Incorporating Climate Information and Stakeholder Engagement in Groundwater Resources Planning and Management

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American Water Works Association (AWWA)
Incorporating Climate Information and Stakeholder Engagement in Groundwater Resources Planning and Management

or

GCASE – Groundwater, Climate and Stakeholder Engagement

Presentation Outline

1. Project Goals and Approach, including stakeholder engagement and transferability - Megdal
2. Modeling Approach and Case Study Results - Shamir
3. Next steps – Megdal/Shamir
4. Questions/discussion
Project Goals and Approach

1. Develop water resources decision support modeling framework that addresses future climate uncertainties
   - Climate scenarios and surface water flows
   - Linkages to groundwater recharge
   - Linkages to water management decisions

2. Increase stakeholder capacity to adapt water planning and management to future climate uncertainties

3. Establish transferability of the modeling approach and stakeholder engagement
Project Team

• Principal Investigators and Co-PIs – Sharon B. Megdal, WRRC; Eylon Shamir, HRC; Susanna Eden, WRRC; Christopher Castro, Atmospheric Sciences (ATMO); Karletta Chief, Soil, Water, and Environmental Science

• Additional personnel – Graduate Outreach Assistant, Jacob Prietto, WRRC; Graduate Research Assistant, Carlos Carillo, ATMO; Research Associate, Hsin-I Chang, ATMO

• Project Advisory Committee – Representatives from Arizona Dept. of Water Resources, US Geological Survey, Salt River Project, and City of Nogales, AZ

• Stakeholders
“The management goal of the Santa Cruz AMA is to maintain a safe-yield condition in the active management area and to prevent local water tables from experiencing long term declines.”

Arizona Revised Statutes

http://www.azwater.gov/azdwr/WaterManagement/AMAs/SantaCruzAMA/default.htm
Groundwater, Climate And Stakeholder Engagement (GCASE)

Project Summary
Planning to meet water demands in semi-arid regions is particularly challenging for groundwater dependent communities where aquifers are being threatened by intermittent streamflow events. Projected and observed climate changes for the Southwest increase uncertainties. The project, Incorporating Climate Information and Stakeholder Engagement in Groundwater Resources Planning and Management, employs a novel modeling framework and extensive stakeholder interactions to achieve the following three objectives: (1) Address climate uncertainties with a sophisticated modeling framework; (2) Increase stakeholder capacity to adapt water planning and management to future climate uncertainties; and (3) Develop the transferability of the modeling framework and capacity building approach.

WRRC to Host Nov. 20 GCASE Milestone Workshop

The WRRC and the Hydrologic Research Center are conducting research designed to help water managers deal with climate uncertainties through a collaborative model development process. Groundwater, Climate And Stakeholder Engagement (GCASE) is a project combining an innovative modeling framework with extensive stakeholder participation. The WRRC will host a Nov. 20 Milestone Workshop in Tucson (Bay Room Conference Room, 350 N. Campbell). The workshop will present the results of a case study focusing on the Upper Santa Cruz River and the shallow groundwater aquifers near Nogales, Ariz. Updates on water management and climate studies will also be discussed with a diverse group of stakeholders.
Project Workshops

• **Kickoff Workshop**
  – October 18, 2012
  – Presented modeling framework and developed case study; discussed stakeholder concerns

• **Milestone No. 1 Workshop**
  – April 11, 2013
  – Presented case study for comments and revised modeling framework; presented climate projection findings for the region

• **Milestone No. 2 Workshop**
  – November 20, 2013
  – Presented revised case study and discussed transferability

• **Four additional workshops**
  – Transferability
Seasonal Precipitation & Streamflow

RAINFALL

STREAMFLOW

Nogales Gauge

Years

Rainfall (mm/season)

Winter

Summer

Years

Streamflow (1000 m$^3$/season)

Winter

Summer
Regional Hydrological Modeling Framework

Hourly Rainfall Generator

Streamflow [Nogales]

Streamflow Routing and Groundwater Recharge

Groundwater Model [Microbasins]
Hydrologic Projections

Regional climate model output

MPI Summer [July-September]

Rainfall Generator

Winter / Summer

Wet  Medium  Dry

Inter-arrival time of clusters

Duration of clusters

Chance for hour rainfall

Hourly rainfall magnitude

Future Likely Rainfall Scenarios
Projections of Wetness Categories from Eight Regional Climate Models

- U of Arizona: Dynamically (WRF) downscaled (Castro et al. 2012)
  1. Hadley center
  2. Max Planck Institute

- North American Regional Climate Change Assessment Program, Six models
  (Bukovski et al. 2013)

SUMMER
- 7 models indicate higher frequency of dry summer
- 6 models indicate lesser frequency of wet summer

WINTER
- 8 models indicate higher frequency of dryer winter
- 6 models indicate higher frequency of wet winter
Rainfall Scenarios

Streamflow

Groundwater Recharge

3 Depth to Water Thresholds: 10, 20 & 30 ft

Groundwater Threshold

Historic & Future Rainfall Scenarios

Three Pumpage Scenarios:
2000, 3000, and 5000 Acre-Feet per year

Pumpage

Aquifer (microbasins) Management Schemes
Supply Reliability Considering Eight Regional Climate Models
62-year Total Water Deficit [based on 100 likely realizations]

Historic Data
Pumpage goal 3000 ac-ft/yr; DTW 20ft

Future Projection
Pumpage goal 3000 ac-ft/yr; DTW 20ft
Accomplishments to Date

- Incorporated downscaled climate information into integrated surface water-groundwater model for an arid to semi-arid environment along the US-MX border
- Established robust dialogue with informed stakeholders throughout development of the case study, which involves multiple scenarios
- Connecting the scientific results to water resources planning and management
Next Steps

• Case study documentation
  – Technical and scientific documentation
  – Materials for stakeholders of diverse backgrounds

• Transferability workshops in four locations
  – Locations under consideration
    • Upper San Pedro watershed
    • Gila River watershed
    • Hassayampa/Tonopah Region
    • Prescott-Verde River area
    • Oro Valley region
    • Santa Cruz River downstream of the current study area, which receives outflows of binational wastewater treatment plant
    • Others?

• Additional workshop prior to transferability workshops