Ambient Water Quality Monitoring in the Upper Tennessee and Big Sandy Watersheds

Dr. Terri Brown – Assistant Professor of Geology, UVA Wise

Resources for the routine monitoring of nonpoint source pollution indicators are scarce across the Commonwealth. In southwest Virginia, students from the University of Virginia's College at Wise have conducted ambient water quality monitoring of streams, springs, and wells in the region for several years, providing an important public service to local communities. Physical and hydrochemical parameters measured include stream and spring discharge, temperature, dissolved oxygen, specific conductance, turbidity, pH, nitrate, and fecal indicator bacteria (fecal coliform and *E. coli*), data essential for assessing levels of agricultural runoff, illegal straight-pipes, leaking sewer lines, and failing septic systems in the watersheds. A standard method for analyzing fecal indicator bacteria in water is the IDEXX Colilert system, in which fluorescently labeled organic substrates mixed with 100-mL samples are heat-sealed in trays and incubated for optimal enteric bacterial growth. Positive fecal coliform and *E. coli* growth can be quantified within 24 hours using colorimetric and fluorometric analysis. The method is rapid, inexpensive, requires no media preparation, and is accurate across a range of 1 to 2,419 colony-forming units with a 95% confidence limit.

These data are shared with community and agency partners for use in planning, permitting, and grant applications to fund infrastructure improvement projects. This project is invaluable for teaching environmental monitoring protocols to our students, several of whom have gone on to work for public service authorities, commercial laboratories, consulting firms, and state and federal agencies upon graduation. When the old heat sealer unit suddenly stopped operating at the beginning of the Spring 2025 sampling season, we received an Environmental Resilience & Sustainability challenge grant to replace it. This timely award allows us to continue providing real-time water quality data to stakeholders in the region, to expand citizen science programs to celebrate improvements to water quality, and to help address concerns related to public and private water supply sources. Future research plans include the correlation of fecal indicator bacteria with a source-tracking method, such as eDNA, to distinguish inputs from livestock, humans, and wildlife that will enhance efforts to resolve sources of nonpoint source pollution in the headwaters.

Farm, Fork, and Future: Promoting Environmentally Sustainable Food Choices in Central Appalachia

Drs. Eddie Shen – Assistant Professor of Exercise Science, UVA Wise and
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The global food system accounts for over one-third of greenhouse gas emissions, yet its environmental impact remains underrecognized, especially in rural areas like Central Appalachia. Promoting awareness of how food choices affect climate and health offers a critical pathway to advancing both sustainability and health in local communities.

Co-led by faculty from the Education Department and the Business and Economics Department at UVA-Wise, the proposed project aims to promote healthy food choices and environmental sustainability through experiential learning. College students from the Education Department will receive training in nutrition, sustainable food systems, environmental health, and the role of local food businesses and marketing in shaping consumption habits and environmental outcomes. These students will then lead interactive sessions at a local middle school, where they will teach these concepts and guide middle school students in creating hands-on projects to promote sustainable food choices within their school community. Additionally, the program offers professional development for Health and PE (Physical Education) teachers, providing them with practical resources and strategies to incorporate sustainability-related content into their classrooms.

To evaluate the program's impact, innovative methods, including photovoice, learner-generated drawings, and reflective activities, will be employed to capture both the college and middle school students' understanding, engagement, and personal growth during the project. These assessment tools enable participants to express their learning experiences in meaningful and personal ways. The project will follow a phased timeline, including planning and staffing in Spring 2026, followed by curriculum development in Summer 2026, and implementation and evaluation in Fall 2026.

Vanadium-Catalyzed Deoxydehydration (DODH) of Biomass Derivatives into Fuels

Dr. Suresh Mummadi – Assistant Professor of Chemistry, UVA Wise

The current dependence and steadily growing demands for the depleting fossil fuels is a global challenge. The need for alternative synthetic fuels is rising. Oxygen-rich biomass, especially lignocellulose, has been shown to be an alternative to producing value-added chemicals and fuels. However, the carbon-oxygen functionalization of lignin and its derivatives requires catalyst activation. Numerous late and precious transition metals have shown promising conversion of alcohols into hydrocarbons via deoxygenation. However, replicating the same transformation using earth-abundant vanadium catalysts has been directed via the disproportionation mechanism to produce unwanted carbonyl products along with hydrocarbon. Herein, we propose to develop the reaction using two pathways. The first approach uses tripodal-vanadium-oxo catalysts to suppress the oxidized carbonyl byproduct formation by trapping the oxygen using bis-boranes as reductants. Second, use the tripodal-vanadium-oxo compound in combination with a Lewis acidic borane, $B(C_6F_5)_3$, as a co-catalyst for hydrogenation of carbonyl compound into alcohol starting material, which further undergoes deoxygenation to hydrocarbon.

Leveraging Community-Engaged Research to Investigate the Role of High-Elevation Wetlands as a Climate Refugium in Virginia's Cumberland Mountains

Drs. Walter Smith - Associate Professor of Biology, UVA Wise, and
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The Cumberland Mountains ecoregion, located across portions of southwest Virginia, eastern Kentucky, and eastern Tennessee, has been identified by recent modeling studies as a "climate refugium" for wildlife adapting in response to anthropogenic climate change. The region's diversity of microhabitats such as cliffs, wetlands, and headwater streams embedded in hardwood forest ecosystems has been cited as a contributor to this designation, although little field-based data exist to support model predictions. This study will examine the role of high-elevation wetlands as a climate refugium for the Allegheny Mountain Dusky Salamander (*Desmognathus ochrophaeus*), a species more commonly found across portions of New England and Quebec whose southern range periphery overlaps with the Cumberland Mountains in southwest Virginia. Using a community-engaged approach, this project will involve local residents in monitoring populations of *D. ochrophaeus* in isolated wetlands and nearby upland forests to determine if and how these habitats are serving as refugia during periods of climate extremes such as floods and short-term "flash droughts." Data produced from this project will be used to evaluate theoretical, model-based predictions and inform the design of best management practices that improve the sustainability of timber harvesting operations and recreational trail development efforts that overlap with the project's target habitats.