



Center for  
Water Efficient  
Landscaping

# ANNUAL REPORT

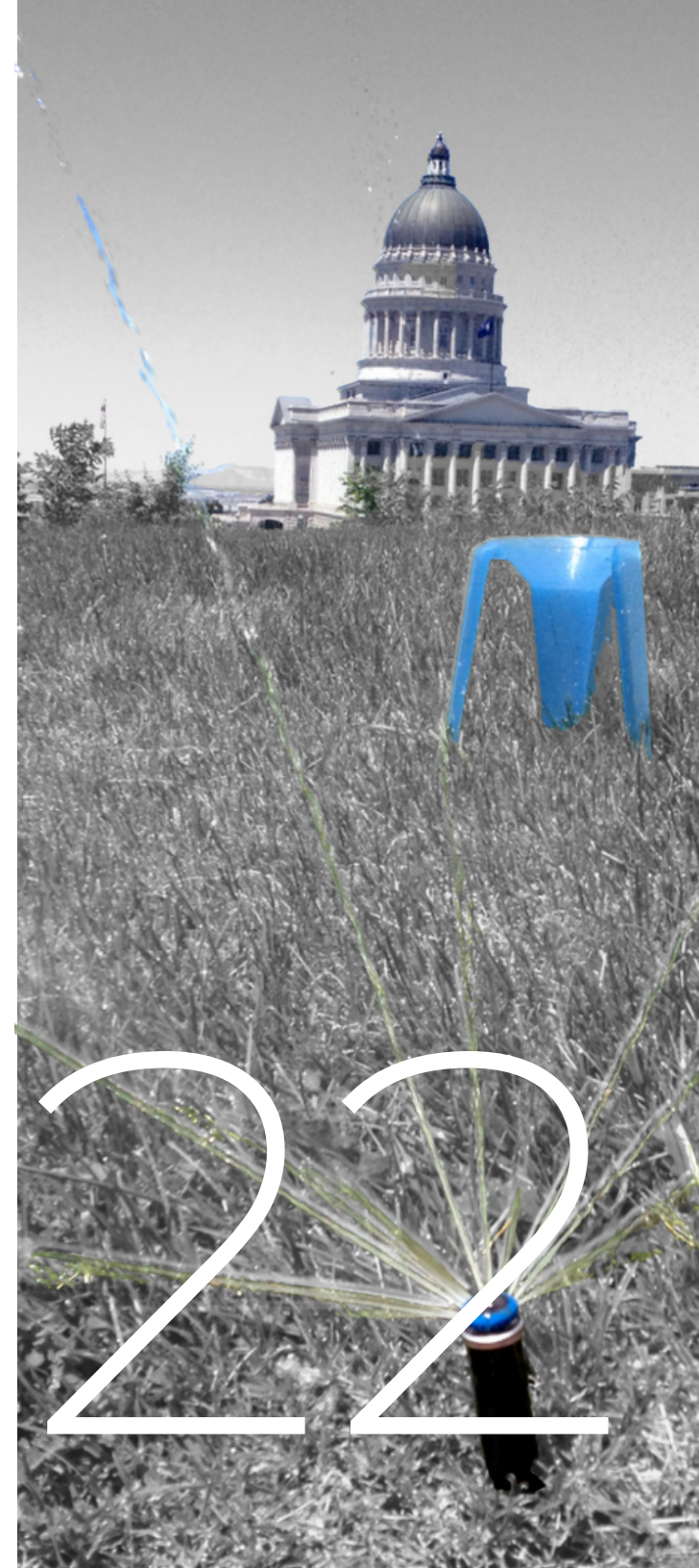
january - december 2022



UtahState  
University

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**Center for Water-Efficient Landscaping**  
**UtahState**University.



**Extension**  
**UtahState**University



S.J. & JESSIE E. QUINNEY  
COLLEGE *of*  
**NATURAL RESOURCES**



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# PEOPLE

The Center for Water Efficient Landscaping's team is a small multidisciplinary group of faculty, staff, and graduate students dedicated to reducing water use in the landscape without compromising the environment, lifestyle, or economics.



## DIRECTOR'S MESSAGE

Drought is the word that will always define 2022 for me. Utah was already reeling after an incredibly hot and dry 2021, and 2022 continued in the same way, placing even more pressure on our precious water resources. The plight of the Great Salt Lake was also top of mind as the lake elevation reached the lowest level in recorded history. With all of this as strong motivation, the Center for Water-Efficient Landscaping at USU (CWEL) worked harder than ever to support water conservation in Utah's urban and suburban landscapes in 2022.

As you will learn as you read through this report, we are continuing our efforts to evaluate ornamental and native plants and turfgrass species and varieties. We have also continued certain short-term drought research projects that were implemented in 2021 to learn just how far we can push landscape plants under drought conditions and how those plants recover. Our WaterMAPS™ team continued working with cities and institutions in the state to relate their landscape water use to plant water requirements and reduce their water use as well.

The program helps municipalities and counties integrate water considerations into land use planning by bringing community staff and decision-makers together to collaborate and build a more sustainable water future.

Newer efforts this year included a public survey about the future of the Great Salt Lake. This survey project will help public officials better understand how Utahns view the lake and their visions for its future. CWEL also supported the Utah Growing Water Smart program in 2022, developing a Utah-specific curriculum and conducting the first workshop of its kind in the state.

One metric that I am particularly proud to share this year is the number of graduate students that are working in our CWEL team. We have a full dozen graduate students working on a variety of research projects, and they are a highly talented and enthusiastic group. Graduate students really are the engine that drives our research endeavors, and we look forward to sharing the results of their work with you.

The only constant in life, as they say, is change and 2022 brought change to our team as we bid a fond farewell to Candace Schaible. Candace was our southern Utah team member for many years but has moved on to the state's Division of Water Resources to assist with their landscape rebate programs. We will miss working with her directly but look forward to an ongoing professional relationship.

We sincerely hope you enjoy reviewing this summary of our accomplishments of the past year and encourage your comments and suggestions.

”

*CWEL promotes water conservation through environmentally, socially, and economically sound landscape management practices*

*Kelly Kopp*  
Director

# FACULTY



## JOANNA ENDTER-WADA

Professor of Natural Resource Policy and Social Science  
Department of Environment and Society  
Quinney College of Natural Resources

- social science and policy aspects of urban landscape water use and conservation
- human dimensions of drought and climate change



## SHITAL POUDYAL

Assistant Professor and Ornamental Horticulture Extension Specialist  
Department of Plants, Soils and Climate  
College of Agriculture and Applied Sciences

- develop sustainable management practices for landscape and nursery plants
- irrigation with unconventional water sources
- develop techniques to protect surface and groundwater by reducing agrochemicals runoff



## PAUL JOHNSON

Department Head and Professor of Turfgrass Science  
Department of Plants, Soils and Climate  
College of Agriculture and Applied Sciences

- develop bluegrass species with increased drought and salt tolerance for better adaptation to Intermountain West environments



## CANDACE SCHAIBLE

Professional Practice Extension Associate  
Professor Horticulture and Water Conservation  
Iron County, Utah State University Extension

- horticulture emphasis
- educate homeowners on best practices for water conservation in the landscape



## KELLY KOPP

Professor/Extension Water Conservation and Turfgrass Specialist, Director  
Department of Plants, Soils and Climate  
College of Agriculture and Applied Sciences

- improve efficiency of landscape irrigation with projects that include plant water-use efficiency evaluations, appropriate irrigation system design, and smart water application technologies.



## YOUPING SUN

Assistant Professor of Landscape Horticulture  
Department of Plants, Soils and Climate  
College of Agriculture and Applied Sciences

- understand whole-plant responses to natural or managed water stress
- promote use of native plants for water-efficient landscapes

# STAFF



## SUSAN BUFFLER

Coordinator of Programs  
Center for Water-Efficient Landscaping

- coordinates CWEL programs
- landscape design
- graphics and reports
- social media outreach coordinator



## MICHAEL KILCREASE

Research Technician & Grounds Manager  
USU Botanical Center / Center for Water-Efficient Landscaping

- assists with a variety of research projects for CWEL at the USU Botanical Center



## CHRIS GARRARD

Programmer / Analyst  
Remote Sensing / GIS Laboratory College of Natural Resources / Center for Water-Efficient Landscaping

- software programmer for the WaterMAPS™ project
- teaches courses on Python scripting for GIS



## TYELAR RHEAD

Extension Undergraduate Intern - Summer 2022

Center for Water-Efficient Landscaping /  
Department of Plants, Soils and Climate

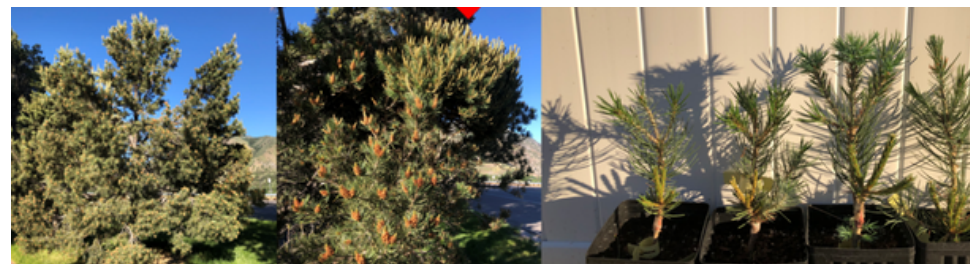
- Water Check scheduling manager, Cache County
- research assistant



## PAUL HARRIS

Research Technician  
Center for Water-Efficient Landscaping

- research in turfgrass drought tolerance
- promotes landscape water conservation



# GRADUATE STUDENTS



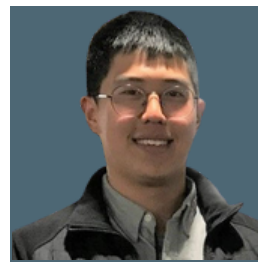
## PAIGE BOYLE

PhD Ecology

Undergraduate Degree: Environmental, Soil & Water Science, University of Arkansas

Master's Degree: Horticulture, University of Arkansas  
Dissertation Project: Clover Inclusion for Value-Added Turf

Committee chair - Kelly Kopp



## JI-JHONG (JJ) CHEN

PhD Plant Science

Undergraduate Degree: Horticultural Science, National Chung Hsing University (Taiwan)

Master's Degree: MS, Plant Science, Utah State University  
Dissertation Project: Drought Tolerance of Landscape Plants

Committee chair - Youping Sun



## SAROJ BURLAKOTI

MS Plant Science

Undergraduate Degree: Agricultural Science, Tribhuvan University, Nepal

MS Project: Effect of variable rate of Phosphorus application in ornamental plants

Committee chair - Shital Poudyal



## MORIAH JACKSON

MPSH - Master of Professional Studies in Horticulture

Undergraduate Degree: Psychology, BS, minor: Chemistry & Nutrition, The University of Utah  
MPSH Capstone Project: The Case for Native Landscapes: Improving Biodiversity in Urban and Suburban areas

Faculty advisor - Kelly Kopp



## ANJU CHAUDHARY

PhD Plant Science

Undergraduate Degree: BS Agricultural Science, Tribhuvan University, Nepal  
Master's Degree: Environmental Studies, Kentucky State University

Dissertation Project: Water conservation in nursery crop production

Committee chair - Shital Poudyal



## ALEXIS KOELLING

MS Plant Science

Undergraduate Degree: BS Biology, minor Chemistry, Utah Valley University  
MS Project topic: Soil amendments for newly disturbed urban and suburban landscapes

Committee chair - Kelly Kopp



# GRADUATE STUDENTS



## JENNY KOLLER

MS Plant Science  
Undergraduate Degree: BS Residential Landscapes. Utah State University, minor: horticulture  
MS Project(s): Enhancing Plant Response to Drought by Amending Native Soil with Peat Moss, Coconut Coir, Vermiculite, and Polyacrylamide; Understanding a plants response to different amounts of irrigation and fertigation rates (Summer 2022)

Committee chair - Shital Poudyal



## CHRISTOPHER M. MCGINTY

PhD Ecology  
Undergraduate Degree: Management and Human Resources, Utah State University  
Dissertation Project: Development of a classification and monitoring approach to identify and assess disturbance in semi-arid ecosystems using multi-scale and multi-temporal remotely sensed imagery: Development of protocols for land managers.

Committee chair – Joanna Endter-Wada



## ABBY DIXON-LAMBORN

MS Plant Science  
Undergraduate Degree:  
MS Project topic: Resource-positive landscapes/climate resilient landscaping

Committee chair - Kelly Kopp



## PRAKRITI NEPAL

MS Plant Science  
Undergraduate Degree: BS National Pingtung University of Science and Technology, Taiwan  
MS Project: Effects of biostimulators on the growth and development of snowbrush ceanothus and onion

Committee chair: Youping Sun



## JESSE MATHEWS

MS Plant Science  
Undergraduate Degree: BS Plant Science, Horticulture & Cropping emphasis, Utah State University  
Project: Determining Sap Yield and the Viability of a Maple Syrup Industry in Northern Utah

Committee chair - Youping Sun



## ASMITA PAUDEL

PhD Plant Science  
Undergraduate Degree: Agricultural Science, Tribhuvan University (Nepal)  
Master's Degree: MS Plant Science, Utah State University  
Dissertation Project: Salinity Stress Responses and Adaptive Mechanisms in Landscape Plants

Committee chair - Youping Sun

# GRADUATE DEGREES AWARDED



## TREVOR KIMBALL

MPSH - Master of Professional Studies in Horticulture 2022

Undergraduate Degree: BLA Landscape Architecture & Environmental Planning, Utah State University

MPSH Capstone Project: Trial Gardens, An Overview and Model for Implementation

Advisory Committee - Kelly Kopp & CWEL faculty

# UNDERGRADUATE RESEARCHERS



## MACIE SANDERS

Undergraduate Researcher  
Utah State University

Project: Effects of Nitrogen on the Nodulation of *Ceanothus velutinus*

Supervisor: Youping Sun





# 13 STUDENT AWARDS & SCHOLARSHIPS





# FACULTY AWARD HIGHLIGHTS

## *USU and CWEL Professor Youping Sun Honored for Research, Sustainable Landscape Horticulture Program*

The American Society of Horticulture Science (ASHS), recognized worldwide as a leading organization for horticulture science and technology, recently honored Utah State University Assistant Professor Youping Sun with its Early Career Achievement Award primarily for a sustainable landscape horticulture program he developed.

<https://www.usu.edu/today/story/usu-professor-honored-for-research-sustainable-landscape-horticulture-program>

## *2022 Crop Science Society of America Extension Education Award presented to CWEL Director Dr. Kelly Kopp*

Presented in recognition of excellence in Extension teaching activities in crop science based on educational innovations developed and used successfully in crop science as evidenced by demonstrated ability to communicate ideas, influence client attitudes, and motivate change in client or audience actions.

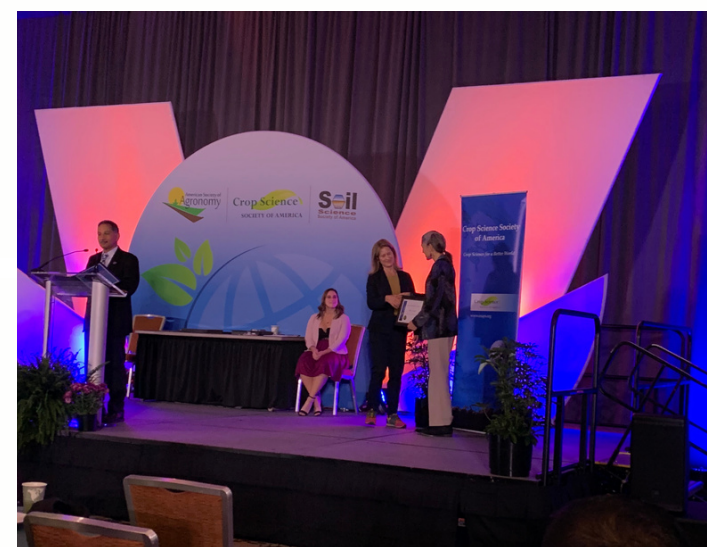
Award was presented to Dr. Kelly Kopp by Dr. Marilyn Warburton, Crop Science Society of America President.

<https://www.usu.edu/today/story/usu-extension-professor-receives-national-crop-science-award>

## *USU Extension Career Specialist Award, 2022*

Awarded to the Extension Specialist who “effectively uses a variety of educational methods, conducts, publishes and disseminates applied research, generates monetary and cooperative support for programs, works well with colleagues in counties and department, and works with enthusiasm, dedication, and willingness to go the extra mile”.

<https://www.usu.edu/today/story/usu-extension-professor-receives-national-crop-science-award>



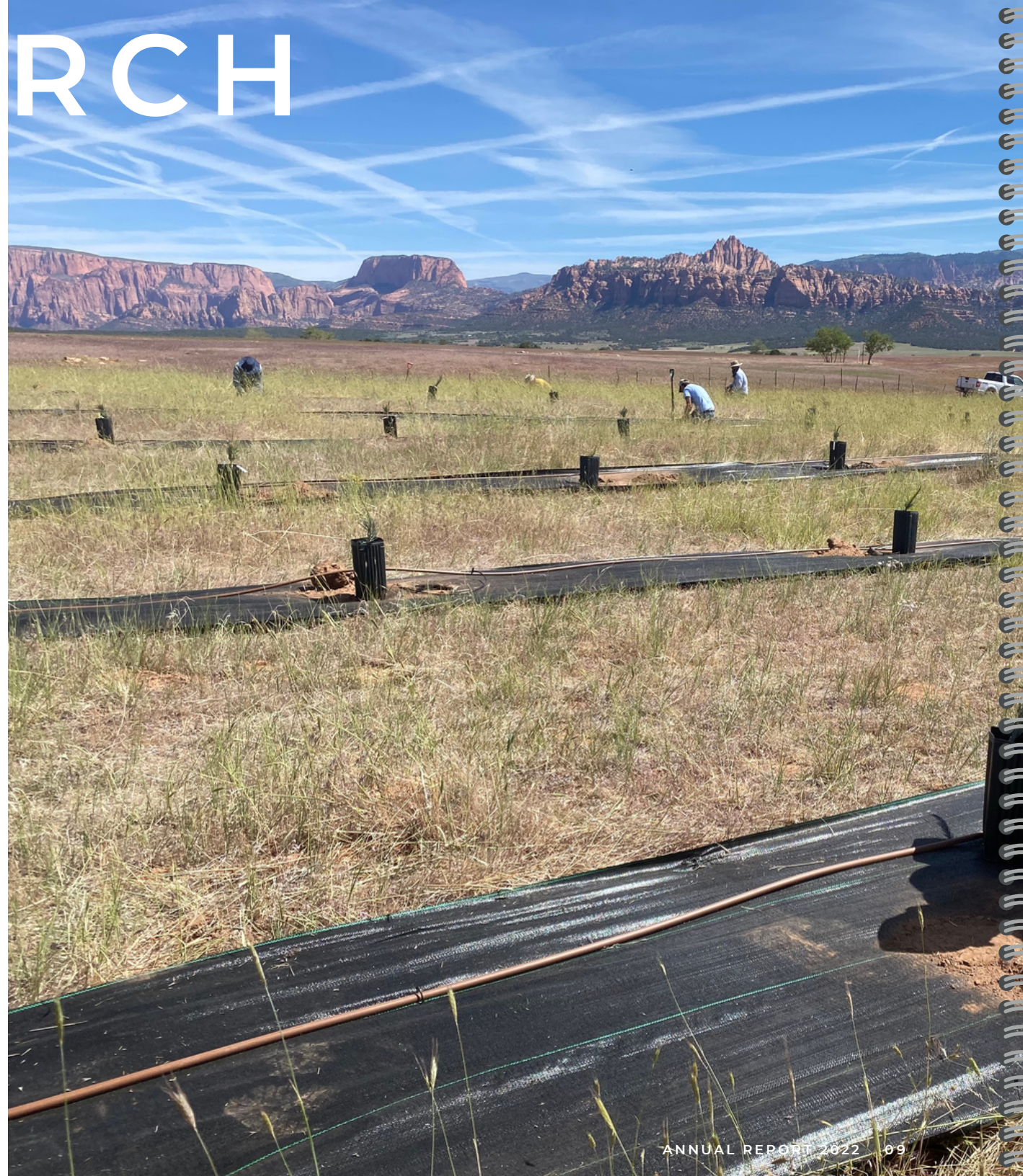


# RESEARCH

Researchers demonstrate that substantially reducing landscape water use does not affect landscape quality or consumer lifestyles.

In addition, homeowners who practice alternative landscape design and irrigation management techniques can reduce water use even further.

Planting grafted pinyon pine in southwestern Utah







## WHAT WE DO

CWEL conducts research in three domains:

- Human Dimensions
- Turf Management
- Ornamental & Landscape Horticulture







## HUMAN DIMENSIONS

- Characterization of community-wide landscape water demand and use patterns
- Analysis of human behaviors contributing to efficiency and overuse of water used on urban landscapes
- Development of water conservation policy and best practices



# HIGHLIGHTS

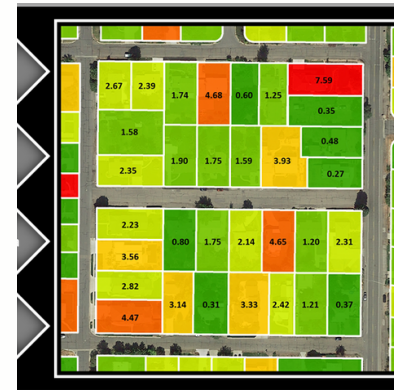
## Water Maps™

WaterMAPS™ is an analytic software program based on parcel-scale landscape water budgets. The program was developed to assist water managers in understanding patterns of landscape water use, identifying areas with the greatest capacity to conserve water, and guiding water conservation planning and programming. The WaterMAPS™ program and team are affiliated with the Center for Water Efficient Landscaping and USU Extension.

The WaterMAPS™ team has been working with the Salt Lake City Department of Public Utilities (SLCDPU) to produce personalized landscape water use reports for all of their residential customers. In the spring of 2022, several focus groups were conducted with members of the public in order to help develop these reports, and they will be available when customers log into their SLCDPU billing portal starting in 2023.

We are also working with SLCDPU to analyze municipal and commercial properties. A draft report was delivered to SLCDPU in December 2022.

<https://extension.usu.edu/cwel/watermaps/>



**Public Utilities** Visit [www.slcc.gov/utilities/conservation](https://www.slcc.gov/utilities/conservation) to learn ways to save!

**Tips to Reduce Landscape Water Use**

- Water vegetable gardens with water hoses or drip irrigation and set a timer.
- Make seasonal watering adjustments by watering less in the spring and late summer.
- Add 3 to 4 inches of mulch to gardens to retain moisture.
- Reduce indoor water use on 7 Gallon Challenge: [https://www.slcc.gov/utilities/indoor\\_water\\_conservation/](https://www.slcc.gov/utilities/indoor_water_conservation/)
- Group plants together with similar watering needs. This is called hydrozoning.
- Sign up for a Free Water Check: <https://extension.usu.edu/cwel>
- Mow lawns higher to stimulate deeper root growth and go bagless to help retain moist

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## Utah Growing Water Smart

In 2021, Utah Governor Spencer Cox announced four water conservation measures to enhance the state's water conservation efforts.

These measures included agricultural water use optimization, an expanded turfgrass buyback program, the installation of secondary water meters throughout the state, and the integration of land use and water planning.

In particular, the *integration of land use and water planning* in Utah is a primary focus of water conservation efforts as new development occurs in the state and competition for water resources increases.

[https://extension.usu.edu/cwel/utah\\_growing\\_water\\_smart](https://extension.usu.edu/cwel/utah_growing_water_smart)

### Workshop Series:

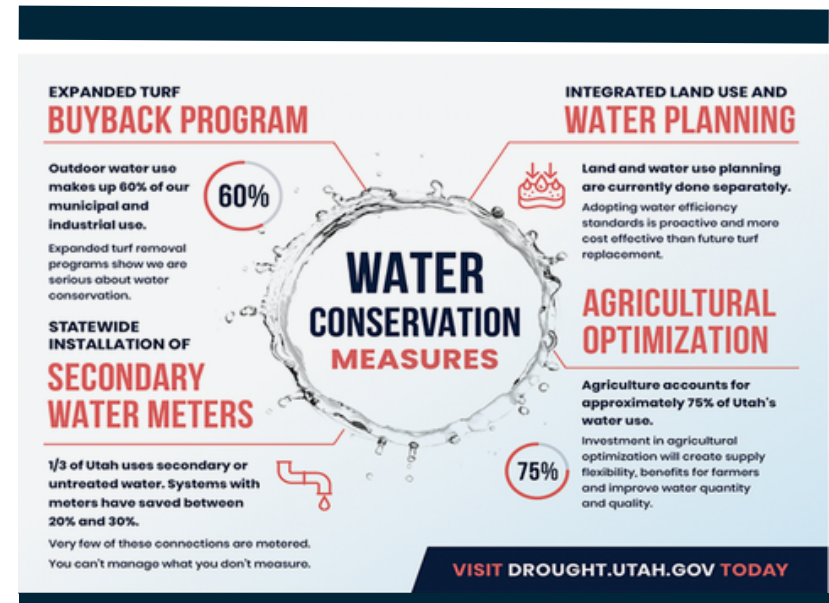
November 15-17, 2022: Five northern Utah communities participated in the state's inaugural *Growing Water Smart* workshop.

Using a Utah-focused curriculum developed by Drs. Joanna Ender-Wada and Kelly Kopp of the Center for Water Efficient Landscaping (CWEL) at USU, the facilitated workshop provided collaborative opportunities, policy tools, technical resources, and assistance for the communities seeking to strengthen their water security in the face of extended drought, climate change, and growing populations and economies.

The next workshop is planned for early June 2023 and will be held in Logan, Utah on the campus of Utah State University.

### Guidebook for Utah Growing Water Smart

Kopp, Kelly, Joanna Ender-Wada, Chelsea Benjamin, Lindsay Rogers, John Berggren, Faith Sternlieb, and Erin Rugland. 2022. [Utah growing water smart: The water-land use integration guidebook](#). A joint program of Utah's Division of Water Resources, Western Resource Advocates, the Babbitt Center for Land and Water Policy, a Center of the Lincoln Institute of Land Policy, Utah State University's Center for Water Efficient Landscaping, and the Sonoran Institute with support from Del Corazon Consulting.





## *USU Research Landscapes: Stewardship for the Future of Great Salt Lake*

Dr. Joanna Endter-Wada, Professor and Program Director in the Quinney College of Natural Resources Department of Environment & Society and CWEL program member, discussed the future of the Great Salt Lake on November 3, 2022, as part of the USU Research Landscapes program.

Research Landscapes is an entry point for state and community decision-makers across the Wasatch Front to connect with the researchers who are investigating the most critical issues facing the state.

<https://research.usu.edu/landscapes/events/the-great-salt-lake>



## HUMAN DIMENSIONS TEAM



**Joanna Endter-Wada**

Professor  
Natural Resource  
Policy  
and Social  
Science



**Chris Garrard**

Programmer/  
Analyst



**Chris McGinty**

Graduate Student  
PhD

---

Kelly Kopp  
collaborator

Professor  
Plants, Soils  
and Climate







# TURF MANAGEMENT

- Water requirements of turfgrass
- Effects of short-term drought
- Development of drought-tolerant and other potentially useful turf species

PHOTO: National Turf Evaluation Trial (NTEP) establishment seeding at the Utah Agricultural Experiment Station Greenville Farm, Fall 2022



# RESEARCH PROJECTS

## *Turfgrass*

### Drought Tolerance

- Turfgrass Water Conservation Alliance: Experimental and commercial varieties of Tall fescue (*Festuca arundinacea*) evaluated for drought tolerance.
- Will more fertilizer make my grass more drought tolerant?

### National Turf Evaluation Program (NTEP) Studies

- Cool season grass water use trial
- Perennial ryegrass fair variety trial
- Fine fescues – ongoing trial
- Creeping bentgrass – ongoing trial

- Zoysia grass hardiness trial

### Persistence of Turfgrass / Legume Mixtures

- Clover inclusion for value-added turf (completed)

## *Integrated Projects*

### Resource Positive Landscapes for the 21st Century

### Utah Department of Facilities Construction and Maintenance Case Study



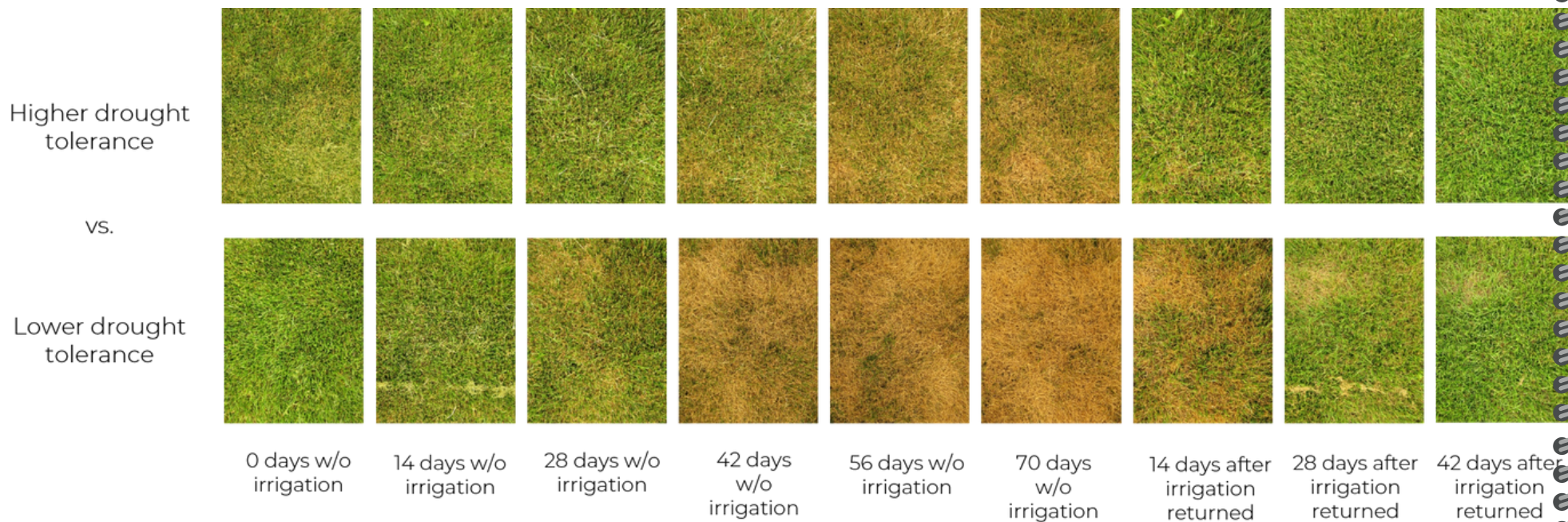


# HIGHLIGHTS

## *Turfgrass Water Conservation Alliance (TWCA) 2022 Data*

Experimental and commercial varieties of Tall fescue (*Festuca arundinacea*) evaluated for drought tolerance.

Grasses went without irrigation for 10 weeks then normal irrigation was returned. Some varieties still demonstrated acceptable turf quality after 6 weeks without irrigation.





## *Resource Positive Landscapes for the 21st Century*

### Summary Overview

Urban landscapes are valued for their capacity to provide space for recreation, public health and safety, community engagement, and natural resource protection. The ecosystem services provided by these landscapes, however, are dependent upon their composition and sustainable management, particularly where natural resource inputs are concerned. Optimized water use efficiency, enhanced carbon sequestration, and improved drought and climate resilience of these landscapes, therefore, should inform their application and use.

The resource-positive landscapes for the 21st-century project is taking a life cycle assessment approach to identifying landscape design, plant materials, management practices, and programs with a primary focus on maximizing water use efficiency of urban landscapes through a holistic framework.

Installation of integrated turfgrass and ornamental landscapes will begin in 2023, so please stay tuned for results of this project.

### Project Objectives

Three project objectives include:

- 1) Implementation, evaluation, analysis of water savings associated with a “turfgrass trade” rebate program in a major metropolitan city,
- 2) Evaluation of carbon sequestration of integrated turfgrass and ornamental landscapes under varying management practices to optimize climate resilience, and
- 3) Development of life cycle assessments of integrated turfgrass and ornamental landscapes to characterize resource positive landscapes for a sample region of the country.



## *Utah Department of Facilities Construction and Maintenance Case Study*

Contributor: Andy Marr, Assistant Director of Facilities, Utah Department of Facilities Construction Management

The mission of the Utah Department of Facilities Construction and Management (DFCM) is to provide professional services to assist State entities in meeting their facility needs for the benefit of the public. This includes jurisdiction over nearly 4000 properties and landscapes across the state such as universities, community and technical colleges, the Utah State Fair Park, and other state agencies.

In 2021 in response to the ongoing drought, Governor Spencer Cox issued Executive Order 2021-10 requiring state agencies to follow the Utah Division of Water Resource's weekly lawn watering guide. All DFCM facilities complied with the executive order, but the public still saw sprinklers running and green grass on state facilities, which presented a public relations challenge. In 2022, the state legislature passed H.B. 121, adding more robust guidance to the executive order to require turfgrass dormancy. To meet the requirements of the new legislation, Andrew Marr, Assistant Director of Facilities, DFCM, consulted with Utah State University's Center for Water Efficient Landscaping.

Quantitative guidelines for irrigation of state facilities were developed, including  $\frac{1}{2}$ " of irrigation applied weekly during shoulder seasons and 1" applied during the hottest weeks of the summer. Slightly higher irrigation amounts were allowed in southern Utah to accommodate a longer growing season and higher temperatures. These guidelines were brought to governor's cabinet, received their approval, and the new requirements were issued to all delegated facilities falling under DFCM jurisdiction. In addition to the new irrigation requirements, all grounds supervisory staff of DFCM were required to complete training through the Qualified Water Efficient Landscaper program to learn how to evaluate their landscapes and irrigation systems for efficiency.

DFCM has also implemented other processes to facilitate the success of its response to the governor's executive order and H.B. 121. A database is now maintained for all managers to indicate their compliance with the reporting requirements of H.B. 121 and any factors that may prevent that compliance (local city or water district requirements, i.e.). Monthly meetings provide an opportunity for managers and stakeholders to discuss questions regarding the new irrigation practices and to request funding for water meters, smart irrigation control technologies, rezoning of irrigation, and water-efficient landscaping to bring facilities into compliance.

Andrew Marr describes DFCM's efforts as an ongoing progression of learning and implementation that is just beginning. "It's time to figure out our process and in the coming seasons our managers will know what to do," he says. "It's more about the buy-in, the common goal and common mission. It's hard to turn the ship around but (by) providing incentives and recognition...we're getting there."



# NEW EVALUATION TRIALS: NATIONAL TURF EVALUATION PROGRAM (NTEP)

## *Perennial ryegrass fair variety trial*

Evaluate 83 varieties of Perennial ryegrass maintained as a golf course fairway.

## *Cool-season grass water use trial*

Evaluate varieties of creeping bentgrass and fine fescue under low, medium, and high irrigation practices.

## *Zoysia grass hardiness trial*

Zoysia grass is a drought-tolerant, warm-season grass. This study will evaluate the cold hardiness of Zoysia grass.

The purpose of this study is to evaluate experimental varieties selected for cooler climates.

Sponsored by Texas A&M





# ONGOING EVALUATION TRIALS: NATIONAL TURFGRASS EVALUATION PROGRAM (NTEP)

## *Fine fescues*

One of the lesser-used turfgrasses in Utah is fine fescue. Fescues do best with lower amounts of fertilizer and are very well adapted to somewhat shady locations.

We are looking at creeping red fescue, chewings fescue, hard fescue, and sheep fescue. In the initial two years of the study, all are providing very good quality with somewhat lower amounts of irrigation. These are grasses that could fit many lawns and parks in Utah.



## *Creeping bentgrass*

Creeping bentgrass is the most commonly grown turfgrass on golf course putting greens. It can be mowed very low and survives very well.

In this photo, we are evaluating the fall color of 25 different varieties. Bentgrass changes from bright green in summer to various shades of green and sometimes purple in fall. The longer the varieties can keep growing late into the season and stay green keeps you the players happy on the golf course.



*"Will more fertilizer make my grass more drought tolerant?"*

Year two of evaluating drought stress with varying fertilizer amounts. Fertilizer amounts ranging from 1 to 6 lbs nitrogen/1000 sqft were applied throughout the growing season. (A typical home lawn is 2-4 lbs/1000 sqft). Plots were irrigated at half the typical amount (50% ET replacement).

Observations: Higher fertilizer treatments exhibited more leaf wilt under drought stress. Higher fertilizer amounts also recovered quicker once normal irrigation was returned.



## TURF TEAM



**Kelly Kopp**

Professor  
Extension Water  
Conservation /  
Turfgrass  
Specialist /  
CWEL Director



**Paul Johnson**

Professor  
Turfgrass  
Science



**Paul Harris**

Research  
Technician



**Paige Boyle**

Graduate  
Student  
PhD



**Abby Dixon-  
Lamborn**  
Graduate  
Student  
MS



**Alexis Koelling**

Graduate  
Student  
MS





# ORNAMENTAL & LANDSCAPE HORTICULTURE

- Water requirements of trees and perennial landscape plants
- Effects of short-term drought on landscapes
- Development and use of drought-tolerant and native landscape plants
- Tolerance to salinity in landscape plants
- Alternative sources of water for use in landscape irrigation



# RESEARCH PROJECTS

## Ornamental & Native Plants

### Drought Tolerance

- Climate Ready Landscape Plants
- Drought Tolerance of Hybrid buffaloberry
- Physiology and canopy temperature responses to drought of four Penstemon species
- Effects of water stress on morphology and growth of four newly developed landscape plants

### Salt Tolerance

- Screening four Utah native plants for salinity tolerance
- Salt tolerance of penstemons
- Salinity stress responses and adaptive mechanisms in pomegranate
- Salt tolerance of woody landscape plants

### Propagation

- Cutting propagation of *Cercocarpus montanus* 'Coy
- Propagation and production of Utah native plants
- Propagation and field trials of a Witches Broom selection of *Pinus edulis*

### Nodulation in Native Nitrogen Fixing Plants

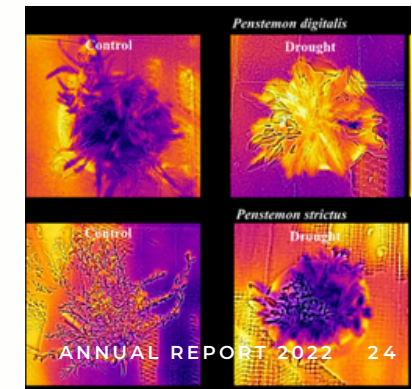
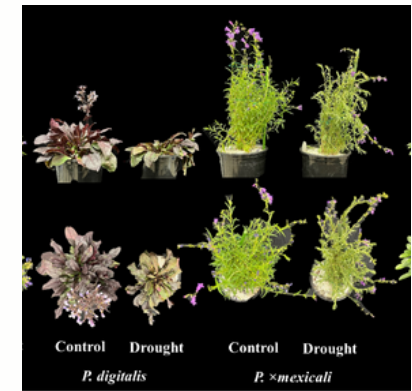
- Nodulation of *Ceanothus velutinus*
- Effects of nitrogen on the nodulation of *Ceanothus velutinus*

### Technology

- Quantifying evapotranspiration of new landscapes using landscape-scale drainage lysimeters

### Applied Collaborative Projects

- Growing grasses on marginal lands for bioenergy production
- Establishing Pinyon pine orchards for nut crop production on marginal lands
- Developing a maple syrup industry for the Interior West through extension and research





# HIGHLIGHTS

## *Climate Ready Landscape Plant Trial*

LOCATION:  
UAES Greenville Farm

OBJECTIVE: To compare water use of landscape plants and provide landscape irrigation guidelines for the Intermountain West.

### SUMMARY:

- Plant water requirements yet to be defined for most landscape plants
- 19 species were planted, 5 species died over the winter
- Each species was given a high, medium, and low irrigation treatment
- Relative plant growth index and visual quality evaluated
- 53 people were recruited to evaluate foliage, flower, and overall appearance. Attendees indicated Rosa 'Radbeauty' had the best visual quality
- In 2022, another plot was established with eleven species
  - these plants will receive deficit irrigation once established

STATUS: Plant growth, morphological, and physiological parameters of plants in the first plot has been recorded. A manuscript entitled “Effects of Deficit Irrigation on Growth and Aesthetic Qualities of Five Rose Species” is currently in preparation for HortTechnology. Plants in the second plot will be evaluated from May to October 2023.

This collaborative project includes a large team led by the University of California, Davis and includes Oregon State University, The University of Arizona, and the University of Washington. Funding is provided by the Specialty Crop Multi-State Program, administrated by USDA Agricultural Marketing Service (AMS).

Top : Rose cultivars entered in the Climate ready landscape plant trials.



Bottom: Graduate student J.J. Chen instructs attendees on visual evaluation





# NEW GRADUATE STUDENTS: FEATURED RESEARCH

## Enhancing Plant Response to Drought by Amending Native Soil with Peat Moss, Coconut Coir, Vermiculite, and Polyacrylamide

(field and greenhouse)

- GOAL: do amendments increase soil water holding capacity and do those amendments enhance plant survival during drought conditions
- Mixed 25% (by volume) soil amendments with the native soil and planted the plants. Polyacrylamide mixed in 30 ml with the native soil
- Two common woody landscape plants: field: *Syringa patula*, 'Miss Kim' and *Viburnum opulus* 'Nanum'
- greenhouse: *Pelargonium spp.* Geranium 'Calliope Hot Pink'
- Plants were subjected to reduced irrigation

## Understanding plant response to different amounts of irrigation and fertigation rates

(Summer 2022 field study)

- GOAL: determine how application of fertilizer at various rates will interact with plant growth at different irrigation rates, including drought-like conditions.
- 72 *Hibiscus syriacus* and *Hydrangea paniculata* planted in 4 and 7" holes in 2sf plots
- Two rates slow release fertilizer (high = recommended rate and low = 25% of recommended rate)

Three irrigation rates for 33 minutes

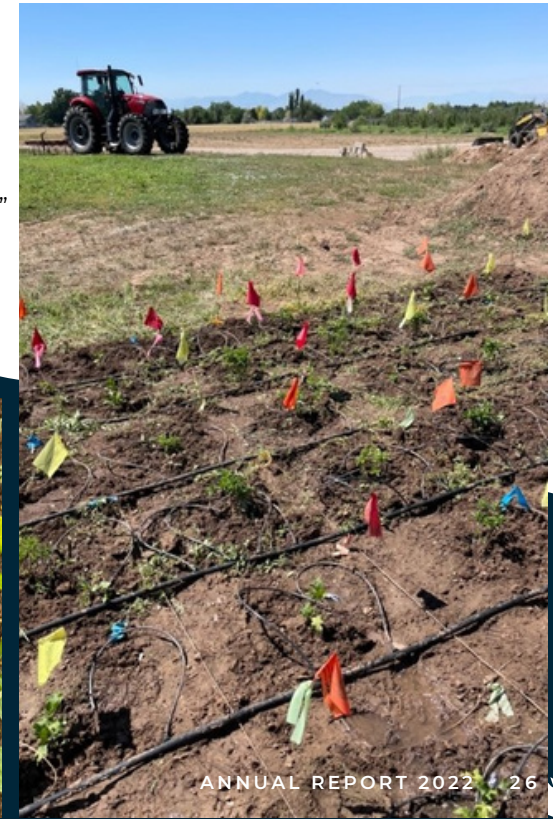
- high = 4x2 gph drip nozzle = 4.4 gallon/sq ft or 7.8"
- medium = 2x12.2 gph drip nozzle = 3.54"
- low = 1x2 gph drip nozzle = 1.1 gallon/sq ft or 1.77")



**Jenny Koller**

MS Plant Science

Committee Chair:  
Shital Poudyal






## Evaluating the water use efficiency of geranium and petunia under different light conditions

- Long-term goal: Determine optimum water requirements of the commonly grown landscape plants in Utah at various light intensity levels to prevent over-irrigation in a greenhouse
- Experimental design: completely randomized design with eight replications and four daily light integrals (DLI) treatments ( $\approx 10, 20, 30,$  and  $40 \text{ mol.m}^{-2}\text{.d}^{-1}$ )
- The DLIs are maintained with help of high-pressure sodium (HPS) lights and with different levels of shade cloth
- Soil moisture is maintained at 30 % volumetric water content using mass balance

## Fertilizer management for container nursery production


- GOAL: optimize fertilizer dose, reduce nutrient leaching, and remediate water-laden agrochemical runoff to increase production sustainability for producers and landscapers
- Optimize phosphorus fertilizer application in production of commonly grown groundcovers in Utah, i.e., *Lysimachia numularia* (Creeping Jenny) and *Vinca minor* (Periwinkle)
- Use various container substrates to reduce fertilizer leachate in production of *Lavandula angustifolia* (Lavender) and *Solidago canadensis* (Golden baby plant)
- Use wetland plants with ornamental value to reduce nitrate from agrochemical laden runoff water: *Geum macrophyllum* (Largeleaf avens), *Helianthus maximilliani* (Maximillian sunflower) and *Asclepias incarnata* (Marsh milkweed)



**Anju  
Chaudhary**

PhD Plant  
Science

Committee  
Chair:  
Shital Poudyal



**Saroj  
Burlakoti**

MS Plant  
Science

Committee  
Chair:  
Shital Poudyal



# ORNAMENTAL & LANDSCAPE HORTICULTURE TEAM



**Youping Sun**

Assistant  
Professor  
Landscape  
Horticulture



**Shital Poudyal**

Assistant  
Professor &  
Extension  
Ornamental  
Horticulture  
Specialist



**Michael Kilcrease**

Research  
Technician



**Asmita Paudel**

Graduate  
Student  
PhD



**JiJhong Chen**

Graduate  
Student  
PhD



**Jesse Mathews**

Graduate  
Student MS



**Jenny Koller**

Graduate  
Student MS



**Prakriti Nepal**

Graduate  
Student MS



**Saroj Burlakoti**

Graduate  
Student MS



**Anju Chaudhary**

Graduate  
Student PhD



**Macie Sanders**

Undergraduate  
researcher, PSC,  
CWEL





The Center for Water Efficient Landscaping's (CWEL) outreach and education programs provide expertise and information to statewide Utah State University (USU) Extension offices, the green industry, water purveyors/institutions, and the general public.

After two years of canceled in-person meetings, CWEL faculty member and Horticulture Extension Specialist Shital Poudyal helped staff the booth at the January 2022 UNLA Green Conference at the Mountain America Exposition Center in Sandy, UT.

# & OUTREACH EDUCATION







## WHAT WE DO

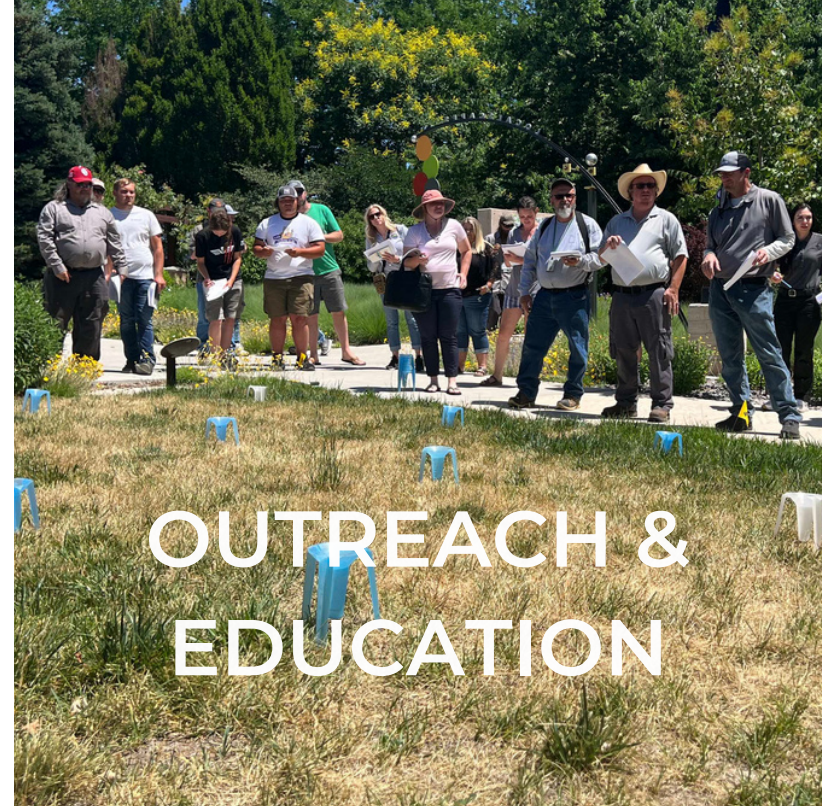
CWEL researchers and students use research findings to create programs and projects that inform, educate, and help change behavior around water conservation in the landscape.





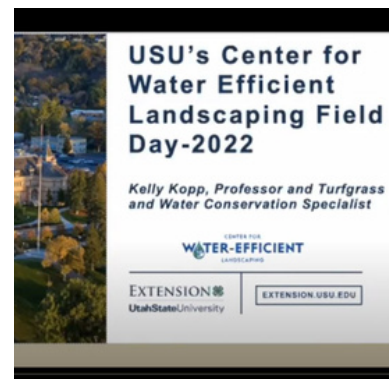
# OUTREACH PROGRAMS & PROJECTS

- NEW PROGRAM: Nursery and Landscape Water Recycling Training Program
- Qualified Water Efficient Landscaper (QWEL)
- NEW PROGRAM: Training Small Growers on Using Smart Irrigation Controllers
- NEW PROGRAM: Utah Growing Water Smart (see page 13)
- Utah Public Gardens
- USU Pest Advisories - Turf
- WaterMAPS™ (see page 12)
- Water Check
- Water Well With CWEL webinar series
- Water-Wise Landscape Demonstration Streets



# OUTREACH ACTIVITIES

- CWEL Field Day 2022 (every even year)
- Campaigns
- Conferences
- News articles
- Podcasts
- Public Events
- Social Media
- Turfgrass Integrated Pest Management Advisory
- Utah Public Gardens (UPG) Network
- Video
- Workshops





# NURSERY AND LANDSCAPE WATER RECYCLING TRAINING PROGRAM

## New Training Program

The project team is currently training and educating 75 individuals from Utah State University Extension, Utah Department of Natural Resources (Utah- DNR), United States Department of Agriculture - Natural Resources Conservation Service (USDA-NRCS), and leading nursery and landscape growers on incorporating a water recycling approach in the landscape and nursery industry.

Following two years of training, the trainees will provide outreach programs to educate, persuade, and promote the water recycling approach in the nursery and landscape industry.

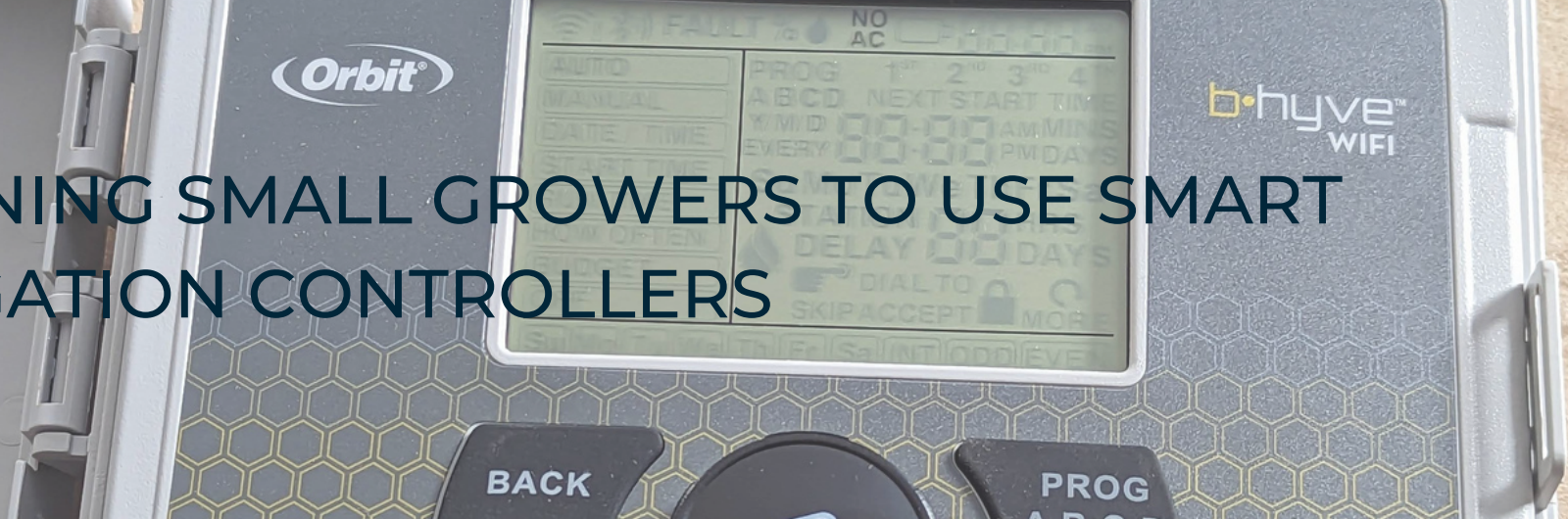
The goal of this project will be to reduce the amount of water used for irrigation in the landscape and nursery industry and indirectly reduce agrochemical pollution into the watershed.

This project will ultimately increase the sustainability of the nursery and landscape industry and will provide region-specific resources to implement a water recycling approach during the nursery production process.





# TRAINING SMALL GROWERS TO USE SMART IRRIGATION CONTROLLERS



## New Training Program

CWEL is partnering with more than 40 small nurseries and garden centers to educate them about the benefits of evapotranspiration-based smart irrigation controllers (SC). Nursery and garden center personnel will also be trained to install and maintain the SC with each partner enterprise provided with one SC.

Over two growing seasons, the team will document the efficiency, water savings, ease of use, and durability of the SC.

Upon completion of the project, CWEL will partner with USU county extension professionals in eight Utah counties to help organize a one-day training workshop with the goal of teaching and training specialty crop producers and county professionals on how to install a SC and eventually present the findings as evidence of water savings.





# WATER CHECK



- The Water Check program continued in 2022, helping homeowners and commercial and institutional property managers evaluate the efficiency of their irrigation systems and providing customized irrigation schedules. It was an extremely busy year as Utah's worked to save as much water as possible because of the extreme drought and our team worked to meet increased demand.
- In the Metropolitan Water District of Salt Lake City and Sandy service area, we completed the equivalent of 654 residential Water Checks (including HOA units) and 17 commercial/institutional Water Checks.

[extension.usu.edu/cwel/watercheck](https://extension.usu.edu/cwel/watercheck)

Free!



since  
1999

654

equivalent residential  
water checks in 2022



residential  
HOAs  
commercial  
municipal  
schools

offered in  
10+  
municipalities &  
counties





# WATER WELL WITH CWEL WEBINAR SERIES



## Top viewed videos of 2022

- Grafting Pinyon Pine  
CWEL Virtual Field Day  
June 2020  
Dr. Larry Rupp
- Creating Water-Wise Park Strips  
August 2019  
Cynthia Bee
- Subsurface Irrigation for Turfgrass Water  
Conservation  
June 2018  
Dr. Bernd Leinauer

2022 snapshot

4,571

total views

53 FACILITATED  
WEBINARS

SINCE JANUARY 2018

68

total likes

1700

TOTAL  
SUBSCRIBERS

31.2K

watch time minutes



April = most views

<https://extension.usu.edu/cwel/webinars>



# QUALIFIED WATER EFFICIENT LANDSCAPER TRAINING PROGRAM (QWEL)



<https://www.qwel.net/>



# PUBLICATIONS & PRESENTATIONS

2022

The Center for Water Efficient Landscaping's research and outreach materials are disseminated through a variety of formats.

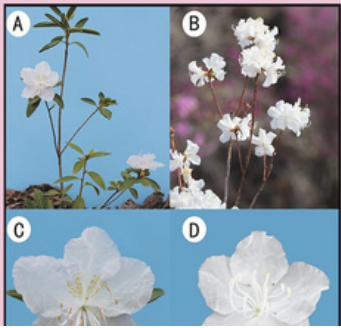
## UTAH GROWING WATER SMART The Water-Land Use Integration Guidebook

Ensuring a Prosperous Future and Healthy  
Watersheds Through the Integration of Water  
Resources and Land Use Planning

### Guidebook for Utah Growing Water Smart

Kopp, Kelly, Joanna Endter-Wada, Chelsea Benjamin, Lindsay Rogers, John Berggren, Faith Sternlieb, and Erin Rugland. 2022. Utah growing water smart: The water-land use integration guidebook. A joint program of Utah's Division of Water Resources, Western Resource Advocates, the Babbitt Center for Land and Water Policy, a Center of the Lincoln Institute of Land Policy, Utah State University's Center for Water Efficient Landscaping, and the Sonoran Institute with support from Del Corazon Consulting.





# WHAT WE DO

## Publications & Presentations

- Peer-reviewed journal articles
- Presentations at state, national, and international conferences
- Research bulletins
- Research reports, manuals, conference proceedings, and abstracts
- Extension Fact Sheets and articles
- Books
- Trade journals

### Water-wise Landscape Design



### Why Design?

Landscape within the built environment is either intentionally or unintentionally designed. Simply letting things happen—design—but one that often generates undesirable results. Following a landscape design process allows you to understand more multiple alternative designs relatively quickly. Making changes to a drawing can happen in minutes and with little effort, making a change after installation in your landscape is time-consuming and expensive. A landscape design acts as a framework within which you can add details, modify maintenance efforts, and make adjustments incrementally over time. And a good landscape design accounts for this evolution and embraces the landscape's inevitable growth. Finally!

## Selected Works

Joanna Endter-Wada  
[https://works.bepress.com/joanna\\_endterwada/](https://works.bepress.com/joanna_endterwada/)

Paul Johnson  
<https://works.bepress.com/paul-johnson/>

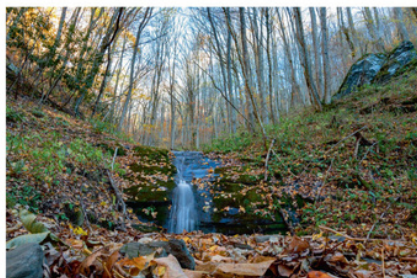
Kelly Kopp  
[https://works.bepress.com/kelly\\_kopp/](https://works.bepress.com/kelly_kopp/)

Youping Sun  
<https://works.bepress.com/youping-sun/>



**JAWRA**  
 JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION

OCTOBER 2022





## ACKNOWLEDGMENTS

- Utah Division of Water Resources
- Salt Lake City Department of Public Utilities
- USU Extension
- USU Quinney College of Natural Resources



**Center for Water-Efficient Landscaping**  
**UtahStateUniversity.**



**Extension**  
**UtahStateUniversity**



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