Arizona
Water Resource
Volume 21 Number 2 Spring 2013

2013 Conference Offers Wide Range of Perspectives on Water Security Challenges

by Susanna Eden and Katharine Mitchell, WRRC Graduate Outreach Assistant

The opportunity to hear expert presentations and discussion on the issue of water security attracted approximately 300 people to the WRRC's annual conference, "Water Security from the Ground Up". The audience represented more than 40 communities across Arizona.

Participants spoke to the topic of water security from a wide range of perspectives. A narrow definition of "water security" as protection of water system integrity was quickly discarded. Although it is an important component of water security, (see this issue, p. 1) conference speakers expanded the security concept in many directions. Although a single definition of water security never emerged, the differences among the presentations illustrated its scope and complexity.

The conference keynote speaker, Anthony Cox, Head of Climate, Biodiversity and Water Division, Environment Directorate, Organisation for Economic Co-operation and Development (OECD), observed that water security has multiple dimensions. These include amount, quality, distribution and uses of water. Globally, population growth and development are straining water resources. The potential for conflict over the many rivers, lakes and groundwater resources that cross borders is increasing. Ecosystems are vulnerable where the water needs of the environment are ignored. Fundamental human health and safety already suffer from lack of services and natural disasters. In much of the world, institutional capacity and economic

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An audience of approximately 300 participated in the 2013 WRRC Annual Conference Source: John Polle, WRRC

Water Distribution System Security

by Ian L. Pepper, University of Arizona Environmental Research Lab, and Daniel Quintanar, City of Tucson Water Department

The security of potable water within distribution systems is the goal of continuing research in industry and academia. Such systems can be compromised by intrusion events that can be accidental or deliberate. Accidental intrusion of contaminants can occur due to inadequate treatment, or due to broken pipes within the distribution system that subsequently allow contaminants to enter. Deliberate intrusion could occur due to terrorist activities or disgruntled consumers or employees. Contaminant intrusion of any form can be chemical or microbial in nature. In addition to chemicals introduced through accident or deliberate action, non-regulated chemicals of concern may be detected in water distribution systems. These may be pharmaceuticals and personal care products or PPCPs, which include hormones such as estrogen and testosterone. Many PPCPs are known endocrine disrupting compounds that interfere

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resources may be insufficient to deal with these challenges.

Cox proposed using a risk approach to deal with water security challenges. Such an approach allows for a realistic balancing of likely consequences of action, or inaction, across dimensions. As Rodney Smith, President at Stratecon, Inc. noted, "We can't live without risk." He said that we can never have perfect security, but

Sharon B. Megdal, Director, WRRC and Anthony Cox, Head of Climate, Biodiversity and Water Division, Organisation for Economic Co-operation and Development (OECD). Source: John Polle, WRRC

prudent risk management provides tools to allocate and reduce risk and thus improve water security. Smith suggested that risk management can be improved by harnessing "the wisdom of crowds" through markets.

Kathleen Ferris, Executive Director of the Arizona Municipal Water Users Association, on the other hand, focused on the role of governments. Within the global context, Arizona is relatively well positioned to deal with its water security challenges. As characterized by Ferris, Arizona's Groundwater Management Act, passed in 1980, was "one of the most progressive laws in the country governing groundwater." Ferris was part of the group that created the law and has watched its implementation and evolution over the years. She said she would like to see a reflection of that visionary government action to address current water security concerns. As an example, Ferris described efforts to provide tools to Arizona's rural communities to meet their growing water supply needs.

Water supply—continued availability and sustainability—was foremost in the minds of many. Brian Betcher, General Manager of Maricopa Stanfield Irrigation District, focused on the supply challenges facing agricultural water users. Physical challenges such as drought and aging infrastructure are only part of the picture. The economic pressure of rising energy costs, unintended consequences of regulation, increasing competition for existing resources, and uncertainty over water rights also keep Betcher up at night.

Very similar concerns disturb the sleep of Alan Forrest, Director at Tucson Water. Water outages caused by infrastructure failure are not an option for the water utility, which has invested in redundant facilities to ensure reliability. The large amount of water recharged into Tucson area aquifers provides a buffer against the impacts of drought and shortages on the Colorado River. Forrest emphasized that recharge of supplies available today buys time to find the new supplies that will be needed to meet future demands.

When Arizona's water users worry about the security of their supplies, a major focus is the future of the Colorado River. The United States Bureau of Reclamation's Colorado River Basin Water Supply and Demand Study, released just weeks before the conference, was described as a wakeup call by WRRC Director Sharon Megdal. The study assessed future water supply and demand and found a sustained imbalance over the next 60 years of 3.2 million acre-feet more demand than supply. A major collaborative effort, the study not only assessed supply and demand, but also assembled portfolios of options that might be used to rebalance the system. Carly Jerla, Program Manager for the study, stated that storage structures on the river can hold more than four times the annual supply. This provides some security against short-term supply shortages. However, demand has already surpassed supply, Jerla said, and we are vulnerable if nothing is done. The study laid a technical foundation that will allow stakeholders to move forward on the same platform.

Providing a science-based platform from which to address water security concerns was another conference theme. The conference's science panel brought the need for better scientific understanding into the water security discussion. Peter Mock, an independent consultant, spoke from the water chemistry perspective on the need to understand the system as a whole. He emphasized that water quality security depends on vigilance that goes beyond meeting standards.

James Leehouts, Associate Director and Investigations Section Chief at USGS Arizona Water Science Center, also advocated water system understanding. He warned that common misconceptions about the groundwater-surface water connection hinder realistic planning for water sustainability. The physical system has more interconnection than people realize. The interconnections frequently are not obvious because of the difference between the human time scale and hydro geologic time scales. William Alley, Director of Science and Technology at the National Groundwater Association, warned that impacts of human actions, such as groundwater pumping and contamination, may not be evident for many years and do not stop when the actions stop. Depletion, subsidence and the spread of contaminants can continue for many years.

Loss of important environmental values may be the consequence of failure to understand the physical system. Linda

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Arizona Water Resource is published quarterly by the University of Arizona Water Resources Research Center. AWR accepts news, announcements, and other information from all organizations.

Editor: Susanna Eden
Layout: John Polle, Katharine Mitchell
Newsletter Link: wrrc.arizona.edu/publications/awr
WRRC Website: wrrc.arizona.edu
WRRC Director: Dr. Sharon B. Megdal

Arizona Water Resource
Water Resources Research Center
College of Agriculture and Life Sciences
The University of Arizona
350 North Campbell Avenue
Tucson, Arizona 85719 USA

520.621.9591 FAX: 520.792.8518 Email: wrrc@cals.arizona.edu

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Stitzer, Senior Advisor at Western Resource Advocates, argued that the environment has not had a place at the table where water policy decisions are made. "It is difficult to include environmental demand in planning and water budgets, since it is hard to quantify," she said. However, water in the environment supports many benefits. In addition to quality of life values, Stitzer described ecosystem

Kathleen Ferris, Executive Director, AZ Municipal Water Users Association and Rodney Smith, President, Stratecon. Source: John Polle, WRRC

services and economic benefits. For example, wildlife based recreation and birding generates billions of dollars for Arizona's economy. Stitzer suggested mechanisms to secure water for the environment that would extend existing programs, build public-private partnerships and expand citizen-voter support.

When describing environmental benefits, Stitzer included heritage benefits to tribal, ranching and farming communities. The concern with cultural heritage was the focus of Elma Montaña's presentation. A researcher at National Scientific and Technical Research Council and Professor at the National University of Cuyo, Argentina, Montaña used the case study of Mendoza in central eastern Argentina to illustrate linkages among the physical system, institutions, and cultural heritage in their water security situation. In Mendoza these interlinked systems tend to disadvantage traditional culture to the point that its existence is endangered. She argued for protection against cultural loss in water security policy decisions.

Preservation of cultural values associated with water also concerns Arizona's native tribes, according to Katosha Nakai, Tribal Affairs and Policy Development Manager at Central Arizona Project (CAP). She warned, however, that the various tribes do not have a single perspective but have many different perspectives (see Guest View, p. 10). They are also in different situations with respect to the security of their rights to water. The CAP is a major source of water for some tribes through agreements and water settlements. Only a small fraction of the CAP water allocated for native tribes remains to help with water settlements for the 11 Arizona tribes whose claims have yet to be settled.

Nakai also illustrated the multiple dimensions of water security with the case of the Navajo Generating Station, a coal-fired power plant that provides most of the energy needed to pump CAP water from the Colorado River to its customers. New air quality regulations for plant emissions are projected to raise the cost of power and therefore the cost of CAP water to customers. The Gila River Indian Community is the single largest CAP contract holder and would therefore bear the largest percentage of cost increases.

After a day of laying out the complex, multidimensional nature of water security, the conference took a look at Arizona's current policy tools. In the final session of the day, Megdal moderated a discussion with Thomas Bushatzke, Assistant Director of the Water Planning Division at Arizona Department of Water Resources, and Dennis Rule, Manager at Central Arizona Groundwater Replenishment District. The panel addressed the question, "Are we on the right track?"

These local leaders expressed their belief that past management has placed Arizona in a good position for the future. Buschatzke noted multiple achievements that demonstrate our ability to address water security challenges, including the Groundwater Management Act and subsequent "tune-ups" that were made in response to evolving conditions. Rule maintained that the Groundwater Replenishment District plays a critical role in providing water security for the Phoenix, Pinal and Tucson AMAs. The District, which helps entities meet legal water supply requirements under the Groundwater Management Act, is in the process of initiating a robust water acquisition program to fulfill its replenishment obligations to its member entities.

Questions from the audience pointed out where current policy falls short, and probed for ways to bring about desired change. Rule cautioned that structural challenges make change difficult, but open discussion and transparent process are fundamental to the way the District operates. Buschatzke turned the focus back to the public, arguing that change can happen when there is public consensus. "If stakeholders reach consensus and come to the department, they would support it," he said.

David Synder, Pinal County, poses question to panel members. Source: John Polle, WRRC

Ending on the importance of the public's role, the conference highlighted education and information exchange as vital to water security. Several of the speakers throughout the day pointed out that the search for solutions rests on a well-informed public. Given its complex, multidimensional nature, a conference on water security needs presentations from many perspectives, and this is what the WRRC's annual conference delivered.

Save the Date

Tuesday, April 8, 2014
WRRC Annual Conference
The University of Arizona, Tucson

Conference Speakers Build Water Security Definition

by Becky Witte, WSP Graduate Outreach Assistant

The meaning of "water security" was a major theme in the WRRC's Annual Conference: Water Security from the Ground Up. In the Winter 2013 *AWR* Guest View, Robert Varady and Christopher Scott offered their definition. WRRC Director, Sharon Megdal addresses the question in her column (this issue, p. 11). As she points out, conference organizers left the speakers and attendees to come up with their own interpretations.

Elma Montaña, Researcher, Human, Social and Environmental Sciences Institute, National Scientific and Technical Research Council, Professor, National University of Cuyo, Argentina. Source: John Polle, WRRC

At the outset, keynote speaker Anthony Cox, Head of the Climate, Biodiversity and Water Division, Environment Directorate, Organisation for Economic Co-operation and Development, articulated a comprehensive, risk-based definition that provided a scope for speakers to express a wide range of concerns.

The most often cited water security concern was availability of the resource. Will the water supply be sufficient to sustain demand, especially an increasing demand in the coming years? World water demand is projected to grow by 55 percent by 2050, said Cox. To meet demand, efficient management of water will be essential in the coming years.

Urban areas will feel the majority of the population growth. In many cities in the United States, much of the current water infrastructure, including pipes and treatment plants, is aging and causing system failures. The Environmental Protection Agency believes that "aging water infrastructure is one of our Nation's top water priorities." Tucson Water Director Alan Forrest stated that a reliable water supply depends on the infrastructure that moves and treats it. Infrastructure failures that disrupt service are becoming more frequent and maintenance, repairs, improvements, replacement and expansion will require substantial investments. In October 2012, a breach in the Central Arizona Project, which supplies water to Maricopa, Pinal and Pima counties, caused 160 million gallons of water to spill out of the canal. This break did not disrupt water deliveries because water could be taken from Lake Pleasant while repairs were made to the canal. However, it serves as a warning about the importance of infrastructure to water security.

Another concern is transboundary water resources. Water supplies do not conform to political boundaries, so many nations must share water resources. There are 263 transboundary lake and river basins that involve 145 nations. Cooperation is essential to manage these water resources, but as water stress increases, tension over shared water resources is expected to rise. Anthony Cox quoted Ishmail Serageldin, World Bank Vice President, Environmentally Sustainable Development, who warned that "the wars of the next century will be fought over water – unless we change our approach to manage this precious and vital resource." In some locations, cooperative steps have been taken to manage transboundary water resources, but there is much work still to be done.

Water is a natural resource that not only sustains humans, but is necessary for plants and animals, creating ecosystems and vibrant natural environments. The environmental benefits of water are sometimes overlooked, and when this occurs over time, it can negatively impact water security. Linda Stitzer, a Senior Advisor for Western Resource Advocates, argued that if the environmental water resource base, for example groundwater or river flow, is not adequately protected from pollution and overuse, valuable natural systems are disrupted and ecosystems can be lost. This not only impacts the visual appeal of the land, but also could have economic consequences. Billions of dollars generated from recreation and tourism are threatened by environmental degradation.

Cox also called attention to natural disasters—major adverse events that result from the Earth's natural processes. Many natural disasters involve water: floods, tsunamis, blizzards, hurricanes, and droughts. Because these events can cause loss of

Alan Forrest, Director, Tucson Water. Source: John Polle, WRRC

life or property damage, natural disasters should be considered a security issue. Cox said that many organizations are now evaluating the trade-off of risks and costs in preparation for natural disasters.

Cox's water security definition included the risk of water pollution. To survive, access to safe water is essential. Many people in developing countries face conditions where clean water and sanitation are a luxury and may suffer adverse health effects as a result. Even in developed counties, water quality is a major concern for water security, in terms of both drinking

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water and environmental protection.

All of these aspects combine to make water security a complex and dynamic concept. Elma Montaña, Researcher at the Human, Social and Environmental Sciences Institute, National Scientific and Technical Research Council, and Professor, National University of Cuyo, Argentina, advocated for cultural security under the umbrella of water security, where cultural continuity depends on continuing access to water. For this reason she offered a definition developed by Robert Varady and Christopher Scott, "Water security constitutes the sustainable availability of adequate quantities and qualities of water for resilient societies and ecosystems in the face of uncertain global change." Montaña explained that concern for resilient societies expressed in this definition should include traditional cultures.

At the conclusion of the conference, Megdal noted that the discussions had not reached a single best definition of water security. The conference "will have to end being unsure what it means," said Megdal. That discussion will have to continue.

Conference Lunch Panel Showcases Young Leaders

by Becky Witte, WSP Graduate Outreach Assistant

Experienced water buffalos were not the only speakers at the conference; the lunch panel provided an opportunity for students and young professionals to provide their perspective on current water issues. The panel included Ross Rayner, a UA Agribusiness Management and Economics and Plant Science undergraduate student; Jamie McEvoy, a UA Ph.D. candidate in the School of Geography and Development; and Lisa Snyders, a process engineer with Carollo Engineers. These speakers focused on the future of our water, with an emphasis on Arizona.

Lisa Snyders, Carollo Engineers. Source: John Polle, WRRC

Guy Carpenter, Vice President, Carollo Engineers, moderated the panel. He noted that with many of the current water experts nearing retirement, these young individuals may have an important role in the water field. When he posed the question, "What do you think we are doing well in water management?", the panelists responded from their different experiences. Rayner, who was born and raised in Arizona on a farm that his family has owned since 1914, thought that the Groundwater Management Act of 1980 was pivotal in establishing water rights. Also, effluent water use for agriculture has been important. McEvoy was impressed by long-term water resource planning and stakeholder involvement in the Tucson area. She also mentioned that public interest in xeriscaping and water harvesting has been a positive aspect of water management. As a young professional, Snyders has worked in the planning, design and construction phases of water and wastewater facilities. During her work, she has realized the unique challenges that the Southwest faces but believes that past leaders have managed surface and groundwater sources well, especially recharging water within the Active Management Areas.

The follow up question was "What are constraints and problems that need to be overcome so that water can be better managed?" McEvoy conducted extensive research for her dissertation on political ecology and the risks and hazards of desalination technology, so she is concerned with the water-energy nexus. Technology, like desalination, could help to supplement water supplies in some areas, but the energy necessary for this process is immense and water needed for power production is also high. This interconnection between water and energy is a problem that will need to be addressed in the coming years. Also, McEvoy was concerned with the equitable distribution of water and believed a greater voice for under-represented groups is necessary to ensure water is distributed fairly. The problem that Rayner saw was population growth. Continuing population growth could strain water supplies. For agriculture, he thought the perception that drip irrigation is always best is an issue because some crops and locations are better suited for techniques other than drip irrigation. Snyders thought that public awareness of water issues is a constraint. More public education on the future of water is necessary. She also said there is an insufficient sense of urgency in addressing water issues and was not sure if we are doing enough, fast enough. To see where the panelists thought reform is needed, Carpenter asked, "You are the future of Arizona water. What sacred cows do you think need to be slaughtered?" Both Rayner and McEvoy questioned the need for unlimited population growth. Growth may need to be curtailed in some areas, or at least managed so that it occurs where and how it is likely to be beneficial. Snyders believed that the prejudice against drinking reclaimed water needs to change. The public needs to learn to trust the treatment technology.

Ross Rayner, University of Arizona. Source: John Polle, WRRC

Jamie McEvoy, Ph.D. University of Arizona. Source: John Polle, WRRC

The lunch session ended with these young water leaders posing questions to experienced water buffalos, many of whom were in the audience, in hopes of starting more conversations about the future of water in Arizona. They asked: Will there be water for agriculture in the future? Is there a need for a new ethic for water? To what degree should stakeholders be involved?

‘Water: The Human Element’ Photo Contest Winners

In the winter of 2012-2013, the WRRC held a photo contest on the theme, “Water: the Human Element”. The theme was chosen to showcase the unique ways people interact with water in our arid state. A requirement of the contest was that the photographs be taken within the state. Arizona is a region of extremes when it comes to water. From a drop of moisture trapped in the spines of a cactus to a view of snow-capped mountains, water in all its forms provides visual treats for photographers. Add humans to the mix and stir. Contest entries went above and beyond, bringing imagination to bear on this year’s theme. The WRRC received more than 60 entries. A panel of judges selected five

1. **"Getting Your Boots Wet"** by Meghan Smart
2. **"Lava Falls"** by Megan A. Powers
3. **"Rope Swing at the 'Crack' in Sabino Canyon"** by Leif Abrell
4. **"Marble Canyon Geologists"** by Magdalena Donahue
5. **"They Are Still With Us"** by Bryce Emily Megdal

winning photographs and 15 runners-up. Although quality, clarity and composition were important, judges were looking for special moments captured and unique interpretations of the theme. The five winners were announced at the WRRC's annual Chocolate Fest in February. The photos were featured at the event and were on display thereafter in the WRRC lobby. In addition, they are highlighted on the WRRC website (http://wrrc.arizona.edu/WRRC-Photo-Contest-Winners). Winning photographers were Leif Abrell and Bryce Emily Megdal from Tucson; Megan A. Powers and Meghan Smart from Phoenix; and Magdalena Donahue from Albuquerque, NM.

Announcements

New "Never Waste" Water Campaign Raises Awareness

To build awareness about the impact of water waste, the Alliance for Water Efficiency has launched a campaign called Never Waste. Central to the campaign is a water bottle imprinted with measures of water waste in numbers of bottles. By comparing the amount of water wasted in our daily lives to something familiar and measurable, the campaign hopes to encourage consumers to waste less. The website, www.NeverWaste.org, provides tips on how to reduce water waste, and a household water calculator that allows consumers to compare their household water use with average and water efficient households. The site also provides an option to purchase a Never Waste water bottle to support the work of the Alliance and its partners helping communities and businesses conserve water.

USGS Pushes Gauge Data on Request

The U.S. Geological Survey has made it even easier to find out about current conditions on thousands of rivers and streams across the country with its WaterNow system. Those who sign up for the service can receive texts or emails about streamflow, groundwater levels, springs, water quality and lake levels in the specific water body of their choice. Conditions are monitored by more than 16,000 stream gauges. The information from these gauges can be useful for a variety of purposes, including disaster preparation, recreation planning or water resource management. A message to WaterNow@usgs.gov containing the USGS site gauge number is all that is needed to start receiving updates. Complete instructions, including how to find the gauge number, are available on the website http://water.usgs.gov/waternow/.

Water and Energy R&D Center Established

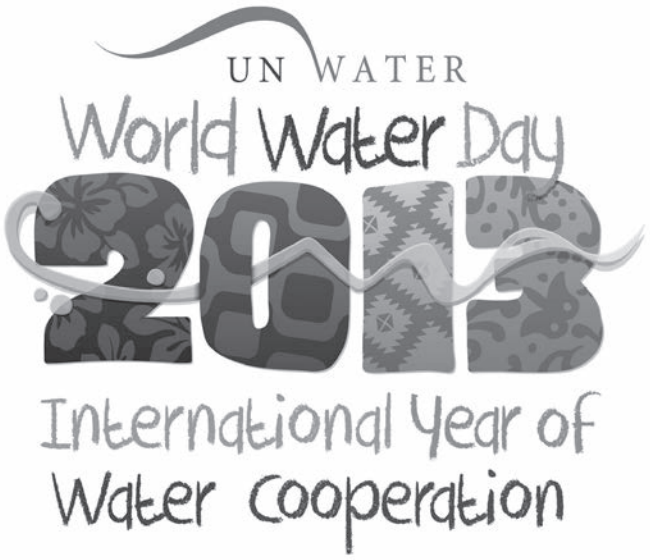
A major agreement between the University of Arizona and Pima County has established a new center for the study and development of water and energy technology. Construction on the new Water and Energy Sustainable Technology—or WEST—Laboratories will begin this summer. The facility will be located at Pima County's new ROMP Central Regional Laboratory Complex. ROMP, which stands for Regional Optimization Master Plan, is Pima County's billion-dollar investment in meeting regulatory requirements for wastewater while protecting the county's environment and water supplies. The ROMP includes plans to upgrade and expand the Ina Road facility and replace the Roger Road plant with a new reclamation facility. The WEST laboratory complex will be housed in a new 23,000-square-foot building. U of A's Environmental Research Laboratory and some water and energy related research programs in the College of Engineering will relocate to the facility. The Laboratories will target the water-energy nexus and focus research attention on reuse of wastewater. Research and development at the WEST Center will include water treatment technologies, contaminant monitoring tools, and energy minimization and production.

American Rivers Releases Guide to Green Stormwater Permits

American Rivers, an organization that advocates on behalf of America's rivers, has released a guide to aid municipalities in developing stormwater permits that incorporate green infrastructure. Green infrastructure uses natural systems to capture and infiltrate rainwater as close as possible to where it falls. As an approach to stormwater management in urban areas, green infrastructure reduces pollution and flooding from storm runoff. The American Rivers' guide, *Permitting Green Infrastructure: A Guide to Improving Municipal Stormwater Permits and Protecting Water Quality,* is intended as a resource for community and watershed advocates. In addition to description and explanation of permit types, the guide contains model permit language and examples of stormwater permits from municipalities that have successfully incorporated green infrastructure principles. Municipalities can use the guide as a resource in rethinking their own stormwater management plans.

Dust Storm App Launched

As spring and summer approach, so does the dust storm season in Arizona. These dust storms can lead to poor visibility and potentially dangerous driving conditions. A new application developed at the University of Arizona uses GPS and the WeatherBug service to provide drivers with warnings about storms on the road around their location. The app also offers safety tips on what to do if a dust storm hits, as well as a list of items people should keep in their cars, such as a flashlight, dust mask, and whistle or pocket siren. The app is available on iTunes as a free download for iPhones, and the Android version is expected to be released soon.



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Student Spotlight

Alex Prescott began his studies in August of 2012 when he entered the Honors College at the University of Arizona. He is pursuing two degrees: a Bachelor of Science focused in Environmental Hydrology and Water Resources, and a Bachelor of Arts in Mathematics, with a minor in Geoscience. During his previous three years in the Phoenix area, he co-founded an Arizona state non-profit corporation with the purpose of initiating and administering community gardens in the Phoenix-metro area, consulted with community members looking to initiate their own community gardens, and began working with Arizona Project WET (Water Education for Teachers) at the WRRC.

His decision to return to university studies was driven by a desire to better understand the processes that affect natural environments, so as to pursue solutions to pressing ecological and social problems from a position of deeper understanding. Alex currently works with teachers participating in Earth Camp for Educators, a project of Project WET, the College of Science, the Arizona-Sonora Desert Museum, and the Planetary Science Institute.

In March of this year, Alex traveled with a group of 15 UA students and 13 University of Bayreuth (Germany) students to Ghana for a volunteer service project. The students were to build three ferrocement household rainwater harvesters, each sized so as to collect enough water in the wet season to meet each family's needs through the annual five-month dry season. The project was organized through Global Brigades (see *AWR* Winter 2012), an international non-profit whose stated vision is "to improve equality of life by igniting the largest student-led social responsibility movement on the planet."

Alex writes of his experience:

Imagine you fill two one-gallon milk jugs almost to the top from a local municipal pond of standing water. Now imagine carrying this water, plus the water your family will use, in a bucket on your head back home. Finally, imagine using this quantity and quality of water for all of your day's needs: washing clothes and dishes, cooking food, washing your body, brushing your teeth and, yes, drinking. Would you value water any differently? How much would you use in a day?

The best estimate from household surveys is 7 liters (1.8 gallons) per person as the daily usage in the coastal community of Srafa Aboano, Ghana. The scenario described above is the reality of life for the 900 members of this community. Although precipitation averages about 100 cm (40 inches) per year, rainfall is seasonal. Sources of water are few and far between for much of the year, and the quality of those sources is quite low by U.S. standards.

The primary sources of water that most families utilize during the dry season are a series of surface ponds connected to the local, highly saline aquifer. These ponds are stagnant, open to the air, and have tested positive for E. coli. At times in the dry season, community members can wait in line for more than 8 hours for seepage to refill the ponds. People state that they don't like to use the water from ponds or from the limited number of wells that exist, but currently there is no viable, reliable alternative. Private water delivery trucks come through the community from time to time, but the prices they charge are more than people can afford. A treatment plant has been built in the area and delivers water to large urban areas in the general region, yet Aboano doesn't have the economic means to build the infrastructure necessary to transport this water, and it is too small and isolated for the government to justify funding the project.

This is just one community experiencing what is a worldwide water security problem. I've heard about the problem a lot, but I didn't really know it until I experienced it. This project gives a whole new appreciation for the comparatively endless supply of high-quality water available here in Tucson, as well as the extent to which a community's water security can be more a function of human engineering than local climate.

For additional information about Global Brigades, go to http://www.globalbrigades.org/vision-mission.

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Wet-Dry Mapping Event

Friends of Agua Fria National Monument and the Upper Agua Fria Watershed Partnership have announced their 6th Annual Wet/Dry Mapping event. Wet/Dry Mapping will take place on Saturday, June 22, 2013. Anyone interested in participating should contact Friends of the Agua Fria National Monument: info@aguafriafriends.org.

Annual AHS Symposium

The 26th Annual Arizona Hydrological Society Symposium will be held September 18-21, 2013, at the Doubletree by Hilton in Tucson. The symposium, "Shifting Boundaries – Recalibrating the Hydrologic Approach," will include a meet-and-greet, two days of plenary sessions, technical workshops, and field trips. For more information go to http://ahssymposium.org/2013/.

"Tribal Perspectives" on "Water Security": A Definitional Conundrum

by Katosha Nakai, Esq., Central Arizona Project Manager, Tribal Relations & Policy Development

What is "tribal perspective" and "water security"? Perhaps the most critical issue for anyone to first understand about tribal perspectives on water security is that no one "tribal perspective"

truly exists. Tribes are dynamic. Tribes are unique. Each tribe has its own distinct culture, history, and, like any government, its own diverse interests and perspectives. Absent a specific tribal policy or fundamental law, which in some cases must ultimately be upheld through a tribal governmental entity like a court, defining a true tribal perspective may seem an exercise in futility—it is not. Those with an interest in effective management of shared resources like water can benefit from the multitude of conversations and examinations as to why tribal members, governments and entities feel, believe and manage the way they do. I cannot provide a singular tribal perspective on water security. What follows is simply this tribal member's single perspective, influenced by working regularly with tribal communities in Arizona in my capacity as Tribal Relations and Policy Development Manager for the Central Arizona Project (CAP).

Certainly tribes have concerns about all water security issues that typically confront any community, but their concerns are often more pronounced on matters more localized to water quality, quantity and infrastructure given an array of historical and legal consequences spanning multiple centuries. During the last century, Arizona and the tribes that reside within its boundaries worked—sometimes against one another's interests and sometimes collaboratively—to develop a framework for shared management of water resources. Still, only one-half of Arizona's tribes have fully resolved water rights. So, how tribes approach water security and future water planning varies greatly depending on whether they have legal confirmation regarding the extent and location of their water supply and ready access to that supply.

Bringing certainty of supply and limiting ambiguity has become a priority statewide and for decades, state water interests have looked to the CAP's Colorado River water supply as a source to satisfy tribal claims. The Arizona Water Settlements Act of 2004 (AWSA) resolved many of the unresolved issues relating to the CAP supply. AWSA quantified and permanently divided the CAP water supply between Indian and non-Indian uses. Forty-six percent of CAP water now is designated for Indian uses. Yet, only 37,107 acre-feet per year remains to complete settlements with 11 tribes. Therefore, tribes with outstanding claims have ongoing security concerns about whether and how their claims will be resolved.

Another security issue for tribes relates to reliable power, and the water-energy nexus has made this a key water security issue in recent years because of the reliance on CAP water. The Navajo Generating Station (NGS), located on the Navajo Nation, supplies more than 90 percent of CAP power using Navajo and Hopi coal. Affordable water is intimately tied to affordable power. When the U.S. Environmental Protection Agency (EPA) first announced its intention to regulate regional haze at NGS, tribal impacts took center stage. Importantly, the AWSA makes excess NGS power, owned by the Bureau of Reclamation, available for sale on the open market to assist with CAP's repayment to the federal government and funding for Indian water settlements. Requiring costly NGS retrofits will push CAP energy rates to a point that will produce no profit for the excess power and will significantly increase the energy portion of CAP rates, which most tribes must pay. To the extent tribes believed they were settling their water rights claims for an inexpensive source of water, tribes now question whether the federal government is essentially stripping them of the benefit of their bargain.

NGS issues highlight how divergent and complex tribal perspectives can be. For example, under the currently proposed EPA regulation, CAP's water users will bear the largest percentage of any NGS related rate increases; this means significant impacts for the Gila River Indian Community, CAP's largest single contract holder, as well as other CAP water using tribes. Meanwhile, excess power will no longer be available at rates that will provide profit to support future Indian water rights settlements. Additional uncertainties related to future royalty and lease agreements will also raise energy rates dramatically. These increases are critically important to the interests of the Hopi Tribe and Navajo Nation, but they also work to the economic detriment of tribes using CAP water and the very fund that might one day be called upon to assist the Hopis' and Navajos' own water rights settlement—rights currently outstanding and unresolved.

Perhaps in the end, that is the best way to define a tribal perspective on water security: outstanding and unresolved. This, however, should not be an excuse for failure to engage, but rather the impetus for dialogue.

Public Policy Review

On Defining and Achieving Water Security

By Sharon B. Megdal

When planning the Water Resources Research Center's 2013 annual conference on water security, we knew that the definition of water security was complex. We decided we would not define it for the speakers and attendees, but rather let an understanding of water security emerge from the conference discussions themselves.

In the Winter 2013 issue of our Arizona Water Resource newsletter, the guest view by University of Arizona professors Robert Varady and Christopher Scott defined water security as constituting "the sustainable availability of adequate quantities and qualities of water for resilient societies and ecosystems in the face of uncertain global change." In his conference keynote address, Anthony Cox of the Organisation for Economic Co-operation and Development (OECD) offered that water security entails "maintaining an acceptable level of risks – in terms of water shortage, excess, pollution, and freshwater system resilience – for society and the environment, today and in the future, through the effective and efficient application of water and water-related policies." By explicitly incorporating the concept of risk, Cox's definition builds off of that provided by D. Grey and C. W. Sadoff in the journal Water Policy (2007 Volume 9, p. 545), who define water security as "the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies."

In Water Security and the Global Water Agenda, an analytical brief issued in 2013 by UN-Water, we find the following definition: "The capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability."

While different, these definitions focus on the same goals. Water security is a concern locally, regionally and world-wide. It relates to both water quality and water quantity. It pertains to human health, economic vitality and natural systems. Risks and uncertainties must be considered when assessing the water security of communities and regions.

Attaining water security is a shared responsibility, a fact that was highlighted in a statement issued by the High Level Forum convened in conjunction with the full-day celebration of World Water Day (March 22, 2013) in The Hague. The year 2013 has been declared by the United Nations as the International Year of Water Cooperation, and, in this context, the statement noted that water security "will be of growing importance" and water matters require adequate attention to prevent water crises. Regarding who is responsible for water security, it stated: "Governments play a key role in securing water for competing demands; however the quest for a water-secure world is a joint responsibility and can only be achieved through water cooperation at local, national, regional and global level and through partnerships with a multitude of stakeholders ranging from the citizens to policy makers to the private sector."

Although this last statement is perhaps obvious, it never hurts to be reminded that development of water policy requires a cooperative and inclusive approach. It requires involvement of stakeholders of many types. The development of sound water policy also requires education and sharing of information. These efforts are as important as those focused on development of technologies for water purification or predictive systems for floods and climate impacts.

Along with colleague Robert Varady, whom I cited above, I had the privilege of attending the World Water Day program in The Hague, which fell between two other international meetings we attended. The first was a consultation of the global Groundwater Governance project (see www.groundwatergovernance.org). At this meeting, I presented results of an initial survey we conducted of the groundwater governance practices of the U.S. states. Part of the World Water Day session in The Hague entailed breakout sessions of about 100 people each. Within the breakout entitled "water cooperation helps preserve water resources and protect the environment", my table focused on the geographic scale of activities. The final meeting I attended was a two-day conference convened by OECD that focused on water governance world-wide. The purpose of the OECD gathering was to kick off a process that will follow up on the water governance recommendations of the Sixth World Water Forum held in March 2012 in Marseilles, France.

These more globally focused gatherings provide me with an opportunity to learn about the experiences of others in water policy making and management, as well as to share our local, statewide and regional practices with others. As I have noted previously in my columns, there is great value in sharing lessons learned, including successes, partial achievements, and failures.

Not surprisingly, there was much commonality to the themes and discussions of the various meetings. Some main take-away messages connect to the goal of achieving water security. There is a recognized need to involve a broad set of stakeholders, especially land use planners and decision-makers, in efforts to address water security and water management challenges. Involving the private sector in the broad range of issues was also highlighted at all three sessions. Elements of the private sector have technological know-how and financial expertise to contribute. The benefits of greater involvement of the private non-governmental (NGO) sector were likewise noted. The general need for more education at all levels and dialogue was underscored.

I think it is safe to say that, regardless of its precise definition, all agree identifying pathways to water security is something on which we need to work together. Agreement on this, however, is the easy part. Achieving water security over the long-term, the "future" referred to in Anthony Cox's definition, is a much more difficult task that will require our continued efforts.

WRRC
WATER RESOURCES RESEARCH CENTER
Water Resources Research Center
College of Agriculture and Life Sciences
The University of Arizona
350 N. Campbell Avenue
Tucson, AZ 85719

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with endocrine glands, their hormones or the activities of hormones. Microbial contaminants of concern include bacterial, viral and protozoan pathogens that cause a variety of illnesses ranging from gastroenteritis and meningitis to hepatitis.

Contamination of water due to intrusion could have serious implications for a community, regardless of how the intrusion occurred. Also, the impact of an intrusion event is time-dependent. The longer the duration of time needed for detection, the more people are exposed. Therefore real-time detection would be the ideal solution to minimizing the number of people exposed to the contaminated water. We define real-time detection as less than one minute, whereas near-real-time can take up to two hours. Laboratory analyses of water typically take several hours to complete from start to finish, due to the time needed to take the sample, transport it to a lab, and then actually conduct the analysis. In contrast, sensors that monitor continuously have been developed that are typically in-line and can monitor water quality 24/7. The University of Arizona, with help from Tucson Water, has developed a Real-Time Sensor Lab that is the envy of the world.

Several in-line chemical sensors have been developed commercially to monitor routine water quality parameters such as chlorine, turbidity and pH. In addition, in-line sensors are available for the detection of nitrate, fluoride and arsenic. More sophisticated real-time chemical sensors utilize multiple sensors in combination. One example is the Hach Event Monitor, which monitors several parameters including chlorine residual, turbidity, pH, electrical conductivity and total organic carbon. Software then utilizes algorithms to convert all collected data into a single value, which is used in a decision making process to evaluate whether or not an intrusion event has occurred. A technology named S::CAN utilizes ultraviolet spectroscopy to evaluate the presence of chemical species in solution. Finally, fluorescence spectroscopy sensors can be used to evaluate dissolved organic carbon.

Inline microbial sensors that detect the presence of microorganisms in real-time are limited in number. Currently, technologies have relied on multi-angle light scattering (MALS), which occurs when laser light interacts with particulates within the water. Instant BioScan utilizes laser light scattering plus fluorescence emissions, which in combination gives an estimate of the number of viable bacterial cells in the water.

An important overall concept with respect to continuous sensing of contaminants is that it is not always necessary to know the identity of the contaminant, regardless of whether it is a microbial or chemical contaminant. Rather, a trigger is needed that indicates in real-time whether or not there is a change in the water quality that could indicate an intrusion event. Once an alert is raised, near-real-time technologies can be used to determine the identity of the contaminant, and indicate the appropriate strategy to eliminate the contaminant.

SCADA, which stands for Supervisory Control and Data Acquisition System, is the software and hardware technology associated with data acquisition and operational control of a water distribution system. Tucson Water's current system uses the SCADA Master Station equipment to monitor and control the quantity, quality, flow rate and pressure levels of the water in the drinking water system. An upgraded Operations Management Center will plan, schedule, control and monitor water system operations by accessing multiple software tools, and applications of optimized business process and decision support systems. In concept, the SCADA would collect data from real-time monitoring technology associated with the distribution system.

The Real-Time Sensor Lab will soon move to a new center, which is currently being developed. This center, the Water and Energy Sustainable Technology Center (WEST) will be located within a newly constructed building, via a partnership within Pima County Wastewater's new Water Reclamation Campus (see Announcements). WEST will officially be launched in 2014.