4th Quarter 2018

Carolinas Climate Connection

Carolinas Integrated Sciences & Assessments, a NOAA RISA Team

Integrating Climate Science and Decision Making in the Carolinas

The CISA team wishes a very happy holiday season to all of our friends and colleagues throughout the Carolinas and the Southeast.

Newsletter Contents

carolinas climate resilience conference

2018 Carolinas Climate Resilience Conference

Presentations Now Available Online

www.cisa.sc.edu/ccrc

Upcoming Events

NC Water Resources Research Institute Annual Conference
March 21 - 22, 2019
Raleigh, NC

National Adaptation Forum
April 23 - 25, 2019
Madison, WI

Sea Level Hotspots from Florida to Maine: Drivers Impacts and Adaptation
April 23 - 25, 2019
Norfolk, VA

Climate Prediction Applications Science Workshop (CPASW)
June 11 - 13, 2019
Charleston, SC

Carolinas Climate Listserv

Subscribe to the Carolinas Climate Listserv to learn about the latest climate research and information, upcoming events, funding opportunities, and other relevant news for the Carolinas.

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RISA
Regional Integrated Sciences and Assessments

UNIVERSITY OF SOUTH CAROLINA

Getting to Know Your RISA

Featured Team Member: Jordan Clark

Jordan Clark is a CISA research assistant and a 2nd year PhD student in the Geography Department at the University of North Carolina at Chapel Hill. Jordan is a North Carolina native, growing up in Shelby in the western part of the state. He received a bachelor's degree from UNC-Chapel Hill in geography, specializing in earth and environmental systems, and a bachelor's degree in political science. From a young age, he developed a fascination with weather and climate, especially with observing and tracking severe weather events and winter storms. Following this passion, his graduate research and work as a CISA research assistant are within the fields of applied climatology and biometeorology, working at the intersection of climate and public health.

His research is focused on the health impacts of extreme heat and exploring the utility of existing heat stress indices in modeling health outcomes and individual-level vulnerability to excessive heat. Currently, this work involves research projects comparing the ability of heat stress indices to predict heat-related morbidity and mortality across North Carolina. This research parallels his other work focused on understanding the variability of heat stress indices across microclimates and the implications of this variability on the accurate identification of dangerous conditions.

2018 Carolinas Climate Resilience Conference Recap

By: Ellie Davis

While Hurricane Florence tried to put a damper on the 2018 Carolinas Climate Resilience Conference, nothing could keep CCRC down! A total of 248 attendees met in October at the Columbia Metropolitan Convention Center after the conference was rescheduled from September. Attendees came from 14 states and the District of Columbia. The majority (84%) were from the Carolinas, but there were also representatives from across the U.S. Attendees represented every sector including NGO's and universities (42%), federal and state governments (29%), private sector (14%), local government (11%), and community organizations and tribal entities (4%).

A feedback survey was circulated to attendees after the event to assess the benefits of attending the conference, what the conference was effective in achieving, and climate information and resource needs. 44% of attendees responded to the survey (n = 101). Below are a few highlights from survey responses.

This was the third CCRC and participants noted the consistency and value of the event. One participant wrote, ***"The CCRC is now a dependable, predictable event. The CISA network is very embedded across many areas--much like the glue that helps facilitate and allow for collaborations that would not otherwise happen."*** Other attendees responded that they appreciated the diversity of knowledgeable contributors, the opportunity to learn from similar organizations, and the chance for communication and knowledge transfer between scientists and decision makers. Many of the participants knew each other by name, but CCRC enabled invaluable face to face meetings. One participant wrote, ***"The value of the interactions is more qualitative in that, for me, it is energizing to know that others think similarly on these types of issues."***

When asked about what climate information is most relevant to their organizations, the top two selections were "extreme events" and "case studies and examples of what other communities and organizations are doing to build climate resilience." These responses will serve as guidance for future stakeholder engagements the CISA team hosts.

Survey respondents overwhelmingly agreed that the conference helped them make new connections with people and organizations, connected them to climate resources in the Carolinas, and provided tangible examples of climate resilience. In addition, they found the CCRC effective at advancing their own thinking or understanding of climate resilience in the Carolinas, helping to learn new decision-making approaches on preparedness planning, and providing new knowledge to address climate-related challenges in their work or community. They plan to follow-up on what they learned at the conference by sharing contact information and resilience activities with their coworkers, connecting or collaborating with people met at the conference, strategizing their direction for future work or research, applying lessons to improve public climate change communication, and applying tools and information to practices in their communities.

2018 RALA Recipients Demonstrate the Diversity of Adaptation in the Carolinas

Contributed by: The American Society of Adaptation Professionals

The first Carolinas Regional Adaptation Leadership Award (RALA) honorees were presented at the 2018 Carolinas Climate Resilience Conference in October, by the American Society of Adaptation Professionals (ASAP). Congratulations to this year's award winner Holly White of Nags Head, NC. Honorable Mentions were also presented to John Fear and Steve Frank. Read on to learn more about how these folks are increasing adaptive capacity in the Carolinas.

Holly White, Principal Planner, Town of Nags Head, NC

Holly White is a dedicated climate adaptation leader in her community and for all of North Carolina. Her tenacity in action, vision, creativity, and sheer determination to engage with others and promote adaptation strategies and planning underscores her efficacy in putting dedication into practice. Through her talent for engaging diverse stakeholders, she has established the Town of Nags Head as a model community for others to emulate in their adaptation efforts. Holly crafted a vision for a resilient Nags Head by learning about adaptation and engaging the public, both those supportive and skeptical of the need for sea level rise planning. To approach adaptation planning, Holly assembled a team across town departments that included planning, engineering, public works, and septic health. Grounded in shared values, her leadership has fostered integrated, interdisciplinary resilience.

Holly is ensuring that adaptation addresses complex hazards, centering the interactions between sea level rise, rainfall, and water use in driving groundwater table height and consequent flooding. The mainstreaming approach to adaptation Holly recommended will ensure that complex hazards are included across all implemented plans. Holly is now sharing lessons learned from Nags Head throughout northeastern North Carolina, initiating efforts to reach across the border with Virginia as well as rural northeastern NC counties. Through her dedication to public service, she is fulfilling her vision of a resilient rural North Carolina.

John Fear, Honorable Mention for Building Capacity and Fostering Connectivity

Deputy Director, NC Sea Grant and NC Water Resources Research Institute

John Fear's vision is a key asset for North Carolina Sea Grant and the Water Resources Research Institute. John's leadership as Deputy Director has shaped each program to meet crucial needs in the state. As part of National Sea Grant visioning efforts, John has helped set the stage for discussion on climate change and adaptation, integrating climate change into strategic plans and daily operations. John chairs the North Carolina Sentinel Site Cooperative, which focuses on climate change impacts along the state's central coast. Utilizing local ecological knowledge, residents provide valuable historical context in research projects, participate in current citizen science efforts, and offer input during planning sessions. A creative expression of this engagement is the innovative RISING project, which uses fine art photography and oral histories to stimulate discussions of environmental changes that include community members and scientists.

The North Carolina Community Collaborative Research Grant Program exemplifies John's ability to identify needs, work with colleagues to develop solutions, and leverage partnerships to accomplish goals. John recognizes there is a significant training component needed to underpin adaptation practice and planning efforts. John is a mentor and facilitator for graduate studies, leading programs to provide strong research experiences for students. John also coordinates recruitment and review of applications for national fellowships in marine policy, coastal management and fisheries management. Combined, these state and national fellowships offer graduate students critical opportunities to approach challenges such as climate change — and development of related adaptations — from real-world perspectives that demand interdisciplinary approaches.

Steven Frank, Honorable Mention for Adaptation Integration

Associate Professor of Entomology, North Carolina State University

Steven Frank is an internationally recognized Entomologist known for his work to understand how urban heat islands affect tree health and pest populations, and whether the effects of urban warming can predict the effects of global warming and climate change. As trees are critical to mitigate urban heat islands, remove air pollutants, and benefit human health, Steven's mission is to understand why urban tree health declines and develop ways to sustain urban trees and ecosystem services. A hands-on climate adaptation leader training arborists, municipal foresters, landscape architects, government regulators and others, he envisions an adaptive urban environment that supports health and conservation.

Steven is a founding member of the Southern Nursery Integrated Pest Management working group, a regional consortium of horticulturists, plant pathologists, and entomologists. Steven's passion for his work creates enthusiasm among his stakeholders about tree care and research-based adaptation. He has built trust with stakeholders, municipal leaders, and the public because of his innate curiosity and willingness to listen, learn from others, and develop tools and techniques to help solve problems.

Climate Change and Conservation in the Southeast

A Review of State Wildlife Action Plans

By: Kirsten Lackstrom

CISA team members Kirsten Lackstrom and Kirstin Dow are co-authors on a recently published report Climate Change and Conservation in the Southeast: A Review of State Wildlife Action Plans.

The report is part of a larger, collaborative project called "Vital Futures: Conservation Adaptation Planning for Landscape and Climate Change in the Southeast." Changes occurring in the Southeast United States – such as high rates of population growth, urbanization, land use change, and shifting climate conditions – are presenting near- and long-term challenges to the health and sustainability of the region's fish and wildlife populations and habitats. The Department of Interior Southeast Climate Adaptation Science Center funded the Vital Futures Project to support the Southeast Conservation Adaptation Strategy (SECAS) and its work to develop and coordinate regional conservation goals and actions, including those intended to address climate threats. Other Vital Futures project partners represent the National Wildlife Federation, North Carolina State University, and the University of South Carolina's Department of Geography.

The report examines State Wildlife Action Plans (SWAPs) across 15 southeastern states and Puerto Rico. SWAPs are required in order for states and territories to be eligible for State and Tribal Wildlife Grants (SWG) funding. They are also important tools for the states to identify and protect vulnerable species and habitats. The first editions of the plans (due in 2005) typically did not consider climate change. Since then, more state agencies not only recognize the need to prepare for a changing climate but now have access to a multitude of resources, tools, and guidance documents designed to help them assess climate impacts and develop adaptation options.

Research objectives were to 1) document and assess the status of states' ongoing efforts to address climate change, 2) improve understanding of challenges and needs related to climate change and conservation, and 3) identify success and opportunities to facilitate future progress in state and regional conservation efforts. Methods included detailed review of the SWAPs and follow-up interviews with SWAP coordinators.

Key findings and **recommendations** from the report follow on page 5.

Access the report summary at http://go.ncsu.edu/pgzal1 and the full report at http://go.ncsu.edu/se_swap_review_report.

For more information about the Vital Futures Project, visit bit.ly/VitalFutures

Climate Change and Conservation in the Southeast (cont.)

Key Findings:

- While all states recognized the climate change threat, they exhibited a diversity of planning approaches. Factors such as staff capacity and expertise and consistency with other planning processes influenced the methods and extent to which the SWAPs integrated climate change.
- Few states conducted climate change vulnerability assessments expressly to inform their SWAPs. Many interviewees suggested that interstate collaboration and resources to conduct regional-scale assessments would enhance the current, limited use of impact and vulnerability assessments.
- Climate adaptation strategies tend to be stated in general terms and few examples of implemented actions exist thus far. Acting with intentionality (i.e. linking specific strategies to climate impacts) and developing Southeast- specific resources for monitoring change and the effectiveness of conservation actions could enhance the uptake of novel management strategies.
- Overarching conservation goals as articulated in the SWAPs tend to be persistence- oriented, although some internal conversations are considering how climate change will affect the future feasibility of conservation strategies designed with static climate conditions in mind.

Recommendations:

- The project team developed a set of recommendations intended for state fish and wildlife agencies, as well as the various governmental and non-governmental partners working to develop shared conservation goals and actions for the region
- Enhance collaborative planning and implementation efforts by capitalizing and building on existing regional activities, networks, resources and expertise.
- Advance the application and use of both state and regional climate change impact and vulnerability assessments by making use of existing assessments and strategically allocating time and funding to develop regional-scale assessments.
- Facilitate the development and implementation climate adaptation strategies through the creation of Southeast-specific guidance and being explicit as possible in linking climate impacts and actions.
- Foster the adoption of climate-informed conservation goals by exploring how climate change may affect the feasibility of existing goals and which species, habitats, and areas should be targeted for conservation action.
- Enhance monitoring and evaluation efforts by engaging with scientists and others to identify effective indicators of climate change and its effects on conservation targets and management outcomes.

Examples of climate planning challenges and opportunities identified by interviewees

Challenges	Opportunities
• Lack of information for some state-specific habitats and species of concern • Lack of information on impacts, which reduced the sense of urgency to address the issue • Lack of resources to conduct more research • Limited staff • Lack of expertise within the agency • Difficulty planning on long time frames • Long-term climate change considered less urgent than other threats (e.g., agriculture, urbanization)	• Availability of information for some topics and species • Availability of trainings to increase familiarity with the issue • Assistance from the Land Conservation Cooperatives, the Southeast Climate Adaptation Science Center, and other outside experts • Ability to engage staff when they realized that addressing climate change could be linked with other ongoing activities

Report Citation:

Lackstrom, K., P. Glick, K. Dow, B. A. Stein, M. N. Peterson, E. Chin, and K. Clark. 2018. Climate Change and Conservation in the Southeast: A Review of State Wildlife Action Plans, http://go.ncsu.edu/se_swap_review_report.

https://www.nwf.org/Our-Work/Environmental-Threats/Climate-Change/Climate-Smart-Conservation/Adaptation-Reports

Fourth National Climate Assessment Released

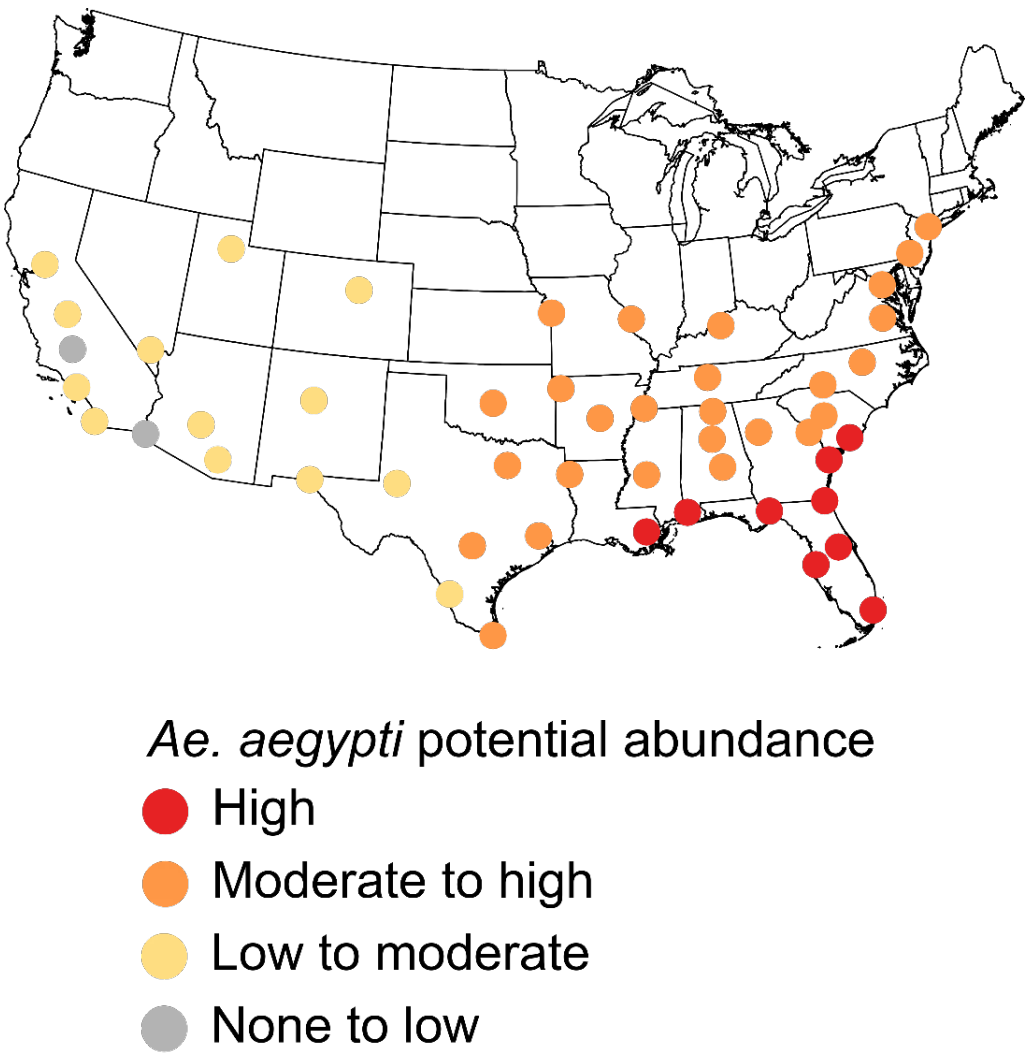
Southeast Chapter Highlights the Impacts to Our Region

By: Ellie Davis

Have time over the holidays for some light reading? The Fourth National Climate Assessment was recently released by 13 Federal Agencies and the Southeast region's chapter was co-authored by none other than CISA's Dr. Kirstin Dow. The Southeast continues to experience extremes in temperature, precipitation, and flooding. From an increasing trend in hot days and warm nights to a growing pattern of heavy precipitation, many urban and rural areas of the Southeast are vulnerable to climate change. Kirstin and her co-author Doug Marcy (NOAA Office for Coastal Management) discussed these changes and the impacts they will have on the region in a recent webinar hosted by the Southern Alliance for Clean Energy, available here. Below is a summary of the key messages from this chapter, highlighting how projected changes will impact the region.

Urban Infrastructure and Health Risks

Although the Southeast has a history as a rural region, it is currently undergoing rapid urbanization. These cities are particularly vulnerable to heat, flooding, and vector-borne disease. However, these urban areas also "offer opportunities to adopt effective adaptation efforts to prevent future negative impacts of climate change."

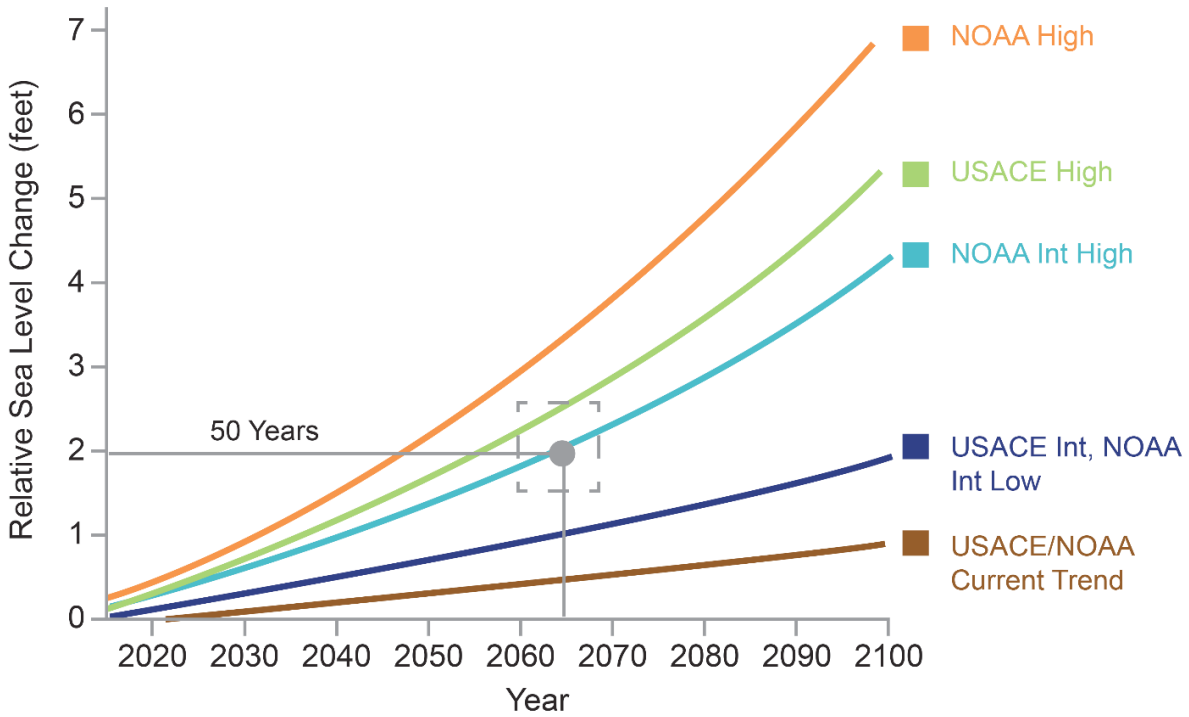


The map shows current suitability for the *Aedes aegypti* mosquito in July in 50 different cities. *Aedes aegypti* mosquitoes can spread several important diseases, including dengue fever, chikungunya, and Zika fever. The Southeast is the region of the country with the greatest potential mosquito activity. Warming temperatures have the potential to expand mosquito habitat and disease risk.
Source: adapted from Monaghan et al. 2016.

Increasing Flood Risks in Coastal and Low-Lying Regions

Along the coastal plain and inland low-lying regions, the impacts of extreme rainfall events and sea level rise are increasing flood frequencies. Property values, infrastructure, and public safety are all at risks without "significant adaptation measures." The hurricane seasons of 2016, 2017, and 2018, brought with them heavy precipitation and storm surge causing devastating flooding in these regions.

A Charleston Case Study was highlighted in the report. The Charleston, SC crosstown highway (U.S. 17 Septima Clark Parkway) consistently experiences flooding. In 2015 and 2016 Charleston experienced record-setting numbers of high tide flood occurrences, 38 days and 50 days respectively. As estimated by the City of Charleston, the cost of each event is $12.4 million (2009 dollars). By 2045, these events are projected to increase in frequency up to 180 a year due to sea level rise. This led the city to develop a Sea Level Rise Strategy, focusing on infrastructure, response plans, and readiness.



The City of Charleston Sea Level Rise Strategy calls for a 50-year outlook, based on existing federal sea level change projections in 2015 (colored curves), and calls for using a range of 1.5–2.5 feet of sea level rise (dashed box). A 1.5-foot increase will be used for short-term, less vulnerable investments, such as a parking lot. A 2.5-foot increase will be used for critical, longer-term investments, such as emergency routes and public buildings. This 1-foot range was chosen to approximate the average of these projections in 2065.
Source: City of Charleston 2015

Natural Ecosystems will be Transformed

"Changing winter temperature extremes, wildfire patterns, sea levels, hurricanes, floods, droughts, and warming ocean temperatures are expected to redistribute species and greatly modify ecosystems." In addition to ecosystem changes such as the replacement of valuable salt marshes by mangrove forests, warmer winters favor invasive species. These changes will impact both the local ecological and human inhabitants, as the people who depend on the ecological resources for livelihood, protection, and well-being are at risk.

Burmese pythons are apex predators (not preyed upon by other animals) that are expected to be favored by warming winters. This photo is from Everglades National Park, where unintentionally introduced pythons have expanded and reduced native mammal populations. Photo credit: U.S. Geological Survey

Economic and Health Risks for Rural Communities

An integral part of the Southeast's heritage and industries, rural communities are particularly at risk from heat exposure-linked health impacts and economic vulnerabilities. Labor-intensive industries such as agriculture and forestry are likely to experience a loss in labor hours due to extreme heat-related impacts. In addition, crops and livestock are vulnerable to higher temperatures, due to a loss in productivity of cultivated crops and the potential for livestock heat stress.

In the southern Appalachians, the Cherokee have harvested ramps for thousands of years. These wild onions are now threatened due to overharvesting and a changing climate. Higher temperatures and lower soil moisture could decrease growth and impact the harvesting techniques that are deeply important to tribal lifeways.

Interested in learning more? Read the entire National Climate Assessment at https://nca2018.globalchange.gov/

This up-close image of a ramp (*Allium tricoccum*), harvested from the wild, shows leaves and the bulb/corm of the plant. Photo credit: Gary Kaufman, USDA Forest Service Southern Research Station.

South Carolina Water Demand Forecasts: Stakeholder Feedback Request

The SC Dept. of Natural Resources, the SC Water Resources Center, and the US Army Corps of Engineers have partnered to develop methods for projecting water demand across the state. Once these methods have been developed and reviewed by stakeholders, they will be applied for each major category of off-stream water demand. Estimates of future water demand will inform water planning at local and regional levels and will be used to develop the 3rd edition of the SC State Water Plan.

Stakeholders are invited to provide feedback on the water demand projection methods as they are developed. Comments received within 30 days of posting draft reports will be compiled and responses will be provided when the final reports are published. A series of meetings will be hosted online to facilitate discussion, and in-person meetings may be arranged as needed. The resulting water demand projections will be subject to further review during stakeholder meetings in each major river basin of the state. The public comment period is ongoing, and there will be additional Technical Advisory Committee meetings scheduled as needed.

More information at www.scwatermodels.com. Send comments or feedback to scwatermodels@clemson.edu.