

Tools for Evaluating and Monitoring the Effectiveness of Urban Landscape Water Conservation Interventions and Programs



EXTENSION 
UtahStateUniversity

CENTER FOR
WATER-EFFICIENT
LANDSCAPING

Diana T. Glenn
with
Joanna Endter-Wada
Roger Kjelgren

IMS - AWWA
ANNUAL CONFERENCE

LOGAN, UTAH
SEPTEMBER 16, 2015

Presentation Outline



- 1. Urban Landscape Water Conservation
Tools developed through CWEL at USU**
- 2. Evaluating Water Conservation
Outcomes ~ Logan City Case Study**
- 3. Research Insights and Implications**

Part 1



Urban Landscape Water Conservation TOOLS

developed through CWEL at USU

Urban Water Conservation Tools developed by



Satellite-based Urban ET



EXTENSION | CENTER FOR WATER-EFFICIENT LANDSCAPING | UtahStateUniversity

Urban Water Conservation

Where does it go? **LANDSCAPES** **COOKING FLUSHING SHOWERING**

Utahns use more culinary/potable water to irrigate landscapes than they use for cooking, flushing and cleaning combined.

Promoting urban water conservation is an important element of managing Utah's scarce water resources in this rapidly growing and urbanizing state. Careful use of urban water supplies will help to reduce pressures to transfer water from agricultural to municipal and industrial uses and will aid in avoiding negative environmental consequences from removing too much water from streams and aquifers. Water applied to landscapes constitutes approximately 65-75% of urban water demand. Reducing water used on established landscapes and promoting greater use of low-water plant material and landscape designs offer the greatest opportunities for reducing urban water demand.

Urban landscapes contribute to the health of urban environments and their residents. Yet, they are often watered in excess of the actual water needs of the vegetation. Our urban water conservation research investigates people's watering behaviors and how those behaviors are shaped by their preferences, knowledge, and experiences as well as by site-specific characteristics of their landscapes (soil properties, plant characteristics, and irrigation systems). We have developed a water use analysis and assessment tool, **WaterMAPS™**, to help municipal water managers identify locations with the greatest capacity to conserve water applied to landscapes and enable managers to direct and tailor their water conservation programs to those locations and users.

CWEL's urban water conservation research integrates social and policy science with the plant and irrigation science of other research areas to provide an integrated approach to promoting water-efficient landscaping.

RELATED PEER-REVIEWED PUBLICATIONS

WaterMAPS™ | **Urban ET** | **Water Check Program**

PROGRAM AREAS
Ag & Natural Resources
Gardening
Home, Family & Food
Utah 4-H & Youth

CONTACT US
Locations
Directory
USU Gardens
About Us
Social Media

INFORMATION
Publication Library
Shopping Cart
FAQ
Ask an Expert

EVENTS
Calendar
Online Registration

INTERNAL RESOURCES
Employee Resources
Working
Employment Opportunities

WEBSITE
Copyright Policy
Report an Error

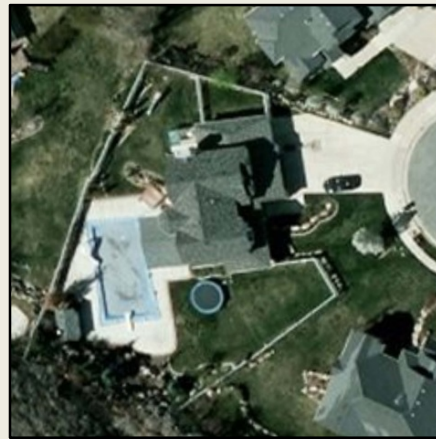
Utah State University is an affirmative action/equal opportunity institution. © 2014 Utah State University. Science

Defining Appropriateness of urban landscape irrigation relative to plant water needs

***Beneficial Use
without waste***



***Recognizing different water
needs of turf vs. trees & 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 landscape choices & local climate estimates (ET)



Landscape Classification

Determines water need for existing landscapes

- **Reference E_t_o**
- **Plant Factors:**
 - **Turf 0.8**
 - **Trees/Shrubs 0.5**
- **Turf under trees**

multispectral imagery



classified imagery



Buffering Routine

Parking strips included as part of landscapes people water

- **Assess** – Methodology
 - Equitable comparisons
- **Deliver** – Credibility
 - Water user acceptance
- **Track** - Planning Policy
 - Evaluate effect



overlay of parcel boundaries

adjusted to include landscape in parking strips



Identifying Capacity to Conserve



Landscape Irrigation Ratio (LIR)

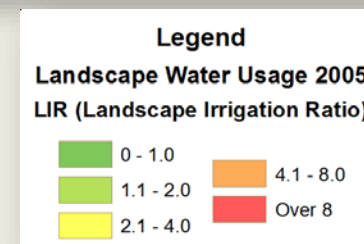
Landscape Water Use
estimated

(derived from meter data)

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

(derived from imagery and ET_0 rates modified by plant factors)

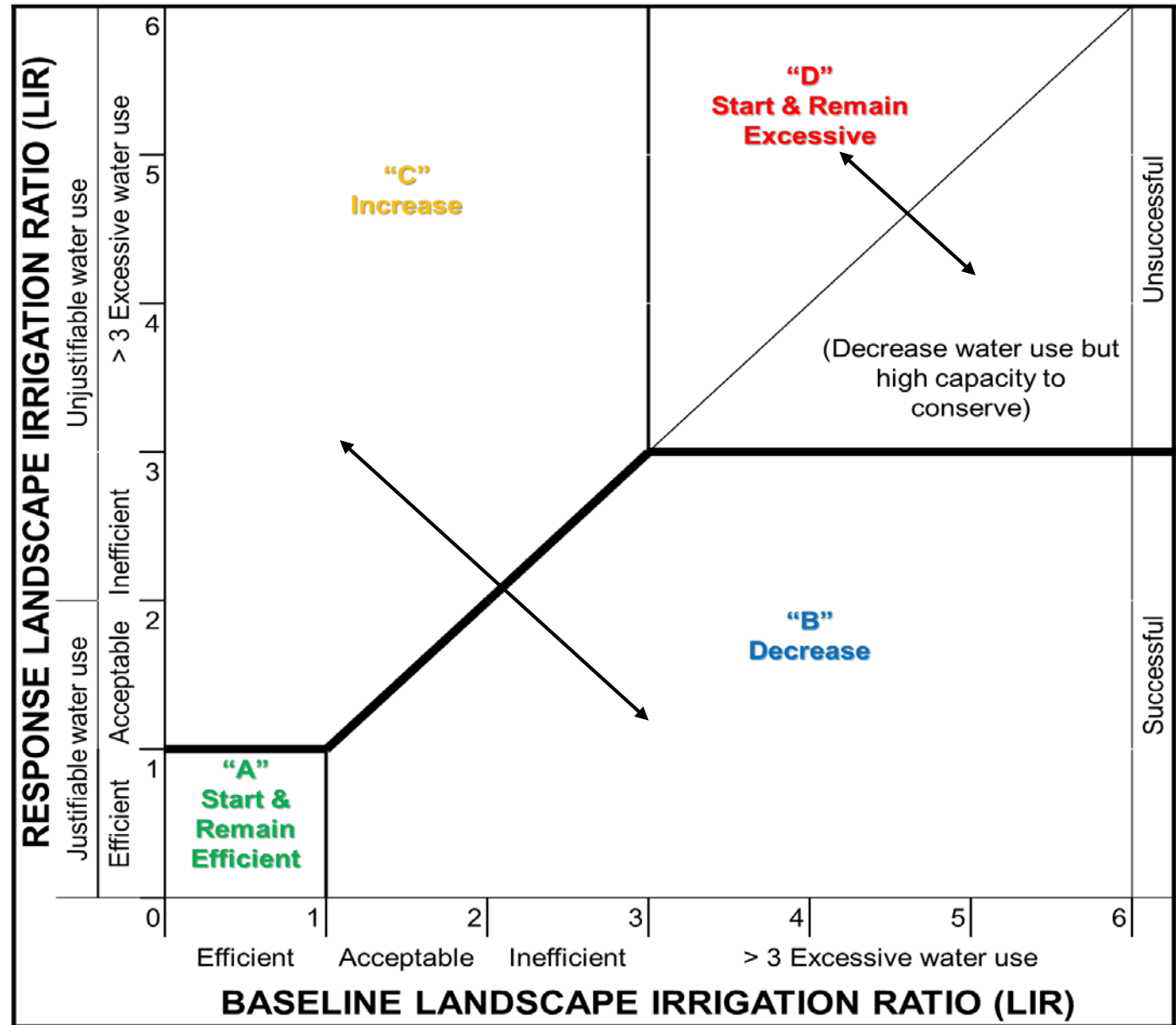
(per unit of landscaped area)





Participant Outcome Evaluation Tool

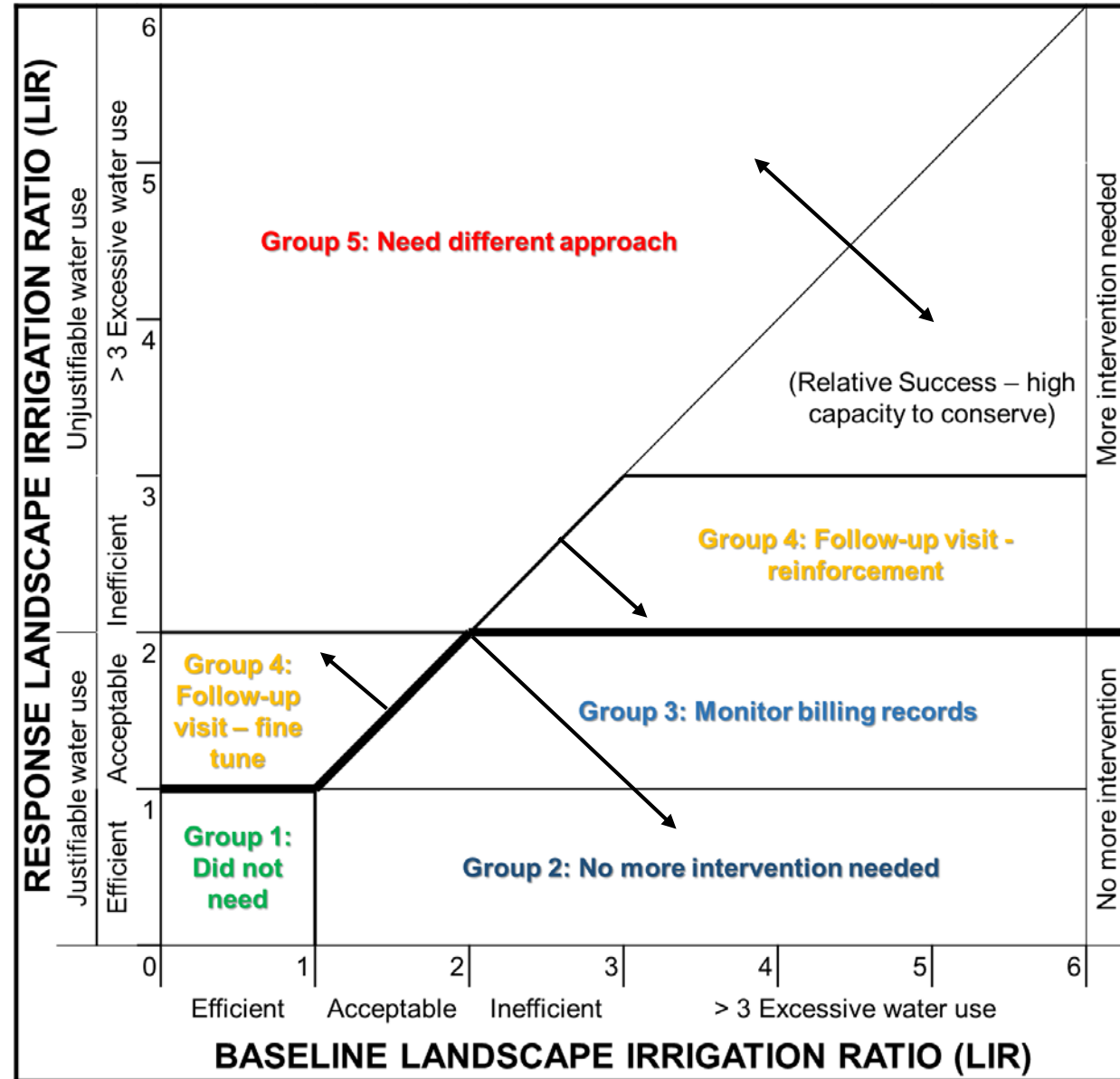
- Characterizes response to water check
- Illustrates appropriateness of water use relative to plant need, and
- Direction of change





Program Evaluation Tool

- Characterizes success of the program
- Describes need for further or different interventions



Part 2



Evaluating Water Conservation Outcomes Logan City Case Study

Interdisciplinary Research Team



Coauthors

- **Joanna Endter-Wada**
 - *Dept. of Environment and Society*
 - *Water Law and Policy; Human Dimensions of Natural Resources*
- **Roger Kjelgren**
 - *Dept. of Plants, Soils and Climate*
 - *Plant Science; Native Plants; Water Efficiency Landscaping*
- **Christopher M. U. Neale**
 - *Div. of Irrigation Engineering, Dept. of Civil and Environmental Engineering*
 - *Remote Sensing; Irrigation Engineering*

Journal Article



Copies or citation available upon request



Participant Recruitment



UtahState
UNIVERSITY



*Logan City and USU
Free Landscape Water
Check Program*

Are you a water customer of Logan City?
Do you have an in-ground sprinkler system?
Do you water your landscape with culinary (City) water?

Call Logan City Public Works at 716-9150 to schedule an appointment
for a FREE landscape water consultation.

Help conserve water and SAVE MONEY on your water bill!

Landscape specialists and USU
researchers will visit your home and
conduct a detailed evaluation of your
sprinkler system as well as ask you some
questions regarding your water practices.

- **Eligibility:**
 - Single-family residential
 - Metered culinary water
 - In-ground irrigation system
- **2004 Volunteers – self-selected**
- **2005 Recruits – above average water users**
 - 2 out of 3 years: 2002, 2003 or 2004
 - 1150 gal. or more per day, and
 - 0.18 in. or more per day



Landscape Water Check Services

- Walk-thru evaluation
 - Landscape plants
 - System design & Maintenance
- Catch cup tests
 - Distribution Uniformity
 - Precipitation Rate
- Soil Test
- Water schedule
- Recommendations





Water User Interviews



- **Pre-Water Check Interviews establish:**
 - Baseline watering habits
 - Conservation attitudes
 - Conservation practices adopted
- **Post-Water Check Interviews document:**
 - Recommendations adopted
 - Problems encountered and how dealt with
 - Participant evaluation of water check effectiveness



Participant Outcome Evaluation Tool

A - green cases: 29%

Low capacity to conserve

B - blue cases: 30%

Good response decreased use

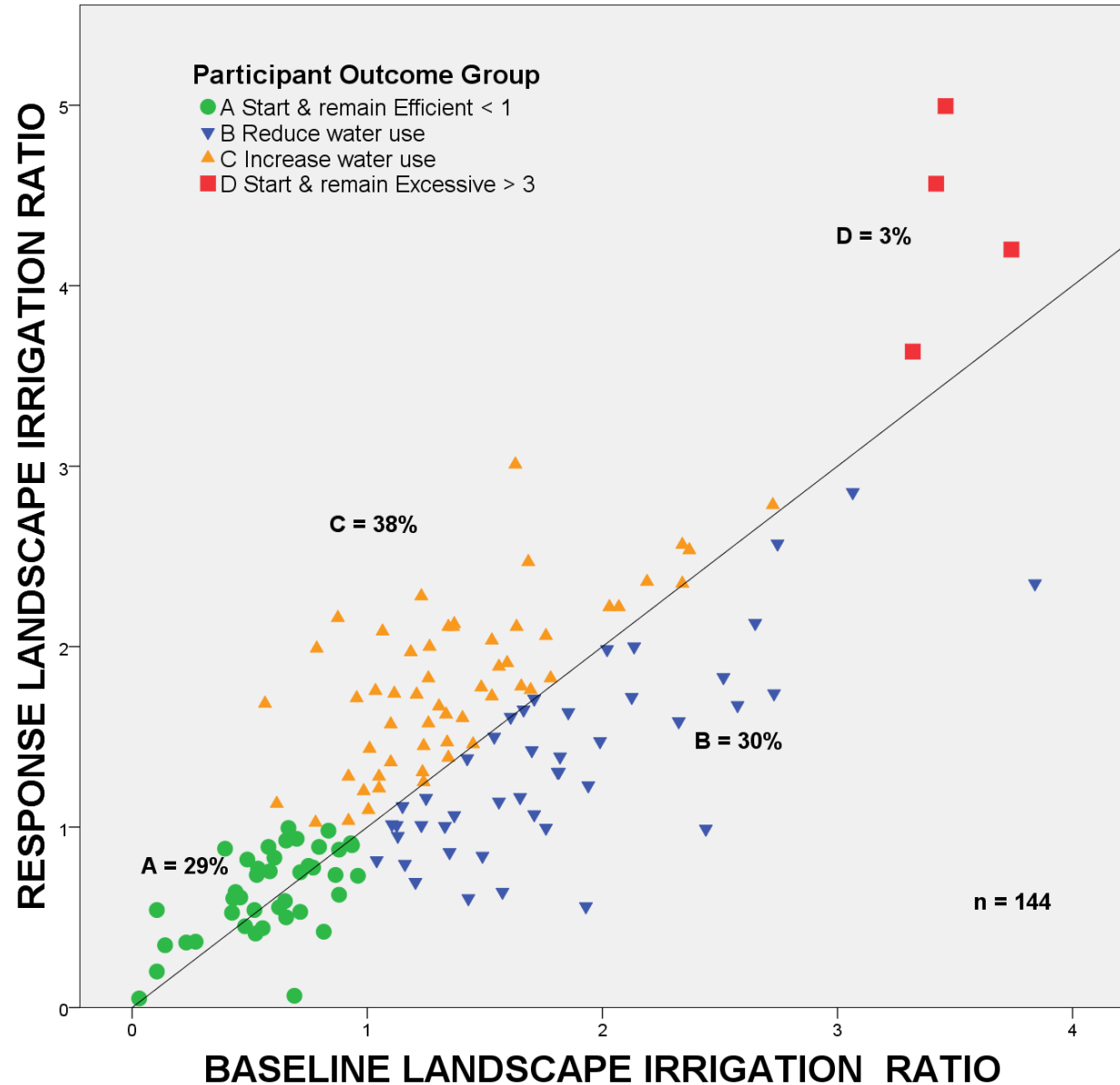
C - orange cases: 38%

Poor response increased use

D - red cases: 3%

High capacity to conserve

(N = 144)





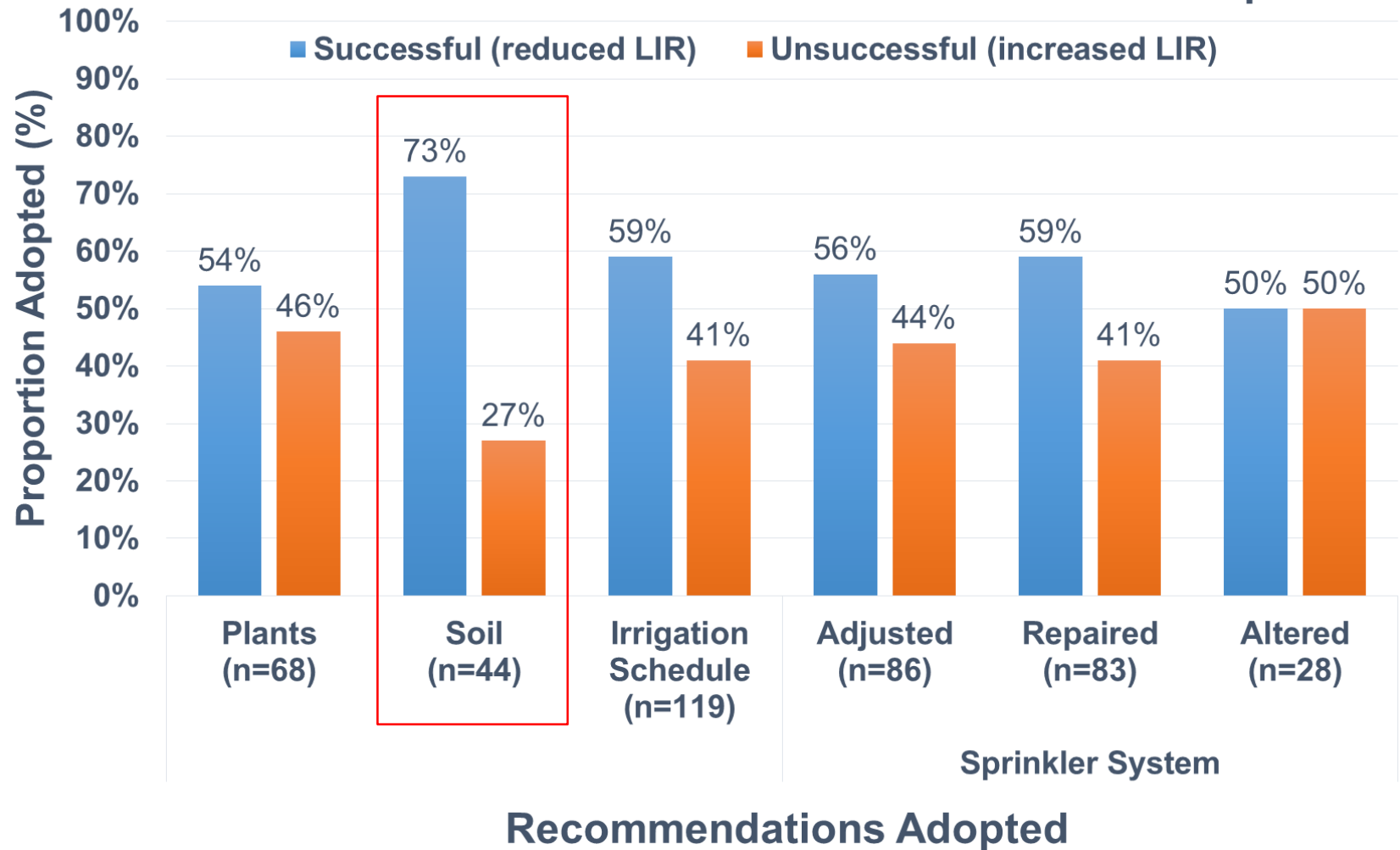
Adoption of soil recommendations:

- Mulching bare soil
- Aerating compacted soil

Significantly effected success:

- 25% less water use on average
- Avg. response LIR 1.15

Distribution of Water Check Recommendations Adopted

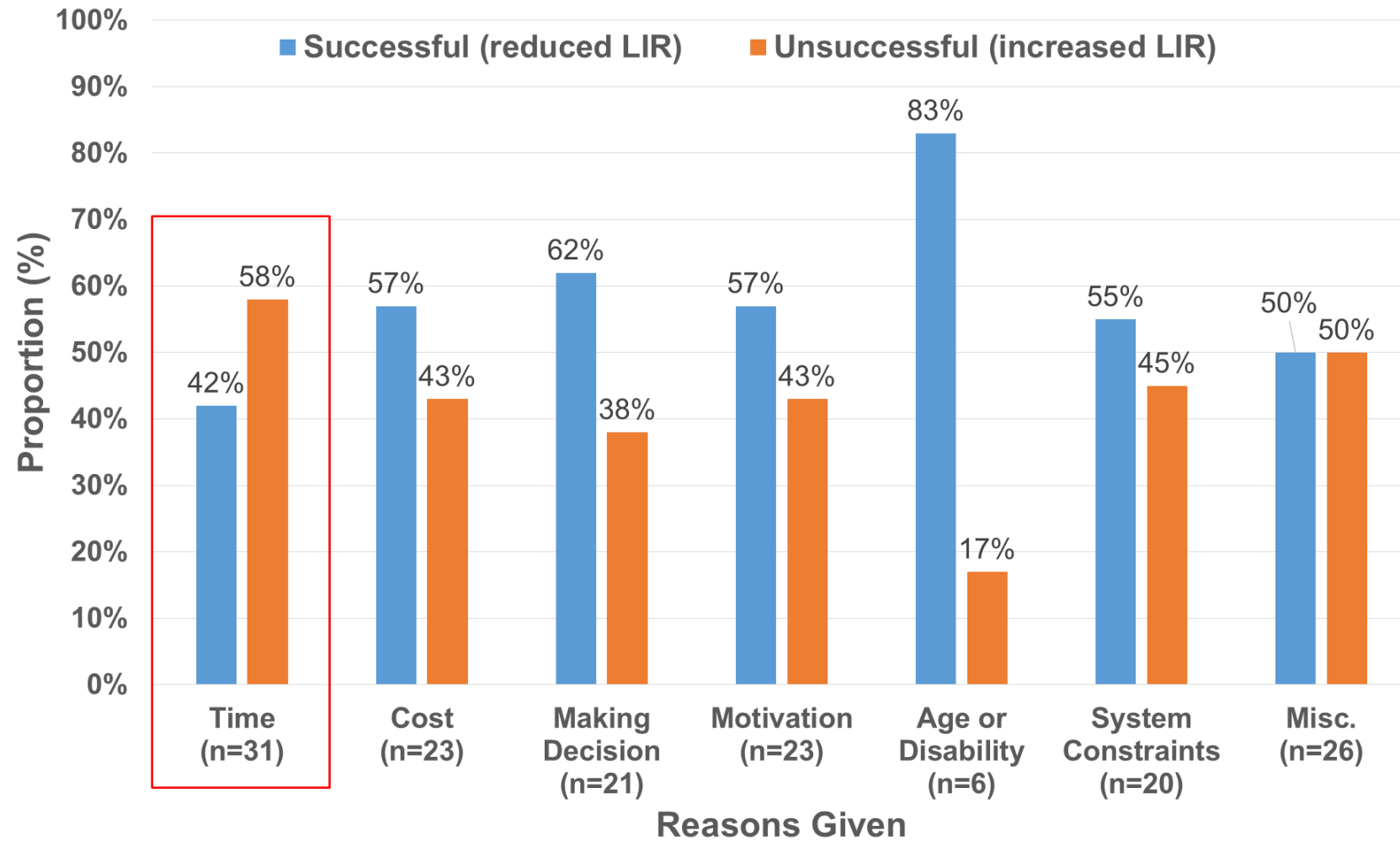




Time constraints significantly effected success:

- 23% more water use on average
- Response LIR 1.74 on average

Reasons Water Check Recommendations Were Not Adopted



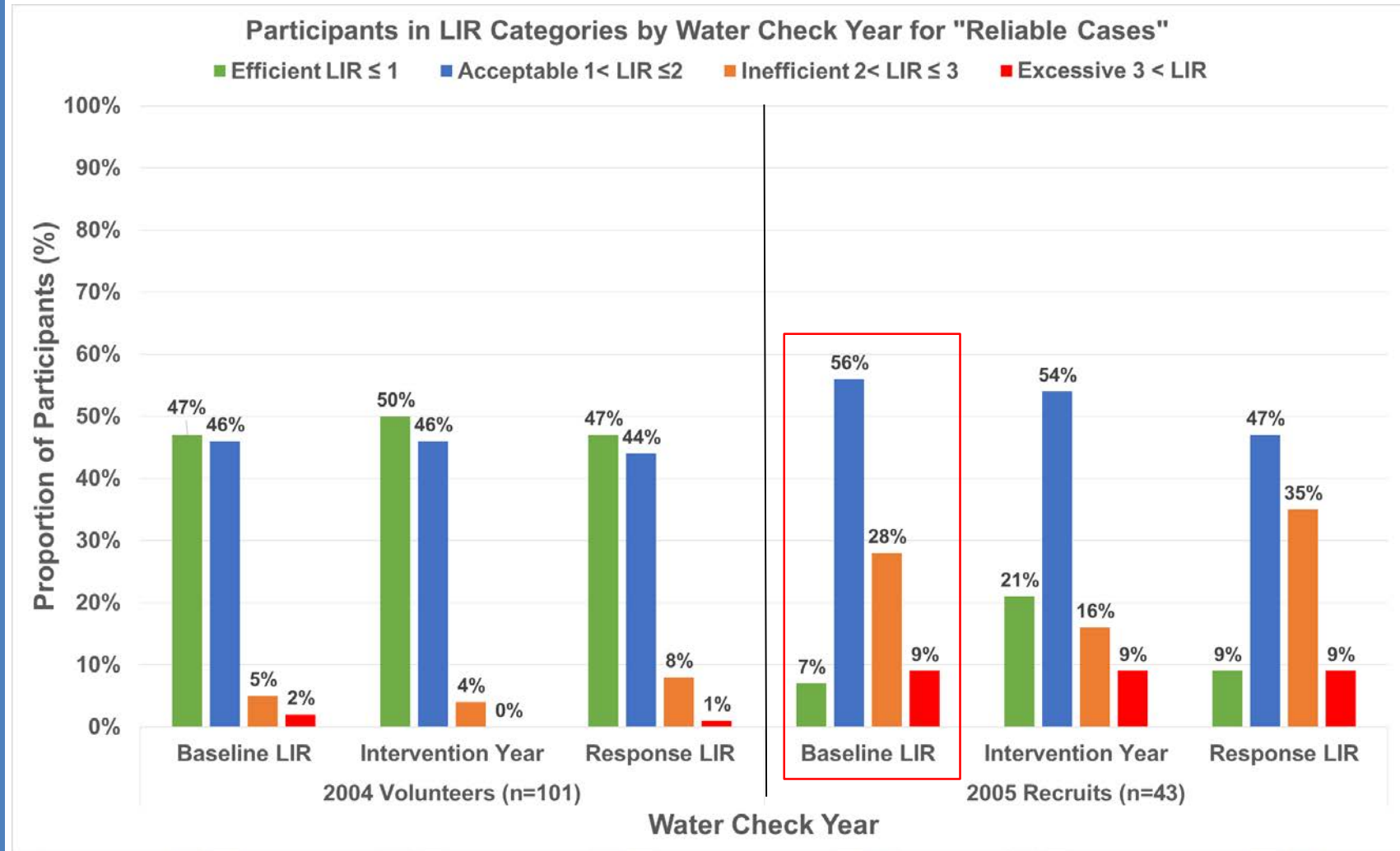


Volunteers are more conserving than Recruits:

- 39% less during baseline
- 41% less during response

Volumetric thresholds did not identify “above-average” water use:

- 63% of Recruits were Efficient or Acceptable

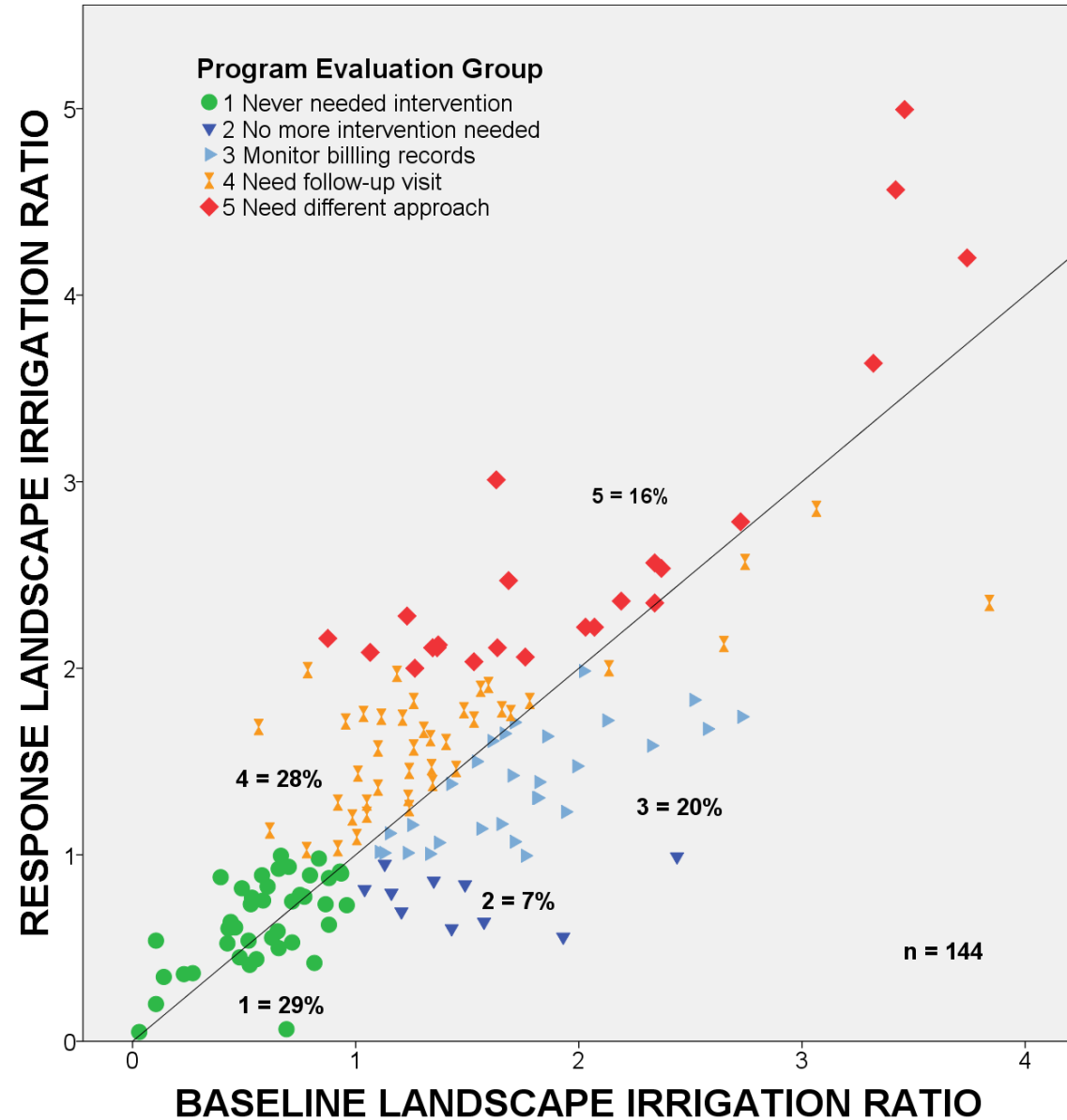


Data based on 144 cases that had no leaks, received correct irrigation schedules, and had the same residents 2002-2007.



Program Evaluation Tool

- 1** Never needed **29%**
- 2** No further intervention **7%**
- 3** Monitor billing records **20%**
- 4** Follow-up visit to fine-tune or reinforce effort **28%**
- 5** Need different approach **16%**



Part 3



Research Insights and Implications



Field Observations:

Water Check Program Delivery

- General observations during household site visits

- Volunteers and Recruits have different motivations, information requirements, and skill levels:
 - Volunteers want more in-depth conservation information
 - Recruits need basic conservation information, technical “how to” information, and on-going assistance
- Water checks delivered as one-time intervention
 - Many participants wanted the opportunity to ask more questions



Field Observations:

Water Check Program Delivery

- General observations during household site visits

- How program administrators interact with households appears to be important:
 - Resolving household disputes over water use
 - Person managing irrigation controller needs opportunity to ask questions
 - Post-water check interviews revealed recommendations were often rejected by other householder
- Household circumstances change:
 - Time constraints
 - Budget constraints
 - Varying interest
 - Conflicting behaviors and goals within household



Implications

Residential mobility affects program evaluation

- Important issue affecting program evaluation
- *Who* participated in program → water management skills that travel with participant
- *Location* where conservation programs received → influence of structural issues tied to location
- *Under what conditions would a conservation program be more effective addressing site/infrastructure factors vs. human behavior issues?*



Implications

Value of Landscape
Irrigation Ratio (LIR)
approach

- Equitable comparison of residential lots
- Based on a standard of plant water need/demand
- Distinguishes efficient locations from those that are inefficient
- *More reliably identifies locations with capacity to conserve than volumetric methods*



Implications

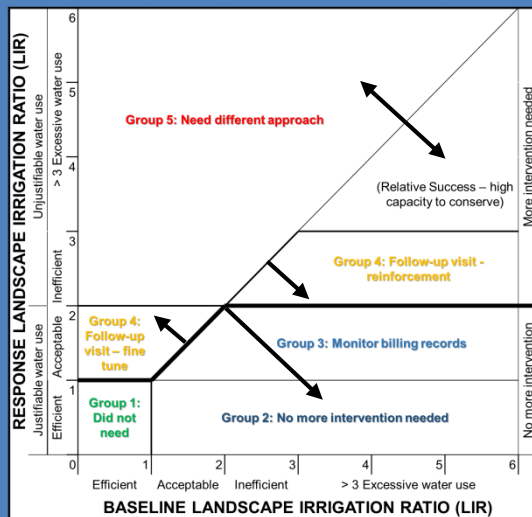
Landscape or personal constraints affect participant success

- Low capacity to conserve → transition to more drought-tolerant plants
- Over-watered lawns with short root systems need time to be weaned
- Poorly designed sprinkler systems and/or older controllers limit ability to reduce water use
- Adoption of recommendations → choosing those with greatest impact, household budgets, participant ability/skills
- *Requires more time to address than most post-intervention monitoring allows*



Implications

Program Evaluation Tool - Water check intervention effectiveness



- Identifies locations that may need more help
- Adjust program procedures: current water schedule compared to recommended
- Reveal different information needs of participants:
 - Tailored to provide contextual relevance
 - Address barriers to change
 - Address gaps in knowledge
 - Address differences in participant skills
- *Provides relevant information to guide program administration*

Acknowledgements



- **USU Graduate Students:**

- Adrian Welsh, M.S., *Human Dimensions of Ecosystem Science and Management*
- Jennie Hoover, M.S., Mark Guthrie, M.S., and Heather Johnson, M.S., *Water Efficient Landscaping Management*
- Clay Lewis, M.E., *Civil and Environmental Engineering*

- **Research Partners:**

- Logan City, UT
- Water Check Program Participants

- **Funding Sources:**

- USDA – Cooperative States Research Education and Extension Service
- Utah Agricultural Research Station (USU)



Questions & Discussion



Diana T. Glenn

Dept. of Environment & Society
Quinney College of Natural Resources
Utah State University, Logan, UT 84322

diana.glenn@usu.edu

(435) 797-9084