	**All Types**
Justifiable (< 2)	100	37	47	63	53
Unjustifiable (≥ 2)	0	63	53	37	47
Total	100%	100%	100%	100%	100%
N	(13)	(24)	(79)	(32)	(148)

Pearson's χ^2 = 16.215**, *Cramer's V* = 0.331**, *Goodman & Kruskal's tau* 0.11**

Note. Sprinkler systems < 2 years old omitted.
[a] Coded: 1 Manual, 2 Mechanical, 3 Combo, 4 Digital.
*$p \leq .05$, **$p \leq .01$.

Diana Glenn MS Thesis, 2010

UtahState University

Study/program participants … a) vary

- Volunteers and "recruits" are different:
  - Motivations, Needs
  - Responses
- Participants need different kinds of help based on:
  - Their own past efforts and experiences with conservation
  - Level of sophistication in the information they are seeking and the detail they expect
  - Whether they can make changes ("do-it-yourselfers") or need help ("hand holders")

b) … volunteers are more conserving

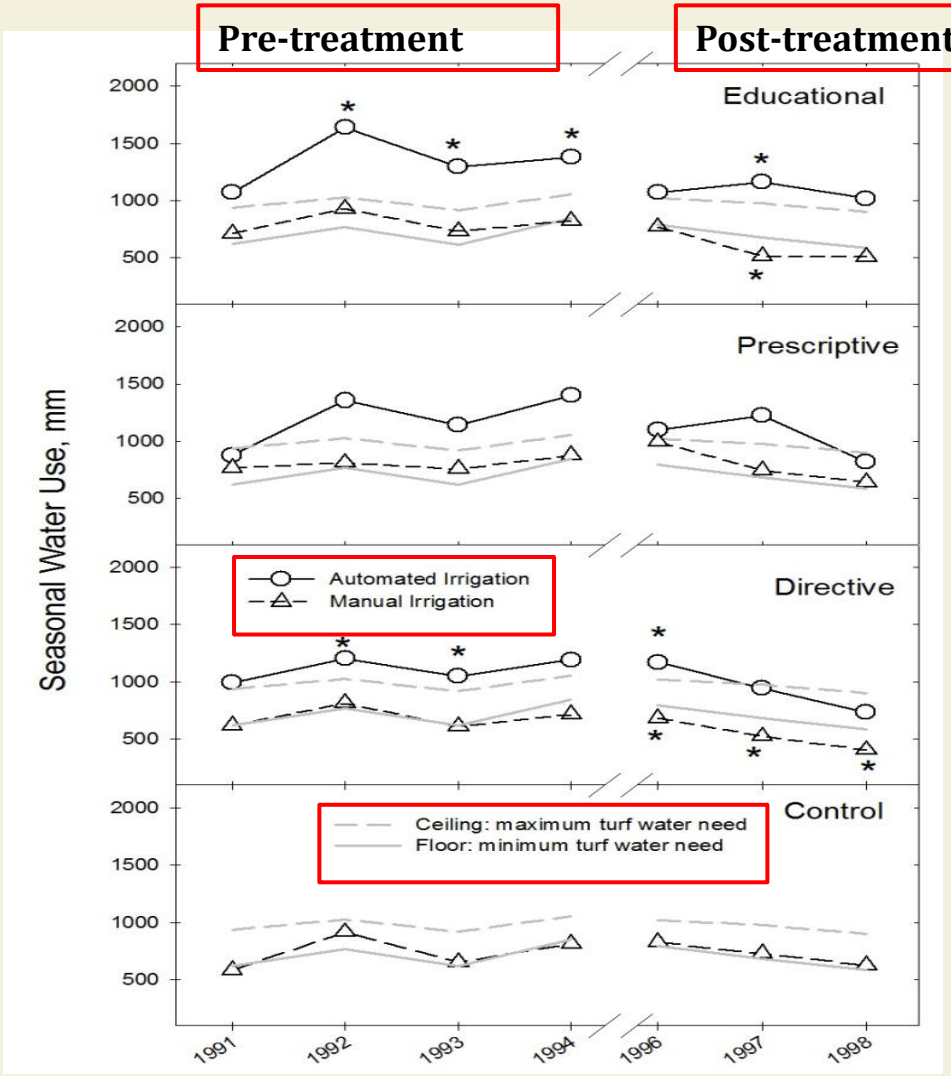
Logan Study
Categorical Benchmarks based on ranges of Landscape Irrigation Ratio (LIR)

Benchmark LIR Category $LIR = \frac{\text{landscape water use}}{\text{landscape water need}}$		Mean Water Use[a] *(mm/day)*	Distribution of Cases[c] 2004 Volunteers *(percentage)*	2005 Recruits *(percentage)*	All Cases *(percentage)*
Justifiable Water Use:					
Efficient:	$LIR \leq 1$	2.01	30	3	19
Acceptable:	$1 < LIR \leq 2$	4.99	35	22	30
Unjustifiable Water Use:					
Inefficient:	$2 < LIR \leq 3$	7.72	24	48	34
Unnecessary:	$3 < LIR$	12.20[b]	11	27	17
	Total %		100	100	100
	N		(148)	(101)	(249)

[a] Compared to the 2004 baseline ET_o of 4.56 mm/day and 2005 baseline ET_o of 4.28 mm/day.
[b] 2 outlier cases with greater than 30 mm/day were excluded, 1 case in each year
[c] Pearson's $\chi^2 = 45.479$, $p \leq .000$ (indicative of inherent differences in recruitment methods)

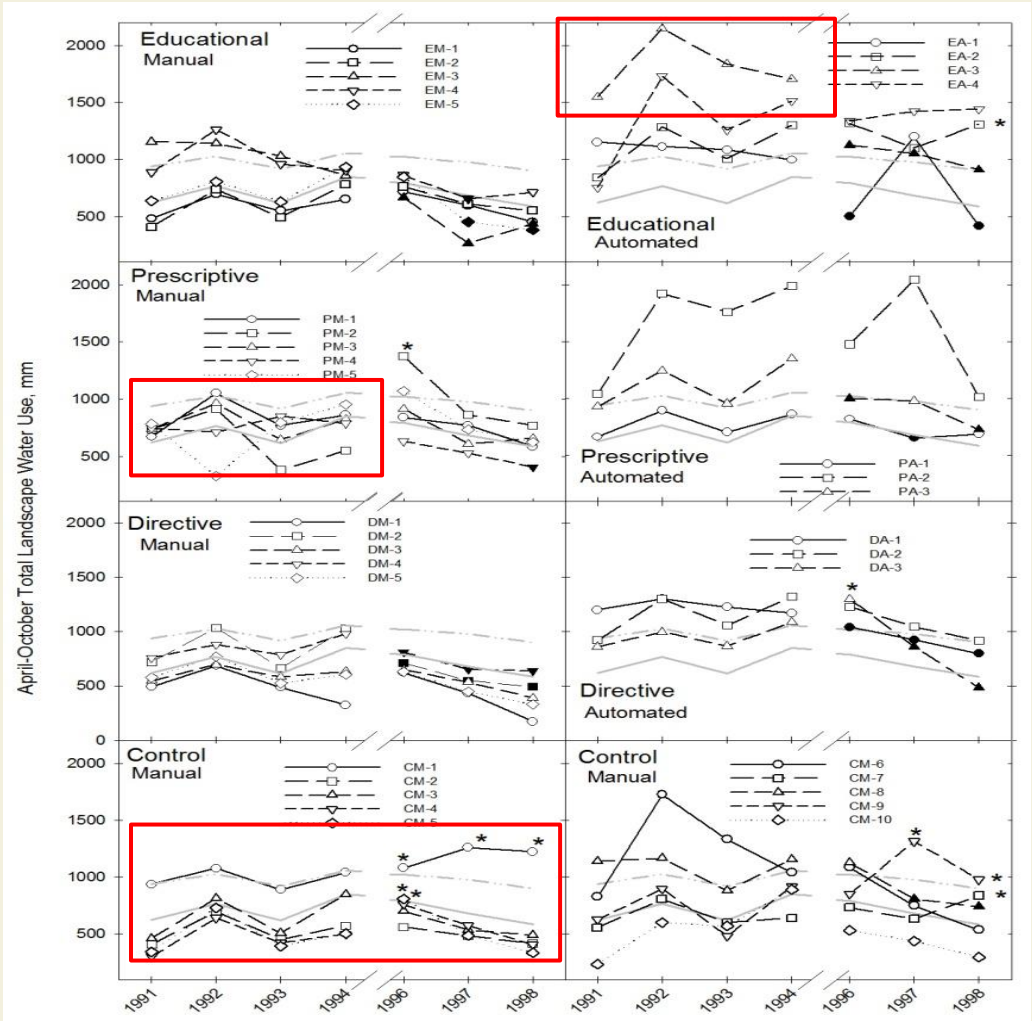
CONSERVATION "SUCCESS"…

a) … is related to initial "capacity to conserve"



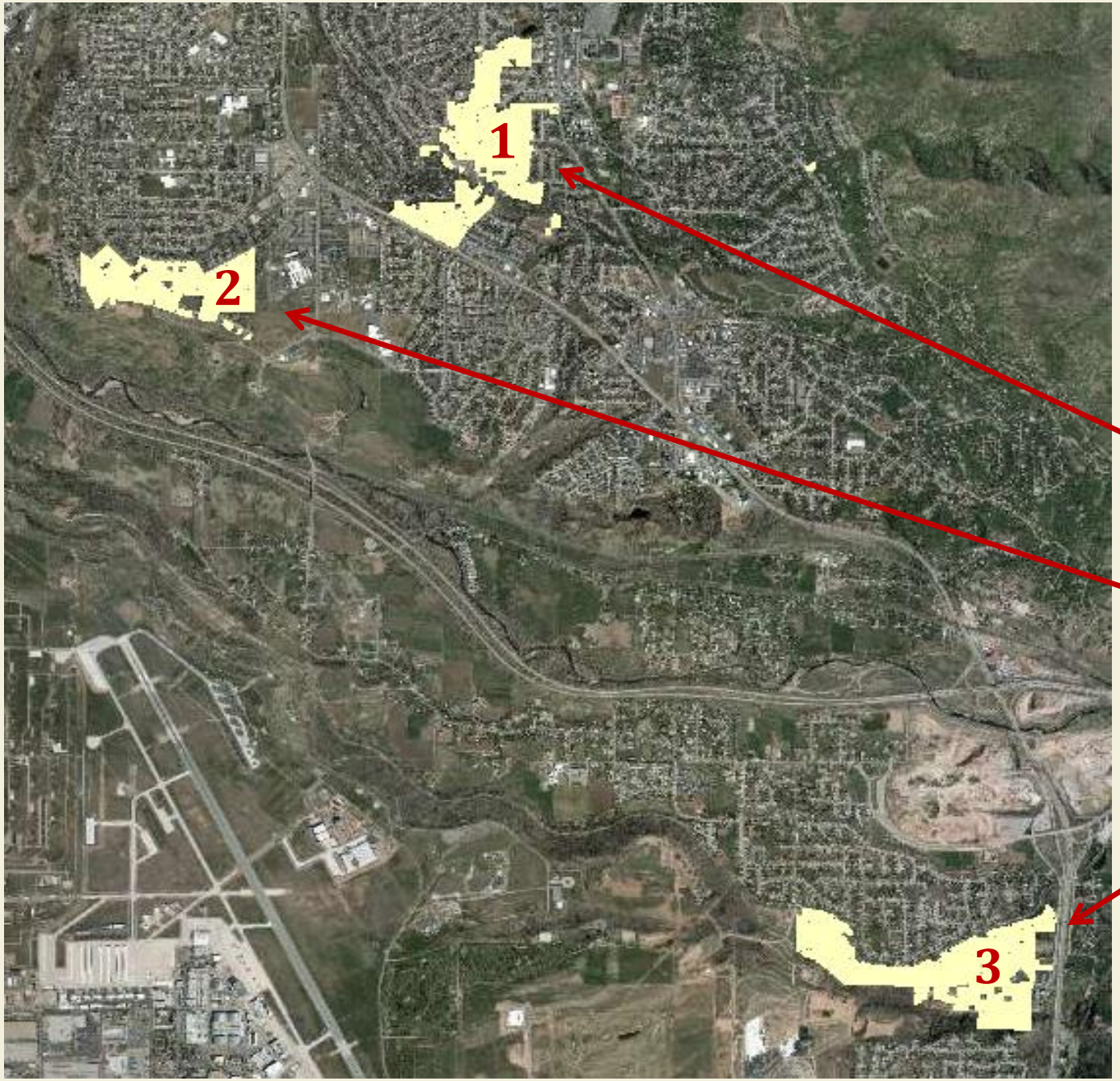
c) … or promoted

b) … is not easily characterized



Kilgren, Endter-Wada, Kjelgren, Johnson, 2010, JAWRA

UtahState University



WBWCD and USU Project Partnership

Meter Implementation Project

1 – South Ogden
(365 meters)

2 – Washington Terrace
(250 meters)

3 – South Weber
(400 meters)

Weber Basin Water Conservancy District

UtahState University

Secondary Water Use Reports

- **Purposes:**
  1) use meter data as information tool instead of pricing tool
  2) share meter data with people
  3) increase awareness of landscape water use
  4) motivate people to become more efficient
  5) provide way for people to monitor their own use

- **Design:**
  1) based on focus group feedback regarding information needs
  2) comparisons based on individuals' own landscapes and use
  3) transparent explanation of estimated landscape water need
  4) awareness that this could be new "anchor point" for water use

Letter from WBWCD

WEBER BASIN WATER CONSERVANCY DISTRICT
2837 East Highway 193 • Layton, Utah 84040 • Phone (801) 771-1677 • (SLC) 359-4404 • Fax (801) 544-0103

May 2012

Dear Weber Basin Water Conservancy District Water User,

As we begin another irrigation season, we look back on a warmer than average winter in which we received about 55% of normal snowpack (based on average snowpack on April 1st of each year). This year it will be important to monitor our water use closely, and use our water more efficiently.

We appreciate your patience as we installed meters and made improvements to your secondary water connection. This meter project was completed in order to accomplish the following goals:

- *Promote water conservation and water use accountability*. A secondary water meter installed on your connection enables the District to provide you with a monthly Secondary Water Use Report to help you evaluate and monitor your landscape water usage.
- *Produce measureable results*. The meter data can help the District identify opportunities for water conservation and develop more effective water conservation programs.
- *Minimize disruptions to your service*. A new valve for Weber Basin's use has been installed on your connection. This allows the District to shut off individual lots, instead of neighborhoods, when a homeowner needs to make repairs.

The District is collaborating with Utah State University to conduct research investigating the influence of water use information on landscape water conservation and efficiency efforts. The USU research team has developed a method for assessing capacity to conserve landscape water by comparing metered secondary water use to an estimate of your site-specific landscape water need. USU's method integrates weather data with information on your lot location, size and landscape characteristics. This method differs from the approach used last year in reporting to locations where meters were installed in 2011, where estimates of landscape water need were based on a household's lot size and a set of standard assumptions about that lot's landscape characteristics.

The USU research team and the District have designed the enclosed Secondary Water Use Report to be an information tool that is intended to aid your water use decisions, such as adjusting your watering schedule. Please see the enclosed information sheet explaining USU's method for estimating capacity to conserve and providing tips for interpreting and using the Secondary Water Use Report. We will mail these reports to you this year but if you would also like to receive it via e-mail, please send your e-mail address to me at drice@weberbasin.com. USU researchers will be contacting you to gather feedback and information that will help us evaluate the Water Use Reports.

We encourage you to visit Weber Basin's Learning Garden at our Layton headquarters (address above) or participate in free landscape classes and other events. All classes are free. For a full schedule and other landscape information, visit www.weberbasin.com/conservation. We hope you will use these resources to achieve your conservation goals while maintaining a healthy landscape.

Sincerely,

David Rice
WBWCD Conservation Coordinator
(801) 771-1677

WBWCD Meter Project Service Hotline
(for questions concerning meter installations)
801-850-1162

Information Sheet (2 pgs)

2012 SECONDARY WATER USE REPORTS INFORMATION SHEET

Prepared by:
Utah State University and
Weber Basin Water Conservancy District

This information sheet will help you interpret the Secondary Water Use Reports that will be sent to you each month during the irrigation season. *Please retain this information sheet for future reference.*

WBWCD will read secondary meters on approximately the 15th of each month starting in May and ending in October. About one week after each meter reading, you will receive an individualized Secondary Water Use Report. This report is designed to provide information on your water use for the past month along with a summary of your landscape water use to date over this year's irrigation season. The Report also provides a site-specific estimate of your landscape's water need. Landscape water need is the amount of water needed to keep your landscape plant material in healthy condition given weather conditions in your local area. This Secondary Water Use Report provides information to aid you in efficient landscape watering and to help you contribute to personal, community and state water management and conservation goals.

Landscape Water Use. Landscape water use is the amount in gallons of secondary metered water used. Meter readings for the current and past read dates and the days in the current reporting period are shown.

Landscape Water Need. Landscape water need is the amount in gallons of irrigation water needed to replace water in the soil used by the plants in your landscape. Landscape water need is determined primarily by a combination of *weather, plant type, size of landscape, and irrigation system efficiency*. The assumptions we made for each of these categories provide a generous estimate of landscape water need.

Weather: Sunny, hot, dry and windy weather results in landscape plants using more water than cloudy, cool, humid and still weather. Day length is also important, as plants will use more water during long July days than under the same weather conditions in September. Rain affects landscape water use two ways. Cool, cloudy, humid conditions reduce plant water use, and rain greater than one quarter inch provides sufficient water to sustain plants, eliminating or reducing the need to add irrigation water. These factors are continuously monitored at weather stations and incorporated into a measurement known as evapotranspiration (ET), which represents the amount of water that "evaporates" from the soil and is "transpired" by plants. USU accessed weather and ET data from Ogden-area stations. Our estimates of landscape water need do not subtract rainfall, thus assuming for the benefit of the user that rain is "extra irrigation water."

Plant type: Your landscape plant types will determine water use and the amount you need to irrigate. Trees and shrubs are one main type of landscape plant material that needs water at a lower rate than turfgrass, the other main type of landscape plant material. Trees and shrubs can have particularly low water needs when they are integrated into non-continuous landscapes with open areas of mulch and hardscape like rocks and paths or when they are in the shade of buildings (such as planters under eves of houses). USU determined the landscape types on your property from 2011 aerial remotely sensed images that were classified for buildings, hardscape, and plant types in urban areas in and around Ogden.

Size of Landscape: USU combined remotely sensed images with publicly-available county GIS data that identified property boundaries and then calculated the area of your different landscape types. Enclosed with your initial Water Use Report is an image of your property. Our estimates of your landscape water need include parking strips and tree canopies that overhang streets. Even though these areas are not part of your property, people are required to maintain and water them, so we have included them in our water need estimates.

Irrigation System Efficiency: Irrigation systems often do not apply water efficiently or uniformly as measured by distribution uniformity (DU), mainly due to design and maintenance issues. In calculating landscape water

Letter from USU

UtahStateUniversity
Department of Environment and Society
College of Natural Resources

Dear Weber Basin Water Conservancy District Water User,

We are excited to collaborate with Weber Basin Water Conservancy District and conduct research in connection with their secondary water meter installation project. The transition to metered secondary water is a unique opportunity to utilize an approach we have developed for analyzing urban landscape water use, to share information produced by that analysis with users of secondary metered water, and to study how the information can aid water users in efficiently irrigating their landscapes. The Weber Basin Water Conservancy District is supporting our research on this project through a grant from the U. S. Bureau of Reclamation and Utah State University is providing matching funds.

Throughout the irrigation season, we will work closely with the Weber Basin Water Conservancy District to provide you with monthly Secondary Water Use Reports. We are available to answer any questions you may have about those reports and are interested in your feedback.

We will also conduct research to better understand how to assess the appropriateness of landscape water use, what water use information you desire to aid your water conservation efforts, and your views about water efficiency, conservation, and accountability. We invite you to participate in one of the following research activities during the irrigation season: 1) a *focus group* that will consist of 6 to 8 people from other households where meters have recently been installed; or 2) an *interview* (either in person or over the phone). At the end of the irrigation season, we will conduct a *household survey* and we encourage you to complete that survey when it arrives. Your experiences and insights will provide valuable contributions to our research and to water management.

If you have questions or comments about your Secondary Water Use Report, or
If you would like to participate in a focus group or be interviewed about landscape water use,
Please call or email Diana Glenn at the USU Urban Water Conservation Research Lab at:
(435) 797-9084 or diana.glenn@aggiemail.usu.edu

We appreciate your time and want to thank you in advance for your participation. The results of this research will help the District consider the needs and preferences of their water customers and the effectiveness of water use information as a conservation tool. Our goal is to provide information that can help the District manage water resources efficiently and equitably.

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College of Natural Resources
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Dept. of Civil & Environmental Engineering (Irrigation Engineering)
College of Engineering
Utah State University
Email: christopher.neale@usu.edu

5215 Old Main Hill Logan, UT 84322-5215 Ph: (435) 797-1790 Fax: (435) 797-4048 www.cnr.usu.edu/envs

May Mailings at Start of Irrigation Season

WEBER BASIN WATER CONSERVANCY DISTRICT

PROPERTY AERIAL PHOTO

Example map of property location sent in May

Example of Secondary Water Use Report for July for that location

WEBER BASIN WATER CONSERVANCY DISTRICT

7/18/2012 June 16 through July 15, 2012

Developed from research at UtahStateUniversity

SECONDARY WATER USE REPORT

For more information on interpreting your Secondary Water Use Report, refer to the double-sided information sheet sent with the May report or also available online at: www.weberbasin.com/conservation/

Landscape Water Use

Last Meter Reading	Current Meter Reading	Number of Days	Your Landscape Water Use	103,578 gal
291,063	394,641	30		

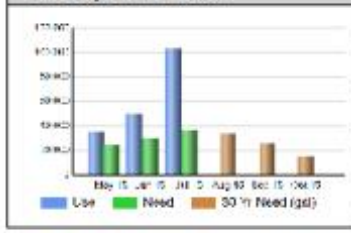
Landscape Water Need

Landscaped Area (sq. ft.)	Turf LA (%)	Non-Turf LA (%)	Your Landscape Water Need	36,800 gal
7,871	50	50		

Landscape Water Management

Water use is:	when LIR is:	Your Landscape Irrigation Ratio (LIR) =	Landscape Water Use / Landscape Water Need	2.81
Efficient	less than 1			
Acceptable	between 1 and 2			
Inefficient	between 2 and 3			
Excessive	greater than 3			

Landscape Water Monitor — Weather Data: Jun 16 - Jul 15



Period	Min	Mean	Max
2012			
ET (in)		8.06	
Precip. (in)		0.28	
Temper. (F)		77.45	
1982-2011			
ET (in)	6.18	6.88	7.66
Precip. (in)	0.00	0.49	1.98
Temper. (F)	59.54	66.09	72.30

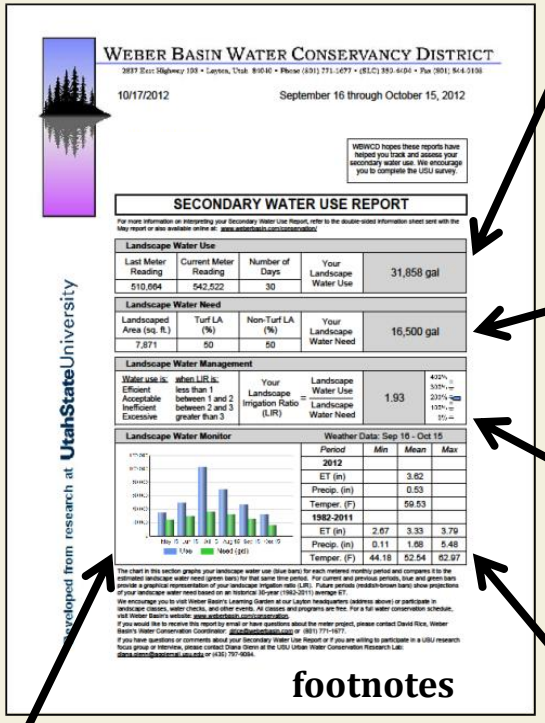
The chart in this section graphs your landscape water use (blue bars) for each metered monthly period and compares it to the estimated landscape water need (green bars) for that same time period. For current and previous periods, blue and green bars provide a graphical representation of your landscape irrigation ratio (LIR). Future periods (reddish-brown bars) show projections of your landscape water need based on an historical 30-year (1982-2011) average ET.

We encourage you to visit Weber Basin's Learning Garden at our Layton headquarters (address above) or participate in landscape classes, water checks, and other events. All classes and programs are free. For a full water conservation schedule, visit Weber Basin's website: www.weberbasin.com/conservation

If you would like to receive this report by email or have questions about the meter project, please contact David Rice, Weber Basin's Water Conservation Coordinator: drice@weberbasin.com or (801) 771-1677.

If you have questions or comments about your Secondary Water Use Report or if you are willing to participate in a USU research focus group or interview, please contact Diana Glenn at the USU Urban Water Conservation Research Lab: diana.glenn@aggiemail.usu.edu or (435) 797-8064.

Secondary Water Use Reports



WEBER BASIN WATER CONSERVANCY DISTRICT

10/17/2012 September 16 through October 15, 2012

WBWCD hopes these reports have helped you track and assess your secondary water use. We encourage you to complete the USU survey.

SECONDARY WATER USE REPORT

Landscape Water Use

Last Meter Reading	Current Meter Reading	Number of Days	Your Landscape Water Use	31,858 gal
510,664	542,522	30		

Landscape Water Need

Landscaped Area (sq. ft.)	Turf LA (%)	Non-Turf LA (%)	Your Landscape Water Need	16,500 gal
7,871	50	50		

Landscape Water Management

Water use is:	when LIR is:				
Efficient	less than 1	Your Landscape Irrigation Ratio (LIR) =	Landscape Water Use / Landscape Water Need	1.93	400% 300% 200% 100% 0%
Acceptable	between 1 and 2				
Inefficient	between 2 and 3				
Excessive	greater than 3				

Landscape Water Monitor

Weather Data: Sep 16 - Oct 15

Period	Min	Mean	Max
2012			
ET (in)		3.62	
Precip. (in)		0.53	
Temper. (F)		59.53	
1982-2011			
ET (in)	2.67	3.33	3.79
Precip. (in)	0.11	1.68	5.48
Temper. (F)	44.18	52.54	62.97

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developed from research at UtahStateUniversity

footnotes

Landscape Water Use

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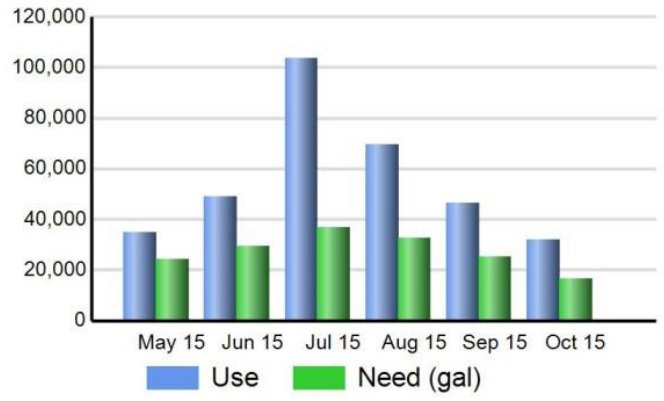
Landscape Water Monitor



Weather Data: Sep 16 - Oct 15

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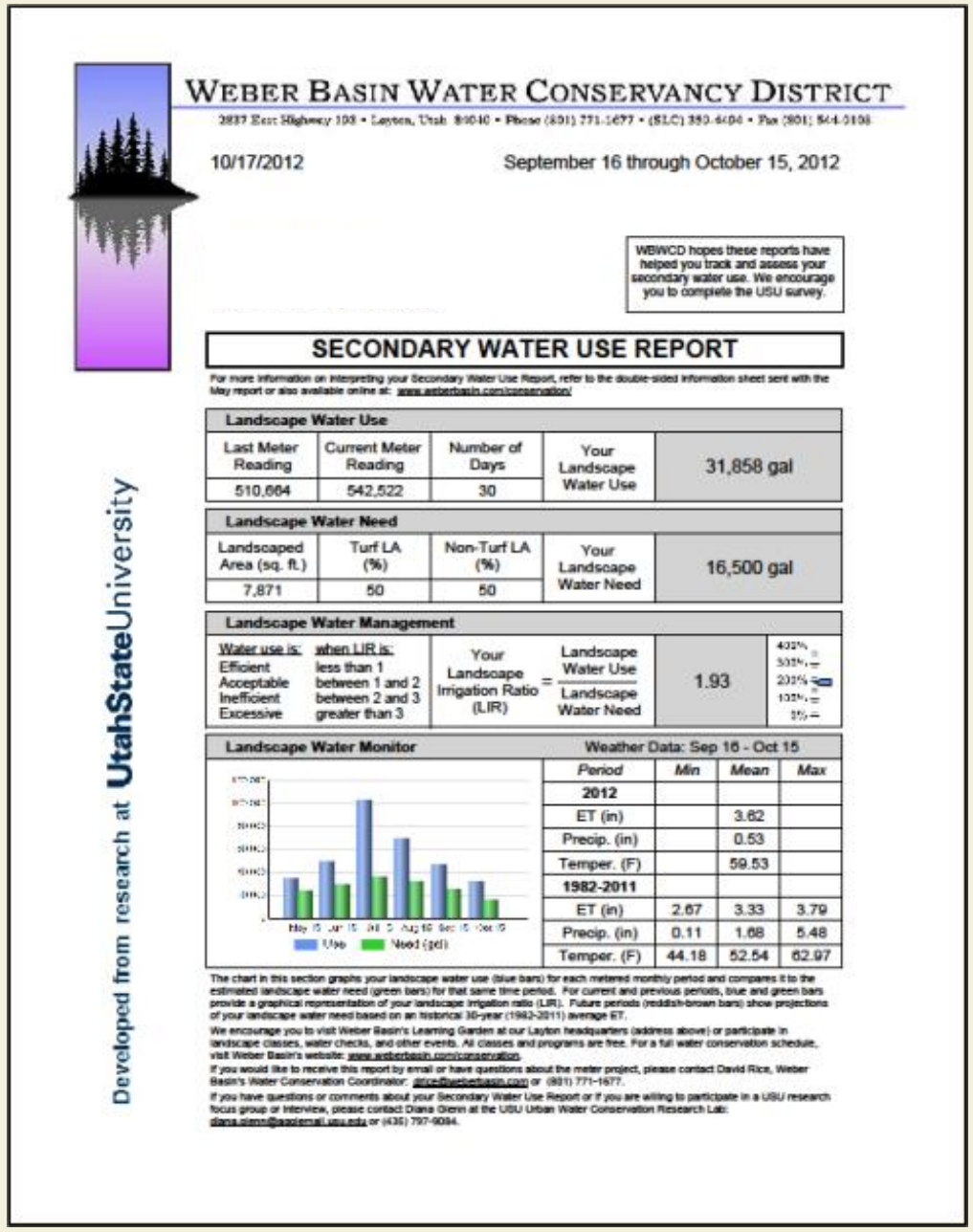
WEBER BASIN WATER CONSERVANCY DISTRICT

Elements of the Secondary Water Use Report

UtahState University



WEBER BASIN WATER CONSERVANCY DISTRICT

2837 East Highway 193 • Layton, Utah 84040 • Phone (801) 771-1677 • (SLC) 393-4494 • Fax (801) 544-0103

10/17/2012 September 16 through October 15, 2012

WBWCD hopes these reports have helped you track and assess your secondary water use. We encourage you to complete the USU survey.

SECONDARY WATER USE REPORT

For more information on interpreting your Secondary Water Use Report, refer to the double-sided information sheet sent with the May report or also available online at: www.weberbasin.com/conservation/

Developed from research at UtahStateUniversity

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Landscape Water Monitor Weather Data: Sep 16 - Oct 15

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Precip. (in)		0.53	
Temper. (F)		59.53	
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Example of a final, end of season report sent in October

Example of monthly LIR tracked over the irrigation season

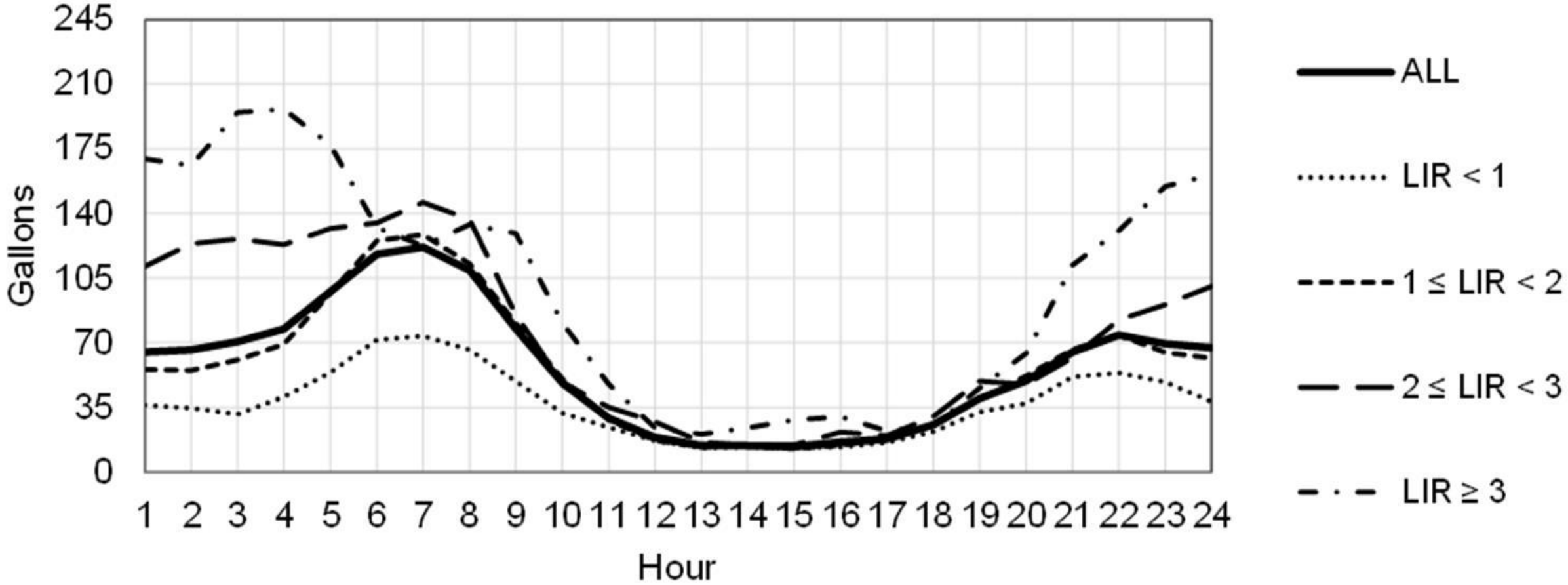
Monthly LIR at this location	
May	1.41
June	1.48
July	2.81
Aug	2.13
Sept	1.84
Oct	1.93

SECONDARY WATER USERS (869)	INEFFICIENCY (Landscape Irrigation Ratio)				
		LIR ≤ 1	1 < LIR ≤ 2	2 < LIR ≤ 3	3 < LIR
VOLUME: *WBWCD contract allocations for pressurized secondary systems (most are 3 af/ac)*	Use ≤ allocation 553 (63.6%)	146 (16.8%) not the target audience	390 (44.9%) Reports?	15 (1.7%) Reports?	2 (0.2%) good candidates for water checks
	Use > allocation 316 (36.4%)	0 (0%) not many relevant cases	170 (19.6%) Reports?	115 (13.2%) Reports?	31 (3.6%) good candidates for water checks

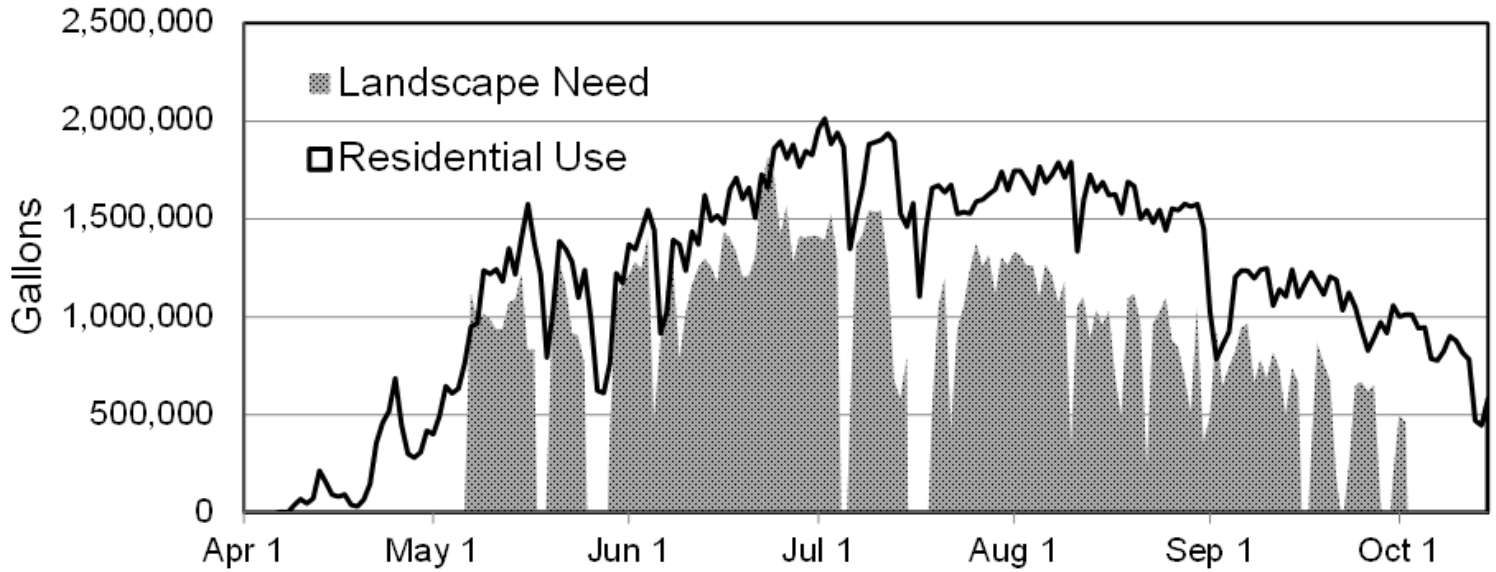
Irrigation Patterns:
Averages for the 869 WBWCD Metered Properties in 2012

Property Subset	No. Cases (% of cases)	Seasonal LIR	Number Days Usage	Total Hours Usage	Number Times Usage	Per Property Usage (gal)	Property allocation (gal)	% allocation used
ALL		1.55	143	887	255	264,925	294,061	90%
LIR < 1	146 (16.8%)	0.71	128	728	209	171,236	358,077	49%
1 ≤ LIR < 2	560 (64.5%)	1.46	143	866	262	259,080	288,117	90%
2 ≤ LIR < 3	130 (14.9%)	2.33	154	1088	271	344,862	263,089	130%
3 ≤ LIR	33 (3.8%)	3.73	158	1143	276	463,714	233,730	198%

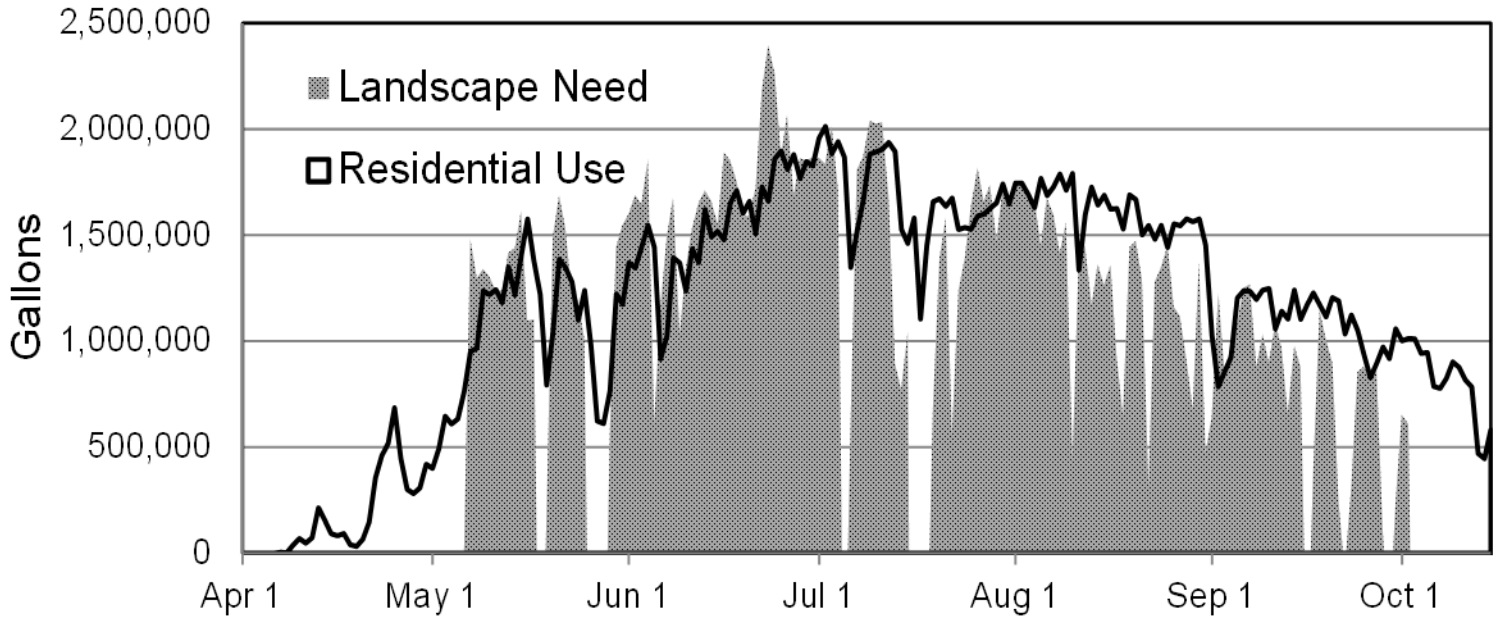
LANDSCAPE IRRIGATION USE BY HOUR FOR 869 WBWCD METERED RESIDENTIAL PROPERTIES IN 2012



Assuming 70% Distribution Uniformity (DU)



Assuming 53% Distribution Uniformities (DU)



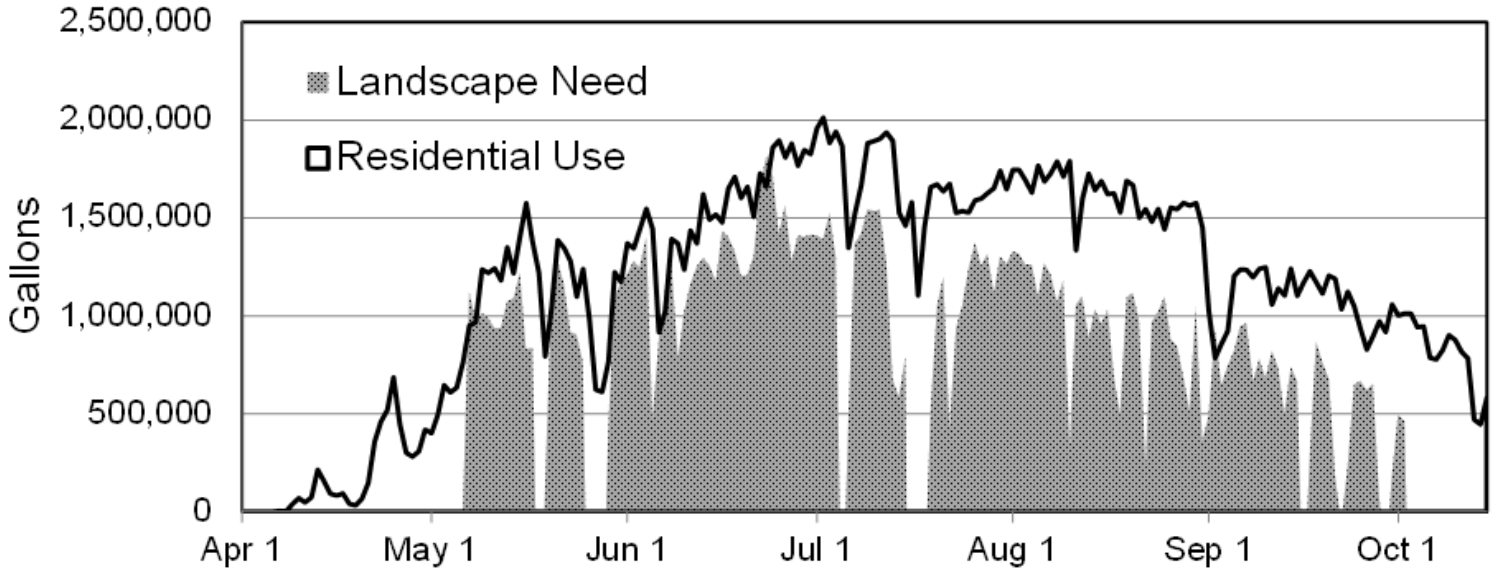
Potential Landscape Conservation through Improved Irrigation Efficiency

- Sum of daily landscape irrigation and need at 869 WBWCD metered residential properties 2012
- Use tracks weather but above landscape need
- Reports assumed 70% DU Average DU was 53%

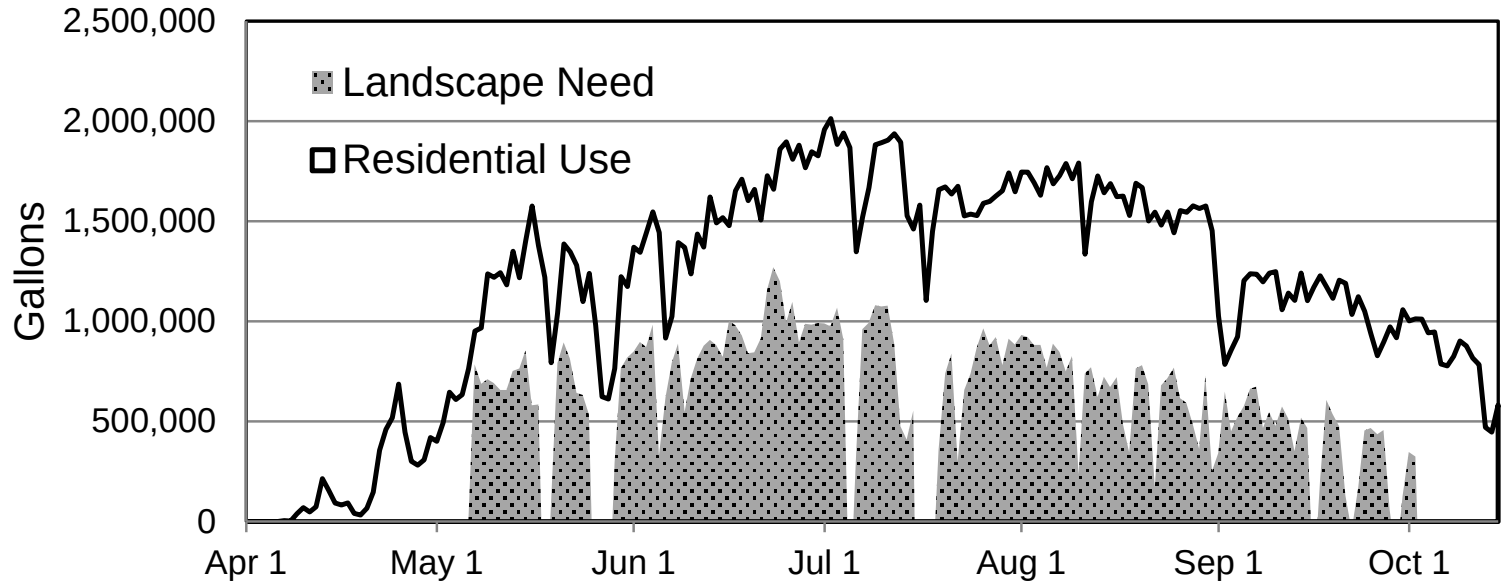
  (WBWCD Water Check Program 2012)
- People misinterpret poor DU for plant water need

UtahState University

Assuming 70% Distribution Uniformity



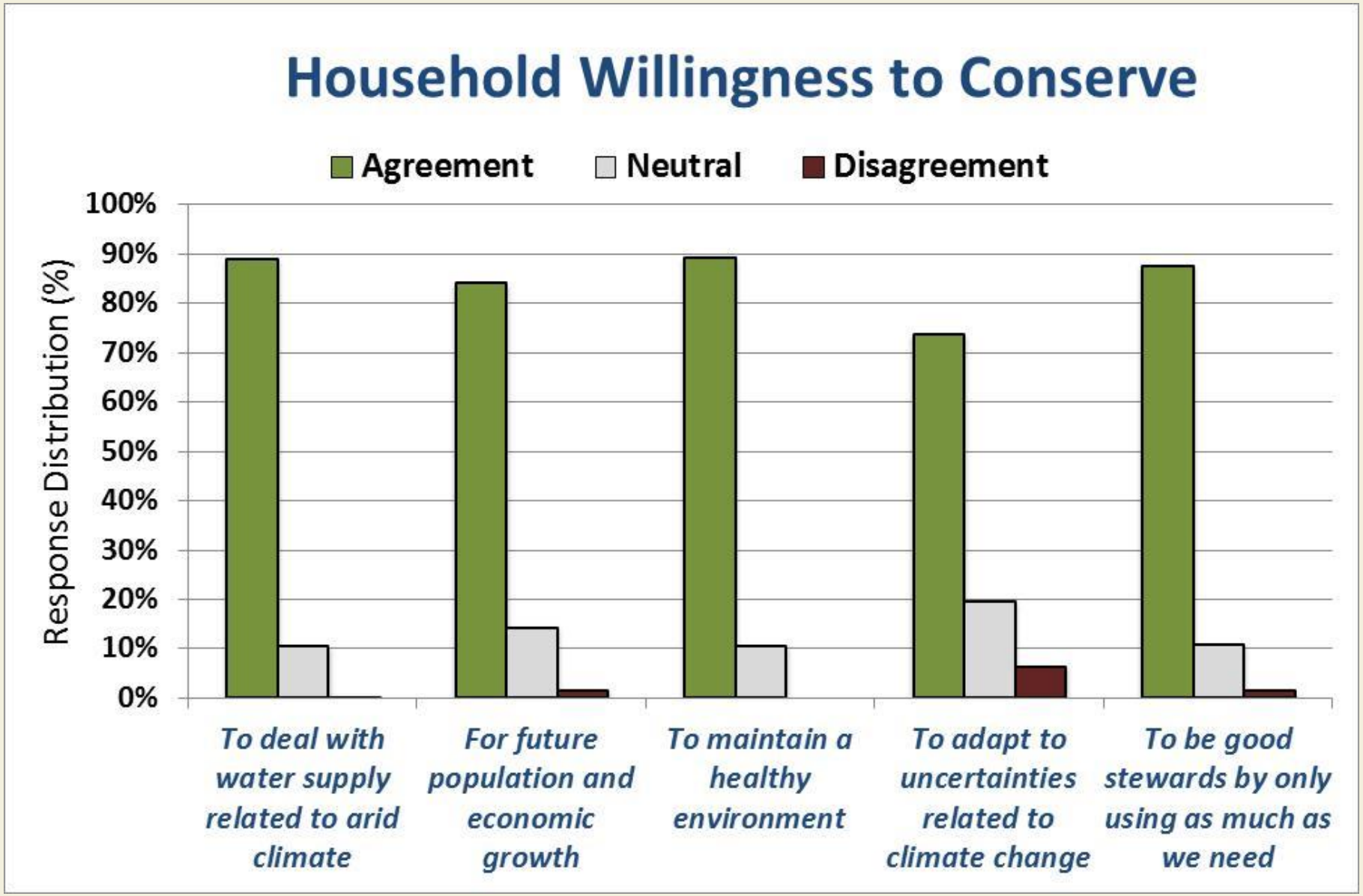
Assuming 100% Distribution Uniformity



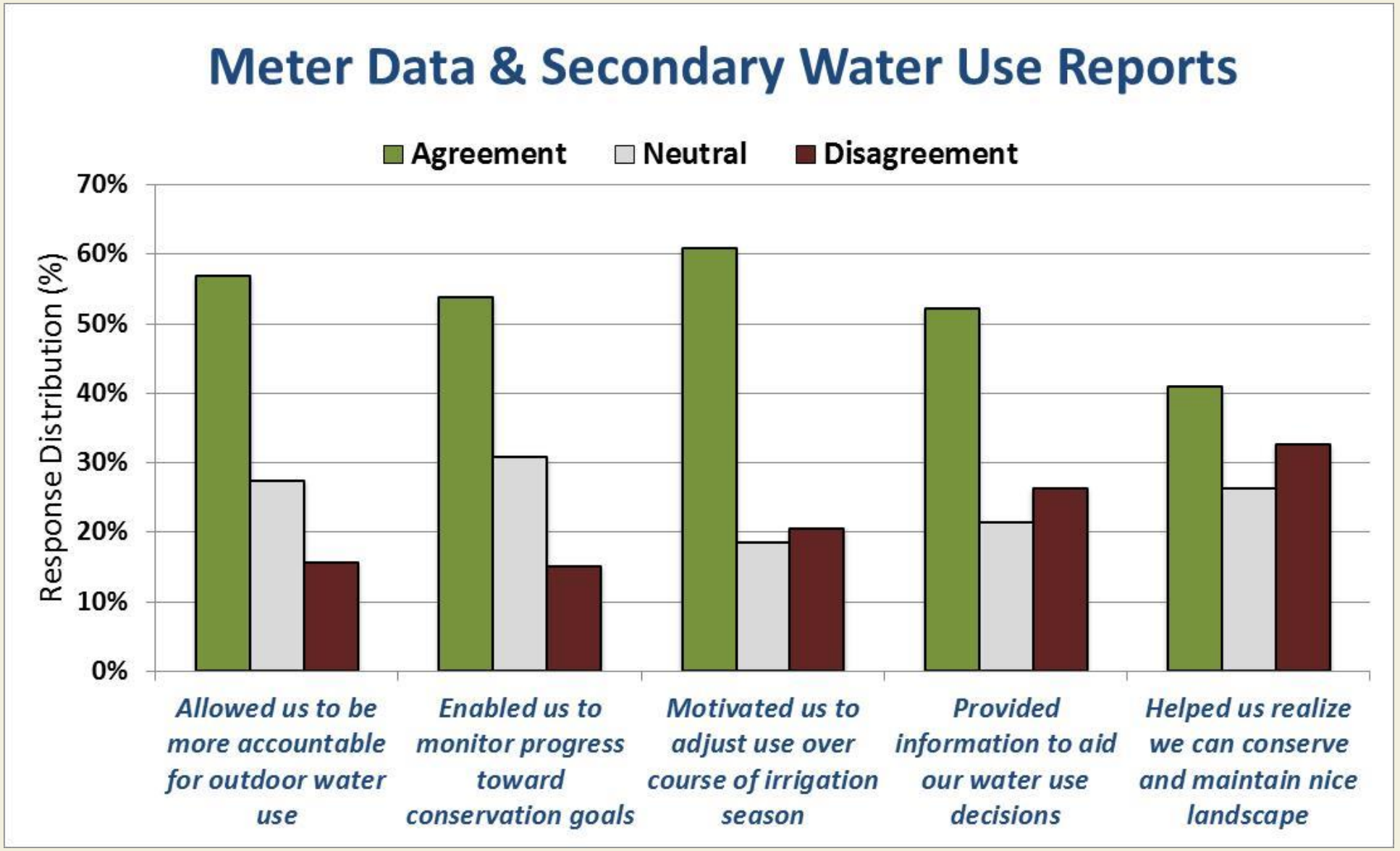
Potential Landscape Conservation through Improved Irrigation Efficiency

- Sum of daily landscape irrigation and need at 869 WBWCD metered residential properties 2012
- Increasing DU above 70% would realize savings
- 93% of households use automated irrigation systems
- 2.4% of respondents stated their sprinkler system is well maintained

Utah State University



PARTICIPANTS INDICATED HIGH WILLINGNESS TO CONSERVE FOR A VARIETY OF REASONS

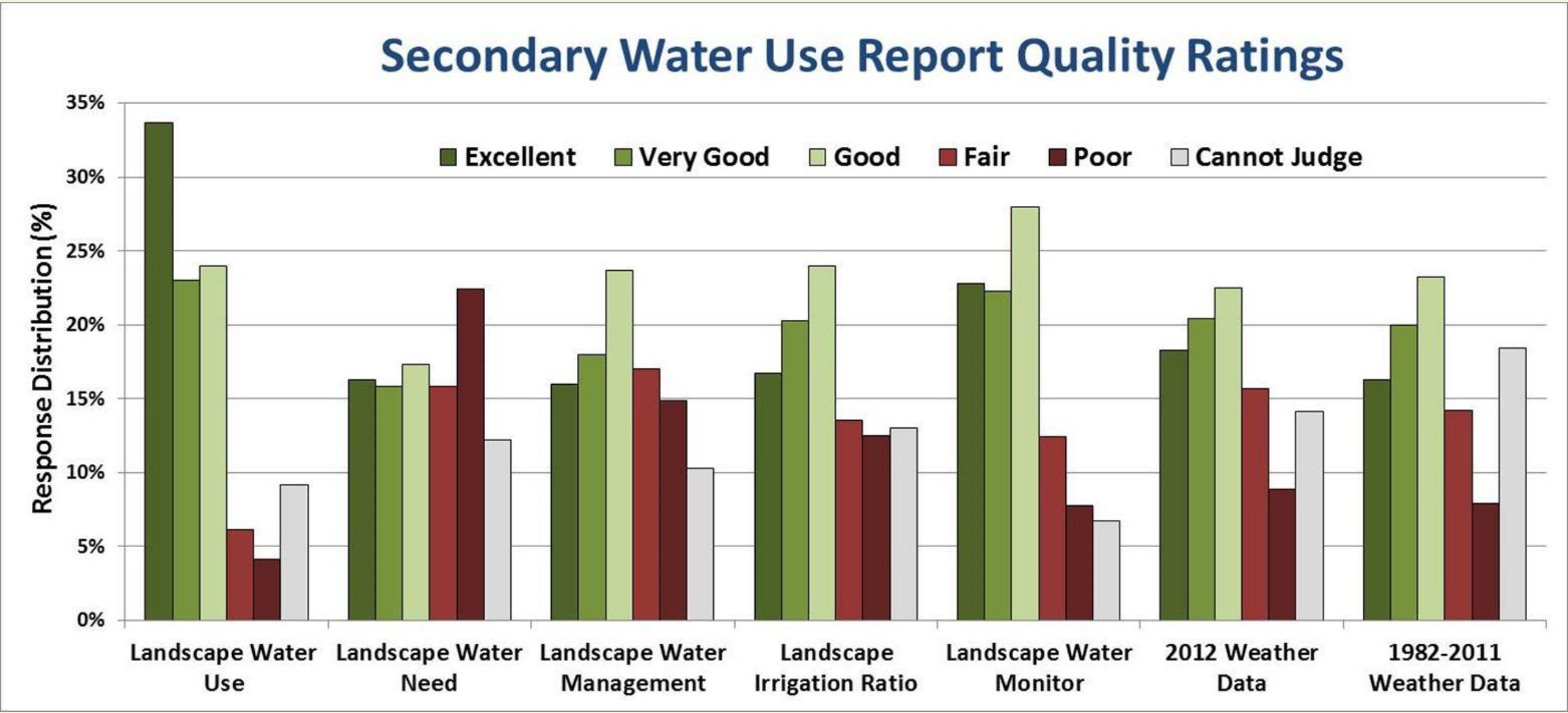


Approach & Reports

- 73% of respondents were surprised to learn the amount of water used on their landscape
- Reports sent the intended message to most users
- Reports provided actionable information to users

Approach & Reports

- Rewarded efficient users with right message
- Created some cognitive dissonance for high users



SUMMARY OBSERVATIONS:
what research tells us
about human behavior
and water conservation

UtahState University

Human Behavior and Water Conservation

- **Good Intentions:** people are generally willing to conserve water and motivated to do so for a variety of reasons
- **Innocent Overwatering:** people don't know how much water landscapes actually need in the context of weather/climate variability
- **"Situational Waste":** role of site specific constraints and opportunities for efficient water use (great variability in residential parcels)

Human Behavior and Water Conservation

- **Conservation programs:** attract people who are already efficient and seeking information to increase their conservation skills
- **Conserving water is a *process*:** involving many actions of change, monitoring, adjustment, and reinforcement; it is *iterative* over time

Landscape Water Conservation Challenges

- **Broaden influence of conservation programs:** reach the "information receivers" as well as the "information seekers"
- **Identify conservation opportunities:** find locations with inefficient landscape water use and direct conservation efforts there
- **Provide relevant information:** help people understand water needs of *their* landscape and how to maintain it while saving water

Landscape Water Conservation Challenges

- **Promote long-term habit change:** provide consistent and repeated messaging to aid people's decision making and helps them monitor their own progress toward conservation goals
- **Prepare for droughts and growing scarcity:** fine-tune people's ability to water appropriately during droughts with less consequence

CLOSING THOUGHT:
so remember .....

People

are a lot like

plants !

Dr. Joanna Endter-Wada

Quinney College of Natural Resources

Utah State University

Logan, Utah

Joanna.Endter-Wada@usu.edu