Environmental Sciences

The Environmental Sciences Division (ESD) is an interdisciplinary R&D organization with more than 60 years of achievement in local, regional, national, and international environmental research. Researchers focus on complex challenges such as clean and available water, and understanding ecosystem response to disturbances like flooding and wildfire. Our vision is to expand scientific knowledge and develop innovative strategies and technologies that will build economic prosperity, ensure energy security, and strengthen the nation's competitiveness while sustaining Earth's natural resources.

Advancing Earth system resilience

ESD scientists enjoy an open, inclusive, and innovative workplace where they conduct research, develop technology, and perform analyses in the following focus areas.

Biodiversity and Sustainable Systems—ESD scientists are exploring how genes, organisms, populations, and communities influence, and are influenced by, the management and health of ecological systems. They advance the state of water resources science and engineering through data analytics, model simulation, engineering design, decision support, and visualization. Researchers develop advanced simulations to understand human health, economic, and environmental protection dimensions of existing and emerging energy sources. They advance innovations in bioenergy and water power to expand the US bioeconomy and support energy security.

Earth Systems Science—To advance our knowledge and predictions of interactions between terrestrial and aquatic ecosystems, ESD researchers study how these environments exchange carbon, water, nutrients, and trace elements across spatial and temporal scales. Researchers examine how plants, soil microorganisms, and their surrounding environment drive important ecosystem functions using cutting-edge experimental, modeling, and analytical approaches. Large-scale manipulative experiments, observations, and integrated modeling are used to improve predictive understanding of ecosystem dynamics, including the Earth's physical, biological, ecological, and human systems.

Earth System Informatics and Data Discovery—ESD scientists are advancing next-generation computational and data analytics that enable scientists to understand ecosystems and their representation in numerical models. Research and technical staff collaborate to provide integrated data products, data management and delivery systems, and data services to facilitate scientific discovery in the environmental sciences. The Atmospheric Radiation Measurement (ARM) Data Center provides cutting-edge computing capabilities and crucial data about atmospheric phenomena to scientists worldwide as part of the US Department of Energy Office of Science ARM user facility. The Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center manages and provides open access to NASA's biogeochemical and ecological data and models.

20,388
Atmospheric and biogeochemical data products

171
Staff

1.7 billion
Tons of potential biomass resources identified

894
Publications in the past 5 years

60 years
Leadership in large-scale ecosystem studies

"Our researchers advance understanding of the natural world from the molecular to the global scale in Earth system science."

—Environmental Sciences Division Director **Eric Pierce**

OAK RIDGE National Laboratory

U.S. DEPARTMENT OF ENERGY | Office of Science

Unique Research Capabilities

Atmospheric Radiation Measurement (ARM) Data Center—Delivering integrated computing and data on atmospheric radiation to inform Earth system models
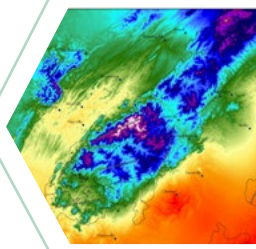
ORNL Distributed Active Archive Center (ORNL DAAC) for Biogeochemical Dynamics—Providing scientists and stakeholders with access to biogeochemical and ecological data and models

Aquatic Ecology Laboratory—Understanding aquatic ecosystem interactions to develop technologies and solutions that will sustain energy and water resources

Next-Generation Ecosystem Experiments (NGEE) Arctic—Advancing predictive understanding of the structure and function of Arctic terrestrial ecosystems in response to environmental change
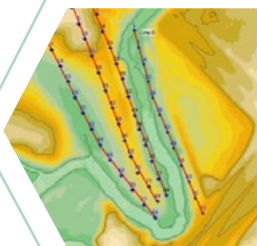
Watershed Dynamics and Evolution—Advancing predictive understanding of how processes controlling watershed function operate under a range of hydrologic conditions

Spruce and Peatland Responses Under Changing Environments (SPRUCE)—Assessing northern peatland ecosystems' response to changing environmental conditions
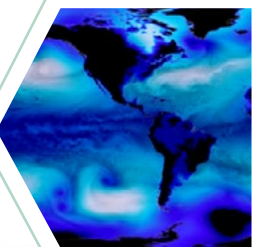
Climate Change Science Institute—Integrating expertise in measurements, data, and simulation to improve understanding and prediction of environmental change
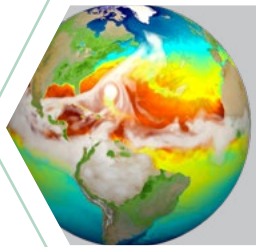
Earth System Grid Federation 2 US—Archiving and distributing model output from international sources to inform global and regional assessments

Circular Bioeconomy Convergent Research Initiative—Using emerging science to produce materials that are recyclable by design and support regional economies