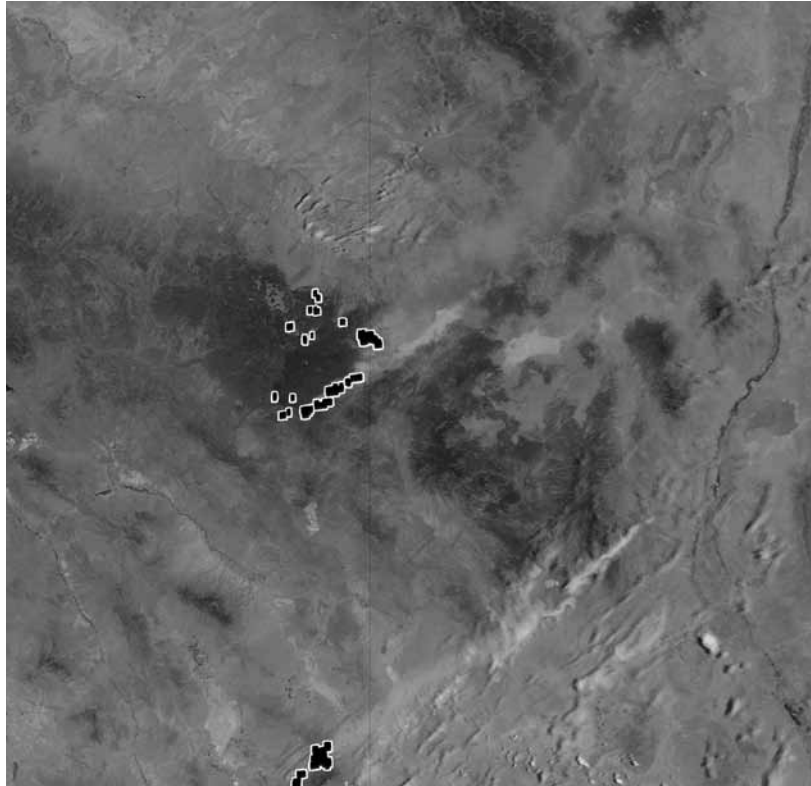


ARIZONA WATER RESOURCE

VOLUME 20 NUMBER 2

SPRING 2012



This satellite image of the Wallow fire was captured on June 13, 2011 at 1:45 p.m. local time by Moderate Resolution Imaging Spectroradiometer (MODIS) on the Aqua satellite. Outlined areas show the actively burning parts of the fire. Prevailing winds carry smoke toward the northeast. Source: Jeff Schmaltz, MODIS Rapid Response Team at NASA GSFC.

Arizona and the Southwest Face Heightened Fire Threat

This year, park and forest managers are deeply concerned about wildfire. The late winter has been exceptionally dry, and it looks like the spring is continuing the same trend. Wildland fire forecasts produced by the National Interagency Coordination Center (NICC) at the National Interagency Fire Center predict significant fire potential for fires greater than 100 acres in large portions of the southwest. NICC produces seasonal fire outlook reports that estimate fire risk by taking into account past and current climate conditions and weather and climate forecasts, along with assessments of the condition of trees and surface fuels such as grasses, shrubs and accumulated forest litter.

Fire potential indicates the likelihood that a wildland fire will require

Fire Threat continued on page 2

Mexico Visit Strengthens Understanding of Shared Environmental Interests

by Joanna B. Nadeau, WRRC Research Analyst

When the captain announced the plane's descent, I put my book down and peered out the window as I always do. I saw sand dunes first, leading my eye to a small mountain range flanked by dirt roads and farm fields. The mountains framed successive basins, each with the same dry ground spotted with desert shrubs. After the next range, a city emerged. Densely packed buildings appeared beside finished roads. And the canals ran from the farm fields into the city, running full next to dry riverbeds. It looked a lot like Tucson. But I was in Torreon, Mexico.

I asked my host, a local translator, about the fields that looked like remnant, dust-filled versions of traditional farmland. Commonly, farmers in north-central Mexico had to abandon agricultural land when it had been overworked. From the looks of things, these fields were not going back into production anytime soon. As we talked, I learned that much of their natural environment has been overworked. Efficiency practices as well as soil protection measures that can help make farms last longer have come too late for some.

I was invited to Mexico to talk to an assembled group of botanists and policymakers about water, to share the range of strategies being used in Arizona to meet the needs of all water sectors.

This group was most interested in the environmental aspects of water management, but clearly Mexico faces challenges similar to Arizona's in reconciling growing water demands on all fronts. Over meals, researchers discussed the water situation in their respective states around Mexico. All of them indicated, despite living in very different parts of the country, that a lot would have to change with both social attitudes and water laws before any water would ever flow in those dry creek beds.

Presentations at the symposium covered several projects working to realize economic value from intact habitats. A large-scale UN program, REDD, is providing financial incentives to landowners to keep land in its natural form. Locally, researchers from the University of

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additional resources from outside the area in which the fire originated. Above normal potential indicates significant fire risk. Efforts to predict areas of significant fire potential are aimed at positioning resources where they can be deployed quickly and efficiently when needed. Predictions also assist decision makers and individuals to take steps to protect people and structures from wildland fires.

Fire potential depends on multiple interacting factors. The amount and timing of precipitation are among the most important. Rain and snow pack influence the air and soil moisture, the growth of fuels and their moisture content. Generally speaking, the more precipitation there is the lower the risk of fire. But, it is not that simple. A wet early spring may delay the start of fire season, but the growth of grasses and shrubs stimulated by the rain, combined with a dry late spring, means more fuel for a fire.

The outlook for this fire season is uncertain in part because precipitation forecasts are uncertain. A major influence on our climate, the El Niño Southern Oscillation (ENSO) recently transitioned from La Niña to neutral. Assuming that the ENSO is moving to El Niño condition, the timing of a transition could be very important. Under neutral conditions there remains a good chance for a normal monsoon in southeast Arizona; while a transition to El Niño would increase the probability of a drier than normal monsoon. Although El Niño conditions are associated with wet winters, winter rains would come too late to mitigate fire risks this spring and summer.

Beyond precipitation uncertainties, climate change is likely to exacerbate the situation. There is strong evidence for a warming earth in the temperature record of the last 20 years. Even if climate change brings no decrease in precipitation, the higher temperatures alone will increase dryness and therefore fire risk. Other evidence of climate change is found in the length of the fire season. According to the Forest Service, there are many parts of the country where the season is a month longer than it was in the past.

The fire season has already had a strong start in some parts of the country. Drought and record high temperatures in western Texas set the stage for dramatic series of lightning caused wildfires that burned more than 19,000 acres of land in late April of this year. This occurred in the same area burned by wildfire last year. At almost the same time, the Apache Pass Fire, a fire burning in the Chiricahua Mountains of southeastern Arizona, burned more than 1,700 acres of Bureau of Land Management, Arizona State Trust, and private land before it was contained.

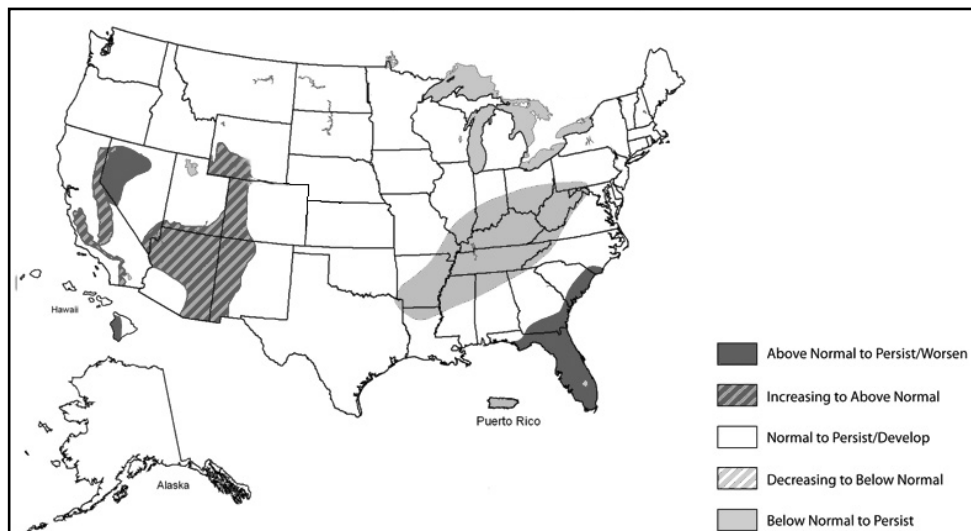
Forestry officials worry that the wildfire season this year could

be as bad as it was last year. The Wallow fire last year set the record in Arizona for acres burned—more than half a million—destroying 32 homes and 4 commercial buildings.

Although the Wallow fire was the worst on record, Forest Service officials maintain that it could have been much worse. Forest thinning practices that have gained widespread acceptance in recent years are credited with turning an intense fire moving rapidly through the crowns of the trees to a ground surface fire that was more easily contained. This was especially important at the human-wildland interface, where thinning and other landscape management practices protected structures and people.

Contrast the Monument Fire that burned approximately 30,000 acres during the same period and damaged or destroyed 62 homes and 4 businesses. Forest thinning was planned but had not been done and many structures were exposed because appropriate landscape management, such as clearing brush, had not been practiced.

In these times of heightened fire risk, it is more important than ever to have scientific information on which to base planning and decision making. UA researchers have been engaged for many years in studying the interactions of fire, climate and hydrology. For example, UA is home to WALTER:



Map indicates National Wildland Fire Potential for fires greater than 100 acres, during the period May-July 2012. Source: Climate Assessment for the Southwest (CLIMAS)

Fire-Climate-Society model (FCS-1), which is an online, strategic wildfire planning model, developed using the Catalina-Rincon, Huachuca and Chiricahua sky island ecosystems as three of four initial study areas. The model allows decision makers to understand their risks by constructing scenarios and generating maps of the fire hazards and fire risks in their area.

In 2011, a team of researchers at UA received a \$1.5 M grant from the National Science Foundation to study fire behavior in the Southwest over the past 2,000 years. The team contains interdisciplinary expertise, including tree-ring science, fire ecology and forest fire behavior, archaeology and anthropology. The project team will be looking into forest fire history, fuels and forests, how human activities have changed them, and the influence of drought and dry conditions.

The devastation of fire is bad enough, but post-fire conditions can amplify damage and delay recovery. After a wildfire the landscape is at risk for additional damage when rain follows the fire. Wildland fires can not only destroy vegetation that anchors soil and minerals, they can actually change soils in ways that lead to drier conditions. Fires can cause formation of a water repellent layer on the soil surface causing water to run off; at the same time they rob the soil of its capacity to retain moisture. These changes can persist for many years.

Because of the loss of anchoring vegetation and changes to the soil, the risk is heightened for major erosion, even mudslides and



WRC Awards 104(b) Grants for 2012-13

Three new research projects received funding through the Water Resources Research Act, Section 104(b) program. The Section 104(b) program, which is administered by the U.S. Geological Survey, provides support for research projects on water-related issues in each of the 50 states, 3 territories and the District of Columbia. This year, the WRC selected three 104(b) projects that focus on toxic substances in Arizona's wastewater.

The call for proposals this year drew attention to on-going efforts to implement research recommendations made by the Blue Ribbon Panel on Water Sustainability. Several of these recommendations aimed to encourage reuse of wastewater by resolving issues of water quality.

Reyes Sierra and James Field focus on nanoparticle contamination in "Fate of Emerging Nanoparticle Contaminants during Aquifer Recharge with Treated Wastewater." The growing application of engineered nanomaterials (particles less than 100nm) in industrial processes and consumer products is leading to increasing emissions of nanoparticles (NPs) into the environment. Engineered NPs are contaminants of emerging concern. Studies conducted over the past ten years have provided compelling evidence that a variety of engineered NPs can cause toxic effects to mammalian cells and other ecologically-important species. Effluent discharges from municipal and industrial wastewater treatment plants are important sources of NP emissions into the environment. In Arizona and other locations where artificial aquifer recharge with treated sewage is practiced, NPs carried by the wastewater could potentially be transported to groundwater used for drinking water supply. The purpose of this study is to determine the extent to which NPs in treated wastewater are attenuated by soil-aquifer treatment.

David Quanrud, Robert Arnold, Eduardo Saez, and Shane Snyder focus on trace organic contaminants in "Toxicity of Emerging Contaminants in an Effluent Dependent Stream: the Role of Suspended Solids and Sediments." This project will evaluate the toxicity and endocrine disruption activity due to trace organic contaminants (TOrcs) associated with solid phase sources and sinks in an effluent dependent stream near Tucson, Arizona. The work builds on a recent study by the principal investigators that examined the transport and fate of a suite of TOrcs along a 22-mile reach of the Lower Santa Cruz River (SCR) extending downstream from two municipal wastewater treatment facilities in Pima County, Arizona. Project results will provide the first information concerning toxicity, including estrogenic, androgenic, and cytotoxicity measurements derived from solid-phase associated TOrcs in sources and sinks in the Lower SRC. Proposed work is motivated by the need to assess the transport and fate of TOrcs toxicity contribution provided by the solid-phase in an effluent dependent stream, along with the need to establish baseline data in the Santa Cruz River prior to the 2015 completion of upgraded treatment processes at the Pima County municipal wastewater treatment facilities, upgrades that are expected to improve effluent quality and river health substantially.

Channah Rock and Leif Abrell focus on conventional activated sludge in "Does Increasing Solids Retention Time in the

Wastewater Treatment Process Affect the Persistence of Antibiotic Resistance Genes?" The conventional activated sludge process exposes bacteria to both ideal growth conditions and relatively high concentrations of trace chemical pollutants. Though increased solids retention time (SRT) has been correlated with reductions in trace antibiotics, higher SRTs also provide prolonged exposure of bacteria to influent antibiotic levels, potentially increasing the development of antibiotic resistance (AR). The proposed study will assess the effects of varying SRT in full-scale activated sludge processes on the degradation of trace antibiotics and microbial selection for AR. A detailed assessment of rates in AR development and identification of bacterial processes contributing to AR will aid in technological advances to decrease the prevalence of AR in recycled water, alleviating environmental and public health concerns.

Public Comments on Proposals for Operating Glen Canyon Dam

Federal officials have come up with nearly a dozen proposals on how to operate Glen Canyon Dam in northern Arizona. The U.S. Bureau of Reclamation and the National Park Service scheduled a two-day meeting in Flagstaff to present those plans to the public. The meeting was held on April 4 and 5, 2012 at the High Country Conference Center in Flagstaff, Arizona. More than 70 people attended the meeting, including members of the public, stakeholders, and project staff from Reclamation, NPS, and Argonne National Laboratory.

Operation of the dam affects hydroelectricity, beach recreation, archaeological sites in the Grand Canyon and native fish in the Colorado River. Since the 1960s, the Dam has starved the river of the sediments that gave the river its name; new operating rules could mitigate that situation.

The agencies have been gathering input on what they say is the first comprehensive review of dam operations in 15 years. They will ultimately produce an environmental impact statement with proposed changes. The EIS will evaluate dam operations and identify management actions and experimental options that will provide a framework for adaptively managing Glen Canyon Dam over the next 15 to 20 years.

New U.S. Water Partnership Formed

The US Water Partnership (USWP) is a new U.S.-based public-private partnership (PPP) that gathers American expertise, knowledge, and resources to address water challenges around the globe. The partnership will create new opportunities for international engagement for a broad spectrum of U.S. entities.

The USWP was derived from a series of consultative meetings held between January and September 2011 with representatives from the private sector, NGOs, academic/scientific institutions, and U.S. government agencies. They agreed on the need to share U.S. knowledge, leverage and mobilize resources, and facilitate cross-sector partnerships in order to scale up innovative solutions. Activities will focus especially on the developing world, where needs are greatest.

The U.S. Water Partnership is intended to connect people and

Water Partnership continued on page 4

ANNOUNCEMENTS



WRRC Student Takes Young Professional Prize at AZ Water Conference

Kelly Mott Lacroix, graduate research assistant at the WRRC, is the 2012 winner of the AZ Water's Young Professionals Fresh Ideas contest for her presentation at this year AZ Water conference, May 2-4. AZ Water will be sending Kelly to the national conference of the American Water Works Association (AWWA) in Dallas, Texas, June 10th-14th to present her poster. The Fresh Ideas poster session at AWWA Annual Conference and Exposition (ACE) is intended to involve young professionals in AWWA and stimulate progressive thinking. Each year AWWA sections hold competitions and select winners to send to ACE. This is the 5th year that AZ Water has sent Young Professionals to the ACE.

Kelly won for her presentation describing her work at the WRRC on assessing environmental water needs in Arizona and the Colorado River basin. Her presentation focused on the WRRC's work with stakeholders across Arizona to understand how to define environmental water needs; identify how to incorporate them into planning; and build upon continuing efforts to address the increasing water demands in Arizona.

Webinar Series on Water Conservation for the Environment Offered

The University of Arizona Water Resources Research Center (WRRC) is hosting a new webinar series focused on innovative approaches to link water use with the environment. This five part series stems from the WRRC's Conserve to Enhance water conservation program and their environmental water planning efforts. The second installment in this series occurred May 10, 2012 with the theme, "Achieving Environmental Goals through Water Utility-based Incentive Programs." Featured speakers included Drew Beckwith (Water Policy Manager, Western Resource Advocates), Dale Lyons (Water Resources Coordinator, City of Santa Fe Water Division), and Candice Rupprecht (Applied Programs Coordinator, WRRC). The final three webinar presentations will take place over the summer and discuss topics such as

- Establishing a User Contribution Program (June 2012)
- Accounting Mechanisms for Tracking Water Conservation and User Contributions (July 2012)
- Program Evaluation and Expansion in Your Community (August 2012)

For more about these webinars, please visit the WRRC website at <http://wrrc.arizona.edu/c2e>.

U.S. Water Prizes Awarded

The Clean Water America Alliance, a non-profit association of individuals and organizations, both public and private, hosted a ceremony in Washington D.C. to award the 2012 U.S. Water Prize. The prize was presented to six outstanding organizations at the ceremony attended by 300 U.S. water leaders. Keynote speakers at the ceremony included the Honorable Anne Castle, Assistant Secretary for Water and Science, U.S. Department of the

Interior; Nancy Stoner, Acting Assistant Administrator for Water, U.S. Environmental Protection Agency, and; Ann Mills, Deputy Under Secretary for Natural Resources and Environment, U.S. Department of Agriculture.

Two of the prize winners have Arizona connections. According to the Alliance's description of the organizations, "Pepsico Frito-Lay is instilling a corporate culture of water conservation and re-use to save water, energy, and money. As one example, a Frito-Lay chip-making facility in Casa Grande, Arizona is reducing its water footprint by cleaning and re-using process water, leaving more for citizens and ecosystems in a thirsty region. A 700,000 gallon-per-day system recycles process water and treats it to drinking water standards for various uses within the plant, saving up to 100 million gallons of fresh water per year that would otherwise be withdrawn from the region's aquifer."

Accomplishments in education were also honored, with the award to Project WET Foundation, a national organization that includes Arizona Project WET. In the description of Project WET, the Alliance stated that the organization "has created a world-wide water web of students, teachers, trainers, and sustainers in 50 states and 56 countries, with no sign of slowing down. Educational and inspirational tools help children of all ages connect to their watersheds, see the worth of water and take action for stewardship and sustainability."

Wild About Water


Have you ever wondered -

- Where does the water that pours from our faucets come from?
- Why are Arizona's rivers so vital for both people and nature?
- What can we do to save water and protect our rivers?

Participants in Arizona Project WET's "Wild About Water" learn the answers to these three key questions about our rivers.

The Nature Conservancy and Arizona Project WET are working together to provide fun and interactive ways for students, teachers and community leaders to learn about Arizona's rivers—and the journey water takes to our faucets.


During the 2011-12 school year, this partnership reached 10,000 students in the Phoenix area. Activities included: classroom activities, science education and water audits; research field trips that give students an invaluable firsthand look at the state's rivers; and water festivals that engage young students in fun activities.

To find out more, watch the video at <http://www.youtube.com/watch?v=uPMPHWC1IA>. 

Water Partnership continued from page 3

resources, making information easily accessible and leveraging the assets of partners to offer a range of "best of the U.S." solutions tailored to priority water needs.

The USWP will measure both quantitative and qualitative results from activities based upon the type of water challenge being addressed. Success will be measured by how well the program meets partners' goals and by the overall impact on the larger water security challenges facing people and the planet.

For more information, visit www.uswaterpartnership.org. 

LEGISLATION



Legislature Adjourned after Active Session

The following is a sampling of water related activity in the past legislative session that adjourned May 3, 2012.

A study of large-scale water harvesting received final OK. HB2363 established a 29-member Joint Legislative Study Committee to evaluate macro-harvested water issues. Large-scale rainwater harvesting has potential that is not as well understood as small-scale harvesting, and this committee aims to fill the information gap. This bill passed in both the House and Senate and was signed by the Governor on March 27, 2012. The study committee must deliver a report with recommendations to the Governor and Legislature by September 30, 2013.

Efforts to force Tucson Water to end its moratorium on extending service outside its boundaries were suspended by adjournment. HB2416 would have required cities or towns in counties with between 500,000 and 1.3 million residents, which provide water services to people outside of its municipal boundaries, [Tucson] to supply water services to landowners outside of their boundaries. Several characteristics would all have to apply: the land outside these boundaries is not within the territory served by the city or town that distributes potable water through a municipal delivery system; the property owner agrees to pay reasonable fees or charges; and the land outside of the boundaries is accessible to the water delivery infrastructure of the town.

A new program will allow cities, towns and schools to set up energy and water savings accounts to fund water and energy saving projects. HB2830 laid out guidelines for cities, towns, or schools that choose to establish an energy and water savings account. The legislation also details how such funds are allowed to be used. Funds can be used for capital investment only in energy or water savings measures in facilities owned by the locality. Or it can be used to repay financial institutions for those projects. The bill was approved by the Senate and signed by the governor on April 10.

An agreement between the United States and Mexico allowing Mexico to store Colorado River Water was supported by a Joint Resolution of the Arizona Legislature. HJR2002 allows the director of ADWR to forebear Arizona's rights to surplus water from the Colorado River in support of the agreement with Mexico. The director is also authorized to enter into agreements to forebear additional Intentionally Created Surplus, provided that there are no adverse impacts on Arizona water users. Having passed in the House, the bill later passed the Senate unanimously on April 3.

The Senate initiated a measure with two separate impacts, one relating to water harvesting and one to instream flow applications. First SB1236 requires ADWR to adopt rules governing acceptable water harvesting practices and to establish a method for measuring the base amount of water harvested. The ADWR will also be required to establish two pilot projects in water harvesting, monitor and evaluate them, and release information from the projects to the public. The legislation also lays out additional specific requirements for people filing instream flow applications, including the requirement to include five years of measured instream flow data with the application. The result is to make application for instream flow permits more difficult. On March 26, the House approved the bill with amendments and the governor eventually signed it on April 17.

A pair of bills dealing with funding for the Arizona Department of Water Resources failed to make it through the legislative process. First, SB1288 would have repealed legislation that gave ADWR the ability to levy fees on municipalities in order to fund its activities. In January 2012, ADWR had collected almost \$6 million in municipal fees. The impact of repealing the municipal fee was estimated at \$6.3 million for FY 2013. Thus SB1288 also appropriates \$6.3 million from the General Fund for ADWR to use in FY 2012-2013. To mitigate the impact on the General fund, HB2493 created a joint legislative committee to investigate possible funding sources for the ADWR. The bill also repealed ADWR's ability to collect fees from municipalities, starting on June 30, 2014. It was estimated that in that year the impact on the General Fund could be up to \$7 million, but made no appropriation. The Senate passed SB 2188 and conveyed it to the House, where it passed House Appropriations on March 21 and held in Rules. HB 2493 made a similar trip in the opposite direction, but was held in Senate appropriations.

Tribal Members Question Navajo-Hopi Settlement Act

The Navajo-Hopi Little Colorado River Water Rights Settlement Act is facing some tribal opposition that may derail chances for passage in the current Congress. The Act essentially settles tribal claims to the Little Colorado River by trading unquantified claims for specified rights and funding for water supply projects. The Act gives the Navajo Nation the right to unlimited amounts of water from the Little Colorado River as it flows through the reservation and from groundwater under the reservation, for use on the reservation. While unlimited, the ability to put these rights to use is constrained by hydrologic, geologic and economic realities.

As Senator Kyl stated when he introduced the legislation in February, "legally the Navajo Nation and the Hopi Tribe may assert claims to larger quantities of water, but ... they do not have the means to make use of those supplies in a safe and productive manner." Despite his strong desire to see passage of the Act before he retires, Kyl told tribal leaders that he would work to advance the bill through Congress only if both the Navajo Nation and the Hopi Tribe give their approval.

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Environmental Interests continued from page 1

Chihuahua, the official hosts of my visit, are exploring the use of native plants – sotol, for example - as alternatives to conventional crops. The native species are less water-dependent than non-native species and can support natural ecosystem processes. If they can establish a market to sustain the plantations, they hope to persuade local landowners away from using more water-intensive crop choices.

The conference offered an afternoon tour of three nearby towns by restored trolley car, visiting important sites in local history. Most of the events described were separated into pre- and post-Revolution history, and Pancho Villa was associated with many. Every one of my new friends talked with pride about how important and positive the Revolution, and Pancho Villa's contribution, was for Mexico. At dinner

after the tour, they offered personal stories. Once, before coming into town, Pancho Villa and his gang had commandeered food and drink from a poor rural family. As part of his intimidation, Villa threatened one man (the storyteller's grandfather) with death. As his grandfather was led towards the creek where he was to be hanged, his grandmother had chased after them, tearfully pleading with Villa to have mercy. Unexpectedly, Villa relented and the man went free. In the next story, Pancho Villa actually killed someone's uncle, a former member of Villa's gang. The story went that the uncle had turned against Villa, breaking the rule about loyalty. And yet, they all maintain great respect for this volatile national figure and what he accomplished.

Fascinated, I took it all in and it stayed with me even after I left Mexico. Pancho Villa is gone now, and Mexico is better for having had the Revolution. Yet I'm amazed that these people found a way to embrace this figure who killed and exploited many along the way as also a national hero. Clearly, the venom is gone: they see no need to hate the man or hide his deeds. I wondered if this is a part of Mexican culture, but could not find a way to ask. Regardless, this perspective remains: understand that the trials of the past are necessary for the fulfillment of the present. The people I spoke to found ways to live comfortably with the contradictions inherent in complicated things, keeping their country's best interest forefront in their minds.

Despite being divided by the border, Arizona and northern Mexico face similar challenges, in part because the landscapes are so similar. We also share a common pattern of human development that started with individual settlers and exploded to create expanses of farmlands, cities, and mines. I imagine that when colonial settlers first entered this region they couldn't see how filling their small buckets with water or making small diversions could ever dewater a whole stream. As population increased and technologies improved, their capacity to develop water resources kept pace to sustain growth.

Unfortunately, increasing water use eventually overcame nature's ability to absorb the impacts. Groundwater withdrawals and stream diversions reduced surface flows, impacting native species and harming riparian vegetation. But the lesson here need not be that those early actions were bad. Taking a cue from the Pancho Villa illustration, the means used for achieving current prosperity may not be the appropriate means to move forward, but that doesn't make the accomplishments any less heroic. Importantly, Arizona's water management does not need a villain: all water users create value from their water use. The complication is that with limited supplies, innovative approaches to water management are needed that reflect modern knowledge.

The social movement to protect the natural environment started in the United States over 40 years ago, years after water, energy, and road infrastructure were in place. But the built environment is not the only place where retrofitting with more sustainable technologies is costly and time-consuming. With advances in human understanding, it takes time for the underlying science to evolve, for society to absorb it, and for institutions to apply new knowledge. By sharing the WRRC's efforts to

portray the environment as a water sector, we hoped to inspire our Mexican colleagues to consider new strategies for engaging the public and developing voluntary arrangements within the existing water management framework. Unexpectedly, they offer us a new perspective on addressing the challenges that remain in reconciling the water demands of all sectors, without looking for a fight. 🏗️



The author, Joanna Nadeau, with her Mexican hosts, Jesus Miguel Olivas-García (right), Jose Álvaro Anchondo-Nájera (left). Source: Joanna Nadeau

Mexican University Students Visit Tucson

On Monday, May 14, 20 undergraduate students from the Autonomous University of Chapingo in Bermejillo, Durango, Mexico spent the day learning about water in Tucson and the activities of the WRRC, including water harvesting, Arizona Project WET and the Water for the Environment Program. The event was part of a larger trip to southern Arizona sites related to the students' program in agriculture and natural resources. Sights included the Biosphere and the Southwest Watershed Research Center. Chaperone Manuel Azpilcueta organized the visit after meeting Joanna Nadeau, WRRC Research Analyst, in March at The International Symposium of the Flora of Arid Zones in Torreon, MX. The students were accompanied during their stay by Carianne Funicelli Campbell from RECON Environmental, Inc, and Leah Edwards and Placido Dos Santos from WRRC. Dos Santos provided help with Spanish translation as well as presenting an overview of Arizona water supplies and water policy. The highlight of their visit was a field trip to Sweetwater Wetlands, Tucson Water's Reclaimed Water Plant, and Pima County's Swan Wetlands Ecosystem Restoration project. Special thanks are due to Tucson Water's Fernando Molina for giving tours, staying on hand all day to answer questions about Tucson Water and aiding with translation. 🏗️

SPECIAL FEATURES



WRRC Conference Inspires Environmental Science Students

In January, students in the Introduction to Environmental Science class, offered to undergraduates by the Department of Soil, Water and Environmental Science, attended the WRRC's Annual Conference, "Urbanization, Uncertainty and Water: Planning for Arizona's Second Hundred Years." As an extra credit assignment, they were to write about what they learned and hold their own panel discussion to talk about the conference topic. Panelist explained to the class the key concepts raised during the conference and led a discussion in which the student's grasp of the complex issues was impressive, given their limited formal education in water resources. While not always exactly accurate, the reports they produced captured some of the essence of the discussions. The following are excerpts from the papers.

Andrew Ranshaw, wrote about the keynote address by Dr. Robert Lang, Professor of Sociology and the Director of Brookings Mountain West at the University of Nevada, Las Vegas. Ranshaw was impressed that "Atlanta ... survives solely on rain fall. This can be dangerous when there are unpredictable, poor, rain seasons." His classmate, Marissa Dudenake noted that the only additional source of water for Atlanta is Lake Lanier, which the city does not control. What struck Dudenake was the contrast Professor Lang drew between water management practices in the East and

needs to realize why change has to be made."

"Brown ended his segment by stating that it is up to the people to decide where we go in the future with regards to Arizona's water supply. The people must decide that they are ready to abandon their current use of water for a more sustainable and environmentally friendly approach."

Both Monique Trejo and Ilison Schannep were interested by the panel of industry representatives. Schannep described the first presentation in this way, "The first speaker, John Graham, owned Sunbelt Holdings for over 30 years. His business master plans communities and consequently water has a large impact on every day decision-making. He consistently deals with issues of water policy and water availability and how they change with new laws. He said he was optimistic however, and wants to protect nature while promoting the growth of his new business. He believed that it's not a question of "if," but "how" and "when" solutions to conserving water and expanding will take place."


Schannep also noted: "The final speaker, Rebecca Comstock, spoke from a mining perspective. She ... presented data that showed that her mining companies only consumed a small percentage of water. She also mentioned that multiple water sources and water management practices are reviewed regularly." Trejo closed by mentioning that her favorite part "was when Comstock explained how her company plans on developing a water Task Force to establish a water conservation program to minimize the environmental impact that mining has on the environment."

Two other students described the luncheon talk by historian Jack August. Jan Brewer repeated the speaker's broad thought questions: "Do we seek to preserve agriculture? What is the balance between current lifestyle and growth? Should we limit landscaping and pools? Should there be higher density housing? He also reinforced the message that we need to change the focus from 'We're going to run out of water.' to 'What do we want to do with the water we have?'"

Brandon Johnson focused on the historical context, "Dr. August argued that events in history affect people today. In turn, events today will affect people in the future." Both students ended with his look to the future. In Brewer's words, "He ended his discussion with the call to demonstrate similar urgency, resolve and wisdom [as shown in the past 100 years], in shaping Arizona's water usage and management for the next 100 years."

Professor Joan Curry, the class instructor, observed, "These students are remarkable – active, engaged and ready to learn about water and the factors that go into managing it. The Water Resources Research Conference was an ideal opportunity to actively bring the students into discussions on current issues in water resources."

We at the WRRC appreciate the interest these students took in the conference. One other point made at the conference was the vital need to involve young people in the resolution of water challenges.

We hope the class concurred with Ilison Schannep's assessment: "Overall, it was a very informative and interesting conference and hearing the views of business owners and environmentalist on the same issues broadened my perspective and increased my awareness of Arizona's great need." 



Robert Lang, keynote speaker at the WRRC's annual conference, talks with conference attendees. Source: John Polle, WRRC

the West. "He also said that many criticize the west for not being sustainable and that it is an incorrect assumption because if the west wasn't sustainable, then there wouldn't be large metropolises and thriving cities that have lasted many years. ... [I]n fact, Las Vegas is a metropolis in the West and it has one of the best water systems [in the country]."

Shelby Thompson focused her report on the presentation by David Brown "a well-known water attorney and Co-Chairman of ... [the] Water Resources Development Commission. Brown presented a report that was not only realistic in terms of Arizona's current water supply, but realistic in terms of what might be done in the future to sustain water resources." Thompson wrote that in summing up The Water Resources Development Commission Final Report, "Brown's first point was that the west has met the challenge of realizing that it has a very variable water supply. This is a positive and significant realization due to the fact that, before Arizona begins to make changes to improve its water supply, it



Watering the Sun Corridor Water Policy Workshop

by Jim Holway, Director, Western Lands and Communities, A Lincoln Institute of Land Policy - Sonoran Institute Joint Venture

What are our key water policy choices? What values underlie these choices? What are our priorities and our major challenges?

Eighty individuals gathered to discuss these questions in the Sonoran Institute sponsored pre-conference workshop on January 23rd, the day before the WRRRC's Annual Conference. A lively discussion ensued on the fundamental policy and value choices we will face about water in the Sun Corridor and on the driving forces that shape these choices.

Grady Gammage opened with his recent Morrison Institute *Watering the Sun Corridor* report and the Sonoran Institute's Joe Marlow discussed driving forces of change. The afternoon focused on small group discussions to dive deeper into four areas of water use that we believed would illustrate key policy and value choices for our region: agriculture, household, urban amenities and public areas, and the natural environment.

Key messages I heard included strong support for continued agriculture; increased priority for natural environment water uses; and a need for increased dialogue and public engagement on water issues

The workshop highlights below were compiled from key pad polling of the entire group and notes from discussions among diverse groups of six to eight people at eleven separate tables. Key pad polling questions interspersed throughout the afternoon were designed to solicit ad-hoc responses, illuminate key values, and provoke discussion. This instant polling and the table discussions of a self-selected audience certainly do not qualify as a systematic or random sample, they do however provide food for thought and identify interesting areas for further work and dialogue.

The participants were evenly split between Pima and Maricopa Counties with 12 percent from outside central Arizona. Participants represented a wide variety of sectors and included a majority with extensive experience participating in water policy meetings.

The first tasks at the eleven tables were to identify the priority water policy topics, to discuss what issues they were most concerned about, and to discuss whether the *Watering the Sun Corridor* report identified the most important water policy choices. We captured the approximately 50 different issues identified and combined these into 14 broad topics. In the final round of small group discussions, participants considered whether any additional topics needed to be included, at which point 3 additional topics were added.

These resulting 17 priority water policy issues and water uses were: Agriculture Use, Industry Use, Growth, Household Use, Public Use, Natural Environment Use, Water Pricing, New Supplies, Energy Production, Decision Making Process, Education, Equity, Conservation & Reuse, Climate, Water Quality, Prioritizing Local Needs, and Sustainability.

Using the key pad polling, participants voted for the five issues they considered top priorities to be addressed. Six of these 17 issues clearly came out on top: 1) Natural environment, 2) Water policy decision making, 3) Economics & water pricing, 4) Climate

change & variability, 5) Ensuring water sustainability, 6) Water & growth. Notably, private landscape uses of water and urban amenity uses of water, two topics highlighted in the workshop, received the lowest number of top five issue votes.

Additional results included:

- A majority of the participants recognized that some agricultural water would likely move to urban uses, but they put a priority on maintaining a viable production agriculture economy in central Arizona.
- Water for the natural environment was identified as a top priority water issue both in the key pad polling and during the individual table discussions. This unusual result for Arizona water discussions was, I believe, not simply the result of who attended the workshop but does in fact represent an evolving shift in Arizona's water discourse. Participants also indicated a significant willingness to pay to sustain natural areas.
- A majority of participants supported reducing household water use and, perhaps surprisingly, elected to do so using "all" tools – including regulatory approaches.
- When asked to prioritize eight different categories of water use, allocating water for new growth was by far the lowest priority. As would be expected, providing sufficient water to meet basic household needs was by far the top priority.
- Participants overwhelmingly supported some basic assumptions behind the workshop. Granted, there is a selection bias in terms of who attended the workshop, but I was surprised by the high level of agreement registered in the concluding votes.
- Future water scarcity will require difficult water allocation and management choices (52% strongly agreed, 35% agreed).
- Increasing uncertainty about supply and demand will require that we develop mechanisms to address uncertainty (63% strongly agreed, 27% agreed).
- Future water management will benefit greatly from broader civic engagement on the fundamental values and policy choices that underlie water management decisions (64% strongly agreed, 23% agreed).
- In the concluding small group discussions, issues related to insufficient water management capacity and decision making were the most frequently discussed topic.

This workshop was an initial step in the Sonoran Institute's efforts to advance a broad-based dialogue on water in the Sun Corridor. Our goal is to engage a larger community of organizations, individuals, and leaders; to consider the fundamental value and policy choices involved; and to move toward an agreed "vision" that can guide our future water policy choices.

Further information on this workshop as well as the issue briefs, presentations, participant characteristics, key pad polling results and summaries of the discussions are contained on the Sonoran Institute website at: <http://www.sonoraninstitute.org/watering-the-sun-corridor-workshop.html> .



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Kelly Mott Lacroix is a second year PhD student in Arid Lands Resource Sciences. She has a BA in Political Science and Spanish from Beloit College in Wisconsin, where she was also a member of Phi Beta Kappa and a Morris K. Udall Scholar. After completing her undergraduate studies she worked in Washington, D.C. as a

research associate for the Environmental Law Institute and then returned home to Arizona to work as a constituent liaison for the Arizona State Senate. In 2004 she moved to Tucson to pursue a MS in Environment and Healthy Cities Planning from the University of Arizona. During her master's degree she worked for Dr. Megdal on one of the first projects in the WRRC's water for the environment program; a study examining environmental restoration projects across Arizona. During her first stint at the WRRC she also assisted Dr. Megdal with a report on water resource availability for the Tucson metropolitan area.

She received her MS in 2006 and worked for the next five years as a water resources specialist for the Arizona Department of Water Resources (ADWR) in Tucson. At ADWR she helped produce the Arizona Water Atlas and later became the manager for the Community Water System program. When she left ADWR last July, she was working on a methodology to assess the vulnerability of Arizona's groundwater basins based on Water Atlas data and input from stakeholders across the state. She presented this methodology at the International Water Resources Association 14th World Water Congress in Porto de Galhinas, Brazil last September.

Last August, after having her second child in July, she returned to the WRRC as a graduate research associate to work on the Connecting the Environment to Arizona Water Planning (EnWaP) project. Kelly works on all aspects of the project, from creating GIS maps and analyzing environmental water needs data to working with water managers and other stakeholders across the state to help build consensus on how to incorporate water needs of the environment into water planning. As a third generation Arizonan who has traveled and lived in both urban and rural Arizona, Kelly particularly enjoys the EnWaP project for the opportunity it provides her to meet other people and gain their perspective on our water resources and the future of our state. Kelly enjoys working at the intersection of hydrology and water policy and has a passion for taking complex scientific data, simplifying it and exploring how it can be used to better plan for our water resources. Last fall she received a Central Arizona Project Award for Water Research for her paper examining how adaptive management theory, which was first used to understand ecosystem cycles, can help us improve water management in Arizona. Over the next year, as part of her dissertation research, she hopes to both synthesize the information the WRRC assembled on environmental water needs and use it to build a model to better understand and plan for the many unstudied streams in Arizona. Kelly intends to finish her PhD in Spring 2014. 🏡

research associate for the Environmental Law Institute and then returned home to Arizona to work as a constituent liaison for the Arizona State Senate. In 2004 she moved to Tucson to pursue a MS in Environment and Healthy Cities Planning from the University of Arizona. During her master's degree she worked for Dr. Megdal on one of the first projects in the WRRC's water for the environment program; a study examining environmental restoration projects across Arizona. During her first stint at the WRRC she also assisted Dr. Megdal with a report on water resource availability for the Tucson metropolitan area.

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Settlement Act continued from page 5

In November 2010, the Navajo Nation Council approved a water rights settlement agreement to resolve Navajo claims to both the Little Colorado River and Lower Colorado River mainstem. That agreement was the result of many years of negotiation among stakeholders in both the Little Colorado and Colorado River basins. However, the current settlement differs substantially from the 2010 agreement, which included \$800 million in infrastructure funding. Unfortunately, the \$800 million price tag was too high for the current Congress. The current settlement contains neither authorization for the Western Navajo Pipeline, nor a Lower Colorado River settlement.

Much of the opposition to the Settlement Act has been attributed to frustration over alleged lack of transparency in the process of translating the settlement into a bill that can be acted on by Congress and the complicated and confusing legalese of the bill. Stanley Pollack, the Navajo Nation's water attorney, admitted that the bill is densely and in some cases badly written.

The bill contains many waivers, contingencies and assurances that are difficult to parse. Its main provisions, however, would authorize roughly \$358 million for water infrastructure: principally the Leupp-Dilkon Groundwater Project, the Ganado Groundwater Project and the Hopi Groundwater Project, along with other smaller authorizations.

One provision of the Act appears to be a primary source of confusion. In addition to settlement of Little Colorado River claims, the Act contains an option for the Navajo Nation to acquire

6,411 acre-feet of Colorado River water without a Colorado River settlement. To acquire this water, certain conditions must be met, including the Nation's approval of leases and permits for operation of the Navajo Generation Station and the Kayenta coal mine through 2044. Although this provision would not affect the Little Colorado River settlement portion of the Act, it is a source of opposition from tribal and non-tribal groups advocating a transition to sustainable, renewable energy.

Arguing in favor of the settlement, Pollack pointed out that although it is not perfect, having no settlement means a return to litigation that has been going on for 33 years, with no end in sight. The settlement means there will be projects to bring water to water-starved areas, as well as other desired benefits, including the reservation of Colorado River water for a future Colorado River settlement.

A series of public meetings were scheduled in April to introduce Navajo communities to the provisions of the Act and take public comment. Public comments were predominantly negative and some exchanges became quite heated. Navajo President Ben Shelley, who initially favored passage of the Act, is now reserving judgment until tribal members have had a chance to learn about the provisions of the Act and to evaluate its meaning for the future of the Nation. The full text of the Act (http://www4.nau.edu/eeop/workshops/docs/wrkshps_WaterBill.pdf) and settlement agreement (<http://http://nnwrc.org/?s=settlement+agreement&submit.x=8&submit.y=10>) are available on line. 🏡



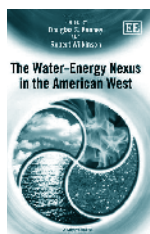
New Publications



Adaptation and Resilience: The Economics of Climate, Water and Energy Challenges in the American Southwest
 Edited by Bonnie G. Colby and George B. Frisvold,
The RFF Press Water Policy Series, February 2011.

In America's arid southwest, climate change will occur in the context of already-keen competition for water for agriculture, urban growth, electricity generation, water-based recreation, and environmental protections. *Adaptation and Resilience: The Economics of Climate, Water and Energy Challenges in the American Southwest* explores the challenges that climate change and variability pose for water and energy managers and users, communities, and policy makers in the arid Southwest and demonstrates the application of economic methods to address these challenges. It provides valuable tools for both those interested in resource management and climate change, and those seeking to understand how economic methods can be used to analyze contemporary social problems and craft appropriate responses.

The book considers both adaptation to long-term climate change and more immediate issues of water and electricity management in the face of inter-annual climate variability and drought. Thus, no matter what one's perspective on long-run climate change projections, the book provides useful lessons for some of the region's most pressing resource management problems.



The Water-Energy Nexus in the American West
 Edited by D. Kenny and R. Wilkinson, Edward
 Elgar Publishing, December 2011.

The nexus between water and energy raises a set of public policy questions that go far beyond water and energy. Economic vitality and management of scarce and precious resources are at stake. The Water-Energy Nexus in the American West contributes to the body of knowledge and understanding regarding water, energy, and the links between the two in the American West and beyond.

The book's first part details the basic methodologies and approaches to analyzing energy inputs to water systems and the water requirements for energy systems, providing suggestions for efficiency improvements. Part two focuses on the water necessary for energy production, including aspects of carbon capture and sequestration, oil shale developments, coalbed methane, solar thermal power production, and biofuels. A chapter specifically focusing on the energy consumed by the Central Arizona Project (Eden *et al.*) was contributed by WRRC's Director S.B. Megdal and Assistant Director, S. Eden, along with Christopher Scott of the UA Udall Center for Studies in Public Policy and Melissa Lamberton, University of Iowa. The chapter uses the Central Arizona Project

to illustrate the connections between economic growth, water scarcity, and the need for environmental stewardship. The final section of the book provides recommendations for more efficient linkages in the water-energy nexus.

The research and analyses presented by the authors shed new light on the choices that must be made in order to avoid unnecessary harm in the development and management of water and energy systems to meet public needs in an ever-changing environmental and economic climate. Indeed, the book shows that thoughtfully designed new technologies and approaches can help restore damaged environments and provide a range of benefits. The focus is the American West, but many of the lessons are global in their applicability. Students and researchers in economics, public policy, environmental studies and law along with planners and policy-makers will find this accessible and very current volume invaluable.

Arizona Blue Ribbon Panel on Water Sustainability
 By Channah Rock, Chuck Graf, Christopher Scott, Jean E. McLain, and Sharon Megdal

Arizona Cooperative Extension has published a bulletin (AZ1567, May 2012) on the Governor's Blue Ribbon Panel on Water Sustainability. The summary covers the purpose of the Panel, its discussions and recommendations, and outlines next steps. Copies are available at <http://cals.arizona.edu/pubs/water/az1567>. For more information, contact Channah Rock channah@ag.arizona.edu

The Final Report of the Governor's Blue Ribbon Panel on Water Sustainability can be accessed at <http://www.azwater.gov/AzDWR/waterManagement/BlueRibbonPanel.htm>.

Science-Policy Dialogues for Addressing Vulnerability and Adaptation to Global Change in the Arid Americas
 By Christopher A. Scott, Robert G. Varady, Francisco Meza, Elma Montaña, Graciela B. de Raga, Brian Luckman, and Christopher Martius, *Environment*, 54(3):30-42.

This article examines dialogues as adaptive responses to adverse effects of global environmental change that affects available freshwater supplies. The focus is on two areas experiencing water stresses relating to global change: the Sonora-Arizona drylands shared by Mexico and the United States and the drylands east and west of the Central Andes in Chile and Argentina.

"In these areas water remains acutely limited even as drought and flood extremes increase, ecosystems are under growing pressure, and economic globalization drives water demand."

There exist policies and actions that can alleviate some of the harm. Discovering and implementing these policies is the work of scientists, agency personnel, civil society, and decisionmakers engage in sustained efforts to reduce vulnerability and improve adaptation through science-policy dialogues. By looking at dialogues in the two study areas, the authors draw conclusions about the effectiveness of such dialogues and the conditions that contribute to their success. 🏗️

PUBLIC POLICY REVIEW

By Sharon Megdal

Arizona's Experience a Model for Groundwater Governance



I have been traveling internationally much of the time since my sabbatical started at the end of February. I spent just over one month in Israel as a Lady Davis Visiting Professor at The Hebrew University of Jerusalem, during which time I traveled to Marseille, France for the World Water Forum. In April, I spent some time in Montevideo, Uruguay attending the first regional consultation of the global Groundwater Governance Project (see groundwatergovernance.org and

the Guest View in the Winter 2012 issue of this newsletter). The Project is designed to bring attention to the importance of groundwater for many regions of the world and to identify best practices or frameworks for good groundwater governance. Most recently I visited Australia, home to the famous Murray-Darling Basin and the object of much interest by water professionals. While I learned a lot during all of these trips, what these experiences have driven home is that, although we have a lot of opportunity to improve groundwater management in Arizona, we have accomplished a lot, and some aspects of our framework can be a model for other groundwater-dependent regions.

Why do I say this? Because I learned that Australians are very interested in our approach to banking Colorado River water and aquifer recharge. I spoke to this topic when addressing researchers at CSIRO, Australia's national science research organization, and staff members at the Murray-Darling Basin Authority. While in Adelaide, I met CSIRO aquifer recharge expert Peter Dillon, who is responsible for writing the thematic paper on aquifer recharge for the Groundwater Governance project. After some one-on-one discussions and review of documents, he is featuring Arizona's approach to managing groundwater storage in his paper.

While at the World Water Forum, I spoke about water banking as a means of connecting surface water and groundwater use, even though Arizona's law considers them separately. Listening to others speak about how, in the context of large basins dominated by river systems, groundwater use and aquifer health are often-times overlooked, I sat there thinking, "that's not the case in Arizona!" We have given much attention to groundwater use, particularly in the Active Management Areas, and careful consideration of both the strengths and the weaknesses of our management approach can inform other efforts, such as the Groundwater Governance Project.

Along with UA colleagues Bob Varady, Andrea Gerlak and others, I have had the pleasure of working with the policy team for the Groundwater Governance Project. One important and challenging task for the project was to offer a working definition

of groundwater governance. We have built off of some existing definitions to define groundwater governance as "the process by which groundwater resources are managed through the application of responsibility, participation, information availability, transparency, custom, and rule of law. It is the art of coordinating administrative actions and decision making between and among different jurisdictional levels – one of which may be global." Here in the United States our decentralized approach to water management requires coordination of activities among different jurisdictions. We also have regulations that require government to conduct its business in an open, transparent way. In Arizona, our framework often establishes general rules but then allows individual water users and providers to determine how to meet the regulations. We do see that information is necessary for good decision making, even though obtaining information on groundwater and aquifers can be costly and time consuming.

I do not wish to suggest that others adopt our framework without careful consideration, as we have numerous outstanding issues to address. In Arizona, we do little management of groundwater unless an area has been designated an Active Management Area. While 80 percent or more of the state's population lives in an AMA, large areas of the state, including regions wholly dependent on groundwater, are not in an AMA. Knowing the rate at which groundwater is being depleted is important, as is knowing how much water is in storage. Additional conservation efforts and well spacing rules could benefit non-AMA regions. Requiring proof of adequate water supplies prior to subdivision development is also a regulatory issue receiving much attention. Within AMAs, where 100 years of assured water for new municipal development must be demonstrated, exempt wells, securing the water supplies for the Central Arizona Groundwater Replenishment District, and addressing areas with localized draw-down are just some of the issues water managers face. Planning for the recovery of the millions of acre feet of water stored is still ongoing, though the possibility of an official declaration of shortage on the Colorado River appears more likely than it seemed just one year ago. The list of outstanding issues is long.

In my presentations I often show a glass that is either half-full, or half-empty, depending on how optimistic or pessimistic I feel. I started this column focusing on the half-full part. Arizona's groundwater management framework can serve as a model for others; there are many things we are doing well. But the framework is not without problems. It's the half-empty part that we need to keep sight of because (1) we need to continue to manage water resources well on behalf of residents of Arizona, and (2) when we share our expertise, we help others and we can learn how to improve upon what we do and devise an even better system. 🏡



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Fire Threat continued from page 2

debris flows in steep terrain. Although gentle rains may contribute to recovery, intense storms and major rainfall events after a fire could be catastrophic.

Post-fire conditions and the responses to them were the subject of the 2012 Southwest Wildfire Hydrology and Hazards Workshop held this April at Biosphere 2, just north of Tucson. The workshop brought together researchers from multiple government agencies with academic researchers and other interested parties to discuss the state of post-wildfire research, disseminate recent advances and coordinate responses to future wildfires in the Southwest.

The workshop, arranged around broad themes, attempted to answer questions that concern the large and varied group of stakeholders. These included: What is the state of the science? What models exist and which model is better in which circumstance? What kind of warning systems have been used and how well have they worked? The focus was on improving responses through research and improved coordination.

Preparation and response to wildfires are key to minimizing damage. Forest managers, emergency response agencies and planners, among others, have a duty to work toward minimizing fire damage; but individual homeowners and business people also have a responsibility to prepare. At the wildland-human interface,

it is important to create defensible space around structures. Like forest thinning, removing potential fuel from around a structure can help if when wildland fire threatens. This means, for example, keeping grass mowed and shrubs trimmed, with no accumulation of woody debris near a structure. Arizona Cooperative Extension has detailed information for fire-resistant communities on their Firewise pages at <http://ag.arizona.edu/firewise/> 

2012 Arroyo Published

On May 1, the WRRRC published the 2012 Arroyo, its annual newsletter. The 2012 issue is titled: Border Water Source of Conflict and Cooperation, and it covers a range of water-related issues along the U.S. - Mexico border, focusing on Arizona - Sonora. Topics covered include differences and similarities in water management institutions and priorities, shared rivers, shared aquifers and transboundary agreements, organizations and programs. It concludes with a look to the future and a call for continued collaboration to solve border water challenges. A downloadable PDF is available on the WRRRC website at <http://wrrc.arizona.edu/publications/arroyo>.