CONFLUENCE

Director's Overflow by Dr. Michael Flinn

The curious world of scientific curiosity

Last month, I had the opportunity to participate in the 3rd Annual Mudbug Festival. The event was hosted by the Kentucky Crayfish Collaborative and is a gathering of regional aquatic biologists from government agencies and academia who want to increase knowledge and conservation of crayfishes. So yes, a mudbug is a crayfish (same as a crawfish, crawdad, yabbie, ditchbug, mountain lobster and 'lil pinchy'). Over several days, the group sampled almost 100 sites in western Kentucky, documenting many new county and state records and a long list of range expansions.

It was during this event that I was struck by two observations that made me question what "we" know about the diversity of life around us. I have always appreciated the small, non-descript and even microscopic life that flourishes around us. But, these crayfish were none of the above, other than the fact that many of them live in burrows along wetlands and streams and ditches here in western Kentucky. I even teach a class (Freshwater Invertebrates) that includes these critters and close relatives, although I'll admit that I hadn't focused on burrowing crayfish, ever.

So, a quick primer that led to these observations. I arrived at the first site and was given a short tutorial on how to sample these crayfish. In a nutshell, we searched for "chimneys", the tall spires of mud that these species excavate from their burrows, and then checked to see that the water table was near the surface of the burrow. If those two requirements were met, we carefully removed the chimney and then excavated around the burrow with our hands until we created a space large enough to fit our hands inside, sometimes up to our elbows in muddy water. The last step was to vigorously plunge our hands in and out of the hole a few times. Then, we waited. Anywhere from 3 to 5 minutes. And repeated the plunging action. And waited.

Continued on next page...

Spring 2025

Inside this Issue

More Information
Follow us:

Directors overflow continued...

Let me remind you, we were in swamps, marshes, ditches, and the general types of places where most people don't envision themselves squatting, kneeling or laying down (my personal tactic) patiently looking for indicators that the crayfish has come to the surface. Alas, in over half of my attempts, my wait was rewarded with a pair of antennae slowly piercing the surface of this small muddy hole, I assume out of curiosity, but that is another discussion. And that is when a quick catlike swipe with my hand would reveal the unknown critter. I'll admit, the first few times I grabbed one of these I had a little anxiety. These were not small crayfish. Some were as long as my hand. And they were armed with two large chelae (pincers). All told, they were beautiful, absolutely stunning, with vibrant colors that most would envision on a cryptic marine lobster.

On to the observations: Professionally and "recreationally", I have been digging around in wetlands and streams for almost 45 years (yes, since I could walk). However, after trekking by thousands of these chimneys and seeing them from the road on hundreds of miles of low-lying ditches and flooded fields, I just now had that world of mudbugs revealed to me. It is absolutely astonishing to me. And highlights two important points. Life is flourishing in hidden places that we know very little about. To put it another way, I knew about them, I had seen some pictures, was familiar with their taxonomy, but I had never held one. How is that? And importantly, if this world is new to me, then I'd guess that it is unknown to most.

And the second observation that is equally important. To find, identify and document these organisms takes curious effort and knowledge. Many of the participants in the festival were there because they were investing the effort, with hopes to gain the knowledge.

In closing, the Mudbug Festival was far more than a quirky gathering in the wetlands — it was a humbling reminder of how much there is still to uncover, even in the places we think we know best. These burrowing crayfish have lived alongside us all along, quietly sculpting their chimneys from the earth, filtering water, feeding predators, and participating in an intricate web of life. And yet, they remained mostly invisible to me until I was elbow-deep in the muck, waiting.

This experience has reinforced two truths. First, there is a vast amount of biodiversity that remains undocumented or poorly understood — not in far-off rainforests or deep oceans, but right in our ditches, fields, and backyards. Second, meaningful discovery isn't always about technology or lab breakthroughs. Sometimes it comes from slowing down, getting dirty, and cultivating curiosity.

To anyone reading this — student, scientist, naturalist, or neighbor — I hope you find the time to stop and look more closely. Our natural world still has secrets to share, and sometimes all it takes is a muddy hole, a careful hand, and a little patience.

Auburn graduate student, James Rodgers, pictured to the left samples for crayfish. See video here:

Featured Faculty: Dr. Matt Carroll

"Dr. Matt Carroll has been an Assistant Professor of Wildlife and Conservation Biology at Murray State University since 2022. Dr. Carroll received a B.S. in Biology from Mansfield University of Pennsylvania, an M.S. in Biology from the University of Arkansas, and a Ph.D. in Natural Resource Ecology and Management (Wildlife Concentration) from Oklahoma State University. His graduate research and work as a post-doc at Oklahoma State University focused on gamebird ecology and management with an emphasis on northern bobwhite (Colinus virginianus) responses to thermal exposure.

Dr. Carroll's current research focuses on applied studies that integrate field data and modeling approaches to inform future wildlife conservation efforts. He is presently advising Master's research projects focused on northern bobwhite nesting ecology, factors influencing woodpecker diversity in bottomland hardwoods, and the effects of invasive species on KY landscapes. In addition, he is mentoring undergraduate students researching shorebird habitat use and amphibian habitat quality in the context of prescribed fire.

In addition to research, Dr. Carroll places a major emphasis on teaching and has instructed 18 different college courses. At MSU, he teaches Disturbance Ecology, Dendrology and Forest Conservation, Wildlife Techniques, and Principles of Ecology, among others. In his spare time, he enjoys reading, running, and spending time with family. He has also been a dedicated hunter and trapper for over 25 years.

Pictured below: Dr. Matt Carroll exploring the effects of a recent wildfire in Alberta, Canada, during Summer 2024.

Pictured below: Dr. Matt Carroll conducting salamander surveys in northern Pennsylvania during Summer 2024.

Featured Graduate Student: Marissa Miles

Before I started college, my first introduction to conservation and natural biology as a potential career was through a great opportunity with the Missouri Botanical Gardens where I spent a year teaching conservation ecology to 4th graders. Despite being from the city with little experience in the outdoors and not even owning a pair of hiking boots, I was completely hooked on nature and conservation. So MSU was both the opposite of my life before and everything I was looking for. After realizing that science was where my passion was strongest, I switched my major, picked up a pair of boots, and dove into the classes as a wildlife and conservation biology major. I learned all that I could there about how natural ecosystems functioned, drilled on local flora and fauna, and I got to experience the unique natural resources that this area of western Kentucky had to offer, all through my coursework. Knowing I needed more experience to be competitive in this field, I began seeking opportunities to do research with a professor during my undergraduate degree.

Once I began research with Dr. Jessica B. Moon, my entire life changed. I fell in love with field research and the pursuit of answering questions. I helped out whenever I could, growing my knowledge of wetlands and research, until eventually I was offered the chance to stay in Murray as a graduate student. I developed my own research focus on greenhouse gas emissions from trees in different wetlands across western Kentucky. This research focus, investigating the extent that natural systems are a source of greenhouse gases, was something that drew me in from the beginning. Given my undergraduate major being in conservation biology, I was surrounded with material on seeking, quantifying, and presenting the justification for the natural world to be preserved. So, the idea of researching a potential "con" of wetlands/trees was a unique challenge that captivated me. I measure the greenhouse gas source potential of these systems because global carbon budgets need complete information to be accurate, and I search for patterns in these emissions to one day assist land managers with recommendations for tree plantings to optimize carbon storage and reduce emission potential.

My research throughout my graduate program has focused on methane and carbon dioxide (CH_4 and CO_2) that is being directly released by tree trunks (referred to as stems) in different types of local wetlands. Over my entire graduate research, I have studied five tree species, primarily bald cypress, in wetlands at Murphy's Pond State Nature Preserve, Clarks River National Wildlife Refuge, and along the western edge of Kentucky Lake, over two years. With the assistance of other students in my lab, we developed a method to measure the trees at multiple positions on a single tree (see pictures). We have found that all trees were sources of CH_4 over various points of the year, with the greatest levels being from trees in the warmest and wettest environmental conditions.

Prairie Burn

March 2025

Benefits of a safe and successful prescribed burn:

- Combats trees and shrubs that shade out prairie and other shade-intolerant plants.
- Removes old vegetation to make room for new growth.
- Shifts soil nutrients to a state more favorable to prairie species.
- Helps reduce invasive species.

Dr. Laura Sullivan Beckers Ornithology class

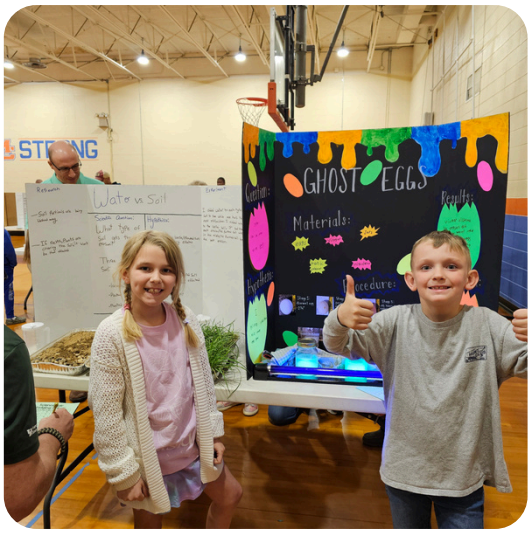
March 2025

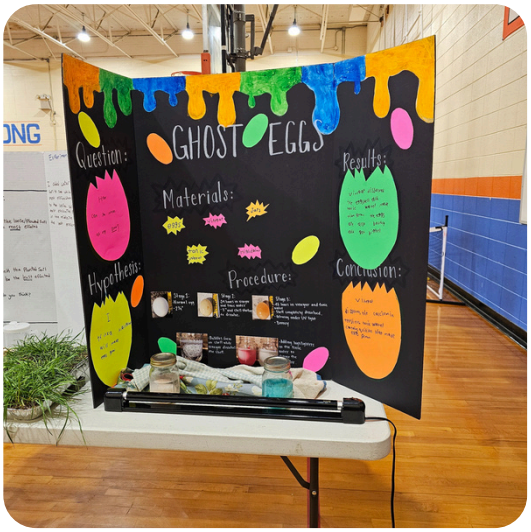
Dr. Laura Sullivan Beckers brought her Ornithology class to the Station. This class studies avian biology with emphasis on anatomy, physiology and classification of birds. The station provides the serene location for their field work.

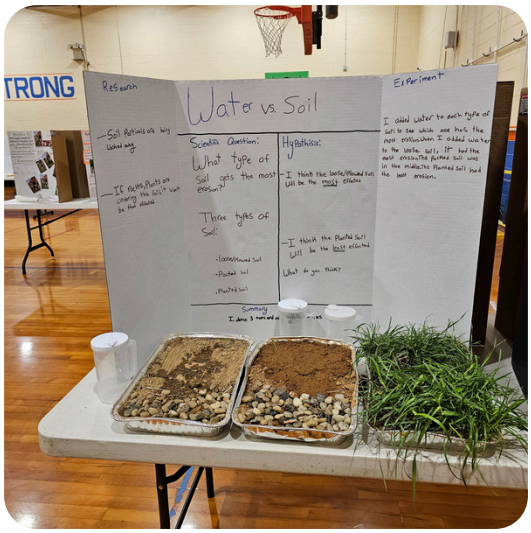
South Marshall Elementary Science Fair

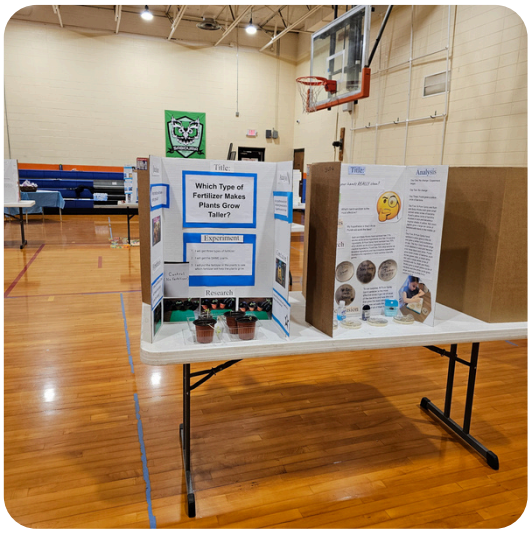
March 2025

Angie Hayden and Xulong Peng were judges at this years South Marshall Elementary Science Fair. Pictured below are the youngest scientists of the group.









Environmental day at Bee Creek

April 2025

We added a new element to our 2-day outreach program with the Calloway County students at Bee Creek this year. As always, the students sampled the creek for macroinvertebrates. In addition, Grad Student William Gooden, taught the students about skull morphology and dentition of predator and non-predator species.

Watershed Studies Institute
16th Annual Research Symposium
April 2025

This years presenters (pictured above) from left to right (name and title of presentation below)

·**Megan Zerger** - Biological Sciences/Watershed Science
Assessing the Interaction of Stress Physiology and Bd Infection in Arizona Tiger Salamanders (Ambystoma mavortium nebulosum)
·**Cord Lemons** - Biological Sciences
Can Red Wolf Audio Cues Establish a Landscape of Fear Within a Naive Mesopredator Population?
·**Marissa Miles** - Biological Sciences/Watershed Science
The Relationship Between Hydrogeomorphic Settings and Greenhouse Gas Emissions from Bald Cypress Trees in Western Kentucky's Freshwater Mineral Soil Wetlands
·**Nadia Castillo** – Earth and Environmental Sciences
Quantifying the Importance of Methane Transport Pathways in Mineral Soil Wetlands
·**Garret Gallion** – Biological Sciences
Baseline Assessment of Shorebird Use and Habitat Quality at Interior Mid-continental Stopover Sites
·**Brittney Nelson** – Mathematics and Statistics
Predicting Capture and Survival Probabilities of the Arizona Tiger Salamander: A Comparison of Capture-Recapture Models.
·**Charlotte Saltsman** – Biological Sciences
Systematic Leaf Morphology Based on Anatomical Attributes of Members of the Arum Family (Araceae)
·**Jillian Murphy** – Biological Sciences
Evaluating Connections Between Environmental Conditions, Wood Duck (Aix sponsa) Health Biomarkers, Nest Outcomes, and Duckling Survival
·**Andrew Brown** - Biological Sciences
Temperature and Density-dependent Effects on Mole Salamander (Ambystoma talpoideum) Growth, Life History, and Trophic Cascades
·**Emily Haner** – Biological Sciences
Passive Integrated Transponders: An Effective Marking Technique for Individual Identification of Anaxyrus fowleri?
·**Skylar Ross** – Earth and Environmental Sciences/Watershed Science
Do Bald Cypress Knees Control Belowground Nutrient Cycling?
·**Megan Causey** – Biological Sciences
Assessing the Long-term Effects of Turtle Racing on the Movement and Habitat Selection of Eastern Box Turtles (Terrapene carolina)

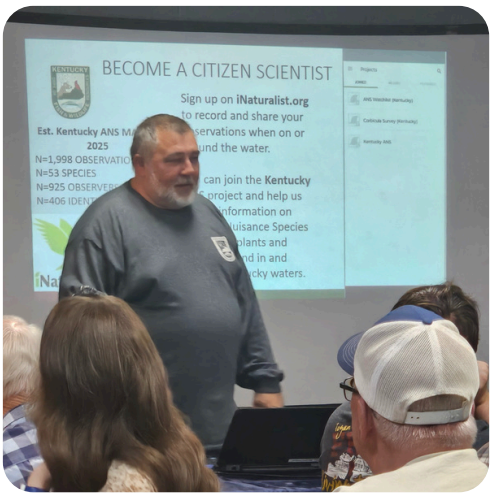
Earth Day

April 2025

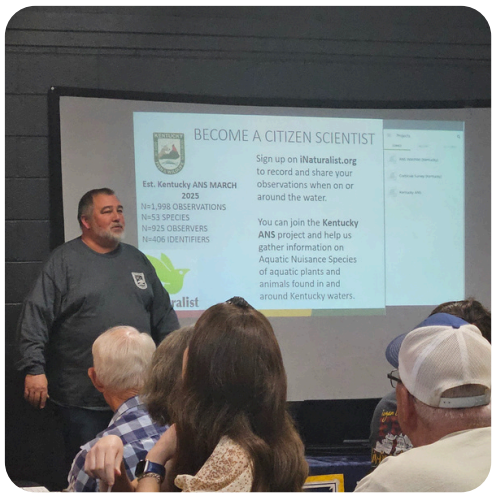
The Earth and Environmental Science Club at Murray State University hosted an Earth Day Event in the Quad of the Main Campus on Earth Day. This event included interactive activities, and a variety of informational booths on the environment issues and sustainability resources, crafts and plant giveaways. HBS and WSI joined efforts and spoke about conserving water.

Science Cafe

April 2025



The Science Cafe commenced with an award presented to Maggie Morgan for all of the achievements. Maggie's family accepted the award on her behalf. The award ceremony was followed by our guest speaker Jeffrey Herod who spoke about Aquatic Invasive Species in Kentucky.



Biodiversity 3rd Annual Art Award

April 2025

In celebration of the 2025 Earth Day and to raise awareness of biological conservation through art, the MSU and local communities exhibited their works at the Biology Atrium during the month of April. The sponsors of this event included the Jones College of Science, Engineering, and Technology, Watershed Studies Institute, Departments of Biological Sciences and Art and Design, and the Murray Art Guild.

This year, over 80 artworks were submitted and 30 of them were selected for exhibition by the judging panel. The judging panel included Executive Director of Murray Art Guild, Ms. Debi Danielson; Professor Cintia Segovia from the Department of Art and Design, and Drs. Kate He and Howard Whiteman from the Department of Biological Sciences.

Participants of this year's exhibition included students, staff, and faculty from various departments, as well as professional artists and nature lovers from the region. Professor Segovia announced the competition winners at the reception, which was held in the MSU Biological Science Building Atrium on April 24.

The Best Overall Award winner was Susan Krieb from Murray, KY for her work entitled "Interflow, reliquary triptych". This is how Susan describes her artwork: "Interflow, a reliquary triptych, transports viewers into a sacred space where the natural world and human experience converge. The title is inspired by Welsh poet John O'Donohue's notion of "interflow"—a state of mutual awareness and connection that transcends boundaries between beings and the earth. Interflow serves as a visual bridge to the interconnectedness of all living things, urging viewers to pause and reflect on the wondrous world around them."

The Second Place Award winner was Zack Benz from St. Louise, MO. His artwork title was "Good Ash". Zack shows the audiences how easily natural ecosystems can be destroyed and removed from earth, and the importance to conserve natural habitats in a healthy state so species can thrive. Zack summarizes his artwork as: "the art title Good Ash references the famous essay "Good Oak" by Aldo Leopold, in which he describes cutting down an oak tree and each annual ring represents a different event in environmental history. Good Ash serves as a modern visualization of this idea--a collage of tree rings each representing a different event in modern environmental history. The tree has changed from an oak to an ash as a call to the emerald ash borer- instead of an axe merely chopping through our history as it was for Leopold, it is now an invasive species eating it away from the inside."

The Third Place Award winner was Dr. Dena Weinberger from Murray. Her work titled "Endangered in MN: Pallid Shiner with Dwarf Trout Lily". This is how Dr. Weinberger introduced her artwork: "This pen and ink work is reminiscent of Scandinavian folk art that is common in Minnesota and features two species that are endangered in that state. Much of the pallid shiner's habitat is represented, preferring quiet waters over sandy or silty bottoms that are threatened by human activity."

Honorable Mention Award winners were Piper Von Almen from Murray for "Bug Box", Paul Grumley from Paducah for "Nature Wins", and Basil Drossos from Paducah for "Brown Marmorated Stink Bug on Moth Orchid".

The exhibition organizer, Dr. Kate He, believes that this collaborative project provides a great opportunity for students, professional and amateur artists, and nature lovers to showcase their talents, and at the same time to communicate with the public about the importance of keeping a healthy Earth for all. Dr. He would like to thank all individuals involved in the project, especially, Dana Vinson from Biology; Barbara Like and Gerry Harris from WSI, who had provided tremendous support to make this event successful.

River Cleanup

April 2025

HBS hosted a river cleanup and volunteers collected several hundred pounds of trash from area boat ramps and shorelines. We teamed with Kentucky Waterways Alliance who provided materials for the cleanup and shared their River Cowboys documentary.

Crayfish Workshop at HBS

May 2025

Dr. Zac Loughman from West Liberty University visited HBS for a Crayfish 101 workshop. Participants learned basic taxonomy and tips on how to identify crayfish.

Butler County Bears Den visit

May 2025

The "Bears Den" group comes to us each year from Butler county. This year Dr. Flinn took the students to the pond to introduce them to wetland aquatic community critters. In addition, the students sampled plant species in our prairie and compared biodiversity to other places around HBS. Our resident grad students and staff also showed the group how to make paint using soil and they painted a snake rock (pictured below).

EXPLORE *Giving*

DONATIONS HELP US IN MANY WAYS! YOUR SUPPORT PROVIDES OPPORTUNITIES FOR STUDENTS IN THE FORM OF SCHOLARSHIPS AND RESEARCH SUPPLIES. YOUR DONATIONS HELP FUND PROJECTS THAT IMPROVE OUR INFRASTRUCTURE: UPDATING LABS, RENOVATING STUDENT AND GUEST HOUSING, AND PROVIDING FUNDS FOR ITEMS NOT COVERED BY GRANTS. LISTED BELOW ARE PROJECTS WE ARE WORKING ON.

- *Monitoring Kentucky Lake Water Quality every 16 days
- *Native and invasive fish tracking on lake and streams
- *eDNA research
- *Backpack electric fishing stream surveys
- *Threatened species tagging and population estimate
- *Shad population age studies
- *Methane emissions from Cypress Trees
- *Golden mouse habitat research
- *Monitoring Armadillo burrows
- *Toad monitoring and tagging
- *Native Beetle surveys
- *Ecology, Herpetology and Wildlife management classes

For a list of Current Needs click QR code:

CONTACT US

561 Emma Drive, Murray, KY

270-809-2272

murraystate.edu/hbs