

The Walker Branch Watershed on the Oak Ridge Reservation

With its unique ability to “reinvent” itself every decade, the U.S. Department of Energy’s Walker Branch Watershed has a long history as a premier research site.

Located in the National Environmental Research Park (NERP) on the Oak Ridge Reservation (ORR), the 240-acre watershed is one of the few large, contiguous forests in the Tennessee Valley. While its research focus has evolved since it was set aside for ecological study in 1967, its mission to provide answers to the country’s greatest environmental questions has remained the same.

Watershed History

Prior to World War II, the Walker Branch Watershed was a typical rural area with a mix of forest, sustenance agriculture, and open woodland grazing. After the federal government acquired it in 1942, the watershed returned to a forested state and has not been disturbed since except naturally by fire and the invasion of insects such as the southern pine beetle.



Stream gauging stations known as weirs (insert) are located above the confluence of the East and West Branches of Walker Branch (main picture). The v-notch weirs continuously monitor stream discharge.

Research over the Decades

The watershed is an important area where Oak Ridge National Laboratory (ORNL) scientists have taken long-term measurements of incoming and outgoing water as well as forest composition and development. In the 1980s measurements of atmosphere deposition (also known as acid rain) provided the country’s first understanding of the impact of burning fossil fuels on forest and stream ecosystems. Research on the watershed also demonstrated nutrient spiraling theory, a major tenet of stream ecology, which explains how stream ecosystems cycle chemicals between biota and water and transport those chemicals downstream.



Integrated air samples taken every 2 weeks are used to interpret isotopic signals of carbon flux.



A dendrometer band is used to make short-term, repeated measurements of changes in diameter of trees.



ORNL researchers inject a radiotracer as phosphate into Walker Branch to study the uptake and cycling of phosphorus in streams.

The 1990s brought renewed interest in how the pattern of water flow through soil influences the chemistry of streams. This period included studies of how stream chemistry and grazing snails control algae. As part of a large, international network called Ameriflux, researchers measured the exchange of water vapor, carbon dioxide, and energy between the atmosphere and the forest.

Over a decade beginning in 1993, the Throughfall Displacement Experiment (TDE) manipulated precipitation to simulate both an increase and reduction in rainfall. The response of the largest forest trees to wetter and drier climate-change scenarios indicated a surprising resilience to rainfall change, although negative effects were observed in seedlings and saplings growing beneath the tall trees.

Watershed researchers are able to take existing conditions and use them for scientific discovery. An unexpected release of radiocarbon on the ORR in 1999 gave researchers the unique opportunity to monitor processes of soil carbon cycling over just a few years. The old approaches required decades.

The Walker Branch Watershed continues to be part of the U.S. network of sites measuring chemical deposition in rainfall (National Atmospheric Deposition Program, <http://nadp.sws.uiuc.edu/>). It is also expected to be part of a new network of sites to intensively monitor ecological changes in natural ecosystems across the United States (National Ecological Observatory Network, <http://www.neoninc.org>).

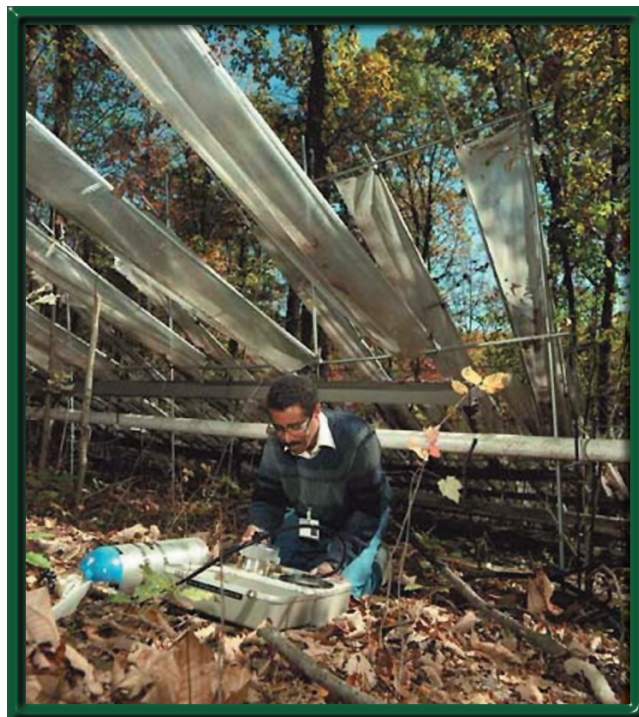
The primary focus of the watershed research today is sustained climate-change observations and study. Researchers continue to monitor its hydrological and biogeochemical responses and the impacts of climate change on forest growth and species composition. In 2004 continuous monitoring of total metabolism (gross primary productivity, ecosystem respiration) in the stream began in order to evaluate long-term changes in stream ecosystem dynamics related to climate variability and change.

Local and Global Value

The Walker Branch Watershed Research Area is known around the world as one of the few sites of long-term forest and stream research. Data are shared with U.S. and international researchers and are available to the public through the Walker Branch web site.

The Walker Branch Watershed Research Area has modified its focus over the years, but its ability to provide scientific data to answer timely environmental and hydrological questions continues to make it valuable not only for Tennessee, but also for the nation and the world.

For more detailed information on the NERP, contact Pat Parr, the ORNL Natural Resources Manager, at 865-576-8123, parrpd@ornl.gov, or check the NERP web site at <http://www.esd.ornl.gov/facilities/nerp>. For more information about the Walker Branch Watershed, contact Pat Mulholland at 865-574-7304, mulhollandpj@ornl.gov, or check the Walker Branch Watershed web site at <http://walkerbranch.ornl.gov>.



Plastic troughs were used in the TDE to intercept rain as it fell through the forest canopy.