WATER RESOURCES

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Key Messages

Amplified Water Cycle: Warmer temperatures and higher humidity can increase the frequency and intensity of heavy rain events (2,4) but can also increase evaporation from bodies of water and soil; this can lead to increases in both flooding and droughts across Georgia.

Drought Conditions: Faster evaporation rates due to higher temperatures and periods of low rainfall could increase the severity of droughts, ultimately impacting groundwater and surface water availability, agricultural yields, power production, recreation, and Georgia's high levels of freshwater species diversity (1,2,3,7).

Flooding: Along with prolonged droughts, climate change is also predicted to make heavy rainfall events more frequent and intense, which could increase flooding, putting Georgia communities at risk for home displacement, infrastructure disruption, and health effects (1,2,3,4).

Water Quality: Climate change effects such as warming water temperatures, increased precipitation, and intensified droughts are expected to decrease dissolved oxygen levels and worsen pollutant runoff into Georgia's major water systems (2,3,4).

Water Infrastructure: Changing weather patterns are hindering the performance of wastewater and storm water infrastructure, water treatment plants, dams and levees, increasing repair costs and exacerbating urban runoff (4).

Water Resilience: Opportunities exist to expand the Georgia State Water Plan (5), regional water plans, and the state Rules for Drought Management (6) to sustainably manage Georgia's water resources to promote economic, social, and environmental resilience to climate change.

Overview

Water is a vital resource that not only sustains human life, but also drives agriculture, industry, energy, public health, recreation, and ecosystems. Georgia's water resources are abundant and diverse with 70,150 miles of rivers and streams, 4.8 million acres of wetlands, 425,382 acres of public lakes and reservoirs, 854 square miles of estuaries, and 100 miles of coastline. Georgia also receives an average of 50 inches of precipitation a year, far more than many other states. However, as climate change progresses, Georgia is becoming more vulnerable to water extremes, such as regional droughts and flooding. Proper management and water resilience planning will be critical for Georgia to prepare for future climate change impacts on water resources (5).

Precipitation patterns in Georgia are projected to fluctuate between the extremes of too little water and too much water (2,4). Higher temperatures and faster evaporation rates during periods of low precipitation could lead to longer and more severe droughts, reduce surface water and groundwater availability, and increase water demand (1,2,3). Increasing populations across the state of Georgia will further increase competition for the state's water resources under drought conditions.

Aside from direct impacts to Georgians, prolonged droughts also threaten aquatic ecosystems throughout the state. Georgia is home to an incredible array of freshwater animal species. The Georgia Department of Natural Resources estimates that there are 546 species of freshwater fish, mussels, crayfish, and snails within the state, which places Georgia in the top 5 states in terms of freshwater species diversity (7). Some Georgia river systems, like the Etowah, Conasauga, and Coosawattee are home to many species that cannot be found anywhere else in the world (8). Unfortunately, the state recognizes that 152 (27.8%) of these species are at risk of population declines or extinction. Climate change will likely make the situation more pronounced, as prolonged droughts will reduce water levels that many of these species depend on and put conservation into competition with freshwater use for human needs (7).

Although droughts are a major concern, increased flooding is also highly likely under climate change. Many parts of Georgia are already contending with heavier rain events, which cause inland flooding, higher stream flows, and excess stormwater runoff. The 1990s, 2000s, and 2010s were the three highest recorded decades for the frequency of storms that produced over three inches of rainfall (2,4). Scientists predict by the year 2100, two-day extreme rainfall events may be up to twice as frequent as they are currently (2). Not only will heavy rainfall events become more common, but the amount of rainfall during these storms is expected to be 5-10 percent higher relative to 20th century conditions (2,4). These extreme flooding events have the potential to displace people from their homes and can cause adverse health effects, such as injuries, contact with water-borne diseases, and exposure to toxic pollutants (3). They can also overwhelm stormwater infrastructure, leading to damage to bridges, culverts, and roadways.

Too little or too much water has further destructive consequences beyond droughts and flooding. Water quality in many areas across the state is predicted to decline as warmer water temperatures and increased pollutant runoff may create uninhabitable aquatic environments. Runoff from both point and nonpoint sources will intensify as land use changes to accommodate growing populations. Land use change and increases in impervious surface cover will interact with more high-intensity rainfall events to exacerbate runoff (2,4,5). Higher nutrient pollution can trigger the growth of harmful algal blooms, altering ecological food resources, species distribution, and dissolved oxygen concentrations (4). Water infrastructure is also susceptible to the challenges of a changing climate. More frequent extreme precipitation events may damage septic systems, wastewater treatment plants, and drinking water systems, which could have negative impacts on human health (2,3,4). Additionally, increased variability between droughts and heavy rainfall, as well as warmer temperatures, can erode the soil that supports dams and levees (2).

The compounding risks of climate change will bring challenges for water demands, use, and management in Georgia. Since water resources vary across the state, policymakers are tasked with creating regional and local goals specific to water needs of that community. Georgia has both statewide and regional water plans in place designed to conserve Georgia's water resources, but most of these plans assume that precipitation and river flows will remain unchanging (9). Effective planning requires realistic forecasts of future conditions so we can build infrastructure and management systems that are resilient and continue to support Georgia's economy, public health, and overall quality of life, even under a changing climate (5). Preserving Georgia's water resources will require dedicated planning for climate change across all levels of Georgia's government.

Resources

EPA: Climate Change and Georgia (1997)

A 4-page document created by the EPA that details the anthropogenic input of greenhouse gases into the atmosphere and its future climate change impacts on human health, coastal areas, water resources, agriculture, forests, and ecosystems.

2017 NCEI Climate Summary for Georgia

A 5-page document published by the NOAA National Centers for Environmental Information that summarizes Georgia's climate

Georgia Comprehensive State-wide Water Management Plan (2008)

A guide for future water management decisions to ensure Georgia's water resources continue to support growth and prosperity while maintaining healthy natural systems.

Georgia Drought Management Rules

Georgia EPD website with information on drought indicators and links to state rules detailing how Georgia manages water resources during drought conditions.

Georgia River Information

General formation on Georgia's expansive water resources from the Georgia River Network.

Saving Water in Georgia (2013)

A 2-page document created by the EPA that outlines Georgia's population growth impacts on water supply and solutions for the future.

Georgia's Aquatic Species Diversity

A webpage hosted by the Georgia Department of Natural Resources that discusses Georgia's incredible freshwater biodiversity and threats to this rich collection of animals.

References

1) EPA, 1997: Climate Change And Georgia. (EPA 230-F-97-008j).

2) USGCRP, 2018: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 1515 pp. doi:10.7930/NCA4.2018

3) Horin, C., Ruth, M., Ross, K., & Irani, D., 2008: Economic Impacts of Climate Change on Georgia. University of Maryland Center for Integrative Environmental Research.

4) Metropolitan North Georgia Water Planning District, 2015: Utility Climate Resiliency Study.

5) Georgia Water Council, 2008: "Georgia Comprehensive State-Wide Water Management Plan."

6) "Drought Management." Georgia Environmental Protection Division. Subject 391-3-30

7) Georgia Department of Natural Resources, 2015: Georgia's State Wildlife Action Plan: Appendix E.

8) Elkins, D., Sweat, S. C., Kuhajda, B. R., George, A. L., Hill, K. S., & Wenger, S. J., 2019: Illuminating hotspots of imperiled aquatic biodiversity in the southeastern US. *Global Ecology and Conservation*, *19*, e00654.

9) Werner, K., & Svedin, L., 2017: States, water, and climate: Who's planning for change?. *Climate Risk Management*, *16*, 59-72.