U.S. Department of Energy
Bankhead National Forest

By the end of 2023, the Atmospheric Radiation Measurement (ARM) user facility plans to open a new atmospheric observatory in northwestern Alabama.

For at least five years, the Bankhead National Forest (BNF) atmospheric observatory will collect data for researchers to learn more about aerosols, clouds, and land-atmosphere interactions in the Southeastern United States. In turn, their studies will lead to improvements in models of the Earth's climate.

A U.S. Department of Energy (DOE) workshop in August 2018 identified the Southeast as a priority region of interest for further study by ARM, a DOE Office of Science user facility that operates fixed-location and mobile observatories worldwide.

The Southeast experiences high humidity, frequent convection, and high biogenic emissions. The land surface, boundary layer, vegetation, and aerosol properties across the region are markedly different from those seen at ARM's long-term observatory in Oklahoma, allowing opportunities to explore new research questions.

Collaborative, Interdisciplinary Science

DOE selected a multi-institutional site science team, led by Brookhaven National Laboratory in New York, to develop the science plan and initial research project for the BNF. This team, supported by ARM and DOE's Atmospheric System Research (ASR) program, provided scientific guidance to ARM on the BNF's location and measurement strategy, as well as a science plan to support inter- and intra-community engagement and collaboration.

The site science team aims to improve process understanding and model representations of aerosols, clouds, and land-atmosphere interactions, as well as coupled surface-atmosphere feedbacks and aerosol-cloud interactions. The BNF is located in an area where interactions between aerosol, convection, and land-atmosphere processes can be clearly and carefully studied within a representative region of the Southeastern United States.

ARM will make BNF data freely available for scientists worldwide. ASR has funded an initial set of projects led by university researchers to use BNF data to study interactions in the boundary layer between new particle formation and cloud systems; examine influences of aerosols, thermodynamics, and forest canopy on convective clouds; and improve the characterization of cloud formation properties and how well aerosols absorb moisture.

Future DOE funding opportunities for additional research activities using BNF data are expected.

Already, BNF collaborations are in the works with the University of Alabama in Huntsville and field measurement networks such as AmeriFlux, the National Ecological Observatory Network (NEON), and the Alabama MesoNet. The site science team has also been reaching beyond the ARM/ASR community, building relationships with other DOE science groups, agencies outside DOE, regional universities, and historically underrepresented institutions in STEM.
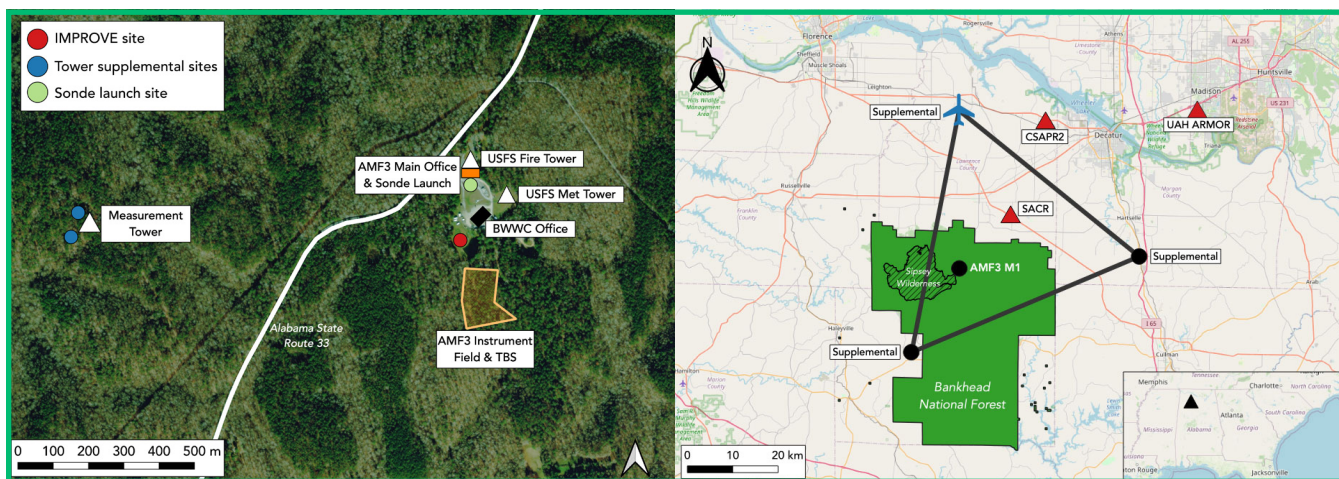
The map on the left shows the planned Phase 1 installation locations for the Bankhead National Forest (BNF) main site, office, and tower near the Black Warrior Work Center (BWWC) and U.S. Forest Service (USFS) towers. AMF3 is the ARM mobile observatory that will be deployed. The map on the right indicates the planned partner facilities and ARM radar (SACR/CSAPR2) and supplemental sites for phase 2 of the BNF installation.

Instrumentation and Data

The BNF is expected to be installed in a phased approach with the main facility and core instrumentation operational first, and then distributed sites and/or additional advanced instrumentation installed at later dates.

ARM plans to place more than 50 instrument platforms or suites at the BNF, including radiometers, radars, lidars, surface meteorological instrumentation, aerosol instrumentation, a total sky imager, a ceilometer, and radiosondes.

Most of the instruments will be located in a 300-by-300-foot area immediately south of the U.S. Forest Service's Black Warrior Work Center.

To address the land-atmosphere science goals of the deployment, ARM plans to operate a 140-foot instrument tower in a mixed pine-oak forest that is representative of the larger Bankhead and forests in the Southeast. The tower will sample a range of key properties within and above the forest canopy.

Several supplemental sites with a subset of instruments will provide information about surface and atmosphere characteristics outside of the forest, including heat fluxes and aerosol properties. ARM also plans to install a scanning centimeter-wavelength radar for observing precipitation over the region.

Researchers will be able to supplement the continuous ARM observations with guest instruments during field campaigns or by requesting increases in the frequency of measurements, such as radiosonde launches. ARM expects to start supporting guest instruments at the BNF no earlier than spring 2024.

Some activities proposed by the research community will likely require special use permits from the Forest Service, so scientists interested in submitting a field campaign proposal should propose early and plan on additional time for reviews.

User Information

Researchers will be able to use the BNF's facilities and data in a number of ways:

- Access data gathered during normal operations or field campaigns through the ARM Data Center

  www.arm.gov/data

- Propose and conduct a field campaign

  www.arm.gov/research/campaign-proposal

- Visit the BNF in person

  www.arm.gov/capabilities/observatories/bnf

For more information:

Mike Ritsche
BNF Manager
Argonne National Laboratory
mritsche@anl.gov

Chongai Kuang
BNF Site Science Team Lead
Brookhaven National Laboratory
ckuang@bnl.gov

Sally McFarlane
DOE Program Manager
Atmospheric Radiation Measurement
sally.mcfarlane@science.doe.gov

www.arm.gov/capabilities/observatories/bnf