

Food Safety Concerns Drive Research

by Susanna Eden and Katharine Mitchell, WRRC Graduate Outreach Assistant

Fungicide in orange juice, Arsenic in apple juice, Listeria in cantaloupe--these are the latest "food safety issues you care about" listed at foodandwaterwatch.org. But how important are these issues? The public can see Food and Drug Administration reports on all three by going to the FDA website. An outbreak of Listeria associated with contaminated cantaloupe caused 30 deaths in 2011, and concern continued in 2012 with an additional death and recalls of potentially contaminated fruit. Washing the fruit before cutting it might have lowered the death toll. Responsibility for food safety lies with the consumer, who should be informed about the real risks of foodborne illness. But it also extends to a wide range of parties including farmers, producers, processors, and establishments that serve food. All of these people need reliable, science-based information to ensure the safety of our food supply.

Food safety is a continuing concern, with major recalls of food products and outbreaks of foodborne disease occurring with alarming regularity. Over the years, as distances from the farm to table have increased, concern has been growing. According to the Centers for Disease Control and Prevention, 48 million Americans are sickened by and 3,000 die of foodborne diseases annually. "Reducing foodborne illness by just 10 percent would keep 5 million Americans from getting sick each year."

Food contamination can originate from many sources at multiple locations, but one of the major sources is water. Food safety is affected by the quality of the water used in production and processing of food. When contaminants are present in the water used in food production and processing, they may cling to or be incorporated into food. In the United States, there have been

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Yuma produces 90 percent of leafy greens consumed in the United States in Winter. Source: Haley Paul, Arizona Cooperative Extension

Building Bridges, Wetlands, and Water Sustainability: Lessons from an Arizona-Baja California Sur Partnership

by Jamie McEvoy, Graduate Student, UA School of Geography and Development, and Plácido dos Santos, WRRC Analyst

There is a lot of buzz about working with stakeholders to improve water sustainability. But what does this look like in practice? A recent four-day educational exchange between water managers and urban planners from Arizona and La Paz, Mexico provides an excellent example. Seven dignitaries from the capital of Baja California Sur spent four days touring water facilities and interacting with practitioners and researchers in Phoenix and Tucson. Notably, the group included the Director of the Municipal Water and Wastewater Utility, the Director of Urban Development and

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Ecology, Chairman of the state's watershed advisory board, two city councilmen, and two representatives from key non-governmental organizations, The goal was to discuss common challenges, exchange information and examine a range of water management options that might be applied to achieve water sustainability in their desert city.

La Paz, Phoenix and Tucson share similar challenges, including low annual rainfall, rapid urbanization, and concerns about groundwater overdraft. Aware of these similarities, the San Diego-based International Community Foundation supported the engagement and contacted Plácido dos Santos at the UA Water Resources Research Center for advice and assistance to implement the program. To optimize opportunities for the La Paz group, the WRRC-hosted tour was timed to coincide with a meeting of the InterAmerican Development Bank and 17 Latin American and Caribbean nations at ASU.

In the last four decades, Arizona has made significant financial investments in water infrastructure (e.g., the Central Arizona Project) and created new legislation (e.g., the Arizona Groundwater Management Act)

to promote the delivery of renewable water supplies and reduce the reliance on groundwater in critical areas. Decision-makers in the municipality of La Paz are currently considering options for interbasin water transfers, sea water desalination, wastewater reuse, and transferring water rights from agricultural to urban users as ways to address water shortages and overexploitation of groundwater resources. While there are many similarities, there are also important differences in the institutional structures that shape

water management in the two regions.

This four-day exchange resulted in an increased technical understanding of various infrastructure projects, as well as an increased appreciation for the long-term vision and commitment to water sustainability that is exemplified by these projects and the water experts who manage them. At the conclusion of the visit, the La Paz representatives said they intend to pursue concepts that were not previously considered. Artificial recharge and reuse of reclaimed water, the incorporation of constructed wetlands and the use of native vegetation in multipurpose facilities are now prominent

concepts for La Paz's water resources planning. The engagement of our visitors and all the host organizations in Arizona made for a rich binational dialogue. 🏡



Members of the Arizona-Baja California Sur Patnership workshop and tour pause for a photo on day four. Source: John Polle, WRRC

Water Patnership Tours Sights

ASU Decision Theater: The four-day event began with a visit to Arizona State University's Decision Theater where participants saw how interdisciplinary knowledge can be brought together to better inform decision-making.

Indian Bend Wash: Scott Strosnider, senior stormwater engineer with City of Scottsdale, described how visionary leadership in the 1970s led to the creation of a greenbelt that not only provides flood protection, but also creates municipal amenities in the heart of the city.

City of Phoenix Water Services Department: Carlos Padilla, assistant water services director and his staff gave useful technical presentations on the control of system water losses, aquifer storage and recovery (ASR) and the use of reclaimed water for environmental restoration. The tour include a visit to the Tres Ríos Project, a wetlands system at the City of Phoenix's 91st Avenue wastewater treatment plant that improves the quality of reclaimed water. Our group was greeted by a chorus of avian life including ducks, cormorants, pelicans, great blue herons, egrets, osprey

and a bald eagle.

Water Resources Research Center (WRRC) and Institute of the Environment (IE): Plácido dos Santos, a WRRC Analyst, provided an overview of Arizona's statewide water management and discussed parallels and differences with Mexico. Dr. Marvin Glotfelty of Clear Creek Associates, described hydrogeological considerations for aquifer recharge and the control of sea water intrusion. UA Professor Jim Buizer emphasized the need to plan for climate change and the value of linking researchers and stakeholders in the co-production of usable science for improved environmental management. As an advisor for the new president of Mexico, Dr. Buizer was able to provide the group with some insight into likely future initiatives by his incoming administration.

Tucson Water and Sweetwater Wetlands: Tucson Water's Director, Alan Forrest and his staff highlighted the importance of long-term financial planning for public utilities. On a tour of the Sweetwater Wetlands, our group observed wildlife wonders, including three Harris Hawks hunting as a pack, underscoring the value of multipurpose infrastructure projects

that provide water supply benefits, water quality functions, environmental services and educational opportunities for children and the public at large.

Rillito Swan Restoration Site and Linear Parks System: Evan Canfield, Chief Hydrologist with Pima County Flood Control District, and Carianne Funicelli-Campbell of Recon, Inc. explained how vegetation restoration was integrated with a bank stabilization project. The resulting project reduces the velocity of storm flows, restores a desert ecosystem and beautifies this stretch of the Rillito River system. B.J. Cordova, program director of Tucson Clean and Beautiful, discussed the key role that citizen groups play in Tucson-Pima County linear park system development.

Kino Environmental Restoration Project (KERP): A visit to the KERP showcased how best practices for storm water management have evolved. The facility manager, John Madril, explained that half of their annual water demands to irrigate the numerous baseball and soccer fields at the Kino Sports Complex are met with captured storm water runoff and the rest is met using reclaimed water.

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numerous water quality-related foodborne disease outbreaks reported over the years. Outbreaks in the early 1990s of salmonella, a common food contaminant, were traced to the water used in a tomato packing facility. In 2006 an outbreak of *Escherichia coli* O157:H7 linked to bagged fresh spinach affected at least 200 people in 26 U.S. states. Officials at the Centers for Disease Control (CDC) found two potential sources of contamination for the spinach. The first was contaminated irrigation water, and the second, wildlife, possibly deer or feral pigs.

Fresh fruits and vegetables are most vulnerable to water-related contamination. Leafy greens are especially vulnerable because of the large surface area and growth form that provide plenty of sites for pathogens to grow. In addition they tend to be eaten raw. Nearly 90 percent of leafy greens consumed in the U.S. in winter are produced by Yuma growers and processed in Yuma facilities.

In the United States, food safety policies, which include standards, monitoring and enforcement of farming practices, handling, and packaging—"farm to fork", have improved food safety considerably. But new strains of pathogens and changes in production environments mean that food safety challenges will continue to arise.

Farm food safety guidance is provided by the FDA and by industry standards. The FDA is in the process of revising its rules as a result of the Food Safety Modernization Act. Meanwhile the industry relies on guidance issued in 1998 and updated several times, most recently in 2009. In general, guidelines for water state that it should be of appropriate quality for the use, it should comply with state and local regulation, and steps should be taken to assure that the water meets appropriate quality criteria. On the other hand the guidelines also state that all animals, including reptiles and insects, can be vectors for pathogens to contaminate produce. They recommend reducing vegetation and standing water near fields. Large produce buyers have insisted on compliance with this guidance in order to protect the reputation of their brands. In strict compliance with food safety guidance, farmers are removing features put in place to protect water quality, such as tailwater recovery ponds, grass-lined waterways, and filter strips, which can be considered attractive to wildlife. This means efforts to exclude disease organisms from farms conflict with traditionally accepted methods for protecting surface water quality from fertilizers and pesticides used in food production.

This seeming conflict underscores the need for research, which among other benefits could resolve the competing needs of water quality protection and food safety. One effort in California to develop research priorities gave top honors to investigating the fate of pathogens potentially present on farms. Other priorities included characterizing the influence of specific farm management practices on food safety and improving our understanding of vector processes.


Food safety research priorities such as these have stimulated research funding across the country, and have increased emphasis in extension, education, and outreach efforts aimed at informing consumers and producers alike. In 2010, The USDA's Agriculture and Food Research Initiative (AFRI) Challenge Area Funding Program focused on food safety research, dedicating \$100 million over the next 5 years. Providing research on the AFRI research priorities was the impetus for a series of conferences held in Arizona by the University of Arizona Food Safety Consortium to inform researchers on the issues and develop project ideas.

Thanks to funding provided by Water, Environmental, and Energy Solutions, the Third Annual Food Safety Consortium

Conference was hosted by the University of Arizona on October 12, 2012. With 108 people in attendance, the conference program offered a wide range of expertise and views on current issues of food safety. Speakers represented a range of food industry professionals who shared with researchers the challenges and constraints they face on a day to day basis. With this information, researchers at the University of Arizona are able to design research projects that meet the needs of the food industry.

Dr. Jeanette Thurston, the National Program Leader for Food Safety at the National Institute of Food and Agriculture (NIFA), spoke at the workshop. Dr. Thurston provides national leadership on food safety issues and leads USDA grant programs focused on food safety. She stated that people at risk for food borne disease "are being given information that may not be science-based, but based on public or cultural perceptions." The need for top quality research and extension of that research to the appropriate audiences is vitally important.

As a follow-up to the conference, members of the University of Arizona's Food Safety Consortium are undertaking a two-day trip to Yuma in December to tour fields and harvesting operations as well as cooling and processing facilities. Debbie Reed, from the Food Safety Consortium reports, "Attendees will meet with the Yuma Food Safety Council, growers and food safety professionals. The follow-up tour will strengthen relationships forged at the Food Safety Conference, educate researchers about the intricacies and problems involved in water distribution and the irrigation needs of growers to sustain and manage crops, while also increasing the understanding of Food Safety Consortium research among stakeholders." Close interaction between the researchers and the growers will ensure that future research is focused in areas of greatest concern.

Research priorities that emerged from the conference included technical challenges, but also challenges in understanding human behavior. For example, along with recognition of the need for methods to detect contamination, conference speakers noted that research in the social and behavioral sciences were not receiving funding. There is a need for the social and behavioral sciences to work together on issues of cultural and public perceptions. Dr. Thurston urged, "People's behavior is the biggest uncertainty, and is a complex area to study. Educating consumers is a huge need, and obtaining the science-based information so that our consumers can make the best choices for safe food for their families is very important." 



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NEWS BRIEFS



New Film on Colorado River Screened, Discussed

On September 19, 2012, the Tucson premiere of *WATERSHED*, the latest movie release from The Redford Center, was held at the Loft Cinema. The Water Resources Research Center (WRRC), in partnership with the Sonoran Institute and Tucson Audubon, hosted the premiere. Panelists were on hand following the screening to discuss the film and its message.

WATERSHED tells the story of the Colorado River with firsthand perspectives from people who live and work along the River. It provides a compelling view of multiple stressors that affect the vitality of the River and prevent it from reaching its mouth at the Gulf of California. A special plea is made for renewing the River's delta, where lack of water has destroyed a once thriving ecosystem.

The screening of *WATERSHED* was followed by a question and answer session and lively panel discussion, moderated by Nina Trasoff, a former City of Tucson Council Member. The panel discussion afforded the opportunity for the panelists to share their work – in Tucson, southern Arizona, and across the border into Mexico – and how it benefits the Colorado River. Osvel Hinojosa-Huerta, Director of the Water and Wetlands Program for Pronatura Noroeste, A.C. and Francisco Zamora Arroyo, Director of the Sonoran Institute's Colorado Delta Legacy Program, talked particularly about efforts to reinvigorate environmental assets in Mexico and the delta region.



Panelists Sharon Megdal and Francisco Zamora discuss Colorado River issues at the *WATERSHED* screening. Source: Sonoran Institute

The film's Director, Mark Decena, from Kontent Films, was on hand to answer questions about the making of the film and to take part in discussions. The WRRC's Director, Sharon Megdal, and Luther Propst, Executive Director of the Sonoran Institute, offered perspectives on challenges posed in the film and potential solutions, highlighting actions that Arizonans can take to help improve the Delta region and other natural environments.

Navajo-Gallup Water Supply Project Design/Construction Startup Funded

Sections of the Navajo Nation, Jicarilla Apache Nation, and the city of Gallup, New Mexico have been rapidly depleting groundwater supplies, which are of poor quality and inadequate

to meet current and future demands. In September, a \$43 million financial assistance agreement for design and construction of a portion of the historic Navajo-Gallup Water Supply Project was signed by Secretary of the Interior Ken Salazar and Navajo Nation President Ben Shelly with the hopes of providing a long-term, sustainable water supply. This project will have the capacity to deliver clean running water to a potential future population of approximately 250,000.

The water will be diverted from the San Juan River and travel through 280 miles of pipeline, several pumping stations, and two water treatment plants. Navajo President Ben Shelly said "We are going to bring safe drinking water to thousands of Navajo families. We are also going to create more than 600 jobs for our people." Construction started in June and water is expected to start flowing in two to three years for the reaches in this agreement. This project is designated as one of 14 high-priority infrastructure projects around the country identified by the Obama Administration that will be expedited through the permitting and environmental review process in an effort to improve the efficiency of federal reviews and more quickly move projects from the drawing board to completion.

Agreement with Mexico Reached on Colorado River Water

Mexican government leaders have been meeting with U.S. officials to develop a pact that adds areas in Mexico to the Colorado River water sharing agreements. This addendum to the 1944 U.S.-Mexico water treaty would link Mexican and U.S. water allocation from the Colorado River during surplus and drought. If approved by water agencies and the seven Western U.S. states that receive Colorado River water, then Mexico would adjust its delivery schedule during low reservoir conditions and have access to additional water if there are high reservoir conditions. The pact also has a commitment to work together on a pilot program involving water for the environment.

SRP - GRIC Partnership to Restore River

The Gila River Indian Community's long-held dream of restoring portions of the Gila River may soon become a reality. The Community's nearly 80-year-long struggle to restore its water rights finally ended in 2004 with passage of the Arizona Water Settlements Act. Under that legislation the Community is entitled to up to 311,800 acre-feet of Central Arizona Project water per year, making it the largest single customer of CAP water in Arizona.

The CAP water is key to restoring the Community's self-sufficient agricultural economy but the Community's irrigation infrastructure will not be fully built out until 2029, and in the interim, it is not physically able to use its full CAP entitlement. However, this water could be used to restore wetlands and the riparian habitat that is so important to the culture of Akimel O'otham and Pee Posh.

The Community turned to SRP for its expertise in riparian recharge and water storage. That expertise will help the Community

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STUDENT SPOTLIGHT



Jenna Cleveland is a Masters student in the Planning at the University of Arizona. As an undergraduate, she attended Roanoke College in Virginia on a full-ride scholarship. Jenna graduated as Roanoke College's valedictorian in 2005, earning both a BS in History and a BS in Religion. After graduating she moved to Istanbul, Turkey, where she taught English as a Second Language for two and a half

years. When she moved to Tucson, Jenna took a course on water sustainability at the University of Arizona that opened her eyes to the world of water.

In pursuit of this new interest, Jenna applied for a summer position with the WRRC in 2011 to help organize a water harvesting roundtable. This effort was a response to the growing number of questions WRRC staff were fielding regarding water harvesting. The roundtable brought together practitioners, interested community members, and academics to discuss the state of water harvesting in the Tucson region. Another aim of the roundtable was to open communication channels between the various groups involved with water harvesting. To further this goal, the WRRC established the Rainwater/Stormwater Professionals Network (RSPN) and holds semi-annual meetings of the group. Jenna also communicates with the network via email to pass along updates and interesting news.

A second result of the roundtable was the decision by the WRRC to apply for a Bureau of Reclamation WaterSMART Grant

to develop a decision-support guide for water utilities considering implementing water harvesting. The grant application was successful, and Jenna was asked to work as a graduate research assistant on the two-year project, entitled "Utility Guide to Rainwater/Stormwater Harvesting as an Adaptive Response to Climate Change." As a member of the project team, Jenna has the chance to work closely with an environmental consultant who helped develop the City of Tucson's Commercial Water Harvesting Ordinance as well as the members of the diverse Technical Advisory Committee. She has also had plenty of opportunities to practice her presentation skills! Her poster on the WaterSMART project garnered second place in the Graduate Student Showcase, Architecture, Planning and Landscape Architecture division.

Working on the WaterSMART grant has afforded Jenna several other exciting opportunities. She is a member of the Pima County Regional Flood Control District's (PCRFCD) Low Impact Development Working Group. This group meets monthly to provide guidance on development of a neighborhood-scale water harvesting manual and case studies catalog. In addition, Jenna worked with the Pima Association of Government's Sustainable Environment Program this past summer to help create a "report card" of water harvesting, green infrastructure, and low impact development efforts in the region.

In her own coursework, Jenna is interested in the intersection between water and urban planning. She sees a strong role for planners in the design and implementation of water harvesting practices in the urban environment, especially since one of the strongest arguments for water harvesting is the wide-spread community benefits it can afford. Appreciating these benefits requires an interdisciplinary approach that planners are well-equipped to pursue. 🏡



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recreate a part of the Gila River, while at the same time creating long-term storage credits that it can use and sell, if appropriate, to help finance future riparian recharge activities.

"The Community's motto is 'where water flows, life grows'" said Gregory Mendoza, the Community's Governor. "For the Akimel O'otham, which means the 'River People,' the Salt and Gila Rivers were part of our identity, so when the river was diverted, we were not only harmed economically, but culturally and religiously as well." Governor Mendoza believes that this partnership with SRP marks a new chapter in Arizona's water history. "We used to be on the opposite sides of the table when it came to water, but now we are partners," said Governor Mendoza.

This sentiment is echoed by SRP. John Sullivan, SRP's Chief Resources Executive, noted that the process of working with the Community on the Arizona Water Settlement led to understanding of the importance they place on restoring the Gila River. "The partnership not only will help the Community achieve its objectives, it will make available vital water supplies for growing Valley communities and for SRP water users during periods of severe drought" he said.

The agreement with SRP provides needed expertise in exchange for access to a portion of the Community's water supply for certain projects and in short supply years.

General Electric Survey Gauges Public Attitudes on Water and Water Reuse

A study conducted by General Electric in October revealed growing support for water reuse among Americans because people believe that it could help the U.S. be economically competitive and protect the environment. The survey of 3,000 consumers in the U.S., China, and Singapore found that 83 percent of those polled are concerned about the availability of water and 66 percent of Americans have positive attitudes toward water reuse. More than 80 percent of Americans strongly support using recycled water for non-drinking uses including agricultural irrigation, power generation, landscaping, industrial processing and manufacturing, and toilet flushing. In addition, 84 percent of Americans believe that water resources should be a national priority and 44 percent would be willing to pay more to ensure that future generation are less vulnerable to water shortages. 🏡

ANNOUNCEMENTS



Maricopa County Master Watershed Steward Program Wins Valley Forward President's Award

On Saturday evening, September 29th, the Valley Forward Association awarded the Maricopa County Master Watershed Steward Program top honor—the President's Award—during its 32nd Annual Environmental Awards Gala at the Westin Kierland Resort in Scottsdale. Awards were made in many categories, recognizing achievements in buildings and programs that express the values of sustainable development. The Maricopa County MWS program also earned the first-place Crescordia Award in the Environmental Stewardship category.

The MWS course educates participants about their local watersheds using classroom instruction and field training. The 10-week course uses the Arizona Watershed Stewardship Guide, which provides information on watersheds and related issues. Graduates receive Master Watershed Steward certification after completing the course and performing 40 hours of volunteer activities relating to what they have learned. Volunteers in Maricopa County contributed more than 1800 hours of service on projects including education, restoration, and monitoring.

Summer Waters, is the Water Resources Extension Agent who runs the Phoenix MWS program. "It was a great honor to receive this level of recognition for the MWS program here in Maricopa County. This has been one of my favorite programs to work with over the years. The stewards themselves have greatly contributed to the awareness of water resources and the environment in the Phoenix area, so I think this award is very appropriate."

University of Arizona Green Fund Seeks Proposals

The University of Arizona's campus sustainability initiatives include one component, the Green Fund, which provides support for projects that contribute "to making the university an environmentally sustainable institution". The two year old fund was created by a fee included among the tuition and fees paid by students each year. The Green Fund Committee, consisting of ten students, holds a series of meeting each year to review UA student and employee proposals. Their task is to allocate the approximately \$400,000 in the fund to campus sustainability projects.

The UA Green Fund Committee is seeking proposals for projects of all sizes from University of Arizona students and employees. For this annual cycle, a brief but succinct pre-proposal should be submitted by November 26, 2012, and final proposals are due January 28, 2013. Mini-grant proposals of up to \$1,500 can be submitted at any time. The Committee considers mini-grant proposals through April 2013.

Joe Abraham, Director of the UA Office of Sustainability, commented "In just a couple of years the UA Green Fund has been surprisingly successful at engaging students and employees across the university in making the UA a more environmentally sustainable place to study, work, and play."

Funded projects include sustainability initiatives of many


kinds and sizes, from individual buildings to campus wide efforts, and include research efforts at the University's facilities such as Biosphere 2 in Oracle. Aware that the University is located in an arid environment, the Green Fund Committee has allocated funds to several water-related projects, such as initiatives in water harvesting, green infrastructure, and reduction in campus water consumption.

Water Related Research Takes Top Prizes at the 2012 "Grad Blitz"

Each year, the Institute of the Environment holds an environment-related research event on campus offering opportunities for collaboration across departments, and for students to present their research findings to other students, faculty, and university administrators. This year the list of students who presented research on a wide range of topics included over fifteen students engaged in water-related research. Participants presented their research in one of two ways: a poster presentation or a five-minute talk, including no more than three slides. The event took place on November 8th at the Tucson Marriott University Park. Students who presented water-related research were well represented in both the poster session and rapid-fire talks.

Stefan Walston won first prize and Best Science and Society Linkage prize for his talk titled, "Does Increasing Solids Retention Time in the Wastewater Treatment Process Affect the Persistence of Antibiotic Resistant Genes?". Zulia Mayari Sanchez Mejia won first prize for her poster presenting research on the role of soil moisture and vegetation in semi-arid ecosystems. Other prizes taken by water-related work included the Audience Choice Poster and the Best Interdisciplinary Talk. Natalie Brassill's winning poster presented her research on the assessment of *Escherichia coli* as an indicator of microbial quality of irrigation waters used for produce. Her methods included the installation of twelve underwater cameras, equipped with infrared light to record both day and night activity. America Lutz Ley's interdisciplinary talk on the social distribution of water in the Sonora River Basin detailed her investigation of water users in arid northwest Mexico. The highly unequal distribution found has important implications for water policy in the region, as well as for environmental and social justice issues due to severe water shortages.

EPA Launches How's My Waterway App

EPA recently launched a new app and website to help people find information on the condition of thousands of lakes, rivers and streams across the United States from their smart phone, tablet or desktop computer. Available at <http://www.epa.gov/mywaterway>, the How's My Waterway app and website uses mobile device location or a user-entered zip code or city name to provide information about the quality of local water bodies. This app was released on the 40th anniversary of the Clean Water Act, which Congress enacted on October 18, 1972, giving citizens a special role in caring for the nation's water resources. Forty years later, EPA is providing citizens with a technology-based tool to expand that stewardship. 



7:30- 8:30	Registration & Breakfast
8:30- 8:45	Welcome Sharn B. Megdal , Director, Water Resrouces Research Center (WRRC), University of Arizona (UA) John Hoffmann , Director, Arizona Water Science Center, United States Geological Survey (USGS) Shane Burgess , Dean, College of Agriculture and Life Sciences , UA
8:45- 9:15	Session 1 Opeing Keynote- What is Water Security? Anthony Cox , Head of Economy and Environment Integration Division, Organization for Economic Co-operation and Development (OECD)
9:15- 10:15	Session 2- From the Ground Up- How secure are we? Moderator- Leslie Katz , Hydroecologist, Principal, Montgomery & Associates William Alley , Director, Science and Technology, National Groundwater Associates Peter Mock , President and Principal Scientist, Peter Mock Groundwater Consulting, Inc. James Leenhouts , Associate Director and Investigation Section Chief, Arizona Water Science Center, USGS
10:15- 10:30	Break
10:30- 11:00	Session 3 Climate and Water Security, Colorado River Scenarios Carly Jerla , Program Manager for the Colorado River Basin Water Supply and Demand Study, United States Bureau of Reclamation, Lower Colorado Region
11:00-12:00	Session 4 Water Security Challenges- What keeps you up at night? Moderator- Dave Roberts , Senior Director, Water Resource Management, Salt River Project Brain Betcher , General Manager, Maricopa Stanfield Irrigation District Linda Stitzer , Senior Advisor, Western Resource Advocates Alan Forrest , Director, Tucson Water
12:15- 1:45	Lunch & Poster Session Speaker Panel- A Look to Our Water Future Moderator- Jean E. McLain , Associate Director, WRRC
1:45- 3:00	Session 5 Water Security Policies Moderator - Robert Varady , Deputy Director and Research Professor of Environmental Policy, Udall Center for Studies in Public Policy Kathleen Ferris , Executive Director, Arizona Municipal Water Users Association Rodney Smith , President, Stratecon, Inc. Elma Montaña , Researcher, Human, Social and Environmental Sciences Institute, National Scientific and Technical Research Council, Professor, National University of Cuyo, Argentina
3:00- 3:30	Session 6 Native American Perspectives Katosha Nakai , Tribal Affairs & Policy Development Manager, Central Arizona Project (CAP)
3:40- 3:45	Break
3:45- 5:00	Session 7 Solutions to Water Security - Are we on the right track? Q&A Moderator - Sharon B. Megdal , Director, WRRC, UA Sandra Fabritz-Whitney , Director, Arizona Department of Water Resources Dennis Rule , Manager, Central Arizona Groundwater Replenishment District, CAP Rita Maguire , Attorney, Maguire & Pearce, PLCC
5:00	Closing Comments

Gray Water as a Resource in Arizona: Prospects and Challenges

by Chuck Graf, Arizona Department of Environmental Quality

Reusing bath and washing machine water outdoors on plants has become a popular way to save water since California droughts introduced the concept of “showers for flowers”. In 2001, when the Arizona Department of Environmental Quality transformed its gray water rules, such household gray water use was the focus of its effort. Until then, householders desiring to use gray water to irrigate turf and plants had to pay a fee and obtain a written permit from ADEQ. By 2001, after more than a decade of using that “hard-permitting” approach, ADEQ had issued only two such permits.

Yet, an extensive 1999 survey of the greater Tucson area by the Water Conservation Alliance of Southern Arizona, or WaterCASA, and the WRRC found 13 percent of the residences surveyed made some use of gray water. More than half of those systems simply conveyed gray water by hose or pipe from a clothes washer to landscape plants. Still, the results of the survey, when extrapolated to the entire state, meant that about 200,000-300,000 home gray water systems in Arizona were operating without benefit of permit—in other words, illegally.

ADEQ adopted a new approach in 2001, allowing a householder to operate a gray water system if a dozen common-sense best management practices are followed. No registration or application is required. As long as the householder follows the best management practices, the gray water system is considered to comply with a general permit that is written in rule.

Under this new “soft-permitting” approach, ADEQ relies on education and outreach rather than burdensome application requirements and resource-draining permit-writing and enforcement activities. Following Arizona’s lead, other states have since adopted similar approaches to gray water regulation.

ADEQ also developed in 2001 a general permit for larger-scale, non-household use of gray water, but there was little interest at the time. In recent years, interest has grown. Eight large-scale systems have been permitted. The systems range in complexity from a simple shallow, gravel-filled trench at an educational center, used to supply water for landscape irrigation, to a sophisticated 225,000 gallon per day system at a prison that stores, treats, and recycles water from showers for toilet flushing.

Governor Brewer’s Blue Ribbon Panel on Water Sustainability in 2010 highlighted gray water reuse as one component in achieving water sustainability. This prompts the question, how big

a role can gray water play?

The City of Tucson has compiled detailed data on water distribution and use that can be used to calculate the amount of gray water potentially available from single-family residences. Tucson estimated the percentages of delivered water used outside, for toilets, washing machines, faucets, showers, leaks, and other. Per capita usage of potable water at these residences in 2011 was 95 gallons per day.

By law, gray water is defined in Arizona as “wastewater that has been collected separately from a sewage flow and that originates from a clothes washer or a bathroom tub, shower or sink but that does not include wastewater from a kitchen sink, dishwasher or toilet.” Wastewater from kitchen sinks, dishwashers, and toilets is excluded because of potential health risks associated with the number of bacteria in the water from those sources.

Assuming that one-half of the faucet water is from the kitchen sink, and therefore not gray water, Tucson’s data indicate that gray water could account for 27 percent of total water usage. For a family of four, more than 100 gallons of potential gray water is generated per day. If this volume is substituted for part of the water used outdoors, household water usage would drop by 21 gallons per capita per day—a significant savings.

Tucson also compiled data for multi-family residential use. These data indicate that about 30 percent of the supplied water is

available for use as gray water if appropriate plumbing is in place. For non-residential sites, the volume of available gray water is harder to estimate. However, potential opportunities for larger-scale systems include hotels, office buildings and other workplaces, schools, prisons, car dealerships, car washes, and campgrounds.

While it is clear that a household can realize water savings from gray water reuse, this is not likely to translate into significant water conservation gains in existing residential neighborhoods. There, the difficulty and high cost of retrofitting are likely to create too large an obstacle to extensive gray water use. Appreciable water conservation gains might be achieved in new subdivisions plumbed to separately collect gray water.

On the other hand, more extensive use of gray water may have negative consequences due to reduced sewer flows. The Pima County Regional Wastewater Reclamation Department identified possible impacts that include more sewer line blockages, increased odors, and decreased asset life due to corrosion. Increased operations and maintenance costs, and eventually, capital spending for replacement can be expected. Also, since reduced flows would be most pronounced in the upstream ends of the collection system, sewer lines in these areas will need steeper slopes, which would



This landscape on the Arizona State University campus is watered by a permitted gray water system. Source: Chuck Graf

SPECIAL FEATURES



WRRC Hosts Scientists from the Royal Scientific Society of Jordan for Gray Water Workshop

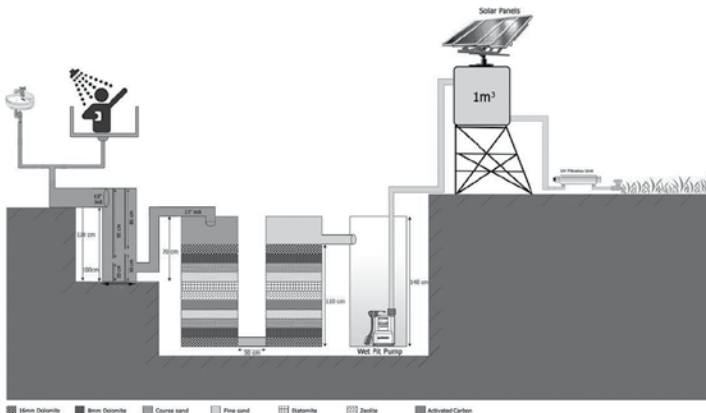
by Jean McLain, WRRC

In early October, the WRRC hosted a 4-day workshop that grew from a project located in Jordan, on which WRRC Director Dr. Sharon Megdal serves as USA expert. Jordan is located in an arid to semiarid region and is one of the most water scarce countries in the world. The gray water system being developed with the input of Jordanian and U.S. scientists will contribute to a less expensive and more sustainable water supply in low income, rural agricultural areas of Jordan.



Rooftop tank and solar array for distribution of filtered gray water to plantings. Source: Sharon Megdal, WRRC

The Jordan project involves the design and installation of an innovative filtration system for household gray water use. Due to the success of the pilot gray water project, the International Arid Lands Consortium funded the assembly of a scientific team at the WRRC to prepare proposals to fund the next phases of the work in Jordan. The new work will characterize the physical, chemical, and biological parameters of the collected gray water and test local Jordanian materials for removal of a range of gray water contaminants. It will also increase public awareness in rural



Schematic Diagram shows components of innovative filtration system for gray water use. Source: Ayoup Ghrair



The proposal writing team. Left to right: Drs. Othman Almashaqbeh, Sharon Megdal, Ayoup Ghrair (on video screen), Chuck Graf, Jean McLain, Channah Rock.

areas of that country of gray water treatment and reuse.

The workshop began with a half-day “Gray Water Information Exchange” between local water professionals, University of Arizona researchers, and Jordanian scientists. Workshop attendees learned of gray water use in the Tucson region from Val Little of the Water Conservation Alliance of Southern Arizona. Chuck Graf, from the Arizona Department of Environmental Quality, spoke about the regulation of gray water use in Arizona, and several University of Arizona researchers spoke on ongoing water quality research. Dr. Othman Almashaqbeh and Dr. Ayoup Ghrair (Royal Scientific Society of Jordan) described the first phase of the Jordanian gray water project and provided information on gray water treatment and use in the Jordan Valley.

Following the half-day information exchange, the proposal writing team worked intensively for the remainder of the workshop to define the research activities for the next phase of the project. Following each day of intensive writing, the team visited local water sustainability “success stories”, including the Sweetwater Wetlands and the UA Controlled Environment Agricultural Center.

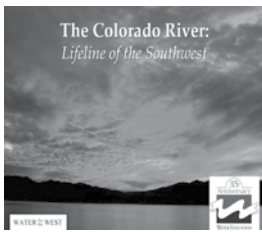


Prototype of the gray water filtration system demonstrates real world application in Jordan. Source: Sharon Megdal, WRRC





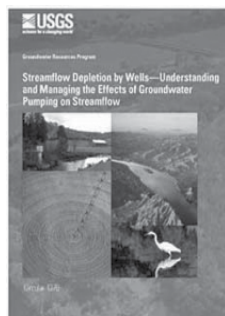
“The Colorado River: Lifeline of the Southwest” Online Slideshow



The Colorado River provides water to 25 million people in seven states and irrigation water to over 3 million acres of farmland. The online slideshow traces the river from its headwaters as it passes through the seven Basin states to the Gulf of Mexico. The slideshow conveys graphically the scale of the river and its

tributaries, as well as its connections and expansive impact on the people who depend on it. Although the presentation includes over one hundred slides, the use of colorful graphics and limited text on each slide will keep viewers watching. Highlighted in the title, and emphasized throughout the slides, is the importance of the river and its resources to the longevity of the communities depending upon it. Whether learning about the Colorado River for the first time or revisiting familiar territory, viewers from a wide range of audiences will find the slideshow informative and engaging. Funding for the slideshow was provided by the Water for the West Foundation. This slideshow is free to view on Aquaformia and on the Foundation’s website under Free Programs and Information.

Streamflow Depletion by Wells—Understanding and Managing the Effects of Groundwater Pumping on Streamflow



Groundwater provides drinking water for millions of Americans and is the primary source of water to irrigate cropland in many of the nation’s most productive agricultural areas. Despite the many benefits of groundwater development, connected streams and rivers may suffer from reduced flows through a process called streamflow depletion by wells. This report, just released by the USGS, summarizes what is known about streamflow depletion, highlighting

common misconceptions, and presenting new concepts to help water managers and others understand the effects of groundwater pumping on surface water.

Groundwater and surface-water systems are connected, and groundwater discharge is often a substantial component of the total flow of a stream. In many areas of the country, pumping wells capture groundwater that would otherwise discharge to connected streams, rivers, and other surface-water bodies. Groundwater pumping can also draw streamflow into connected aquifers where pumping rates are relatively large or where the locations of pumping are relatively close to a stream.

The report’s major conclusions throw into relief the water management issues related to balancing groundwater uses with preservation of streamflows. The report concludes that individual wells may have little effect on streamflow depletion, but small effects of many wells pumping within a basin can combine to produce substantial effects on streamflow and aquatic habitats.


Basinwide groundwater development typically occurs over a period of several decades, and the resulting cumulative effects on streamflow depletion may not be fully realized for years. Streamflow depletion continues for some time after pumping stops because it takes time for a groundwater system to recover from the previous pumping stress. In some aquifers, maximum rates of streamflow depletion may occur long after pumping stops, and full recovery of the groundwater system may take decades to centuries. The major factors that affect the timing of streamflow depletion are the distance from the well to the stream and the properties and geologic structure of the aquifer. Streamflow depletion can affect water quality in the stream or in the aquifer. For example, in many areas, groundwater discharge cools stream temperatures in the summer and warms stream temperatures in the winter, providing a suitable year-round habitat for fish. Reductions in groundwater discharge to streams caused by pumping can degrade habitat by warming stream temperatures during the summer and cooling stream temperatures during the winter. Sustainable rates of groundwater pumping near streams depend on the total flow rates of the streams and the amount of reduced streamflow that a community or regulatory authority is willing to accept.

The report supports its conclusions with a wealth of technical explanation and examples in understandable prose and attractive explanatory graphics. Although not light reading, this report could be used as a reference for anyone with an interest in streams and rivers and the impacts on them of groundwater pumping.

The report, a product of the USGS Groundwater Resources Program, is available in print and at <http://pubs.usgs.gov/circ/1376/>.

Ambient Groundwater Quality of Ranegras Plan Basin: A 2008-2011 Baseline Study- June 2012

The Arizona Department of Environmental Quality, as part of its Ambient Groundwater Monitoring Program, conducted a baseline groundwater quality study of the Ranegras Plain basin from 2008 and 2011, and has released two versions of the report in print and online: a 63-page report and a condensed 4-page fact sheet. Arizona Revised Statutes 49-225 mandates ongoing monitoring of waters of the state including its aquifers. The study is based on samples collected from 55 sites within the Ranegras Plain groundwater basin, which covers approximately 912 square miles in western Arizona within La Paz County.

According to the report, “Most groundwater pumped in the Ranegras Plain is used for irrigation in the central part of the basin.” As discussed in the report, the study determined that the most important factor affecting water quality in the Ranegras basin is the recharge age of the groundwater. Concerns with drinking water sources in the area involve recent recharge, which is generally preferred over older recharge. The study resulted in recommendations from ADEQ for private domestic well owners in the basin to have their drinking water tested for contaminants particularly arsenic, chromium, fluoride, and nitrate by a certified laboratory. 

PUBLIC POLICY REVIEW

By Sharon B. Megdal

Israel Water Management Program Provides Rich Learning Experience



As regular readers of this column know, I've been speaking to the benefits of learning first-hand about water management in other parts of the country and world. During the first half of November, I had the pleasure of exploring water management in Israel with nine others from our region. Through seven days of site visits and interaction with top water experts, we learned about the region's successes as well as challenges. This uniquely designed Israel Water Management

Program included stops at sites of historical water significance, tours of state-of-the art water treatment facilities, and stops at areas of environmental restoration and/or concern. The program was followed by participation by half of our group in the four-day biennial Drylands, Deserts and Desertification (DDD) Conference at the Sede Boqer campus of the Ben Gurion University. At the conference, three of us shared information and perspectives at a session, entitled "Water Management in Arizona and the Lower Colorado River Basin: Good Practices and Long-term Challenges".

Both the water management program and the conference provided a rich framework for placing our local, state and regional water management into perspective. They provided evidence that many things are possible when stakeholders collaborate. They underscored the value of developing strategies and action plans for implementation, including financing plans. There were ample examples of successful approaches as well as situations where action plans are needed. I would like to touch on a few that are particularly relevant for Arizona and the Lower Colorado River Basin.

The first is wastewater treatment and reuse. Israel is known as a leader in the use of recycled water by agriculture. About 80 percent of treated wastewater is reused. This high level of reuse is critical to meeting the water needs of Israel's agricultural sector. Not all water used by agriculture is recycled water. Depending on the crops and location, freshwater or brackish water may be used. However, not all household and industrial waste is properly collected and treated. Raw or inadequately treated sewage flows into streambeds. Progress is being made, but environmental problems associated with lack of proper collection and treatment persist. Although the transboundary political issues are quite different, a look at how the U.S. and Mexico have worked together at the border, particularly in recent years, could perhaps be instructive.

Another example is brackish water desalination. Israel's well-known accomplishments with seawater desalination were discussed with us at the Hadera plant. There we met with Abraham Tenne of the Israel Water Authority and Boris Liberman of IDE, the private company that has built the large reverse osmosis plants currently operating in Israel. Great strides are also being made in brackish water desalination. We visited the Granot plant, which has been undergoing expansion for some time. Arizona will likely construct more brackish water desalination plants in the future.

A major issue associated with inland desalination is disposal of the brine. The brine from the Granot plant is transported to the Mediterranean Sea. However, a plant located close to the conference site in the middle of the Negev desert far from the Mediterranean pumps the brine to evaporation ponds, which I saw during a field trip associated with the DDD conference. I was the only one on the tour bus super-excited to take a photo of the setting sun's reflection in the evaporation ponds; I've already used the photo in multiple presentations! The Yuma Desalting Plant was predicated on discharge of the brine to what is now known as the Ciénega de Santa Clara. As additional plants are built, Arizona will have to consider its options for brine disposal, which could include evaporation ponds. Time will tell if a possible disposal alternative is well injection, the mechanism employed at the Kay Bailey Hutchinson desalination facilities in El Paso, Texas, which I visited in late September.

Common to our regions are dry or trickling streams and rivers and interest in restoration. The mighty Colorado River rarely flows to the Delta. We heard the many reasons for low flows of the Jordan River below the Sea of Galilee and the concomitant reduced flows into the Dead Sea. Gidon Bromberg, Israel Director of the NGO Friends of the Earth Middle East, told us about collaborative efforts to improve the Jordan River. FOEME has operations in Israel, Jordan and the Palestinian Territories. Those who saw the documentary movie Last Call at the Oasis will recall seeing the three regional directors standing together discussing the Jordan River.

From representatives of the Dead Sea Works, a privately held company, we learned about some of the many complex implications associated with potash processing operations. We also heard about proposals involving desalinating water from the Red Sea, which are the subject of a World Bank study. At the Israel Water Authority we were briefed on Israel's Master Plan and we visited with the consultants working on the wastewater master plan. Here the difference between Israel's centralized approach to water planning, management and pricing and our region's decentralized approach are apparent. There, all municipal customers on the national system pay the same price for water. In our region, water prices for municipal customers vary significantly by water system.

We saw and learned so much more than I can touch on in the limited space of this column. We saw natural beauty as well as polluted streams. We saw water features of historical significance, as well as examples of deployment of state-of-the-art technology. Historically and currently, water in desert and semi-arid regions is precious. As populations grow, the challenges associated with providing safe and reliable water supplies grow. Resolving the many challenges will require creativity, tenacity and partnerships. I think we all came away from the program with renewed resolve to work collaboratively to identify and implement solutions appropriate for our region.

Note: Our independent program benefited from the participation of a professional tour guide and a liaison from the Jewish National Fund. JNF provided extensive in-kind assistance in planning the itinerary and throughout the visit. 🏡



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Guest View continued from page 8

increase the number of lift stations needed.

Ultimately, a community will have to consider the positives and negatives of implementing gray water policies. For example, on a lifecycle basis, is increased gray water utilization better from the standpoints of water savings, water quality, and cost than centralized or decentralized wastewater treatment and reuse of reclaimed water?

On a positive note, concerns about long-term irrigation of landscape plants by gray water appear to have been answered by a recent study by the Water Environment Research Foundation. Except for a few sensitive plants (lemon tree, Hass avocado, and Scotch pine, for example), the study found no significant adverse impacts.

With more facilities seeking LEED green building certification, which gives points of credit for gray water reuse, ADEQ expects to

see continued interest in larger-scale projects and non-household reuse of gray water. However, current permitting mechanisms for such systems are unwieldy and inefficient. The Blue Ribbon Panel recommended that ADEQ streamline permitting provisions for larger systems, including development of general permits aimed at the type of systems under consideration today. The current fee structure for permit applications and renewals also has been criticized as being a disincentive for large-scale gray water recycling.

In any case, while we in Arizona can take pride in being a leader in gray water regulation, there is still more to do to advance the program. 