

2016 NC Source Water Protection Nomination Summary: USDA-Forest Service, Southern Research Station

This nomination is for the Leadership category, and may be unconventional when compared with other nominees or previous recipients. I felt like this category best fit the nominee.

The fact of the matter is that much of the effort today to protect source waters is based upon the findings from research that established the base of knowledge that we all have come to take for granted, as it relates to the processes, effects, benefits, threats, and solutions for protecting source water.

One key message that is becoming more and more clear is that *Healthy Forests = Clean Water*.

This presumption, while at times is accused of being naïve or overly simplistic, still holds truth as citizens, policy makers, regulators, and watershed advocates are barraged with rules, data, opinions, and social issues that all focus on the protection of source water for human needs and ecological function. This simple statement that links forests with water is validated by 75+ years of fundamental research, demonstration, and education; much of it originating from the Southern Research Station (and its predecessors) of the USDA-Forest Service.

The Southern Research Station (SRS) has evolved into the leading research entity to examine, understand, define, and explain the critical role that forests, and forest management practices, play in the protection of source water and watersheds in general. The inter-connections between forests and water are especially important to recognize in the South, as population increases will shrink the amount of forestland while concurrently increasing demand for water supply. In particular, there are three North Carolina-based research work units within the SRS that are specifically focused on the nexus between forests and watersheds:

- Coweeta Hydrological Laboratory
- Eastern Forest Environmental Threat Assessment Center
- Center for Integrated Forest Science

USFS SRS Website: <http://www.srs.fs.usda.gov/index.php>

1) Coweeta Hydrologic Laboratory

One of the nation's first outdoor experimental forest laboratories dedicated exclusively to the study of forest hydrology was established in 1934 in western North Carolina at the Coweeta Hydrologic Lab, within the Nantahala National Forest, near the town of Otto. The volume of research and subsequent outreach from Coweeta served as the genesis and foundation for the development of forest industry-adopted Best Management Practices (BMPs) for controlling sedimentation and protecting water quality. Much of what we know today about hydrology in the Southern Appalachian Mountains originated from the fundamental research that was accomplished at Coweeta. Today, ongoing research at Coweeta examines the long term changes in hydrology and forest ecology that might be anticipated from changes in climate and the effects from widespread forest species alterations due to invasive insect or disease outbreaks (specifically, the loss of Eastern Hemlock due to the non-native Hemlock Woolly Adelgid insect).

Website: <http://www.srs.fs.usda.gov/coweeta/index.php>

Link to a 6-minute video from UNC-TV, "NC Science Now" summarizing the work being done at Coweeta:
<http://www.srs.fs.usda.gov/video/long-long-water-record/>

2) Eastern Forest Environmental Threat Assessment Center (EFETAC)

The EFETAC work unit is housed on the campus of N.C. State University. The EFETAC leads the effort within the USDA on researching and modeling potential changes in surface water availability due climate and consumption. This effort is centered around its comprehensive “Water Supply Stress Index” Model (WaSSI), that continues to be refined, validated, and demonstrated around the world. In addition, the EFETAC work unit conducted on-the-ground research to investigate the effects of timber harvesting on water supply and water quantity in headwater stream systems of the Falls Lake Watershed, in partnership with multiple State of North Carolina agencies. This study adds to the base of knowledge regarding how forest management can protect source waters, through the use of forestry BMPs.

Website: <http://www.forestthreats.org/>

WaSSI Model: <http://www.wassweb.sgcp.ncsu.edu/> ,
<http://www.forestthreats.org/research/projects/project-summaries/WaSSI>

Falls Lake Timber Harvesting Study: http://www.forestthreats.org/research/projects/project-summaries/evaluating_effectiveness_of_streamside_management_zones

3) Center for Integrated Forest Science (CIFS)

This relatively new work unit was established approximately 5 to 6 years ago, and is housed on the campus of N.C. State University. The main goal of CIFS is to distill, summarize, and synthesize research and deliver the findings in a manner that is applicable to help solve real-world challenges. One of the first products from CIFS was the distillation of past research into an information brochure, “Forests and Water”, that provides a snapshot of how forests, and forest management, are a preferred solution for protecting watersheds. An ongoing effort underway at CIFS is examining the long-term water supply availability of the Triangle Region of central North Carolina, and how forested landscapes may be able to contribute to sustaining the needs of this water supply.

Website: <http://www.srs.fs.usda.gov/cifs/>

CIFS Publications: <http://www.srs.fs.usda.gov/cifs/publications/>

Communicating Research Findings

The Southern Research Station, in my opinion, is the leader in USFS in communicating the findings of research in a manner that is usable by multiple stakeholders. Examining the number of publications, journal articles, and conference presentations from the SRS illustrates the value with which the Station places on not only research, but communicating and educating others of their findings. Their online blog, “Compass Live”, summarizes new research on a weekly basis. In addition, staff from the SRS are readily available to assist and partner with state agencies, universities and other cooperators from across the Southern Region, and their level of engagement and interaction has proven fruitful in accomplishing mutually-beneficial goals.

Compass Live Blog: <http://www.srs.fs.usda.gov/compass/>

October 20, 2016 Blog Article, summarizing a new book authored by SRS researchers, "Forest Hydrology: Processes, Management and Assessment."

<http://www.srs.fs.usda.gov/compass/2016/10/20/forests-water-climate-and-management/>

USFS Online Catalog of Research Publications: <http://www.treearch.fs.fed.us/>

(Note the number of publications by each Research Station; the SRS has >10,000 published online)

Publication Search: <http://www.treearch.fs.fed.us/advanced-search.php>

- You can conduct an Advanced Search in *Treearch*, by selecting "SRS" from the "Station" drop-list and using an appropriate key word such as "watershed" or "wassi" or "water supply".

Select Examples of Recent Work Products from the USFS Southern Research Station, Related to Source Water Protection

2014: "Quantifying the Role of National Forest System Lands in Providing Surface Drinking Water Supply for the Southern United States." http://www.srs.fs.usda.gov/pubs/gtr/gtr_srs197/gtr_srs197.pdf (PDF, 8MB)

Abstract: "Forests and water are inextricably linked, and people are dependent on forested lands to provide clean, reliable water supplies for drinking and to support local economies. These water supplies are at risk of degradation from a growing population, continued conversion of forests to other land uses, and climate change. Given the variety of threats to surface water, it is important for forest managers to know how much of the drinking water supply originates in forests they manage and what populations and communities are served by that water. In this analysis, we used a hydrologic model, Water Supply Stress Index (WaSSI), and a database of surface water intakes to quantify the extent to which people depend on surface water from USDA Forest Service National Forest System (NFS) lands and State and private forest lands in the South. We computed the water yield for NFS lands in addition to other land cover types, and accumulated and tracked water from NFS and State and private forest lands through the river network. We then estimated the population served by water from NFS lands across the South using the U.S. Environmental Protection Agency's Safe Drinking Water Act database of drinking water intakes. We estimated that NFS lands contributed 3.4 percent and State and private forest lands 32.4 percent of the approximately 900 million m³/year of total surface water supply in the region. Of the 6,724 public surface water intakes in the South, 1,541 intakes serving 19.0 million people receive some water from all NFS lands in and upstream of the 13 Southern States. Of the 1,541 intakes, 427 received more than 20 percent of their water from NFS lands and served 3.2 million people. Similarly, 6,188 intakes serving 48.7 million people receive some water from State and private forest lands. Of the 6,188 intakes, 3,143 received more than 20 percent of their water from State and private forest lands and served 29.0 million people. These results highlight the importance of southern forests in providing clean and dependable water supplies to downstream communities. While environmental and economic factors are likely to interact and cause changes in water availability and quality, forest conservation and proper management can help mitigate these effects."

Figure 5 from this report is excerpted on the following page.

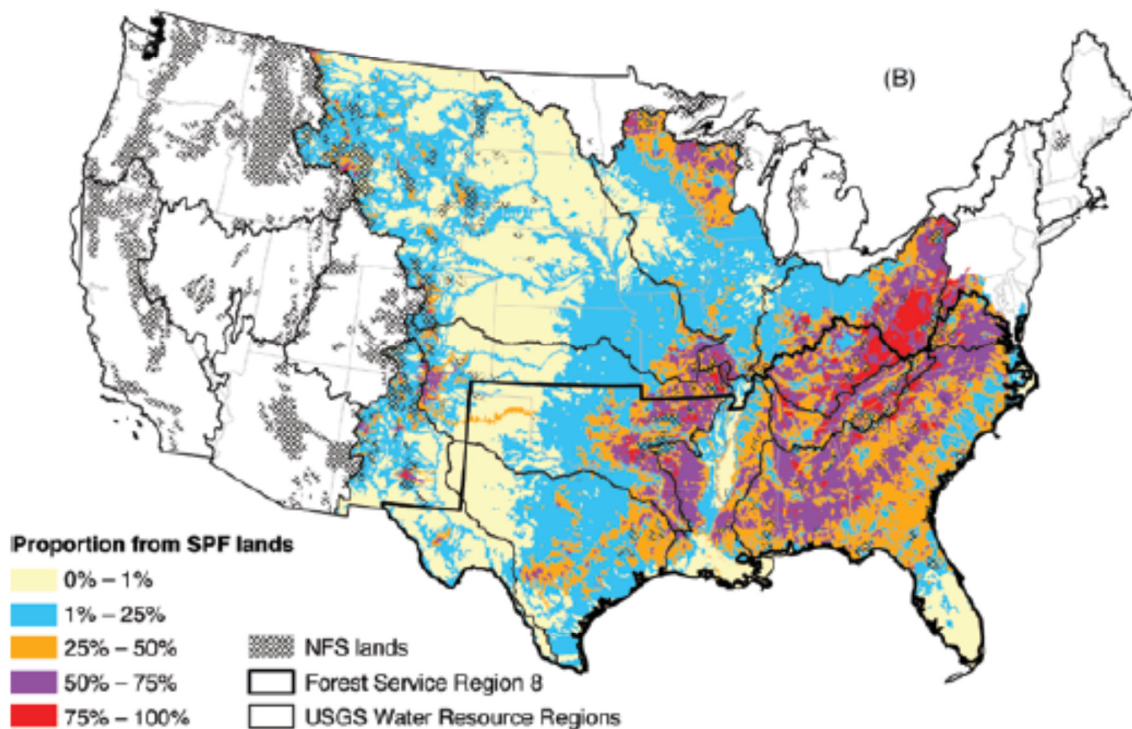
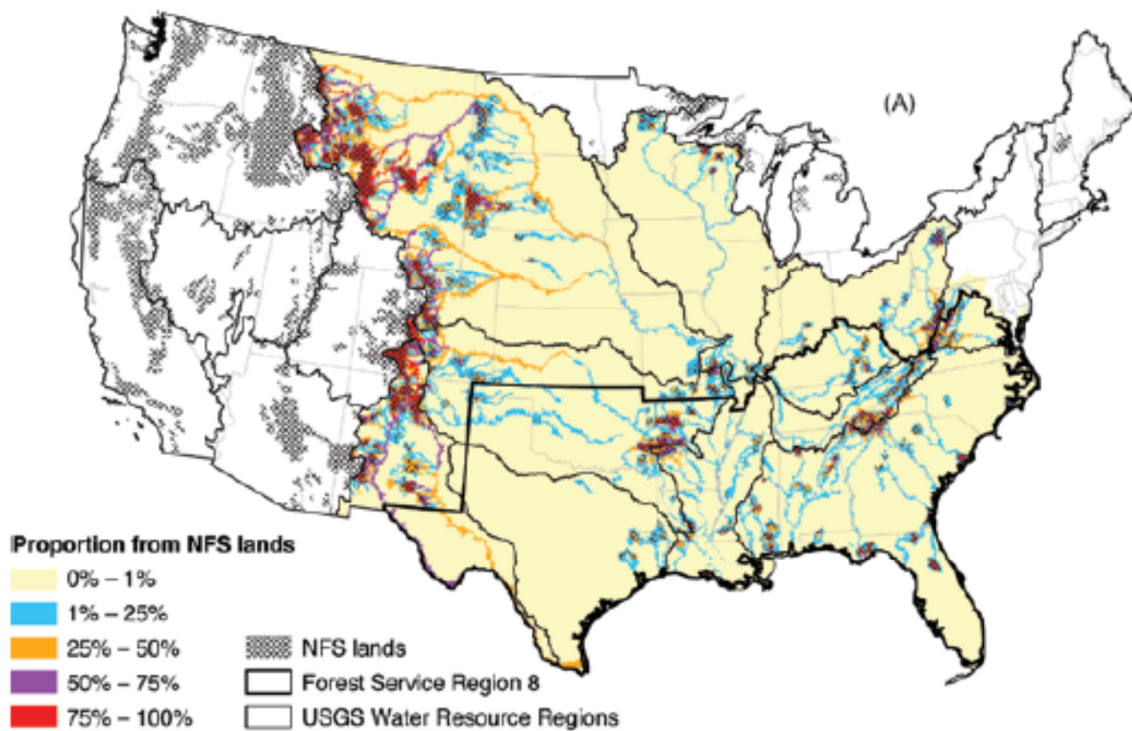


Figure 5—Proportion of the total 2001–2010 mean annual water supply originating on (A) National Forest System (NFS) lands and (B) State and private forest lands by hydrologic unit code (HUC) watershed. Water supply is the total amount of surface water available at the outlet of each HUC watershed, including flow accumulated from HUCs upstream. The 12-digit (sixth level) HUC watersheds are colored according to the fraction of total water supply at the watershed outlet that originated on NFS or State and private forest lands.

2014: **“Flow Down! Can Managing Forests Help Maintain Water Supplies in the Face of Climate Change?”**

http://www.srs.fs.usda.gov/pubs/gtr/gtr_srs183_027.pdf (PDF, 11MB)

Summary: This article was published in a magazine intended for school children to learn about forest research and apply their lessons to real-world applications.

Abstract: “Climate change can have a direct and indirect impacts on water resources. Direct impacts of climate change can be seen by the presence of more extreme weather events. Extreme weather events include things like heat waves and droughts. Droughts have a direct impact on water and water supply. The indirect impacts of climate change on water resources relate to temperature and the amount of carbon dioxide in the atmosphere.”

2013: **“Chapter 13: Forests and Water. The Southern Forest Futures Project Technical Report.”**

http://www.srs.fs.fed.us/pubs/gtr/gtr_srs178/gtr_srs178_309.pdf (PDF, 3MB)

“Key Findings

- Forest conversion to agriculture or urban use consistently causes increased discharge, peak flow, and velocity of streams. Subregional differences in hydrologic responses to urbanization are substantial.
- Sediment, water chemistry indices, pathogens, and other substances often become more concentrated after forest conversion. If the conversion is to an urban use, the resulting additional increases in discharge and concentrations will produce even higher loads.
- Although physiographic characteristics such as slope and soil texture play key roles in hydrologic and sediment responses to land use conversion, land use (rather than physiography) is the primary driver of water chemistry responses.
- Conversion of forest land to urban uses may decrease the supply of water available for human consumption and increase potential threats to human health.
- Increases in urbanization by 2060 in the Appalachians, Piedmont, and Coastal Plain will increase imperviousness and further reduce hydrologic stability and water quality indices in the headwaters of several major river basins and in small watersheds along the Atlantic Ocean and Gulf of Mexico.”

2012: **“Water Quantity and Quality at the Urban-Rural Interface.”**

http://www.srs.fs.fed.us/pubs/ja/2012/ja_2012_sun_001.pdf (PDF, 5MB)

Abstract: “Population growth and urban development dramatically alter natural watershed ecosystem structure and functions and stress water resources. We review studies on the impacts of urbanization on hydrologic and biogeochemical processes underlying stream water quantity and water quality issues, as well as water supply challenges in an urban environment. We conclude that converting forest lands to urban uses increases stormflow rates and volumes, alters baseflow dynamics, and degrades water quality by increasing impervious surface areas. Alterations of watershed water cycles are the root causes of many chain reactions of stream ecosystem degradation present in today’s urban areas. Knowledge gaps exist regarding interactions among processes of urbanization (land conversion, increasing impervious areas, new pollutants), hydrological functions (water budget change, infiltration and evapotranspiration processes), and ecological (biota change) functions at different temporal and spatial scales. Innovative implementation of watershed services is the key to mitigating impacts of urbanization on water and sustaining urban-rural ecosystems.”

Technology Transfer and Practical Applications of USFS Research

High Rock Lake Watershed Analysis

In 2011, with grant funding provided by the USFS State & Private Forestry Program, the N.C. Forest Service partnered with UNC-Charlotte to examine the correlation between forest land cover, water quality, and water supply treatment costs in the High Rock Lake Watershed. The findings of this study have been presented at previous meetings of the NC Source Water Collaborative, NC-WRRI Annual Conference, and most recently via poster presentation at the Fifth Interagency Conference for Research in Watersheds. The work of this watershed-specific study was driven by the larger findings from broad-scale examinations by the Southern Research Station, and supplements the body of knowledge related to how forests can contribute to source water protection. http://www.srs.fs.usda.gov/pubs/gtr/gtr_srs211/gtr_srs211_127.pdf

South Eastern Partnership for Forests and Water

The work being done by the SRS has proven critical in establishing a groundwork of knowledge to foster improved communications, relationships, and understandings between state forestry agencies and water supply operators in multiple states across the South. The Partnership is facilitating working groups, tours, meetings, and demonstration projects between forestry and water system stakeholders, bringing to life much of the research conducted by the SRS on the subject of source water protection.

<https://sites.google.com/a/scrwa.org/south-east-water-quality-collaborative/home?pli=1>

U.S. Endowment for Forests and Communities

“The Endowment works collaboratively with partners in the public and private sectors to advance systemic, transformative and sustainable change for the health and vitality of the nation's working forests and forest-reliant communities.” Through the Endowment’s Healthy Watersheds program, it has funded projects nationwide focusing on delineating tangible outcomes of how forests can contribute to source water protection.

<http://www.usendowment.org/>

Nominator Contact Information

Tom Gerow, Jr.
Water Resources Staff Forester
NCDA&CS - North Carolina Forest Service
1616 Mail Service Center
Raleigh NC 27699-1600
Office: 919-857-4824
Email: tom.a.gerow@ncagr.gov