Texas Water Research Network Meeting
May 8-9, 2017

DAY 1

Meeting goals

- Establish and advance relationships between researchers
- Explore the science of communication relating to interdisciplinary research and stakeholder interactions
- Explore issues of importance to water policy makers and managers
- Learn about shale development implications on water

Welcome (Jay Banner, UT Austin)

Jay reviewed of mission of TWRN, emphasizing the development of new knowledge and innovation, and synthesis of existing information. He reviewed that the project originated with a grant from the National Science Foundation Coupled Human and Natural Systems Program to investigate urban water resiliency in climatic and demographic hotspot. TWRN currently consists of researchers from 20 institutions. Previous meetings have i) delineated the purpose of the network and identified the challenges to be addressed and applications to target (May 2015), ii) framed the network (Dec 2015), and iii) heard about the lessons learned from other water challenged region and began creation of actor and system maps to better identify research needed to inform decision making. The goals and agenda for this meeting were reviewed.

Science of communication (Katherine Hayhoe, Texas Tech)

Katherine provided insight into her approach to communicating science and engaging participants. She provided examples of how this approach might be individually applied. Three assumptions that academics (professionals) commonly make were identified and strategies to address them were presented:

Assumption #1. Our audience is like us. On the contrary, scientists tend towards a specific personality type that prefers big picture thinking, whereas most others prefer the concrete and tangible. To address this, be aware of the personality types of your audience and develop relatable, concrete examples to better connect with your audience.

Assumption #2. Everyone will understand what we say. On the contrary, terms such as uncertainty, error, bias, positive feedback, and conservative can have very different meanings to non-scientists (and even scientists in other disciplines). When addressing uncertainty, consider how your audience copes with uncertainty already. Instead of focusing 10% of the talk on what you know and 90% on what you don't know (or are figuring out), flip it and spend 90% on what is known and 10% on what is unknown.

Assumption #3. People are blank slates, ready to receive the information presented to them. However, people not blank slates, and it is important to determine what framework (or narrative) that people are working with and figure out how to use it to your advantage or disrupt it.

When communicating with people, given assumptions 1-3, it is critical to bond, connect, explain (a little), and inspire. Only when our clever brain and our human heart work together in harmony can we achieve our full potential (i.e., use your heart more).

Implications of shale development on Texas water
(JP Nicot of UT Austin, Danny Reible of Texas Tech, and Dan Mueller of the Environmental Defense Fund**)**

The three panelists gave brief presentations to set up some talking points:

- Water use for shale development is small relative to other users in the state. Local impact on water resources can be great (e.g., potentially Alpine High). The regional impact is less constrained.
- Natural gas power plants use less water than coal fired power plants, so growth of natural gas plants in Texas can offset water for development.
- When considering saline water sources, it is critical to consider where saline groundwater is connected or disconnected from fresh groundwater sources.
- Water is cheap. If you have to put water in a truck, might as well get it from the closest supplier (whether it is fresh or not).
- Water contamination is not systematic. Biggest contamination concern is spills associated with the handling, transport, and storage of produced water at the surface. The more handling, the more opportunity for spills.
- Before produced water can be (re)used it needs treatment for salinity, formation water constituents, added chemicals, and byproducts and degradation products from high temp and pressure reactions.
- Knowledge of the nature and risk of surface spills is limited by reporting requirements, standards, and availability as well as limited in the ability to detect constituents and lack of information about exposure pathways and toxicity.
- An 'academies'-like report on the implications of shale gas development is expected out in June 2017.

What matters to policy makers and water managers?
Four panelists provided their prospective on two questions – what water-related concerns are of greatest concern to you? And, what information from researchers will help you make better decisions?

<u>Robert Puente – San Antonio Water Systems</u>
Critical information from the perspective of SAWS includes who are the customers (i.e., different customers use water differently), how will the population growth and how will this affect the make up of the customer base, who will not be customers, what will the regulations be, and what will the costs be. Keep in mind that wastewater handling is just

as important as water supply. The biggest challenge is uncertainty in the regulatory (policy) environment. Science tends to take a back seat to other political priorities. Four projects were discussed in this context - aquifer storage and recovery (pump to permitted amount each year, store excess for years with higher demand), brackish plant (desalinization), conservation (convincing customers to buy less of your product), and direct recycle (use of treated wastewater).

Robert Mace – Texas Water Development Board

Policy makers can have different perspectives of science. Science is used by every actor in a policy debate for good and bad purposes, and bad (or idiot) science (special interest science) can cancel out good, reliable science. If every interest brings science to the table, policy makers will be challenged to know what to believe. Transparent science is the best way forward, although it slows the process down. Your science needs to be fool proof and without any appearance of bias. Make it simple, share your bottom line in a true and technically correct way. Consider if there are other, better connected messengers.

Carlos Rubinstein – RSAH_2O

A review of critical legislation, including Senate Bill 1, 2, and 3, and House Bill 4, was provided and key strengths and weaknesses were pointed out. Lawsuits are an effective means of affecting weaknesses in policy.

Issues of greatest concern:

1. Do we have honest water planning? i.e., reservoirs will not be built, but included in water plan to provide the yield. Allowing such strategies inhibits creative thinking that might provide a more resilient position during droughts. There is a need to define viability, feasibility, and sustainability to prevent bad water strategies and enable development and inclusion of good strategies.
2. How can water demand be meet with voluntary transfers (Senate Bill 1) without knowing the value of water? i.e., need more water markets. Valuation of water needs to include environmental impacts. There should be an aquifer level view on things.

On research side, need more and better data to develop water availability models for surface and groundwater systems and for day-to-day management of allocations.

Ken Kramer – Sierra Club

There is a critical need for information regarding real solutions For example, what aquifers are appropriate for aquifer storage and recovery, what are potential problems with this strategy (e.g., mixing waters), and to what precision can water be recovered? More data is needed about relationship between fresh water inflows and biology – how do flows affect organisms in rivers and streams, land-based animals that depend on rivers and streams, and estuary and marine organisms. Policy research is needed to determine what are the options for maintaining or increasing flows? Who would the constituency be? More applied research – if I do x than I can expect y. e.g., what would the impact of toilet replacement programs be, Research on links between energy and water. Water resource needs have energy implications. What are energy implications of various things we do regarding water conservation and increasing supply?

How can TWRN members provide this information to policy makers?
Reports from TWRN groups:

A consortium is needed that is long-term and shares expertise and tools with the goal to aid small groups that don't have the resources to do the science. The focus should be hands-on and applied in ways to solve data and modeling problems, and have a strong outreach effort. In the short term, might look something like the mesonet, however this is not sustainable over the long term. Long term vision might include creating a data catalog, development and sharing of data standards, providing a common database platform and interactive workspace. There would be a need to conduct a comparative study to show how doing things in this manner accelerates understanding, which would include bench marking and scenario analysis of well vs. poor instrumented basin and the affect on ability to provide recommendations.

Other ideas included needs for building relationships to transfer science to policy makers, better data visualization and use of downscaled remote sensing, collaboration of data and modelers, economic impact statements, working with marketing to create more compelling executive summaries, and programs to get scientists (grad students, faculty) to work with legislature or state agencies.

DAY 2

Report from climate node (John Neilson-Gammon, Texas A&M):

The climate node is producing a white paper that synthesizes recent research on climate change in Texas as it relates to water resources and implications for water policy. The effort kick- started during a meeting in Feb 2017 that was held to take advantage of Katharine Hayhoe's presentation at Environmental Science Institute's Hot Science Cool Talks presentation at the Paramount Theater. The paper will address what we know about climate change with respect to water in TX, and what are gaps between what scientists can produced and what managers need to make decisions. The paper will serve as an example of developing a document from both the scientist and planner viewpoints (i.e., co-production of knowledge).

Science of communication (Bob Duke)

Bob addressed the question of his talk title, what's wrong with people? The talk emphasized that we have more in common than we have differences, and explained that learning is difficult and requires much more than the presentation of information in one direction. Learning is most effective with feedback, and requires the practice of information retrieval, of making and resolving errors, and the development of connections. Learning is biologically expensive. The brain developed for the purpose of anticipating what will happen next, and has a very short-term perspective. The more complicated functions of the brain developed as an addition (not replacement), so the more primitive structures still guide our thinking. People are not blank slates, and it is

difficult to change people's minds. An effective teaching strategy will create confusion that the learner has the wherewithal to work through in time and with patience. Learning/intelligence is a reflection of one's tolerance for ambiguity and patience. Learning requires making (and correcting) errors, but there is a cost (e.g., grades, social status) to making errors. Need to decouple error-making from the costs.

Report from the water science node (Michael Young of UT Austin, Venki Uddameri from Texas Tech)

Goal – understand resiliency along new 100th meridian, and to build technical frameworks to improve the state of science. A focus is on model interfaces (e.g., water energy nexus) as, currently, models don't interface well at the boundary conditions.

Activities – A review of available integrated assessment models to combine various inputs (e.g., climate, demographics, WAM and GAM output) to model water availability across six water use categories has been conducted. The Water Evaluation and Planning (WEAP) model was selected for development and calibration in the Llano River Basin. A webinar was held on integrated assessment modeling.

Results: Characterization of the Llano River basin show that stream flow is influenced by climate.Winter droughts have a bigger impact than summer droughts due to greater watershed sub-surface connectivity during winter (relative to summer). Results from the WEAP model suggest that the unmet water demand is 500 acre-ft, which is the equivalent of all the current indoor water use in the river basin. Next steps include connecting other HUC-8 watersheds.

Wrap Up

There is a preference for the next TWRN meeting to be held in Jan 2018 (relative to Dec 2017).