FAR WEST TEXAS CLIMATE CHANGE CONFERENCE

June 17, 2008 | El Paso, Texas

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Dear Conference Participant:

On behalf of the Texas Water Development Board and the Far West Texas Regional Water Planning Group, we would like to thank you for participating today in the Far West Texas Climate Change Conference. As directed by Senate Bill 1762, authored by State Senator Eliot Shapleigh during the 80th Texas Legislative session, the purpose of this conference is to review potential impacts of climate change on surface water supplies from the portion of the Rio Grande subject to the Rio Grande Compact. As part of this review, today's speakers will present an overview of potential climate change impacts to the Far West Texas region, as well as research and ongoing initiatives in New Mexico, Arizona, and Colorado. We will also hear from preeminent water managers in the region. In the afternoon, we will have the opportunity to brainstorm strategies to offset the potential impacts of climate change. We will also explore additional research needs and options to fund strategies and research.

Because of the unique geography and scarcity of water resources in Far West Texas, planners and water resources managers in the region are already at the forefront of innovative water management. We are honored to have with us today Senator Eliot Shapleigh and experts in the fields of climatology, geology, economics, and water management, as well as a diverse array of participants working together to identify potential impacts of climate change on water resources and to explore adaptation strategies to address these impacts. Findings from the conference will be delivered to the Texas Legislature by December 31, 2008, and will help inform the Far West Texas Regional Water Planning Group and the other 15 regional water planning groups in Texas on both science and policy issues related to climate change.

Thank you again for your participation, and we are confident that this conference will be an exciting and influential event.

Sincerely,

J. Kevin Ward
Executive Administrator

FAR WEST TEXAS CLIMATE CHANGE CONFERENCE

Program

7:45 Check-in

8:15 Welcoming Remarks by **Kevin Ward**, Executive Administrator, Texas Water Development Board
Introduction by **State Senator Eliot Shapleigh**

8:30 **Overview of Potential Climate Change Impacts to Far West Texas**
Dr. Gerald North, Distinguished Professor of Atmospheric Sciences, Texas A&M University
Dr. Bruce McCarl, Regents Professor of Agricultural Economics, Texas A&M University

9:30 Break

9:45 **Overview of Potential Climate Change Impacts to Far West Texas, Continued**
Dr. John Nielsen-Gammon, Texas State Climatologist/Professor of Meteorology, Texas A&M University Department of Atmospheric Sciences
Dr. Charles Jackson, Research Scientist, The University of Texas at Austin Institute for Geophysics, Jackson School of Geosciences
Dr. Edwin Maurer, Assistant Professor, Santa Clara University Civil Engineering Department

11:00 **Perspective on Climate Change from Other States**
Dr. Brian Hurd, Associate Professor, New Mexico State University Agricultural Economics and Agricultural Business Department
Dr. Connie Woodhouse, Associate Professor, University of Arizona Department of Geography and Regional Development
Nolan Doesken, State Climatologist/Senior Research Associate, Colorado Climate Center

12:00 Catered Lunch (Optional tours of Kay Bailey Hutchison Desalination Plant available during lunch break)

1:30 **Current and Proposed Water Management Strategies for Far West Texas**
Commissioner Patrick Gordon, Rio Grande Compact Commission
Wayne Treers, Hydraulic Engineer, U.S. Bureau of Reclamation, U.S. Department of the Interior
Gary Esslinger, Treasurer Manager, Elephant Butte Irrigation District
Dr. Bill Hutchison, Water Resources Manager, El Paso Water Utilities–Public Service Board
Jesus Reyes, General Manager, El Paso County Water Improvement District #1

3:30 Break

3:45 Concurrent Facilitated Discussions
Potential Water Management Strategies to Address Climate Change in Far West Texas
Research Needs to Address Climate Change in Regional Water Planning
Potential Options to Fund Water Management Strategies and Research

FAR WEST TEXAS CLIMATE CHANGE CONFERENCE

Presentation Abstracts

GERALD NORTH, PH.D.
Distinguished Professor of Atmospheric Sciences, Texas A&M University
Global Climate Change and Texas Water

Numerous indicators and assessments suggest that the planet is warming and the basic cause is the increase in greenhouse gases attributable to the burning of fossil fuels and land surface changes over the last two centuries. There has been considerable progress in gathering and understanding climate data over the last 30 years, along with improvements in our building and understanding of global and regional climate models. The models are now good enough to make projections into the future of climate for such regional areas as the U.S. Southwest and perhaps even Texas. All models say that Texas will be several degrees Celsius warmer over this century. Water is a primary concern and although precipitation and evaporation are more difficult to model, the indications are that available water will be scarcer in the next 50 years, particularly in the western portion of our state.

BRUCE A. MCCARL, PH.D.
Regents Professor of Agricultural Economics, Texas A&M University
West Texas Agriculture Water and Climate Change: Economics of Vulnerability

Forces likely to affect future Texas irrigated cropping are reviewed. Results are then given on the effects of climate change in Texas relative to the United States and the Edwards Aquifer region. Results show Texas is quite sensitive both in the profitability of irrigated agriculture and in the cost of environmental protection.

JOHN NIELSEN-GAMMON, PH.D.
Texas State Climatologist/Professor of Meteorology, Texas A&M University Department of Atmospheric Sciences
Temperature and Precipitation Changes in West Texas: Models vs. Observations

Computer-based climate models are in complete agreement that Far West Texas should become warmer and probably drier as greenhouse gases continue to accumulate. But greenhouse gases have been accumulating for more than a century, and they have been the dominant force on the global scale for at least the past 30 years. What can local climate observations tell us about present and future climate?

Temperatures have increased across Far West Texas over the past century. This is in contrast to the rest of Texas and the southeastern United States, which has actually seen a century-scale decline in temperatures. However, in all areas, temperatures have trended sharply upward over the past 30 years and are now at or above the previous period of warmth in the early 1950s.

Despite undergoing a period in the 1990s that was among the driest on record, precipitation in Far West Texas overall has increased slightly over the past century. The rate of increase is smaller than in the rest of Texas. Generally in western Texas, New Mexico, and southern Colorado, no significant long-term precipitation trend is present.

In summary, given both model output and observations, temperatures are very likely to continue to increase and precipitation is more likely than not to decrease slightly. Because rising temperatures would lead to increased water demand by cities, agriculture, and ecosystems even if precipitation remained steady, the effects of droughts are likely to become more severe over time.

CHARLES JACKSON, PH.D.

Research Scientist, The University of Texas at Austin Institute for Geophysics, Jackson School of Geosciences

Projections and Uncertainties Concerning Climate Impacts on Water Availability in Western Texas

A review will be presented of multiple model projections of Texas climate for the next 50 to 100 years. In general, predicting change for specific regions of the globe like Texas is difficult owing to the many remote and regional factors that can affect a given region's climate. The scatter among the multiple model projections for Texas precipitation illustrates this. Nevertheless, there appears to be sufficient agreement among models concerning the combination of factors that will increase aridity in western Texas. These projected changes appear to be significant when compared to tree ring proxies of regional drought over the past millennium.

EDWIN MAURER, PH.D., P.E.

Assistant Professor, Santa Clara University Civil Engineering Department

Downscaling Global Climate Change Projections for Assessment of Water Resources Impacts

The warming temperatures we have experienced in recent decades are unequivocal and have been largely attributed to human activities. The climate disruption caused by the perturbed radiative balance of the planet is a complex picture, with significant variability in the observed and projected future impacts for different regions. One of the principal effects on humanity is that on water resources, which respond to changes in both temperature and precipitation in locally dependent ways. Western water resources, in general, are highly managed by constructed systems that were designed based on historic climate observations, leading to a high potential for vulnerability as climate diverges from historic patterns. Anticipating future changes and understanding what uncertainties are associated with different projected changes are essential to adapting efficiently to inevitable changes and motivating mitigation activities to avoid more severe impacts. This presentation presents a method for estimating local and regional projections of climate change and quantifying the principal uncertainties in a risk-based framework applicable to water resources management.

BRIAN HURD, PH.D.

Associate Professor, New Mexico State University Agricultural Economics and Agricultural Business Department

Climate Change and the Upper Rio Grande Watershed: Assessing Impacts and Developing Insights for Strategic Adaptations

With limited opportunities for new water sources in the Rio Grande watershed, continued population growth must necessarily compete with existing water users for available supplies. This presentation explores two aspects of climate change and the water resources of the Upper Rio Grande. First, the role of water and the effects of climate change on its use and economic productivity is examined by using scenarios of climate change, a model to estimate streamflow responses, and the RioGEM hydro-economic model. Together, these are used to explore possible changes in patterns of water use, transfer, storage, and economic consequences resulting from long-run changes in climate. The analysis suggests that climatic changes are likely to diminish surface water resources—even for scenarios deemed relatively "wet"—and that competition for water will be exacerbated and is likely to heighten pressure for water transfers from agriculture. With the onset of more persistent and widespread shortfalls in streamflow, all water users will likely experience the adverse economic consequences that accompany diminished water supplies and rising water costs. The second aspect highlights the potential for careful and systematic planning to enhance the adaptive capacity of the region and to identify initial strategies that can aid the region's transition to greater water scarcity.

CONNIE WOODHOUSE, PH.D.

Associate Professor, University of Arizona Department of Geography and Regional Development

Reconstructions of Past Streamflow from Tree Rings: Placing the Gage Record in a Long-Term Context

The current climate is being impacted by human activities to a degree that has not occurred in the past, and, consequently, the climate of the past will not be exactly analogous to the climate of the future. However, understanding the past climate can provide insights on what may be expected in the future. In the Southwest, tree-ring data have been used to reconstruct high-quality records of water year streamflow for past centuries in the Colorado and Rio Grande basins. Tree-ring-based reconstructions of hydrology provide information about a broader range of variability and extremes than provided by gage records alone, allowing recent climate trends and events to be assessed in a long-term context. The duration of drought events and the variety of sequences of flow years in the reconstructions indicate that the gage records contain just a subset of possible conditions. Understanding the range of conditions that have occurred in the past is useful for gaining insights on possible future variability, even without the impacts of climate change.

NOLAN DOESKEN

State Climatologist/Senior Research Associate, Colorado Climate Center

Monitoring Colorado Climate, Tracking Changes, and Thinking Ahead

Large seasonal and interannual variability in precipitation and snow accumulation is common for the southern Rocky Mountain region, including the upper Rio Grande Basin. Understanding and adapting to variability is a sufficient challenge for water planners, managers, and administrators even without the additional uncertainty added by climate change. The extreme drought experienced over the entire state of Colorado in 2002 had a profound effect on attitudes about drought, climate variability, climate change, and firm yield. Organizations that were previously highly skeptical about including climate change scenarios in water resource planning have subsequently invested in research and planning. The Western Water Assessment at the Cooperative Institute for Research in Environmental Sciences at the University of Colorado is working closely with climate change scientists and water managers to provide climate information of value for planning and decision making. The huge uncertainty in future precipitation patterns does not make the planning process any easier. The Colorado Climate Center (Colorado State University) focuses on tracking current climatic conditions statewide. A "Colorado Climate Trends" Web site will be launched later this month to provide the public with current and unbiased information on recent trends (40-120 years) and variations in temperature, precipitation, and snow accumulation. In October 2008, the Governor's Conference on Managing Drought and Climate Risk will be held in Denver to continue to encourage communication and planning.

WAYNE M. TREERS

Hydraulic Engineer, U.S. Bureau of Reclamation, U.S. Department of the Interior

Rio Grande Project— 100 Years of Hydrologic History and Climate Change

In 1905, the U.S. Congress authorized the building of Elephant Butte Dam and Reservoir and the associated irrigation delivery system to irrigate nearly 178,000 acres that encompassed the Rio Grande Project. A key component of the Project was to supply irrigation water to Mexico under the terms of the 1906 Treaty between the United States and Mexico. This treaty represented the first apportionment of Rio Grande waters. In 1935, the U.S. Congress authorized the building of Caballo Dam and Reservoir for flood control and irrigation storage water as part of the Rio Grande Project. In 1938, Colorado, New Mexico, and Texas signed the Rio Grande Compact, which further apportioned the waters of the Rio Grande between the three states. Under the compact, the Texas portion is identified as the area from Elephant Butte Reservoir to Fort Quitman, Texas, which is essentially Reclamation's Rio Grande Project.

The water supply for the Rio Grande Project is managed in Elephant Butte and Caballo reservoirs. Nearly 70 percent of the annual flow to Elephant Butte Reservoir is derived from spring snowmelt runoff from the mountain ranges of northern New Mexico and southern Colorado. Spring runoff forecasts in the upper Rio Grande Basin are developed and issued jointly by the Natural Resources and Conservation Service and the National Weather Service. Reclamation uses these runoff forecasts to make predictions of the rate and volume of water that will enter Elephant Butte Reservoir during the spring and the available water supply for irrigation to the Project water users.

The effects of climate change on the upper Rio Grande Basin hydrology and water supply to the Rio Grande Project is still unknown. Although we have over 100 years of hydrologic data and climatic history in the upper Rio Grande Basin, are these historical trends and averages enough to predict climate change, or will climate change yield new trends and averages? Finally, since 1945 when the Rio Grande Project's irrigated lands were fully developed, we have 63 years of water and crop demand data. How will climate change affect water supply and cropping patterns in the future on the Rio Grande Project?

GARY ESSLINGER

Treasurer Manager, Elephant Butte Irrigation District

Adapting to a Changing Climate

The western United States and particularly the area encompassed by the Rio Grande Project have experienced natural wet and dry cycles in the past. Current water flow trends differ in length and strength from past natural variations.

Changes over the past half century have meant less snow pack and more rain. These changes foretell water shortages, lack of storage to meet seasonally changing river flow, and perhaps more transfers of water from agriculture to urban use.

The Elephant Butte Irrigation District is addressing the impacts of climate change in the region and is developing its own adaptive management policies to meet these challenges, in particular, adapting our flood control infrastructure to be more accommodating for storm warning storage, sediment removal, reuse, and environmental enhancement. The localized monsoon season has the potential to capture sufficient runoff to offset decreasing snow pack runoff. However, current water policies have relied on the premise that historical water patterns will continue. The Elephant Butte Irrigation District is looking "outside the box" to develop innovative and localized projects that create opportunities for regional water supply problems to be resolved by regional solutions and local initiatives.

BILL HUTCHISON, PH.D., P.E., P.G.
Water Resources Manager, El Paso Water Utilities—Public Service Board
Climate Change Impacts on Municipal Water Management in El Paso, Texas

Municipal water supplies for the City of El Paso include both surface water and groundwater. As outlined in the 2006 Regional Water Plan, these supplies are conjunctively managed: when surface water supplies are reduced due to drought conditions, groundwater pumping is increased in order to meet demands. Water planners in the area have always understood the nature and consequences of climatic variability on managing water supplies. Considerable investments have been made to ensure adequate supplies under a wide range of climatic conditions.

This investigation assesses the vulnerability of El Paso's water supplies to historic variations of regional climate as well as to the consequences of predictions in the 2007 Intergovernmental Panel on Climate Change (IPCC) report. Historic variation was defined using published tree-ring data for northern New Mexico to simulate annual Elephant Butte inflow data for 1,007 years (1001 to 2007). The simulations show that the 50-year average Elephant Butte inflow has ranged from about 600,000 acre-feet per year to over 1,200,000 acre-feet per year. Current 50-year average inflow is about 800,000 acre-feet per year. IPCC precipitation predictions for the area are based on 21 Global Circulation Models. Due to limitations associated with these models in mountainous terrain, predictions range from a 25 percent decrease in precipitation to a 10 percent increase in precipitation. Temperature increases are predicted by all 21 models, ranging from 1°C to 5°C, which would affect reservoir evaporation.

This investigation included simulating 60 scenarios of various precipitation and reservoir evaporation conditions based on the IPCC predictions. Each scenario included 958 50-year simulations, for a total of 57,480 simulations. Key results included estimated changes to surface water diversions, estimates of required groundwater pumping to meet demands under the current management approach, and estimates of resulting groundwater storage changes. Based on the analysis, future demands outlined in the 2006 Regional Water Plan can be met with the current infrastructure and under the current management approach though the year 2060 under all scenarios. This detailed analysis confirms the effectiveness of the past investment made in water infrastructure and the efficacy of the current management approach in dealing with climatic variability.

JESUS REYES
General Manager, El Paso County Water Improvement District #1

This session will feature a presentation on these topics: 1) current water management and history of the Rio Grande Project; 2) telemetry system upgrade and water monitoring; 3) concrete lining of Riverside Canal; 4) automatic gate installation throughout El Paso County Water Improvement District; and 5) placement of canals with underground pipeline projects with school districts.

Sponsored by:
Texas Water Development Board, Far West Texas Regional Water Planning Group, El Paso Water Utilities–Public Service Board, VIVA Environmental, Inc., El Paso Electric, HillCo Partners