From Fish Habitat to Drinking Water – Gearing Up For Changing Climate Conditions in Southeastern Streams

Joint research by the U.S. Geological Survey and the U.S. Forest Service Southern Research Station

The southeastern United States is a water-rich region criss-crossed by major rivers and streams that shelter some of the most unique and diverse aquatic ecosystems in the world. These ecosystems, often stressed by drought, may be altered by rising temperatures and other effects of global climate change, threatening the persistence of temperature-dependent species such as the eastern brook trout. In recent years, the Southeast has also experienced some of the highest rates of population growth in the Nation, increasing the demand for ecosystem services such as an abundant supply of drinking water and water-based recreation. Resource managers in the Southeast are particularly challenged in ensuring they balance human demands for ecosystem services with the habitat needs of freshwater aquatic species.

To manage for likely changes to aquatic systems and the ecosystem services they provide, resource managers and planners need precise predictive tools to help them make informed decisions and to develop effective strategies to minimize the effects of change on aquatic ecosystems. To provide this information, the U.S. Geological Survey (USGS) and the USDA Forest Service are working together to assess how land-use, water-management decisions, and climate change may affect ecosystem services and coldwater species such as brook trout.

Background

In 2010, the USGS and the FS joined forces to study how aquatic systems in the Southeast are responding to climate change. The multi-year project, with a total budget of $500,000, is led through the Southeast Area Office of the USGS and the Southern Research Station of the Forest Service. By working together, scientists will refine and combine climate and hydrologic models to provide a better understanding of climate effects on freshwater fish and water quality and quantity in the region.

Activities

The southeastern United States is home to many kinds of aquatic systems, ranging from the high-elevation coldwater streams of the Appalachian Mountains to the low-elevation warm-water streams of the Coastal Plains.

Scientists on this project are teaming up to integrate models under development that capture stream features such as water movement and temperature, channel characteristics, and fish populations. The result will accurately reflect how real stream ecosystems in two high-elevation watersheds — located within the Apalachicola–Chattahoochee–Flint and the Albemarle–Pamlico — respond to changes in air temperature and land cover. USGS will investigate the changeable nature of stream channels, surface water, and water temperature using newly collected data as well as the detailed baseline data collected by the Forest Service. Scientists from both agencies will assess specific stream conditions needed to support key fish species that rely on cold water and model the likelihood of the occurrence of those species in any given stream patch. With combined models, the project will define cold- and warm-water stream areas, highlighting potential transitions from cold- to warm water, and the resulting effects on fish communities.

To test a range of climate change scenarios from 2000 to 2100, climate-change projections will be integrated with the new stream models. The Forest Service will examine how changes in land use affect local air and water temperature, forming the basis for models that test how land-management approaches, in conjunction with climatic changes, will affect ecosystem services. Finally, Forest Service researchers will apply these models in a high-priority basin, the Albemarle–Pamlico, to assess how climate change will likely influence three specific ecosystem services: water temperature, supply, and quality (sediment and nitrogen).

Outcomes

The goal of the modeling effort is to provide tools those managers and planners can use to confidently evaluate how different resource management strategies will fare as the regional climate changes and as land-use patterns change. Therefore, USGS and Forest Service researchers will engage representatives of key regional agencies to determine what types of management scenarios they need to test. By combining efforts, the USGS and the Forest Service will not only improve the science of stream modeling, but will also provide essential tools necessary for managers and policy makers to make science-informed decisions.

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