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From the Director’s Desk:

OWRRI: A Linkage Institution

Most states have multiple water research, education, and outreach organizations. They can be found not only in public and private universities but also in different colleges within a single university. Others are located at government and non-government organizations. Moreover, the functions of these organizations vary widely: from basic research, technology demonstration/transfer and information repository/dissemination to policy analysis, public education and advocacy. The challenge facing federal policymakers in their consideration of the mission and resourcing of the nation’s 54 Water Resources Research Institutes is the niche that they should occupy. I believe that the Oklahoma Water Resources Research Institute is ideally suited to service as a linkage institution.

Linkage between Researchers and the State

The Water Resources Research Act requires that Institutes devote their federal funds to research, education and outreach that serves the host State’s water resource management needs. More specifically, the most recent WRRA amendments mandate that Institutes demonstrate that their activities contribute to improvements in the quantity, quality, and reliability of water supplies. The requirement that WRRIs conduct applied research is consistent with the requirement to establish advisory boards that set research priorities to ensure that research meets the needs of the State. The OWRRI consults with its Water Research Advisory Board, comprised of 24 leaders of water agencies and organizations, to define its research agenda.

Linkage between Basic Research and Policy

Many university-based water research centers focus their efforts on investigator-designed basic research at national, transnational, and global scales – in part because sponsors such as NSF, NOAA, and EPA are most interested in this research. However, insufficient attention is devoted to translating basic science in the service of water resource management “on the ground.” The OWRRI sponsors research aimed at linking basic science to practical problem-solving.
From the Director’s Desk, cont.

Linkage among Water Centers

Institutes can facilitate coordinated research among water research centers across their states. Focused on state needs, they are in a position to know the research and other activities in which the centers, and their affiliated researchers, are engaged. The OWRRI maintains a database of water researchers across Oklahoma and has funded research at four universities.

Linkage between Researchers and the Public

Given the statutory mission of education and outreach, Institutes are best suited for linking the findings of water research to the needs of water managers and users. The OWRRI sponsors water research symposia, film seminars, essay competitions, and other avenues to increase public awareness of water issues and resource management strategies.

Conclusion

The WRRA situates Institutes in an important linkage niche: science to policy, researchers to state agencies and the public, and centers to each other. No other linkage institution exists in most states. WRRIs should seek to successfully occupy this niche to benefit host states and the nation.

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Oklahoma water issues have been in the news quite a bit in the past several years due to lawsuits and attempts to buy water from the state. However, water issues have not been a key part of the 2010 legislative discussion. Of the more than 20 water related bills that were introduced this session only three remain alive and one, regarding wastewater treatment plant permitting, was signed by the Governor.

House Bill 3061 would create a Water Infrastructure Revolving Account. The purpose of the fund would be budgeted and expended by the Oklahoma Water Resources Board to establish and maintain critical water infrastructure in all areas of the state. The fund would be a continuing fund and not subject to yearly limitations. The measure passed the House and was referred to the Senate.

The Senate amended the bill to include a change to the Oklahoma Groundwater Law that would require any water trapped in a producing mine, originating from a sensitive sole source groundwater basin or subbasin be subject to the Oklahoma Groundwater law. The only sensitive sole source aquifer within Oklahoma at this time is the Arbuckle-Simpson Aquifer. This same language was originally in its own bill, Senate Bill 1285, both of which are now dormant, and was later included in Senate Bill 1689, which is also now dormant.

The Senate approved the amended bill, but the House, which requested a conference, rejected the amendments. The conference was granted and the members from the House have been named. This bill may end up dormant in the end due to the additional language added that has not successfully found its way into a law yet.

Also of interest is House Bill 3173, which would have consolidated the Oklahoma Scenic Rivers Commission into the Oklahoma Department of Tourism and the Oklahoma Conservation Commission. The original bill passed the House and sent to the Senate where it was amended and the title stricken. The new language would not only consolidate the Scenic Rivers Commission but almost every other state agency into the Oklahoma Department of Natural Resources. The bill lists 16 appropriated agencies and eight non-appropriated agencies that should be consolidated. The amended bill was passed by the Senate on April 21 and referred back to the House where the amendments were rejected and a conference was requested. As of the writing of this article no other action has been taken.

The final bill to discuss is Senate Bill 1761. This bill suggests changing the review period on out-of-state water sales from ten years to five. It appears this is a shell bill as the enacting clause was stricken by the House. However, a conference has been granted and conference members from both chambers named. It may not develop into anything but it is worth keeping an eye on for any last-minute changes.

On April 19th, the House introduced House Concurrent Resolution No. 1061 which demands that the parties involved in the Sardis Reservoir agreement not take or complete any further action on the agreement to sell or lease Sardis Reservoir assets until the Oklahoma Comprehensive Water Plan is complete. HCR 1061 also directs that any monetary or economic benefit be proportionally distributed to all governmental entities and citizens.

If you are interested in tracking the bills yourself you can visit the state’s bill tracking website at http://webserver1.lsb.state.ok.us/WebBillStatus/main.html. Just click on the Basic Search Form tab on the left and enter the bill number in the Measure Number(s) box and hit Retrieve.
2010 Sponsored Research Projects

A Fluvial Geomorphic and Sediment Transport Study of the Little River Upstream of Lake Thunderbird Using an Acoustic Doppler Current Profiler (ADCP)
Randall L. Kolar, Baxter E. Vieux, Robert W. Nairn, Jason Julian

Sediment is one of the major issues facing Oklahoma water resources. Not only does the suspended sediment degrade water quality, but it also reduces the quantity of available water in reservoirs when it settles. In addition, the sediment often results from significant stream bank erosion that can damage property.

Yet given its importance, sediment transport is rather poorly understood. This is because of the difficulty in accurately measuring it. First of all, most sediment is transported during high flows, so measurements must be made under challenging circumstances. Second, there is huge variation in the size of the particles and the manner in which they are transported, from tiny dust-sized particles that are suspended to large boulders that roll along the bed of the stream. Finally, traditional methods for measuring sediment involve placing instruments in the stream flow to capture particles. However, the presence of these instruments alters the current and may impact the amount of sediment trapped.

This project seeks to improve our understanding of sediment transport in Oklahoma streams by testing a new Acoustic Doppler Current Profiler (ADCP) developed for streams of less than 2 m depth. ADCP has the advantage of measuring sediment in the water without having to capture the particles and so does not interfere with water flow.

Researchers will measure the amount of sediment in the Little River over a range of flow rates. This will allow them to estimate the total volume of sediment transported by the river into the lake. A better measurement technique will lead to a better understanding of sediment transport, which can then guide efforts to combat this significant problem.

Water conservation in Oklahoma urban and suburban watersheds through modification of irrigation practices
Justin Quetone Moss, Michael Smolen, Dennis Martin, Tracy Boyer, Damian Adams, Kemin Su

The goal of this project is to promote more conservation-oriented landscape water use in Oklahoma. This will involve understanding homeowners’ perspectives regarding landscape irrigation, improving the information available to home owners and others about the water needs of lawns and associated landscaping in Oklahoma, and finally preparing educational materials to inform citizens about ways to conserve water while maintaining the health of these plants.

The researchers will survey homeowners and lawn care companies to better understand their knowledge and decision making about irrigation. Furthermore, in order to better understand the water needs of lawns, researchers will assess the evapotranspiration data provided by Oklahoma Mesonet. Finally, the researchers will develop a program to educate Oklahomans about appropriate lawn irrigation tailored to their location and landscape needs. This program will consist of developing 1) a turfgrass and landscape water use and conservation guide, 2) field based demonstrations of proper turfgrass and landscape irrigation, and 3) a workshop and “train-the-trainer” materials for Oklahoma municipalities and the OSU Cooperative Extension Service.
Drought monitoring: a system for tracking plant available soil moisture based on the Oklahoma Mesonet
Tyson Ochsner, Jeff Basara, Albert Sutherland, Chris Fiebrich

Drought is a frequent and often costly problem for Oklahomans. Although most people think of drought as a lack of rain, measurements of rainfall alone are poor predictors of drought impacts, because costly short term soil moisture deficits can occur in years of average or above average rainfall. Soil characteristics play an important role in determining the impact of dry conditions on plants. Thus, a better predictor of drought impacts is the amount of water in the soil that is available for plant roots to absorb (referred to as plant available water).

The Oklahoma Mesonet provides real-time weather and soil information from over 120 stations across the state. This includes soil moisture sensors but not plant available water. This project involves collecting soil samples from every Mesonet site, measuring the essential soil properties governing plant water availability, and using the resulting information to create the world’s first statewide automated monitoring system for plant available water. This monitoring system will provide resource managers with reliable information on the remaining reserves of plant available water enabling them to better adapt their management strategies.

Recent Publications from OWRRI Sponsored Research

Each year, OWRRI-sponsored research is made available to a broad audience through publications and presentations in a variety of settings. Below is a list of some of the recent publications; page 7 begins summaries of the final reports from our 2009 research projects. While OWRRI was not the sole sponsor of all listed projects, we are pleased to play a part. If you need copies of a journal article or final report, contact us so we may assist you.


OWRRI Water Research Symposium
Call for Papers and Posters

Each fall, the Oklahoma Water Resources Research Institute holds its annual Oklahoma Water Research Symposium in conjunction with the Oklahoma Water Resources Board’s Governor’s Water Conference each fall. The 2010 event will take place October 26th and 27th in Norman, Oklahoma.

The OWRRI invites researchers to submit abstracts for oral presentations, professional posters, and student posters for the Symposium.

Abstracts on a wide range of research topics concerning water in Oklahoma – including but not limited to surface water, ground water, water quality, water quantity, aquatic habitat (instream flow needs and habitat maintenance), low impact development, water conservation, water reuse, water transfer, hazards (flood and drought), climate change, and water resource policy – are encouraged.

Audience: The 2010 Symposium will highlight scientific content. Abstracts should be focused on specific scientific research while remaining accessible to a general, non-expert audience as this symposium/conference combination attracts over 400 water professionals, policymakers, and interested citizens from many disciplines.

Submission Details: Abstracts cannot exceed one page in length and must include the presenter’s complete contact information. Also, please indicate whether it is proposed as an oral presentation, professional poster, or student poster (students are strongly encouraged to present posters). Email abstracts to OWRRI@okstate.edu. The submission deadline has been extended to June 30th.

Date and venue: This year’s Symposium is tentatively scheduled for two days, 26-27 October 2010, at the Embassy Suites Hotel and Conference Center in Norman. For the first time, we will be holding concurrent sessions, with Symposium and Governor’s Water Conference sessions taking place simultaneously. Both events will offer content on both days.

Student Poster Contest: The Symposium will include a student poster contest featuring cash prizes. Both undergraduate and graduate students are invited to submit abstracts of their original research at this time. More information on this contest will be announced in a subsequent email.

For further information, contact the OWRRI.
Evaluation of Water Use Monitoring by Remote Sensing 
ET Estimation Methods 
Yang Hong, Baxter Vieux, Sadiq Khan, Wenjuan Liu

In order to more effectively allocate water, water resource managers must understand water consumption patterns over large areas. One common and increasingly available method for surveying large areas is satellite telemetry. Recent improvements in satellite imagery provide researchers with more detailed information about the land surface including information about water.

To understand the movement of water from lakes, streams, and the ground, it is important to understand how much water evaporates from the land and water surfaces. For land covered by vegetation, one of the most important pathways of evaporation is through plants. This is known as transpiration, and when combined with evaporation, it is referred to as evapotranspiration or ET.

The amount of ET is important to agriculturalists as it helps determine the available soil moisture. So much so that Oklahoma’s Mesonet routinely calculates hypothetical ET for sites across the state. However, this hypothetical ET can differ considerably from the actual ET. Real-time actual ET measurements would allow better management of Oklahoma’s scarce water resources.

This research project successfully integrated satellite images (MODIS, Moderate Resolution Imaging Spectroradiometer) produced twice daily with information from the Oklahoma Mesonet to calculate actual ET for the entire state in real time. The method was tested by using data from Tilman and Texas counties and comparing it to actual ET measurements made in the field. The results indicate that method is accurate to within 15% of actual ET for any given day and 8% when averaged over a season. The method developed in this study shows great promise as an efficient, accurate, and inexpensive approach to estimate actual ET over large areas.

Future work on this project will include integrating the actual ET data and radar estimates of rainfall with a water balance model which will allow more accurate predictions of the runoff and could be used to improve flood prediction.
An Assessment of Environmental Flows for Oklahoma
Don Turton, Bill Fisher, Titus Seilheimer, Rachel Esralew

An important part of water planning in Oklahoma is understanding the water needs of the ecosystems that support fish and wildlife in state streams, rivers, and lakes. The recreational activities associated with these bodies of water are not insignificant to the state’s economy; fishing alone generated over $500 million worth of retail sales in Oklahoma during 2006 (according to the American Sportfishing Association). In order to protect these resources, it is necessary to understand the hydrology of these water bodies.

The science of measuring the water needs of aquatic ecosystems is a fairly recent development. Many approaches have been proposed including merely determining the minimum flow necessary to support important species and maintain water quality (sometimes referred to as environmental or instream flows). The hydrology of streams is more complex than just the minimum flow rate. Scientists have identified six components of any natural flow regime that are important to the survival of aquatic animals: the magnitude, timing, frequency, duration, rate of change and predictability of flow events, and the sequence of these conditions.

When considering the wide range of variation in each of these components and all their possible combinations, it is easy to imagine just how complex this process could be. The U.S. Geological Survey has developed a method for assessing these components known as the Hydroecological Integrity Assessment Process (HIP). It has been successfully used in Massachusetts, Missouri, New Jersey, Pennsylvania, and Texas.

During this first year of funding, this project has completed the first three steps in the six-step process of fully developing and applying a HIP tool for Oklahoma (see Figure 1). Flow information from 88 streams across Oklahoma was used to classify the streams into four groups. The results indicate that these groups roughly correspond to the four major eco-regions of the state (southeastern plains, temperate prairies, forested hills and semi-arid prairies).

In the future, this project will apply the HIP tool to selected streams in Oklahoma and provide a clear characterization of the actual flow needs. This information will help fill critical knowledge gaps as the state continues its comprehensive water planning process. As water managers and state agencies try to balance the increasing demands (from both inside and outside the state) understanding the full spectrum of water needs now and into the future will help them to ensure a stable water supply for all.
Rural water systems and small towns often struggle to make decisions regarding their future, particularly when those decisions involve upgrading their infrastructure or consolidating with other water systems. Lack of personnel, records, and funding can make planning an often-neglected luxury for many small systems. Just keeping up with the latest technology can be a challenge, and the highly technical (not to mention costly) professional software used to model water infrastructure is beyond the reach of most rural systems.

This project is the first step in bringing some relief to struggling systems. The researchers have developed a step-by-step process that can be used to model the current water infrastructure and estimate future needs. Once the model is built for a system, it can be used to identify areas that are limiting the system’s capacity, impairing drinking water quality, or reducing economic efficiency. All of this is done using free or readily available software and data, such as EPANET water modeling software, US Census data, Google Earth, USGS elevation maps, and a spreadsheet program. In some instances, the more professional WaterCAD software may be used (priced according to the population served by the utility).

The process begins by assembling the available information such as maps, pipe sizes and ages, known problem areas, and identifying missing information that will need to be developed. Once the information is gathered, it is entered into the various parts of the model. One result of this process is a map that includes elevations and pipe diameters so that the realities of the system are readily visible.

Next, simulations of the system are run at average and peak demands, which provides a good indicator of potential problem areas. This process is then repeated for the estimated conditions 50 years in the future based on census data projections. Such future-oriented analysis can tell managers where system upgrades will be needed. The costs of potential upgrades are estimated based on the types of equipment or construction needed, which allows managers to prepare for the financial realities that lie ahead and identify sources of financial assistance that fit their situation.

The researchers have successfully applied this process to drinking water systems in four small towns (Braggs, Beggs, Oilton, and Kaw City) and in the Lake Tenkiller area where several smaller systems are considering consolidating into one regional system.
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