2018 Summer Specialty Conference

FINAL PROGRAM

The Science, Management and Governance of Transboundary Groundwater

JULY 9 - 11

Worthington Renaissance Fort Worth Hotel  |  Fort Worth, Texas
AWRA would like to thank all of our 2018 Summer Conference Sponsors

TEXAS WATER RESOURCES INSTITUTE, TEXAS A&M UNIVERSITY, COLLEGE STATION, TX

STEVENS WATER MONITORING SYSTEMS, INC., PORTLAND, OR

AWRA acknowledges with grateful appreciation for all of our sponsors
Please support them - they are helping to enhance AWRA's
COMMUNITY | CONVERSATION | CONNECTIONS!

FUTURE MEETINGS

AWRA 2018 ANNUAL WATER RESOURCES CONFERENCE
Marriott Inner Harbor at Camden Yards
Baltimore, MD - November 4-8, 2018

AWRA 2019 SPRING SPECIALTY CONFERENCE
Setting Conditions for the Success of Integrated Water Resources Management
Embassy Suites by Hilton Omaha Downtown Old Market Hotel
Omaha, NE - March 23-27, 2019

AWRA 2019 SUMMER SPECIALTY CONFERENCE
Improving Water Infrastructure through Resilient Adaptation
Nugget Casino Resort
Sparks, NV - June 16-19, 2019

AWRA 2019 ANNUAL WATER RESOURCES CONFERENCE
Sheraton Salt Lake City Hotel
Salt Lake, UT - November 3-7, 2019
Welcome to Ft. Worth, Texas and the 2018 AWRA Summer Specialty Conference - The Science, Management and Governance of Transboundary Groundwater

On behalf of AWRA and the Conference Planning Committee, we welcome you to the Dallas/Ft. Worth area for AWRA’s specialty conference on the Science, Management and Governance of Transboundary Groundwater. The goal of this conference is to forward a discussion on how to understand the behavior of Transboundary Groundwater and discuss the range of management systems and governance frameworks that have been developed to sustainably use and ensure equitable access to this critical resource.

The Transboundary Groundwater Conference starts with keynote presentations by Drs. Neno Kukuric, Director of the International Groundwater Resources Assessment Centre, and Dr. Alfonso Rivera, Chief Hydrogeologist for the Geological Survey of Canada. Dr. Kukuric will address the scientific resources that are being developed to aid in the management of transboundary groundwater resources, and Dr. Rivera will present his recent work on identifying and mapping transboundary aquifers at the global scale. After the opening sessions, the best minds available will populate panels and platform presentations over the next two days that address scientific methods for defining the extent and behavior of transboundary groundwater resources, case studies on the governance and management of transboundary aquifers at all scales, emerging transboundary governance and management issues, and the implications of recent legal arguments regarding access to and protection of transboundary groundwater resources. On the final day, Wednesday July 11th, the conference will depart from its normal course. Lisa Beutler, Principal Executive Facilitator at Stantec and AWRA President-Elect, will conduct a facilitated plenary session that will solicit input on the pressing scientific needs related to better understanding transboundary groundwater resources and discuss current transboundary groundwater management and governance successes, failures, and needs. The outcomes of this facilitated discussion will be the development of a draft set of principles to be used when identifying, studying and developing transboundary groundwater resources, and to initiate the development of a principles and practices document on transboundary groundwater resources. During the conference we hope you will greatly expand your understanding and knowledge of transboundary groundwater resources, but more importantly you will have the opportunity to become active in the development and promulgation of a coherent strategy for addressing transboundary groundwater issues.

We also hope you enjoy your time in the Ft. Worth/Dallas Metroplex, and take advantage of the redeveloped downtown corridor in Ft. Worth, and the wealth of entertainment and cultural opportunities that exist in the area.

John C. Tracy
Conference General Chair
Texas Water Resources Institute, Texas A&M University, College Station, TX

Michael E. Campana
Conference Technical Chair
Oregon State University, Corvallis, OR
GENERAL INFORMATION

MEETING REGISTRATION INFORMATION

All persons, INCLUDING PRESENTERS, are required to register for this meeting and must pay the appropriate registration fee.

REGISTRATION DESK HOURS OF OPERATION

in the Worthington Hotel Lobby
Sunday | July 8 - 4:00 pm to 6:00 pm

In the 2nd Floor Foyer of the Norris Conference Center
Monday | July 9 - 7:30 am to 5:00 pm
Tuesday | July 10 - 8:00 am to 5:00 pm
Wednesday | July 11 - 8:00 am to 12:00 Noon

Please Note: The PRESENTER of each paper/poster is in BOLD type immediately following the paper title. Co-authors are then listed in parentheses. The affiliation given is that of the Presenter.

PLEASE TURN OFF YOUR CELL PHONE WHEN ENTERING THE SESSION ROOMS!

PROFESSIONAL DEVELOPMENT HOURS (PDH’S)

AWRA has instituted a self-reporting system for Professional Development Hours (PDHs). (AWRA is no longer offering CEUs). To meet education requirements for license renewal, conference attendees should report their session attendance directly to their licensing organizations. AWRA will provide at its registration desk, self-reporting forms that can be used to acquire signatures of session moderators.

Please note that self-reporting is an honor system. It places the onus on the individual to report PDHs to their licensing body. The AWRA forms are furnished as a convenience to conference attendees at the registration desk.

The following caveats apply to this PDH policy:

1) AWRA will not notify the licensing organizations concerning earned PDHs. This will be up to the attendee.
2) AWRA will not keep session records or enter PDHs in its record keeping system.
3) Most importantly, AWRA cannot guarantee acceptance of the PDHs by licensing boards.

Because self-reporting reduces AWRA administrative costs, AWRA will not charge a fee for those wishing to obtain PDHs.

GENERAL CONFERENCE INFORMATION

REFUNDS – Cancellations must have been received in writing at the AWRA Headquarters by Monday, June 18, 2018. No refunds will be issued after June 18, 2018. All cancellations received prior to June 18, 2018, are subject to an administrative fee of 25% of the total registration fees. No refunds will be given for ticketed events purchased after June 18, 2018.

BADGES – It is important that the official badge supplied at the time of registration be worn at all times. This practice is a courtesy to your fellow registrants. It also indicates that you have completed registration and may participate in the scheduled events. Admission to all technical sessions and breaks will be by badge only.

INFORMATION DESK – Please consult the staff at the AWRA Registration Desk if you have any questions regarding the events at the meeting.

SESSION PARTICIPANTS – Authors, panelists, and moderators are requested to meet in their respective meeting rooms 10 minutes prior to the start of their session. All participants are required to register PRIOR to their sessions.

SPEAKERS PREPARATION ROOM – It is provided for speakers to prepare their presentation and will be in Breakout 2 room in the Norris Conference Center. Monday, July 9 and Tuesday, July 10 the room will be open from 7:00 a.m. to 5:00 p.m.; on Wednesday, July 11, it will be open from 7:00 a.m. to 12:00 noon. No laptops will be available in the room so please bring a laptop to use.
<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference Sponsors and Exhibitors</td>
</tr>
<tr>
<td>Future Meetings - 2018 - 2019</td>
</tr>
<tr>
<td>Welcome to the AWRA 2018 Summer Specialty Conference</td>
</tr>
<tr>
<td>General Information (PDH's, General Conference Information, Registration)</td>
</tr>
<tr>
<td>Fire Emergency Information</td>
</tr>
<tr>
<td>Program-at-a-Glance</td>
</tr>
<tr>
<td>AWRA Multi-Conference App</td>
</tr>
<tr>
<td>Conference Planning Committee</td>
</tr>
<tr>
<td>Networking Events</td>
</tr>
<tr>
<td>AWRA 2018 Board of Directors</td>
</tr>
</tbody>
</table>

**MONDAY – July 9**
- Conference Opening Plenary Session / 8:30 a.m. – 10:00 a.m. | 12 |
- Conference Lightning Talks / Working Session 1 / 10:30 a.m. - 12:00 noon | 12 |
- Concurrent Sessions 1, 2, 3 / 1:30 p.m. – 3:00 p.m. | 13 |
- Concurrent Sessions 4, 5, 6 / 3:30 p.m. – 5:00 p.m. | 14 |

**TUESDAY – July 10**
- Concurrent Sessions 7, 8 / 8:30 a.m. – 10:00 a.m. | 15-16 |
- Concurrent Sessions 9, 10 / 10:30 a.m. - 12:00 noon | 17 |
- Concurrent Sessions 11, 12 / 1:30 p.m. – 3:00 p.m. | 18 |
- Concurrent Sessions 13, 14 / 3:30 p.m. – 5:00 p.m. | 19 |

**WEDNESDAY – July 11**
- Working Session 2 / 9:00 a.m. – 12:00 noon | 20 |
- Working Session 3 / 1:30 p.m. – 2:30 p.m. | 20 |

- Presenter Directory | 21 |
- AWRA National Headquarters Staff | 22 |
- Meeting Rooms Layout and directions to Norris Conference Center | Back |

**FIRE EMERGENCY INFORMATION - PREPAREDNESS IN HOTELS**

**PLAN AHEAD** - When you check into your room, check the location of exits. Walk to the nearest exit, learn the route, obstacles, etc. Keep your room key on the night stand when you are in your room. Examine your room. Check the windows to see if they open and how. Examine the area outside your window.

**IN CASE OF A FIRE - EVACUATION PROCEDURES** - Immediately investigate all odors, smoke, and/or disturbances. If you smell smoke, grab your key, roll out of bed, and crawl to the door. Feel the door. If the door facing or knob is hot, don’t open it. If the hall is clear of fire, crawl toward the exit after closing your door. Stay against the exit side of the wall. Keep as close to the floor as possible. When you reach the exit, walk down the stairs holding the handrail.

**SURVIVAL TECHNIQUES IN THE ROOM** - If the door is warm or hot, or if the hallway is filled with smoke, you can still defend yourself effectively in your room. Call the front desk to report the fire and let someone know your location. Vent the room. Use the bathroom vent fan or open the window if there is smoke in your room. Don’t open the window if there is smoke outside. Fill the bathtub with water for firefighting. Don’t get in the tub! Use wet sheets or towels to stuff the cracks around the door. Use the ice bucket to drench the walls, mattresses, rugs, drapes, etc. While waiting to be rescued, do not hide from the fire. Stay out of closets and out from under the bed. Keep fighting until help arrives. Place a towel, sheet, or other items in the window to let firemen know that someone is in the room.

**OTHER TIPS - JUMPING** - If you jump from higher than the third floor, chances are you won’t survive the fall. **Elevators...** Never enter an elevator during a fire alert. **Don’t Panic...** It is contagious and almost irreversible once it sets in. If you understand what is happening, what to do, where to go and how to get there, you are unlikely to panic.
## PROGRAM AT-A-GLANCE

### SUNDAY 8 JULY

<table>
<thead>
<tr>
<th>TIME</th>
<th>EVENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Registration - Worthington Hotel Lobby 4:00 pm to 6:00 pm</td>
</tr>
</tbody>
</table>

### MONDAY 9 JULY

<table>
<thead>
<tr>
<th>TIME</th>
<th>Concurrent 1</th>
<th>Concurrent 2</th>
<th>Concurrent 3</th>
</tr>
</thead>
</table>
| 8:30 - 10:00  | PLENARY SESSION: RED OAK BALLROOM-A  
Keynotes by: Alfonso Rivera  
Chief Hydrogeologist, Geological Survey of Canada, Quebec, Canada and Dr. Neno Kukuric, International Groundwater Resources Assessment Centre  
Delft, The Netherlands |
| 10:00 - 10:30 | MORNING BREAK |
| 10:30 - 12:00 | Lightning Talks – To Set The Stage (30 min)  
WORKING SESSION 1: Disciplines Caucus (60 min)  
RED OAK BALLROOM-A |
| 12:00 - 1:15  | LUNCH ON YOUR OWN |
| 1:30 - 3:00   | SESSION 01 - CYPRESS ROOM  
Governance Frameworks |
| 3:00 - 3:30   | SESSION 02 - SAGE ROOM  
Modeling, Data, and Monitoring |
| 3:30 - 5:00   | SESSION 03 - MAGNOLIA ROOM  
Management |
| 5:30 - 7:00   | Opening Networking Reception  
Terrace Room | Worthington Hotel |
|               |               |              |              |

**AWRA 2018 SUMMER SPECIALTY CONFERENCE | JULY 9 - 11 | Fort Worth, TX**
# Final Program

**AWRA in Fort Worth | 7**

## TUESDAY 10 JULY

<table>
<thead>
<tr>
<th>Concurrent 1</th>
<th>Concurrent 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SESSION 07 - PANEL</strong></td>
<td><strong>SESSION 08 - SAGE ROOM</strong></td>
</tr>
<tr>
<td>MAGNOLIA ROOM</td>
<td>Transboundary Groundwater Science</td>
</tr>
<tr>
<td>Depleting Aquifers and Transition from Irrigated Agriculture to Sustainable Agriculturally Related Ecosystems</td>
<td></td>
</tr>
</tbody>
</table>

**MORNING BREAK**

| SESSION 09 - PANEL | SESSION 10 - SAGE ROOM |
| MAGNOLIA ROOM | Global North and Global South |
| Understanding Texas’ Approach to Groundwater Governance and Management | |

**LUNCH ON YOUR OWN**

| SESSION 11 - MAGNOLIA ROOM | SESSION 12 - SAGE ROOM |
| Texas Groundwater – Intrastate and Interstate | Modeling, Irrigation and More! |

**AFTERNOON BREAK**

| SESSION 13 - MAGNOLIA ROOM | SESSION 14 - SAGE ROOM |
| Texas Troubles? | Cooperation, Security, and Conflict |

## WEDNESDAY 11 JULY

**WORKING SESSION 2:**

**RED OAK BALLROOM-A**

Multidisciplinary Assessment of the Future of Transboundary Groundwater Science, Management and Governance

**AWRA CONFERENCE LUNCHEON | LIVE OAK ROOM**

**NORRIS CONFERENCE CENTER**

**WORKING SESSION 3:**

**RED OAK BALLROOM-A**

The Path Forward – Organization and Development of Position and White Papers
AWRA APP

THE AWRA CONFERENCES APP WILL BE LIVE IN MAY!

AWRA Multi-Conference App
1 App download = 3 Conferences

AWRA’s Conference App is LIVE!
Download, check in and start networking today.

Download the App once and receive detailed information on all of our conferences.

- All ABSTRACTS are included in the app.
- No more individual conference app downloads
- Download the AWRA Conferences App once and never again! Events will be updated each year through this one App. No need to re-download each year.
- Each AWRA conference will go live on the AWRA Conferences App 4-6 weeks prior to its opening date.
- Once downloaded, the app will ask that you "check in." This allows you to access the conference information and network/socialize with others who have checked in. You do not need to be a registered attendee or pay a fee to check in. Simply follow the instructions and enjoy the app.

Use the App to view the abstracts for sessions, create your conference schedule and connect with other attendees.
PLANNING COMMITTEE

AWRA 2018 Summer Conference Planning Committee
The Science, Management and Governance of Transboundary Groundwater
July 9 - 11, 2018
Worthington Renaissance Fort Worth Hotel | Fort Worth, TX

CONFERENCE CHAIR
John C. Tracy
Texas Water Resources Institute
Texas A&M University
College Station, TX

STUDENT ACTIVITIES COMMITTEE CHAIR
Amy Truong
Texas Water Resources Institute
Texas A&M University
College Station, TX

TECHNICAL PROGRAM CHAIR
Michael E. Campana
College of Earth, Ocean and Atmospheric Sciences
Oregon State University
Corvallis, OR

FIELD TRIP / WORKSHOP COMMITTEE CHAIR
Allen Berthold
Texas Water Resources Institute
Texas A&M University
College Station, TX

COMMITTEE MEMBERS
Gilbert Anaya
Environmental Management Division
International Boundary Waters Commission (IBWC)
El Paso, TX 79

Stefano Burchi
Chairman of the Executive Council
International Association for Water Law (AIDA)
Rome, Italy

Gabriel Eckstein
Texas A&M University School of Law
Fort Worth, TX

Alexander G. (Sam) Fernald
New Mexico Water Resources Research Institute
New Mexico State University
Las Cruces, NM

W. Todd Jarvis
Institute for Water and Watersheds
Oregon State University
Corvallis, OR

Neno Kukuric
Director
IGRAC - International Groundwater Resources Assessment Centre
Delft, The Netherlands

Mario Lopez-Perez
Coordinator de Hidrologia (Hydrologic Coordinator)
Instituto Mexicano de Tecnología de Agua
(Mexican Institute of Water Technology)

Anne Marie Matherne
U.S. Geological Survey
New Mexico Water Sciences Center
Albuquerque, NM

Sharon B. Megdal
Water Resources Research Center
University of Arizona
Tucson, AZ

Kent Portney
Professor and Director,
Institute for Science, Technology and Public Policy
The George H. W. Bush School of Government and Public Service
Texas A&M University
College Station, TX

Alfonso Rivera
Chief Hydrogeologist
Geological Survey of Canada
Natural Resources Canada
Québec, QC, Canada

Rosario Sanchez
Texas Water Resources Research Institute
Texas A&M University
College Station, TX

Zhuping Sheng
Texas A&M AgriLife Research Center at El Paso
El Paso, Texas
NETWORKING EVENTS

“ASK ME ABOUT...” PROGRAM

Monday, July 9 – Wednesday, July 11

WHAT IS THE “ASK ME ABOUT...” PROGRAM? “Ask Me About...” is AWRA’s way of encouraging fun and informal networking between conference attendees.

HOW DOES THE “ASK ME ABOUT...” PROGRAM WORK? Conference attendees wear “Ask Me About...” ribbons on their nametags. During conference breaks, lunches, and networking sessions, attendees are encouraged to initiate conversation with anyone wearing “Ask Me About...” ribbons. The “Ask Me About...” ribbons function as conversation icebreakers, resulting in interesting and fun discussion among conference attendees.

HOW DO I PARTICIPATE IN THE “ASK ME ABOUT...” PROGRAM?

1. Pick up an “Ask Me About...” ribbon at the conference registration desk. Fill in the blank on your ribbon with a word(s) that provides a clue to your work, background, or professional interests. Attention-getting, witty, interesting, yet professional ribbon content is highly encouraged.

2. Wear your “Ask Me About...” ribbon on your nametag throughout the conference.

3. Engage in conversation with conference attendees by explaining your “Ask Me About...” ribbon.

4. For the benefit of the novice conference attendees, experienced attendees should share conference tips, provide professional advice, and facilitate networking with others.

OPENING NETWORKING RECEPTION

Monday, July 9 | 5:30 – 7:00 pm

Terrace Room | Worthington Hotel

This event is included in the Registration Fee. All registered conference participants are invited to attend the Opening Networking Reception. Come greet old colleagues and make new acquaintances.

Additional tickets may be purchased on site at the AWRA Registration Desk. The cost of an additional ticket is $40.00.

AWRA CONFERENCE LUNCHEON

Wednesday, July 11 | 12:00 noon - 1:15 pm

Live Oak Room | Norris Conference Center

Come join your colleagues for a delicious lunch and some more networking.

This event is included in the Registration Fee. Additional tickets may be purchased on site at the AWRA Registration Desk. The cost for each additional ticket is $45.00.
Dr. Alfonso Rivera
Chief Hydrogeologist, Geological Survey of Canada, Quebec, Quebec, Canada

What We Have Learned on Mapping Transboundary Aquifers at the Global Scale: Current Issues and Emerging Challenges

Alfonso Rivera is the Chief hydrogeologist of the Geological Survey of Canada, author and editor of the book “Canada’s Groundwater Resources”, adjunct professor at the University of Quebec-INRS, Canada, and member of the Académie de l’eau, France. He designed a national framework to assist the developing of innovative research activities to shift from single aquifer-scale mapping to Canada-wide groundwater assessment and accounting. He collaborates with research institutions and universities in Canada, USA, Mexico, France, Switzerland, Spain and Argentina. Alfonso led the ISARM-Americas group of UNESCO in preparing the Regional Strategy for the Assessment and Management of the Transboundary aquifers of the Americas.

Dr. Neno Kukuric
International Groundwater Resources Assessment Centre
Delft, The Netherlands

Aquifers before Borders

Neno Kukurić is a hydrogeologist with about 30 years of experience gained in more than 20 countries worldwide. His professional interest is international water cooperation and application of informed management, encompassing technical, socio-economical, institutional and political aspects of water-related issues. Neno Kukurić is particularly involved in a global assessment and management of transboundary groundwaters. Since 2011, he serves as a director of IGRAC (International Groundwater Resources Assessment Centre) of UNESCO. Previously he worked as a field hydrogeologist, consultant, scientific researcher and project manager.
MONDAY PLENARY SESSIONS

MONDAY, JULY 9 | 10:30 - 12:00 NOON

LIGHTNING TALKS – TO SET THE STAGE
10:30 AM – 11:00 AM  |  RED OAK BALLROOM-A

Moderator:
Michael E. Campana
Oregon State University
Corvallis, OR

(Full talks will be presented in the sessions indicated)

Lightning talks are succinct 5-minute presentations selected to help set the stage for the information and tasks that await the attendees over the next few days.

Reasonable Use? The Challenges of Riparianism on Transboundary Groundwater Regulation in the Eastern United States - Robert Caccese, The Pennsylvania State University  (Session 1)

A Look Beneath the Surface: Developing a Transboundary Groundwater Governance Framework and Agreement for the Memphis Sand Aquifer - Holly A. Mondo, Oregon State University  (Session 1)

The Cooperative Framework for the U.S.-Mexico Transboundary Aquifer Assessment Program: A Model for Collaborative Transborder Studies  Sharon B. Megdal, The University of Arizona  (Session 4)

Managing Hidden Treasures Across International Frontiers: International Law for Transboundary Aquifers - Gabriel Eckstein, Texas A &M University School of Law  (Session 5)

Transboundary Offshore Freshwater: Which Law Will Apply? Renee Martin-Nagle, A Ripple Effect PLC  (Session 5)

WORKING SESSION 1 – DISCIPLINES CAUCUS
(Prepare for Working Sessions 2 and 3 on July 11 – Path Forward)
11:00 AM – 12:00 NOON
RED OAK BALLROOM-A

Facilitator:
Lisa Beutler
Stantec Consulting Service, Inc.
Sacramento, CA

Disciplinary Caucuses:
Prior to this session the conference organizers will identify the disciplines of attendees; disciplinary caucuses will be organized and leaders designated. Where appropriate, the latter will be drawn from the conference Planning Committee.

At the session, leaders will ask the attendees to select which caucus they wish to join. There will be an opportunity to add disciplines and caucuses.

Each caucus will meet to identify:
• contributions they can make to advance integrated, multidisciplinary approaches to transboundary groundwater science, governance, and management;
• what they most need from other disciplines to make such an integrated, multidisciplinary approach possible; and
• strategies for interacting with one another and the other disciplines during two days of presentations to prepare for the third day, during which attendees will determine trends and issues that must be addressed to move forward.

Each caucus will orally report their results at the end of the session.
MONDAY SESSIONS

MONDAY, JULY 9 | 1:30 - 3:00 | Concurrent Sessions - 1, 2, 3,

Abstracts are available for viewing via the Conference App (see page 8).

SESSION 1 | Cypress Room

Governance Frameworks

Moderator: Michael E. Campana, Oregon State University, Corvallis, OR


2. Reasonable Use?: The Challenges of Riparianism on Transboundary Groundwater Regulation in the Eastern United States - Robert Caccese, Penn State University, University Park, PA

3. A Look Beneath the Surface: Developing a Transboundary Groundwater Governance Framework and Agreement for the Memphis Sand Aquifer - Holly Mondo, Oregon State University, Corvallis, OR

4. Prairie Provinces Water Board - Agreement on Transboundary Aquifers (Proposed) - Megan Garner, Prairie Provinces Water Board (Canada), Regina, Saskatchewan, Canada

SESSION 2 | Sage Room

Modeling, Data, and Monitoring

Moderator: Guy Sewell, The Oklahoma Institute/East Central University, Ada, Oklahoma

1. Seasonal Water-Level Perturbations Beneath the High Plains of the Llano Estacado - John Stout, USDA-ARS, Lubbock, TX

2. Evaluation of the Performance and Uncertainties of Simulated Groundwater Storage Over the Ogallala Aquifer Region - Zachary Zambreski, Kansas State University, Manhattan, KS (co-authors: Y. Zhang, X. Lin)


SESSION 3 | Magnolia Room

Management

Moderator: Stephanie Moore, DBS, Austin, TX

1. Resulting Changes from Producer-Driven Groundwater Pumping Reductions in Kansas - Bill Golden, Kansas State University, Meridian, TX


MONDAY SESSIONS

MONDAY, JULY 9  3:30 - 5:00 | Concurrent Sessions - 4, 5, 6

Abstracts are available for viewing via the Conference App (see page 8).

SESSION 4  |  Cypress Room
The Transboundary Aquifer Assessment Program (TAAP)
Moderator: Sharon B. Megdal, University of Arizona, Tucson, AZ

1. The Cooperative Framework for the U.S.-Mexico Transboundary Aquifer Assessment Program: A Model for Collaborative Transborder Studies - Sharon Megdal, University of Arizona, Tucson, AZ

2. The Transboundary Aquifer Assessment Program (TAAP): History and Purpose, Highlighting the Binational Mesilla Basin/Conejos Medanos Aquifer - Avery Olsheski, New Mexico State University, Las Cruces, NM (co-author: A. Fernald)


4. Subsidiarity and Transboundary Groundwater in North America - Jacob Petersen-Perlman, University of Arizona, Tucson, AZ

SESSION 5  |  Sage Room
Legal Instruments
Moderator: Gabriel Eckstein, Texas A&M University School of Law, Fort Worth, TX

1. Managing Hidden Treasures Across International Frontiers: International Law for Transboundary Aquifers - Gabriel Eckstein, Texas A&M University School of Law, Fort Worth, TX


3. Using Compacts to Resolve Interstate Groundwater Issues - Robin Craig, University of Utah College of Law, Salt Lake City, UT

4. Tribal Participation in California’s SGMA Implementation Processes - Mackenzie R. Johnson, UC Davis, Davis, CA (co-author: E. R. Middleton)

SESSION 6  |  Magnolia Room
Case Studies and Lessons Learned
Moderator: Michael Davidson, Davidson Consultants, Altadena, CA

1. Outreach and Engagement in the Sahel Region of West Africa - Michael Davidson, Davidson Consultants, Altadena, CA

2. The Groundwater Professional Revisits (or Visits for the First Time) Garrett Hardin’s The Tragedy of the Commons - Joshua Joseph, Southern University, Baton Rouge, LA

3. The Winters Doctrine Goes Underground - Michael E. Campana, Oregon State University, Corvallis, OR

SESSION 7 | Magnolia Room

PANEL - Depleting Aquifers and Transition from Irrigated Agriculture to Sustainable Agriculturally Related Ecosystems

Moderator: Robert DeOtte, Professor of Civil and Environmental Engineering, West Texas A&M University, Canyon, TX

PANELISTS:

“Modeling for Potential Future Outcomes”, Thomas Gerick, Professor and Center Director Texas A&M AgriLife Blackland Research and Extension Center, El Paso, TX

“Unintended Consequences of Improved Water Use and Agronomic Efficiency. Irregular thoughts of Transboundary Water Transfers”, Brent Auvermann, Professor and Center Director Texas A&M AgriLife Research and Extension Center – Amarillo, TX

“Groundwater Policy and Management for Oklahoma, Kansas, and Texas and Gaps Needing Resources. Overview of Current Major Research Projects”, Daniel Devlin, Director of the Kansas Center for Agricultural Resources and the Environment and the Kansas Water Resources Institute, Manhattan, KS, and Kevin Wagner, Director Oklahoma Water Resources Center and Thomas E. Berry Professorship in Integrated Water Resources Management, Stillwater, OK

“Impact on the Economy of Changes in Water Use and Transboundary Transfers”, Bill Golden, Research Assistant Professor, Kansas State University Department of Agricultural Economics, Manhattan, KS

A hallmark of agriculture in the twentieth century, continuing through to today, has been the increased production credited to improved genetics, management practices, and the perceived abundance of water for irrigation however, those water resources have been sorely taxed and today many, such as the Ogallala Aquifer of the High Plains and aquifers in California, have been markedly depleted, while in others, such as the highly populated coastal region used for Citrus farming in Florida, water quality is in serious decline. Efforts have been ongoing to develop new genetic lines that require less water thereby extending the life of water supplies. Other initiatives have included removal of irrigation and return to dryland agriculture. The problem is more complex than engineering to provide adequate water through mining or water treatment, or agronomics to develop new and better crops. There are economic issues that drive decisions as to how to remain profitable while seeing declines in water quantity as well as social issues related to adopting new models for sustainable agricultural production. At best, current approaches merely delay the inevitable depletion of a nonrenewable resource. The limited efforts thus far have been to address the transition of land committed to irrigated agriculture to either dryland crops or grazing systems. Some evidence indicates that not all irrigated cropland can be readily returned to the native grasslands or dryland agriculture. There needs to be an orderly optimizing transition while there is still adequate water to establish positive alternative land uses such as quality dryland grazing systems or other economically and ecologically sustainable systems. Historical considerations have included transboundary reallocation of surface waters to supplement or replace groundwater. Indeed, Kansas is working through issues of transferring water from the Missouri River. The cattle feeding industries of Colorado, Kansas, and Texas import water from the Midwest in the form of grain via unit trains. Without effective planning, no matter how much water is imported by whatever conveyance, none of that will prevent the Great American Desert from returning to “dust bowl” conditions as the new status quo. The transition will impact producers and the rural communities that are dependent upon them and have cascade impacts throughout the entire food and fiber supply chain. This discussion will focus on potential opportunities and challenges including economics, transboundary groundwater management, policy, and ecological sustainability.
SESSIONS

TUESDAY SESSIONS

TUESDAY, JULY 10  8:30 - 10:00  |  Concurrent Sessions - 8

Abstracts are available for viewing via the Conference App (see page 8).

SESSION 8  |  Sage Room:

Transboundary Groundwater Science

Moderator:  Jeff Pepin, U.S. Geological Survey, Los Lunas, NM

1. Geophysics-Based Assessment of Groundwater Salinity in the Mesilla Basin/Conejos Médanos and Hueco Bolson Aquifer Systems in Doña Ana County, New Mexico, and El Paso County, Texas - Andrew Teeple, U.S. Geological Survey, Austin, TX


5. Assessing the Implications of Variabilities of Climate and Effluent Discharges on Groundwater Recharge Downstream of the Nogales International Wastewater Treatment Plant (NIWTP) in the Santa Cruz Aquifer - Elia Tapia, University of Arizona, Tucson, AZ (co-authors:  E. Shamir)

2018 AWRA BOARD OF DIRECTORS

President
Brenda O. Bateman
Oregon Water Resources Department
Salem, Oregon

President-Elect
Lisa Beutler
Stantec Consulting Service, Inc.
Sacramento, California

Secretary/Treasurer
Noel Gollehon
USDA-NRCS
Beltville, Maryland

Past President
Rafael E. Frias, III
Black & Veatch Corp.
Coral Springs, Florida

Directors
Jerad D. Bales
CUAHSI
Cambridge, Massachusetts

Betsy Cody
Arlington, VA

Lisa Engelman
LB Engelman Consulting, LLC
Rockville, Maryland

Scott Kudlas
Department of Environmental Quality
Richmond, Virginia

Sharon B. Megdal
University of Arizona, Water Resources Research Ctr.
Tucson, Arizona

Laurel E. Stadjuhar
West Sage Water Consultants
Denver, Colorado
SESSION 9 | Magnolia Room
PANEL - Understanding Texas’ Approach to Groundwater Governance and Management
Moderator: John C. Tracy, Texas Water Resources Institute, Texas A&M University, College Station, TX
Panelists:
Sarah Schlessinger, Executive Director, Texas Alliance of Groundwater Districts
Cary Betz, Manager, Permit Support, Compliance and Groundwater, Texas Commission on Environmental Quality
Larry French, Director, Groundwater Division, Texas Water Development Board

Within the United States, Texas is fairly unique in the manner in which it approaches the Governance and Management of its groundwater resources. In its simplest form, groundwater in Texas is subject to the 1904 Rule of Capture, which recognizes groundwater as a privately owned landowner right. Beyond Rule of Capture, however, Texas has developed additional decentralized management frameworks to balance private property rights, management of the resource, and the social, economic and ecologic systems across the state. This panel will discuss the history of the development of the groundwater governance frameworks currently used within Texas; the range of management structures that have been developed within these frameworks; the perceived advantages and disadvantages of Texas’ approach to groundwater governance; and the current issues and directions that groundwater governance and management could head in the future.

SESSION 10 | Sage Room
Global North and Global South
Moderator: Alfonso Rivera, Geologic Survey of Canada, Québec, Canada

1. Transboundary Groundwater Issues Within Canada and Between Canada – US - Alfonso Rivera, Geological Survey of Canada, Québec, Canada


3. Risk Perception and Trust in International Groundwater Sharing: a Texas-Mexico Case Study - Lindsay Sansom, Texas A&M University, Bryan, TX


Abstracts are available for viewing via the Conference App (see page 8).
TUESDAY SESSIONS

TUESDAY, JULY 10  1:30 - 3:00  |  Concurrent Sessions - 11, 12

Abstracts are available for viewing via the Conference App (see page 8).

SESSION 11 | Magnolia Room
Texas Groundwater – Intrastate and Interstate

Moderator: Zhuping Sheng, Texas A&M AgriLife Research, El Paso, TX

1. Transboundary Aquifers: A Summary of Aquifers and Their Characteristics - Larry French, Texas Water Development Board, Austin, TX (co-authors: R. Bradley, R. Boghici)

2. Who Owns the Groundwater? Well, that Depends..... - Ken Rainwater, Texas Tech University, Lubbock, TX (co-authors: P. Giany, S. Joshi, G. Eckstein)

3. Findings from the Ogallala Water Summit: Opportunities to Enhance the Understanding and Management of an Intra-State Groundwater Resource - John C. Tracy, TWRI, Texas A&M University, College Station, TX (co-authors: A. Kremen, M. Schipanski, R. Waskom)

4. Transboundary Groundwater Governance in the Borderland between Mexico and Texas - Rosario Sanchez, TWRI, Texas A&M University, College Station, TX

SESSION 12 | Sage Room
Modeling, Irrigation and More!

Moderator: Joshua Joseph, Southern University, Baton Rouge, LA

1. Allende – Piedras Negras Transboundary Aquifer: an Initial Modeling Assessment - Laura Rodriguez, Texas A&M University, Houston, TX (co-authors: R. Sanchez, H. Zhan)

2. Hydrochemical Connectivity of the Allende-Piedras Negras Transboundary Aquifer - Oindrila Ghosh, TWRI, College Station, TX (co-authors: R. Sanchez, I. Güneralp)

3. Surface-Water/Groundwater Interactions in Watersheds That Recharge the Texas Reach of the Rio Grande/Rio Bravo - Ronald Green, Southwest Research Institute, San Antonio, TX (co-authors: B. Fratesi N. Toll)

4. Irrigation Withdrawals from Transboundary Aquifers: How Crop Markets Overcome Physical and Institutional Water Constraints - Iman Haqiqi, Purdue University, West Lafayette, IN (co-authors: -S. Jame, L. Bowling, T. Hertel, J. Liu)
SESSION 13 | Magnolia Room
Texas Troubles?

Moderator: Lindsay Sansom, Texas A&M University, College Station, TX


2. Understanding Changes in the Water Quality of the Ogallala Aquifer, Texas - Timothy Goebel, Texas Tech University, Lubbock, TX (co-authors: R. L. Lascano, J. S. Stout)


5. Effects of Changing Available Water Regimes on Riparian Vegetation in the Mesilla Valley Basin Aquifer, NM - Aracely Tellez, New Mexico Water Resources Research Institute, Las Cruces, NM (co-authors: K. Boykin, F. Ochoa, S. Fernald)

SESSION 14 | Sage Room
Cooperation, Security, and Conflict

Moderator: Rosario Sanchez, Texas Water Resources Institute, Texas A&M University, College Station, TX

1. The Groundbreaking Mississippi v. Tennessee U.S. Supreme Court Case: Coming Soon to an Aquifer Near You? - Michael E. Campana, Oregon State University, Corvallis, OR

2. Quantifying the Negative Impacts of Damming River Omo on Lake Turkana Communities Consequent Conflicts - John Bosco Namwamba, Southern University, Baton Rouge, LA (co-authors: J.B. Namwamba, Y. Twumasi, F. Namwamba, J. Egbe and R. Okwemba)


WEDNESDAY SESSIONS

WEDNESDAY, JULY 11  9:00 - 12:00 NOON, Working Session 2  |  1:30 - 2:30, Working Session 3

Abstracts are available for viewing via the Conference App (see page 8).

WORKING SESSION 2 –
Multidisciplinary Assessment of the Future of Transboundary Groundwater Science, Management and Governance
9:00 AM – 12:00 NOON
RED OAK BALLROOM-A

Facilitator:
Lisa Beutler
Stantec Consulting Service, Inc., Sacramento, CA

During this session, conference attendees will collectively identify the trends and issues driving the future of Transboundary Groundwater Science, Management and Governance, and contrast the existing responses to these concerns with preferred responses. The group will then refine their assessment to identify gaps and barriers to achieving preferred responses and consider options to address them.

WORKING SESSION 3 –
The Path Forward – Working Session on the Organization and Development of Position and White Papers
1:30 PM – 2:30 PM
RED OAK BALLROOM-A

Moderators:
Lisa Beutler
Stantec Consulting Service, Inc., Sacramento, CA
John C. Tracy
Texas Water Resources Institute, College Station, TX
Michael E. Campana
Oregon State University, Corvallis, OR

Summary of Morning Discussion and Organization of the Development of Position and White Papers
<table>
<thead>
<tr>
<th>Presenter</th>
<th>Affiliation</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albrecht, Tamee</td>
<td>University of Arizona</td>
<td><a href="mailto:talbrecht@email.arizona.edu">talbrecht@email.arizona.edu</a></td>
</tr>
<tr>
<td>Caccese, Robert</td>
<td>Penn State University</td>
<td><a href="mailto:rtc5057@psu.edu">rtc5057@psu.edu</a></td>
</tr>
<tr>
<td>Callegary, James</td>
<td>U.S. Geological Survey</td>
<td><a href="mailto:jcallegary@usgs.gov">jcallegary@usgs.gov</a></td>
</tr>
<tr>
<td>Campana, Michael</td>
<td>Oregon State University</td>
<td><a href="mailto:michael.campana@oregonstate.edu">michael.campana@oregonstate.edu</a></td>
</tr>
<tr>
<td>Carvalho Resende, Tales</td>
<td>UNESCO</td>
<td><a href="mailto:t.carvalho-resende@unesco.org">t.carvalho-resende@unesco.org</a></td>
</tr>
<tr>
<td>Craig, Robin</td>
<td>University of Utah College of Law</td>
<td><a href="mailto:robin.craig@law.utah.edu">robin.craig@law.utah.edu</a></td>
</tr>
<tr>
<td>Cunningham, William</td>
<td>U.S. Geological Survey</td>
<td><a href="mailto:wcunning@usgs.gov">wcunning@usgs.gov</a></td>
</tr>
<tr>
<td>Davidson, Michael</td>
<td>Davidson Consultants</td>
<td><a href="mailto:michael.davidson24@gmail.com">michael.davidson24@gmail.com</a></td>
</tr>
<tr>
<td>De Grandpré, Isabelle</td>
<td>Government of Northwest Territories (Canada)</td>
<td><a href="mailto:isabelle_de-grandpre@gov.nt.ca">isabelle_de-grandpre@gov.nt.ca</a></td>
</tr>
<tr>
<td>DeOtte, Robert</td>
<td>West Texas A&amp;M University</td>
<td><a href="mailto:rdeotte@wtamu.edu">rdeotte@wtamu.edu</a></td>
</tr>
<tr>
<td>Eckstein, Gabriel</td>
<td>Texas A&amp;M University School of Law</td>
<td><a href="mailto:gabrielleckstein@law.tamu.edu">gabrielleckstein@law.tamu.edu</a></td>
</tr>
<tr>
<td>French, Larry</td>
<td>Texas Water Development Board</td>
<td><a href="mailto:larry.french@twdb.texas.gov">larry.french@twdb.texas.gov</a></td>
</tr>
<tr>
<td>Garner, Megan</td>
<td>Prairie Provinces Water Board (Canada)</td>
<td><a href="mailto:megan.garner@canada.ca">megan.garner@canada.ca</a></td>
</tr>
<tr>
<td>Ghosh, Oindrila</td>
<td>TWRI</td>
<td><a href="mailto:oindrilaghosh7@tamu.edu">oindrilaghosh7@tamu.edu</a></td>
</tr>
<tr>
<td>Goebel, Timothy</td>
<td>Texas Tech University</td>
<td><a href="mailto:Tim.Goebel@ars.usda.gov">Tim.Goebel@ars.usda.gov</a></td>
</tr>
<tr>
<td>Golden, Bill</td>
<td>Kansas State University</td>
<td><a href="mailto:bgolden@k-state.edu">bgolden@k-state.edu</a></td>
</tr>
<tr>
<td>Green, Ronald</td>
<td>Southwest Research Institute</td>
<td><a href="mailto:rgreen@swri.edu">rgreen@swri.edu</a></td>
</tr>
<tr>
<td>Haqiqi, Iman</td>
<td>Purdue University</td>
<td><a href="mailto:ihaqiqi@purdue.edu">ihaqiqi@purdue.edu</a></td>
</tr>
<tr>
<td>Heyman, Josiah (Joe)</td>
<td>University of Texas at El Paso</td>
<td><a href="mailto:jmheyman@utep.edu">jmheyman@utep.edu</a></td>
</tr>
<tr>
<td>Johnson, Mackenzie R.</td>
<td>UC Davis</td>
<td><a href="mailto:mrjohnson@ucdavis.edu">mrjohnson@ucdavis.edu</a></td>
</tr>
<tr>
<td>Joseph, Joshua</td>
<td>Southern University</td>
<td><a href="mailto:joshua_joseph@subr.edu">joshua_joseph@subr.edu</a></td>
</tr>
<tr>
<td>Lopez, Mario</td>
<td>IMTA</td>
<td><a href="mailto:mario_lopezperez@tlaloc.imta.mx">mario_lopezperez@tlaloc.imta.mx</a></td>
</tr>
<tr>
<td>Martin-Nagle, Renee</td>
<td>A Ripple Effect plc</td>
<td><a href="mailto:Renee@arippleeffect.net">Renee@arippleeffect.net</a></td>
</tr>
<tr>
<td>Martinez-Morales, Manuel</td>
<td>IMTA</td>
<td><a href="mailto:manuelm@tlaloc.imta.mx">manuelm@tlaloc.imta.mx</a></td>
</tr>
<tr>
<td>Megdal, Sharon</td>
<td>University of Arizona</td>
<td><a href="mailto:smegdal@email.arizona.edu">smegdal@email.arizona.edu</a></td>
</tr>
<tr>
<td>Mondo, Holly</td>
<td>Oregon State University</td>
<td><a href="mailto:mondoh@oregonstate.edu">mondoh@oregonstate.edu</a></td>
</tr>
<tr>
<td>Moore, Stephanie</td>
<td>Daniel B. Stephens &amp; Associates Inc.</td>
<td><a href="mailto:smoore@geo-logic.com">smoore@geo-logic.com</a></td>
</tr>
<tr>
<td>Namwamba, John Bosco</td>
<td>Southern University</td>
<td><a href="mailto:johnbosconamwamba@yahoo.com">johnbosconamwamba@yahoo.com</a></td>
</tr>
<tr>
<td>Olsenfski, Avery</td>
<td>New Mexico State University</td>
<td><a href="mailto:averyo@nmsu.edu">averyo@nmsu.edu</a></td>
</tr>
<tr>
<td>Pepin, Jeff</td>
<td>U.S. Geological Survey</td>
<td><a href="mailto:jpepin@usgs.gov">jpepin@usgs.gov</a></td>
</tr>
<tr>
<td>Pereira, Mauri Cesar</td>
<td>AGUASEMFRONTEIRAS</td>
<td><a href="mailto:mauricesar@gmail.com">mauricesar@gmail.com</a></td>
</tr>
<tr>
<td>Petersen-Perlman, Jacob</td>
<td>University of Arizona</td>
<td><a href="mailto:jacobpp@gmail.com">jacobpp@gmail.com</a></td>
</tr>
<tr>
<td>Rainwater, Ken</td>
<td>Texas Tech University</td>
<td><a href="mailto:ken.rainwater@ttu.edu">ken.rainwater@ttu.edu</a></td>
</tr>
<tr>
<td>Reinert, Scott</td>
<td>El Paso Water</td>
<td><a href="mailto:streinert@epwu.org">streinert@epwu.org</a></td>
</tr>
<tr>
<td>Rivera, Alfonso</td>
<td>Geological Survey of Canada</td>
<td><a href="mailto:alfonso.rivera@canada.ca">alfonso.rivera@canada.ca</a></td>
</tr>
<tr>
<td>Robertson, Andrew</td>
<td>U.S. Geological Survey - New Mexico</td>
<td><a href="mailto:ajrobert@usgs.gov">ajrobert@usgs.gov</a></td>
</tr>
<tr>
<td>Rodriguez, Laura</td>
<td>Texas A&amp;M University</td>
<td><a href="mailto:lmrodriguezlo@tamu.edu">lmrodriguezlo@tamu.edu</a></td>
</tr>
<tr>
<td>Sanchez, Rosario</td>
<td>TWRI</td>
<td><a href="mailto:rosario@tamu.edu">rosario@tamu.edu</a></td>
</tr>
<tr>
<td>Sansom, Lindsay</td>
<td>Texas A&amp;M University</td>
<td><a href="mailto:lindsay.sansom@tamu.edu">lindsay.sansom@tamu.edu</a></td>
</tr>
<tr>
<td>Sewell, Guy</td>
<td>The Oka’ Institute/East Central University</td>
<td><a href="mailto:gsewell@ecok.edu">gsewell@ecok.edu</a></td>
</tr>
<tr>
<td>Sheng, Zhuping</td>
<td>Texas A&amp;M AgriLife Research</td>
<td><a href="mailto:zsheng@ag.tamu.edu">zsheng@ag.tamu.edu</a></td>
</tr>
<tr>
<td>Stout, John</td>
<td>USDA-ARS</td>
<td><a href="mailto:johnedwardstout@gmail.com">johnedwardstout@gmail.com</a></td>
</tr>
<tr>
<td>Tapia, Elia</td>
<td>University of Arizona</td>
<td><a href="mailto:emtapia@email.arizona.edu">emtapia@email.arizona.edu</a></td>
</tr>
<tr>
<td>Teeple, Andrew</td>
<td>U.S. Geological Survey</td>
<td><a href="mailto:apteeple@usgs.gov">apteeple@usgs.gov</a></td>
</tr>
<tr>
<td>Tellez, Aracely</td>
<td>New Mexico Water Resources Research Institute</td>
<td><a href="mailto:atellez8@nmsu.edu">atellez8@nmsu.edu</a></td>
</tr>
<tr>
<td>Tracy, John</td>
<td>Texas Water Resources Institute</td>
<td><a href="mailto:John.Tracy@ag.tamu.edu">John.Tracy@ag.tamu.edu</a></td>
</tr>
<tr>
<td>Triana, Enrique</td>
<td>RTI International</td>
<td><a href="mailto:etriana@rti.org">etriana@rti.org</a></td>
</tr>
<tr>
<td>Xu, Jiajun</td>
<td>University of the District of Columbia</td>
<td><a href="mailto:jiajun.xu@udc.edu">jiajun.xu@udc.edu</a></td>
</tr>
<tr>
<td>Zambreski, Zachary</td>
<td>Kansas State University</td>
<td><a href="mailto:ztz@ksu.edu">ztz@ksu.edu</a></td>
</tr>
</tbody>
</table>
We help our members go farther every day.

Multiple leading edge conferences | Highly rated webinar program (and PDH credit) | Premier multidisciplinary journal in water resources management | Engaged technical committees waiting for your input | Robust online networking community featuring members from around the world helping and advising each other daily | Professional staff that truly care about your member experience; you will speak to a real person every time you call the national office...unless it’s the weekend...we don’t work weekends ;-).

#GOFARTHER

Join AWRA Today.

Check us out. Then Join AWRA Today!

www.awra.org
#GOFARTHER
MEETING ROOMS LAYOUT
Floor 2 - Red Oak Ballroom, Live Oak Room, Cypress, Sage and Magnolia Rooms

Directions to the Norris Conference Center from the hotel:
- Once in the Lobby, located in 2nd Street, between Main and Houston Street, turn right and head to Houston Street
- Norris Center is located in Houston Street, between 2nd and 3rd street.
- It should take them about 1 minute walking to go from the Lobby to the Center.