NGWA POSITION PAPER

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Groundwater Protection and Management Critical to the Global Climate Change Discussion

The National Ground Water Association, founded in 1948, is a not-for-profit professional society and trade association for the groundwater industry. Our international membership includes some of the leading public and private sector groundwater scientists, engineers, water well contractors, manufacturers, and suppliers of groundwater-related products and services. NGWA has been and continues to be a forum for discussing and promoting the responsible protection, utilization, and cleanup of the nation's groundwater.

Background

The administration and Congress have both indicated a desire to address global climate change, and encourage and actively support the growth of renewable energy sources. These initiatives both rely upon and impact sustainable water resource management planning. Additionally, water resource management will be a critical component to the U.S. production of renewable energy sources such as biofuels. (For example, an average of more than 4 gallons of water is used to produce 1 gallon of ethanol.[1]) Recent studies by the U.S. Department of Agriculture identified land and water use as significant constraints to meeting the projected market demand of biofuels feedstock production.[2]

Developing scientifically based strategies for sustainable use of our nation's groundwater resources is essential to the United States' need to address the growing demands of an increasing population and to prepare for the effects of climate change. The National Ground Water Association, whose membership includes the country's eminent groundwater scientists, strongly encourages lawmakers to include the importance of assessing, protecting, and developing long-term strategies for one of our most critical resources—groundwater, as a key component of these initiatives.

Climate trends and impacts on water supply

Climate change has the potential to significantly impact the nation's water resources and water demands. Changes in local and regional temperature and precipitation patterns in the nation have been observed and are well documented over the past century.[3,4] Globally, at continental, regional, and ocean basin scales, numerous long-term changes in climate have been observed, including changes in arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns, and aspects of extreme weather including droughts, heavy precipitation, heat waves, and the intensity of tropical cyclones.[5] Further climate change-related modifications of temperature and precipitation patterns are expected to continue well into the future.

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Current and potential impacts of climate change include:

1. **Reduction in average annual snowpack**
   Impact: Large potential loss of snow water storage
   Impact: Increased challenges for surface reservoir management to balance flood control, water supply, recreation, and power generation
   Impact: Potential increased reliance on aquifers to supplement decreased surface water supply and resultant larger groundwater level declines over time.
2. **Changes in precipitation timing, location, intensity, magnitude, and form**
   Impact: Increased potential for flooding with potential for contamination of water supply wells and property damage
   Impact: Increased potential for drought leading to increasing reliance upon groundwater supplies to offset diminishing surface water supplies, diminished base flow to support rivers and streams, declining water tables necessary to support wetland and riparian areas, and increased competition among users (communities, rural residents, agriculture, and industries) for available surface and groundwater supplies
   Impact: Decreased capability of usable surface water reservoir storage capacity to address potential flooding due to increased intensity and magnitude of storm events increasing the volume of water to be stored while decreasing reservoir capacity due to sedimentation.
3. **Sea level rise**
   Impact: Increased flooding along coastal states with potential for contamination of water supply wells and property damage
   Impact: Increased potential for saltwater intrusion into freshwater aquifers and contamination of coastal drinking water supplies.
4. **Increased surface water temperatures**
   Impact: Potential adverse changes in water quality and aquatic habitats.[6]
5. **Changes in urban and agricultural water demand**
   Impact: Potential higher demand peaks due to increase in evapotranspiration rates
   Impact: Longer demand periods to address shorter periods of precipitation
   Impact: Potential increased use of groundwater to supplement surface water supply and resultant larger groundwater level declines over time and associated greater energy demands for pumping
   Impact: Increased potential for competition among users (communities, rural residents, agriculture, and industries) for available surface water and groundwater supplies.

These patterns, coupled with greater uncertainty in water supply reliability and changes in sea level, all impact how we must evaluate and manage our water resources. Uncertainty in the reliability of water supply and the potential disruption in the nation's ability to meet future demands for potable water are also potential security risks to the nation. These climate change-related modifications may have profound impacts on state and national ecosystems and water resource systems.

The role of groundwater in mitigating greenhouse gas buildup

The disposal of carbon dioxide (CO_2) into the subsurface via well injection, also known as geologic sequestration, is one of a portfolio of technologies under consideration as a viable approach to mitigating greenhouse gas buildup. Both the U.S. Department of Energy and U.S. EPA are deeply involved in development of pilot test projects to determine the feasibility and safety of sequestering carbon in deep saline aquifers and other geologic formations for long-term storage. Recognizing that this option for carbon capture holds great promise, it is important to understand it also has the potential to endanger underground sources of drinking water if proper safeguards are not taken.[7, 8]

Groundwater is pivotal to sustainable water supplies

Groundwater, the nation's subsurface reservoir, will be relied on more in the future to help balance the larger swings in precipitation and associated increased demands caused by heat and drought. Groundwater will also be used to increase water supply reliability through periods of climate fluctuations and may serve as future repositories for CO_2 emissions. There will be more emphasis on conjunctive use, which involves the coordinated and planned operation of both surface water and groundwater resources for conservation and optimal use.[9] There will be an increased focus on efforts to manage aquifer recharge and there should be a greater emphasis on protecting our valuable groundwater supplies.

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Groundwater has, and continues to take on, an expanding and pivotal role in water resource planning. The expanding emphasis on the need and usage of groundwater resources will require improved management, planning, and policy tools based on sound science to provide the nation with safe, reliable water supplies.

Policy leadership required

While groundwater management decision-making is most effective when done at the state and local levels where site-specific considerations can be taken into account, the federal government is currently playing, and must continue to play, a leadership role. Federal leadership is needed to help ensure these water professionals have the tools they need to promote the long-term sustainable use of our groundwater resources, including addressing the potential impacts of climate change. NGWA calls on the federal government to:

1. Support efforts such as the Subcommittee on Ground Water (SOGW) established under the Advisory Committee on Water Information. The SOGW is working to develop a collaborative framework among federal, state, local, and nongovernmental entities to optimize data-gathering efforts. Collecting groundwater data is costly, given its widespread location and variability. While specific data gaps and priorities may vary around the country, collaboration will help optimize data-gathering efforts.
2. Increase federal funding for cooperative groundwater quantity and quality data collection. Groundwater professionals identified the need for additional federal funding for cooperative groundwater quantity and quality data collection as the most useful federal action. Water quality and quantity data are necessary to fill information gaps and will assist states in developing and implementing overall sustainable groundwater management plans in support of economic growth goals.

3. Direct federal efforts toward identifying and funding priority research that will provide the basis for actions that support long-term groundwater sustainability in the face of climate change. Some of the priority research topics identified by groundwater professionals include:
    - Water reuse and conservation
    - Alternative treatment systems
    - Surface water and groundwater interactions
    - Development of brackish groundwater supplies
    - Development of models and data standards that can bring together scientific data and inform local policy decision-makers
    - Aquifer storage and recovery or artificial recharge
    - Emerging contaminants and the development of remediation technologies that can be used to address new and current pollutants
    - Risk or lack of risk from exposure to very low levels of trace organics and emerging contaminants that analytical technologies now have the capability to detect (parts per trillion to quadrillion)
    - Enhanced aquifer characterization (utilization of three-dimensional analysis with modeling and GIS applications)
    - Potential impacts of CO_2 injection on groundwater. Measuring and monitoring tools and procedures necessary to verify safe containment and control of CO_2 in groundwater.
4. Promote collaborative efforts among federal, state, local, and nongovernmental entities and water professionals to better inform decision-makers, professionals, and the general public on relevant topics such as:
    - Which groundwater data are being collected and which data are needed to utilize groundwater data to make sound decisions
    - Which current research projects and technologies are being developed and how to incorporate these developments into groundwater management decision-making.

References

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