Conserving the Natural State

September 6-8, 2024

CONSERVING THE
Natural State

UNIVERSITY OF ARKANSAS
Graduate School & International Education
Environmental Dynamics

COLLEGE OF FORESTRY
AGRICULTURE & NATURAL RESOURCES

WELCOME

Welcome to the "Conserving the Natural State" Forum at the beautiful Winthrop Rockefeller Institute in Morrilton, Arkansas. The purpose of this forum is to bring together researchers, university-level educators, state and local government agencies, non-governmental organizations, industry, and other stakeholders from within Arkansas to address challenges facing natural habitats in the natural state. Our state abounds with natural beauty that attracts residents and visitors alike — beautiful mountains for hiking, clean rivers for kayaking and fishing, bountiful wetlands for birding and hunting. Conserving our forests, waterways, and wetlands assures recreation and a healthy environment for future generations of Arkansans.

In the face of a changing land use and climate patterns, we must work collectively to recognize the challenges that threaten the resiliency of our natural resources to ensure the future of clean water, fertile soils, and productive forested and wetland ecosystems. This forum has three principal goals: 1) to build bridges among faculty and students that stimulate collaborative research and education across universities and colleges in the State of Arkansas; 2) to align priorities among stakeholders in national, state and local government and the private sector to identify challenges to conservation of natural resources that require research and education to solve; and 3) to showcase how the talents and expertise of in-state researchers, students, and other residents can help meet those challenges.

This forum brings together academic partners from universities in Arkansas with representatives from state and federal agencies, non-governmental organizations, and industry to begin to develop a network of communication and collaboration aimed at conserving the natural resources of our state. We purposely chose the Rockefeller institute both because it showcases the natural beauty of Arkansas, but also because of its central location, symbolizing the importance of engaging residents throughout the state in conservation efforts.

We hope you share your expertise and interests, meet and greet someone new, and enjoy the program.

OUR HOSTS

Peter S. Ungar, Ph. D.

Distinguished Professor, Director of Environmental Dynamics, University of Arkansas at Fayetteville

Douglas C. Osborne, Ph. D.

Certified Wildlife Biologist©, Professor of Wildlife Management; University Coordinator of the Five Oaks Initiative University of Arkansas at Monticello – College of Forestry Agriculture, and Natural Resources, Division of Agriculture – Arkansas Forest Resources Center

MAP OF FACILITIES

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Institute
CAMPUS MAP

INSTITUTE BUILDINGS

1 Main Building
2 President's Lodge
3 The Meadows
4 The Orchard
5 The Grove
6 The Studio
7 Boathouse
8 Tennis Court
9 Fitness Center

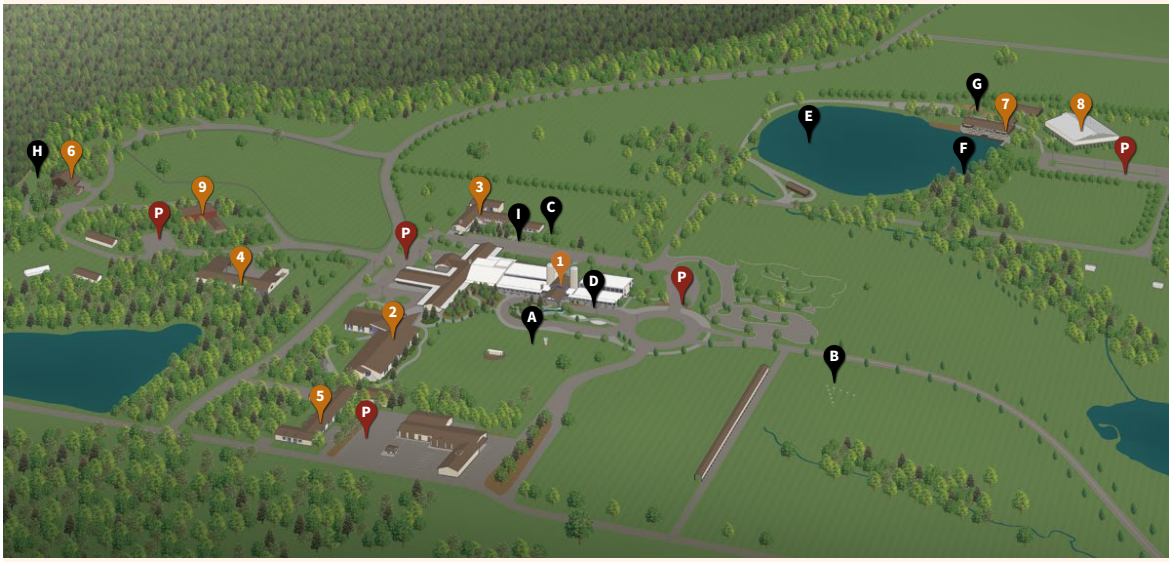
GUEST AMENITIES

A Water as Needed
B Plowing the Troposphere
C Bocce Ball
D Bicycles*
E Lake Abby
F Fishing*
G Horseshoes*
H Studio Overlook
I EV Charging Stations

PARKING

P Parking

*For assistance please call the Front Desk at **(501) 727-5435.**



Institute Campus Map

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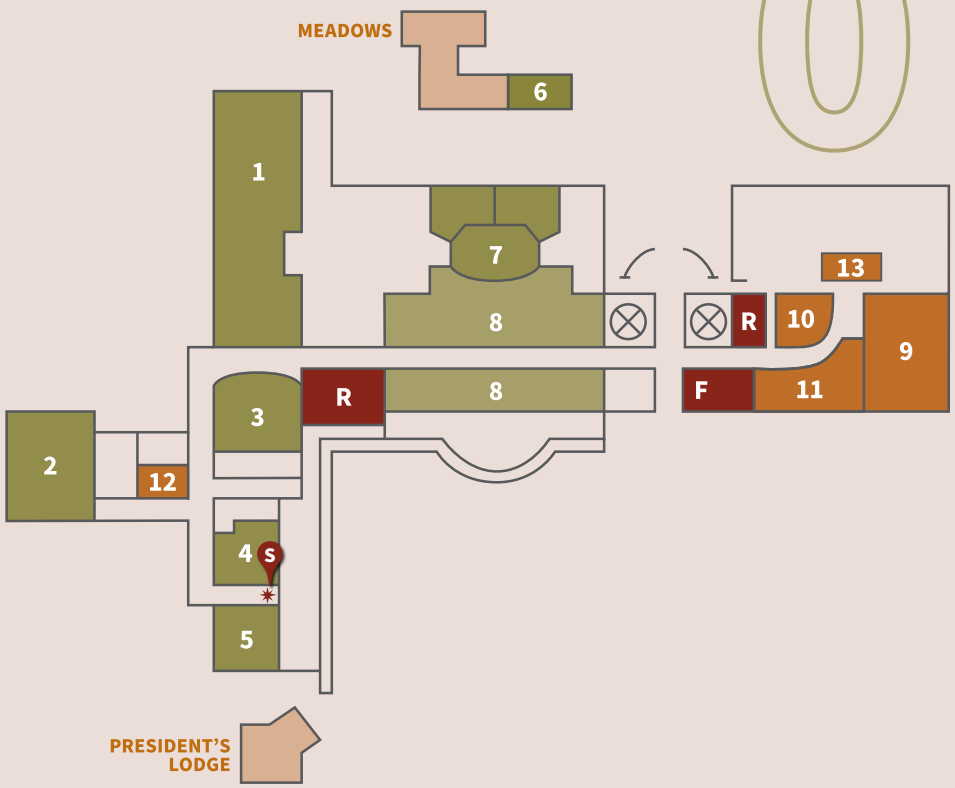

Institute Main Building

Institute
MAIN BUILDING

CONFERENCE ROOMS

1 Show Barn Hall
2 Governor's Conference Room
3 Rock Theater
4 Petit Jean I
5 Petit Jean II
6 Stables Classroom
7 Culinary Classroom
8 Conference Dining

POINTS OF INTEREST

9 Legacy Gallery
10 Legacy Theater
11 The Roustabout Coffee Shop
12 Gov. Winthrop Rockefeller's Office
13 Lt. Gov. Winthrop P. Rockefeller's Office

PLEASE NOTE

F Front Entrance & Desk
R Restrooms
S Storm Shelter

F - Check in and nametags
8 - Welcome and Posters
1 - Oral Presentations and Breakouts
8 - Breakfast, Lunch, and Dinner

KEYNOTE SPEAKER

Dale Hall

Vice President and Board Member, FOAgREC
Retired CEO, Ducks Unlimited
Retired Director, U.S. Fish and Wildlife Service

H. Dale Hall has over forty years of professional experience in fish and wildlife resource management in both the federal and private sectors. He served over thirty years in the U.S. Fish and Wildlife Service, with duties in Mississippi, Texas, Alaska, Washington, D.C., Portland, Oregon and the six states of the Pacific west, Atlanta, Georgia and the ten states of the southeast and the Caribbean, and Albuquerque, NM and the four states of the southwest. In the course of those assignments, Hall worked on nearly every high-profile environmental issue in America. A fisheries and wetlands biologist by training, Hall spent significant time working on the Clean Water Act and the Endangered Species Act. In his last three and a half years with the FWS, he was nominated by President George W. Bush and confirmed by the U.S. Senate to be Director of the U.S. Fish and Wildlife Service.

Following retirement from federal service, Hall was CEO of Ducks Unlimited, Inc for over nine years. During that time, more than $2.5 billion were raised and more than two million acres of wetlands, grasslands and waterfowl habitat were conserved. He is the author of numerous scientific articles and two books: COMPELLED and MY APPALACHIAN TRAIL.

He has been married to the former Sarah Reed of Bunkie, Louisiana for 48 years, has two daughters and a son, and three grandchildren. Dale and Sarah reside in Collierville, Tennessee.

THE PROGRAM

FRIDAY September 6th, 2024

7:00 – 9:00pm Welcome and Poster Section

Amfo-Adu, Agnes, Garrison, Betsy, and Caldwell, Isabelle
The Relationship Between Climate Anxiety and Pro-Environmental Behaviors of Arkansans: Implications for Conservation

Baemmert, Kyle, Nichols, Mason, Gardiner, Emile S., and Babst, Benjamin A.
Examining Seasonal Patterns of Root Growth and Respiration in Mature Willow Oak (Quercus phellos) Trees and Implications for Greentree Reservoir Flood Management

Palumbo, Pasquale, Osborne, Douglas C., Askren, Ryan J.
Spring Migration Habitat Selection of Hen Mallards Wintering in the Mississippi Flyway

Williams, Dalton
Impact of Climate Change on Vector Species Suitability in Arkansas

Hood, Brendan, Van Der Veer, Emily, Wick, Tyler, Askren, Ryan J., Osborne, Douglas C.
Five Oaks Ag Research & Education Center: A Graduate Certificate Program and Training Program for Early-Career Waterfowl Habitat and Wetland Management Professionals

Wirick, MacKenzie, Askren, Ryan J., and Osborne, Douglas C.
Mallard-Bottomland Hardwood Relationship in the Bayou Meto Basin, AR

Allen, Madison and Osborne, Douglas C.
Spatiotemporal Dynamics in Winter Harvest Distribution of Mallards Banded in Arkansas

Tomb, Alyssa and Osborne, Douglas C.
Co-benefits of Climate-Smart Reforestation on Midcontinent Wintering Mallards

SATURDAY September 7th, 2024

7:00 – 7:45	**Breakfast**
8:00 – 8:15	**Sarah Elaine Lewis** Building the Leadership Capacity We Need for the Natural State We Love
8:20 – 8:35	**Michelle Furr** Private Landowners Making an Impact on Habitat-Conservation Incentive Program Update
8:40 – 8:55	**Carice Kimbrell** Conserving Military Lands in Arkansas: Implementing the Sikes Act on Little Rock AFB
9:00 – 9:15	**Rita L. Littrell** Sprouting Arkansas Passion: Using Children's Book to Introduce Conservation Basics
9:20 – 9:35	**Peter Ungar** The University of Arkansas Environmental Dynamics Program (ENDY): Three graduate programs providing advanced degree train with MS and PhD options
9:40 – 10:10	**Break**
10:15 – 10:30	**Michael Blazier** Forestry Informational
10:35 – 10:50	**Matthew Connolly** Mining Contamination, Distribution, and Dispersal of Fluvial Sediments in Rush Creek, Buffalo National River, Arkansas
10:55 – 11:10	**Jeff B. Denman** Desired Forest Conditions for Wildlife In Bottomland Forests of the Mississippi Alluvial Valley

SATURDAY September 7th, 2024 cont'd

11:15 – 11:30 **Benjamin Babst**
A Scientific Basis for Protecting Red Oak Regeneration in Bottomland Hardwood Forests

11:35 – 11:50 **Brian Roy Lockhart**
A Model for Determining Tree Species to Train Oaks in Arkansas Bottomland Hardwood Afforestation

12:00 – 1:20 **Lunch**

JF Meullenet

1:30 – 1:45 **Kenneth McCown**
Building Forest Literacy – The Whipple Family Forest Education Center at Garvan Woodland Gardens

1:50 – 2:05 **Brian Roy Lockhart**
Ecological forestry: a new paradigm to manage Arkansas' bottomland hardwood resource

2:10 – 2:25 **Hamid Zurqani**
The First Generation of a Regional-scale 1-m² Forest Canopy Cover Dataset Using Machine Learning and Google Earth Engine Cloud Computing Platform: A Case Study of Arkansas, USA

2:30 – 3:00 **Break**

3:05 – 3:20 **Sarah Elaine Lewis**
Streamside Protection in the Natural State

3:25 – 3:40 **Kathleen Cutting**
The impacts of unpaved roads on sediment export in an agricultural stream in the Ozark Highlands

SATURDAY September 7th, 2024 cont'd

3:45 – 4:00	**Brandy Everett** Land Cover Effects on Stream Water Chemistry in the Upper Saline River Watershed
4:05 – 4:20	**Sarah Elaine Lewis** Metrics for Watershed Success
4:25 – 4:40	**Caroline Anscombe** Quantifying spatial and temporal variability in nutrient loads in a rapidly urbanizing region of Arkansas
4:45 – 5:00	**Erin Grantz** Water Quality Changes and Perspectives at the Buffalo River
5:30 – 6:30	**Happy Hour**
6:30 – 8:00	**Dinner & Keynote Speaker** **Dale Hall** The History of Conservation in the U.S. and Why It Matters to Arkansas
8:00 – 8:30	**Book Signing**

SUNDAY September 8th, 2024

7:00 – 7:45	**Breakfast**
8:00 – 8:15	**Anne Mini** Achieving Conservation Priorities for Migratory Birds in the Lower Mississippi Valley Region
8:20 – 8:35	**Amelia Villaseñor** Do Similarly Sized Domestic and Indigenous Mammals Affect the Landscape Differently?
8:40 – 8:55	**Don White** Resource Selection of Bull Elk in the Central Interior Highlands, Arkansas
9:00 – 9:15	**Benjamin Runkle** Pathways toward sustainable rice production in Arkansas
9:20 – 9:35	**Sarah Elaine Lewis and Sandi Formica** The River Commons and Institute, Reconnecting People with Cultural and Natural Heritage
9:40 – 9:55	**Break**
10:00 – 12:00	**Breakout Sessions**
10:00 – 12:00	**Lunch & Wrap Up**

ABSTRACTS
oral presentations

Quantifying spatial and temporal variability in nutrient loads in a rapidly urbanizing region of Arkansas

Anscombe, Caroline, Speir, Shannon, and Cutting, Kathleen
University of Arkansas – Fayetteville

With rapid urbanization, we often observe impaired water quality through elevated nutrient concentrations, flashier hydrology, and reduced biodiversity. Increasing nutrients in urban systems put downstream habitats at risk of eutrophication and harmful algal blooms. This is particularly relevant to Northwest Arkansas, where the population is expected to reach 1 million residents by 2045. Despite the significant effects of urbanization on water quality, most urban research focuses solely on nutrient concentrations or on comparisons of urban versus forested streams. This limits our understanding of how nutrient export (as loads) varies spatially and temporally across an urban area. Moreover, we also lack data on how specific urban features (e.g., riparian area, impervious surfaces) control this spatial and temporal variation. Therefore, we quantified nitrate, ammonium, and soluble reactive phosphorus (SRP) loads at a high spatial resolution to determine how nutrient export varied based on subwatershed landscape characteristics. We took biweekly measurement of nutrients and streamflow at 21 urban stream sites across Fayetteville, Arkansas. Additionally, we conducted targeted storm sampling at a subset of our routine sampling sites to better understand the role of storm events in driving nutrient loss from urban systems. We expect that areas with higher impervious surface cover will experience higher nutrient loads. In contrast we expect subwatersheds with greater green space will have reduced nutrient loads. We further predict that storms will be a critical time for nutrient loss in these systems, driving nutrient loads to be higher during storm events. Our study will provide deeper insights into the landscape variables that contribute to impaired water quality, guiding best management practices in urban areas and protecting downstream habitats.

A Scientific Basis for Protecting Red Oak Regeneration in Bottomland Hardwood Forests

Babst[1], Benjamin A., Kressuk[2], Jonathan M., Collins[3], James T., Gardiner[4], Emile S., Bataineh[5], Mohammad M.,
1 Arkansas Forest Resources Center, and College of Forestry, Ag. & Natural Resources, University of Arkansas at Monticello; 2 North Carolina State University, Raleigh, NC; 3 Arkansas Game and Fish Commission, Jonesboro, AR; 4 Center for Bottomland Hardwoods Research, Southern Research Station, USDA Forest Service, Stoneville, MS; 5 Center for Forest Health and Disturbance, Southern Research Station, USDA Forest Service, Pineville, LA

Bottomland forests provide habitat for conservation of diverse wetland species, but many bottomlands are experiencing tree die-off and poor regeneration. Flooding is a key component

in shaping species composition in bottomland ecosystems, but flooding can also contribute to tree stress. Flooding when trees are not fully dormant is happening more frequently in bottomlands, due to altered hydroperiods and unusual weather patterns. To improve the scientific knowledge-base for management, we conducted a series of greenhouse and field studies to investigate patterns of root activity in moderately flood tolerant oak seedlings, like willow oak and Nuttall oak (Quercus phellos, Q. texana), during winter dormancy transitions, and determined the impacts of various flood regimes. Cool soil temperatures reduced root growth and respiration rates, and accelerated leaf senescence during winter, although most seedlings retained some leaves. Flooding during winter stopped root growth. Signs of flood stress were greater if soil temperature was warmer, but even at temperatures that are relatively warm for our region flood stress was minor. There was no decrease in survival due to winter flooding in the conditions of our studies, but flooding in early fall increased seedling mortality. Flooding beyond budbreak did not increase the mortality rate of Nuttall oak seedlings, but did reduce growth. Our results indicate that oak seedlings in the Lower Mississippi Alluvial Valley may continue root growth during typical winter soil temperatures. Cool winter soil temperatures may reduce the potential for stress due to winter flooding. There appears to be a genetic basis for tolerance to winter flooding, as growth of the moderately flood intolerant Shumard oak was affected even when flooding was limited to the winter dormancy period. Our findings point toward adaptive flood management as a possible means to increase long-term sustainability of bottomland forests, and suggest that tree improvement may be worthwhile.

Mining Contamination, Distribution, and Dispersal of Fluvial Sediments in Rush Creek, Buffalo National River, Arkansas

Connolly[1], Matthew H., Pavlowsky[2], Robert T., Aogo[2], Samuel, Lacki[2], Jacob
1 University of Central Arkansas; 2 Missouri State University

The Rush Mining District (RMD) was active from the late 1890s through the late 1930s with sporadic operations continuing until the early 1960s, producing approximately 35% of the Zn ore in Northern Arkansas. Since 1972, the RMD and the lower three kilometers of Rush Creek have been protected by the U.S. National Park Service as a cultural resource. This protection includes all remnant mine workings and mining waste piles, preserving a long-term mining influence on Rush Creek. Therefore, we investigated elemental concentrations in lower Rush Creek surficial sediment deposits to understand the distribution of Zn across space and fluvial landforms. We sampled channel beds, bars, benches, floodplains, and terraces from six 120-meter reaches and a larger downstream sediment accumulation zone near the mouth of Rush Creek. We observed interesting longitudinal and landform concentration patterns, which we will analyze and describe. Initial results suggest an increasing trend for Zn levels downstream of RMD mines, generally higher Zn concentrations near the mouth of Rush Creek, and concentration differences among fluvial landforms. Median Zn concentrations and reach-scale data suggest an inverse relationship between Zn concentrations and fluvial landform elevation, and elemental ratios of Zn, Ca, and Fe also support mining wastes as a source material for elevated Zn levels. Additionally, many samples exceeded local background concentrations and the Sediment Quality Standard TEC (Threshold Effect Concentration) for Zn, hinting at potential health challenges for aquatic organisms.

The impacts of unpaved roads on sediment export in an agricultural stream in the Ozark Highlands

Cutting, Kathleen, Speir, Shannon, Anscombe, Caroline, and Strauss, Alana
University of Arkansas

Excess sediment loss to streams and rivers can block sunlight to the water column, reduce the capacity for primary production and increase contaminant and nutrient concentrations. Many rural areas have a high presence of unpaved roads, which can drive water quality degradation, especially during precipitation events. This problem is particularly relevant to Arkansas, where 85% of roads are unpaved. However, previous studies on the effects of unpaved roads on sediment loss have primarily been conducted in forestry settings in the Northwest USA; few studies explore the impacts in rural watersheds dominated by animal agriculture (e.g. pasture) in the southern US. Here, we sampled Brush Creek, a key tributary of Beaver Lake Reservoir, to understand local and watershed-scale controls on sediment loss from unpaved roads. Brush Creek is also a source of cattle and chicken production. As such, we asked if the type of road crossing impacts sediment loss from unpaved roads and if the extent of unpaved roads and the land use within subwatersheds impact sediment loss in Brush Creek. We collected monthly samples for total suspended sediments (TSS) at bridge, culvert, and direct stream crossings beginning in February 2024. In addition, we conducted targeted storm sampling to capture TSS export under a range of flow conditions. We expect TSS loads to increase downstream of road crossings, especially in direct stream crossings. We also expect larger percentages of unpaved roads in subwatersheds to increase TSS loads during high-flow events, with lower TSS loads in primarily forested subwatersheds. This study can provide insight into the controls on sediment loss to Beaver Lake Reservoir, a critical drinking water resource in Northwest Arkansas, serving over 400,000 people. Overall, conclusions on sediment loss from unpaved roads can inform the implementation of best management practices to reduce sediment loss and help maintain downstream water quality.

Desired Forest Conditions for Wildlife In Bottomland Forests of the Mississippi Alluvial Valley

Denman[1], Jeff B. and Lockhart[2], Brian Roy
1 Denman Company; 2 Hardwood Silviculture LLC

In less than our lifetime, North America's adult breeding bird population has decreased by 2.9 Billion (with a B), nearly 30% since 1970, as published in Science. Productivity of habitat makes a significant difference in wildlife populations, from songbirds to deer, ducks, and turkey.
Desired Forest Conditions specifically for Wildlife arose in the 1990's. A shift in forest management at White River National Wildlife Refuge in east Arkansas moved the focus from present condition to future condition of the habitat. By the 2000's DFCW became widely adopted in the Mississippi Alluvial Valley as recognized by the partnership Lower Mississippi Valley Joint Venture with federal and state wildlife and conservation agencies along with private conservation groups.
Collaboration of wildlife biologists with forest ecologists revealed habitat conditions can be

managed to provide productive habitat for nearly all forest-dwelling wildlife. These efforts led to the 2007 publication Restoration, Management and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat. Forest structure is a key element of productive wildlife habitat at the stand level. An update and revision is being prepared for 2024, Desired Forest Conditions for Wildlife in Bottomland Forests of the Mississippi Alluvial Valley. Printing is expected by the end of 2024. Continued implementation of DFCW is expected to contribute to increased populations of forest birds and other wildlife.

Land Cover Effects on Stream Water Chemistry in the Upper Saline River Watershed

Everett[1,2], Brandy and Haggard[1], Brian
1 University of Arkansas, Arkansas Water Resource Center (AWRC), 2 Environmental Dynamics Program, University of Arkansas

Non-point source (NPS) pollutants and the conversion of natural areas to anthropogenic uses are one of the most critical stressors on water quality. These land conversions increase pollution transport to freshwater systems, leading to increased stream nutrient concentrations and downstream transport. Elevated nutrients can accelerate eutrophication, decreasing water quality and influencing the water's beneficial uses. Watershed-based management strategies can reduce NPSs and protect water quality by prioritizing areas of concern within the landscape, as well as focus efforts on land conservation and best management practices. In this study, we used nonparametric change point analysis (nCPA) and classification and regression tree analysis (CART) to explore the interactions between several watershed characteristics and stream geometric mean concentrations of chloride (Cl), ammonia (NH3-N), nitrate plus nitrite nitrogen (hereafter, NN), total nutrients (TN and TP), total suspended solids (TSS), turbidity, and conductivity within the Upper Saline River Watershed of Arkansas. For each parameter, we identified threshold responses from multiple watershed characteristics to predict water quality, including catchment and riparian land use and unpaved road density. Based on the observed models, we identified key thresholds to protect water quality and reduce NPSs, including watersheds with high percent urban, agriculture, or combined urban plus agricultural cover (i.e., human development index (HDI)) in the riparian and catchment areas, high unpaved road densities in the catchment area, and low percent forest cover in the riparian and catchment areas. Exact thresholds vary depending on the watershed used in the analysis. Final thresholds will be dependent on inputs from watershed stakeholders. Thresholds are specific to each water quality parameter; however, by combining the returned thresholds, we will be able to identify which hydrologic unit code 12 (HUC-12) watersheds should be prioritized within the watershed-based management plan.

Private Landowners Making an Impact on Habitat-Conservation Incentive Program Update

Furr, Michelle
Arkansas Game and Fish Commission

At the Arkansas Game and Fish Commission, our mission is to conserve and enhance our

state's wildlife and their habitats. It's a job we take to heart and one we never take for granted. But our state is vast and only 10% of it is public land that we can manage. We need partners. Landowners are, and always have been, the cornerstone to conservation efforts and wildlife management in our state. The Arkansas General Assembly and Arkansas Legislative Council supported the Conservation Incentive Program, which assists landowners by cost-sharing various habitat management actions. This program includes 9 habitat practices that benefit migrating waterfowl, provide additional cover and food on your forestland, improve your streams, provide fishing opportunities for the public, and control feral hogs and invasive plant species.

Water Quality Changes and Perspectives at the Buffalo River

Grantz, Erin and Haggard, Brian
Arkansas Water Resources Center, UA System Division of Agriculture

The Buffalo River, America's first National River, was established in 1972 to protect miles of Outstanding National Resource Waters in the Boston Mountains and Ozark Highlands regions of Arkansas. The National Park Service invests in extensive monitoring to support assessment of water quality conditions in the Buffalo River, its primary tributaries, and adjacent springs. The present study focused on trend analysis over the most recent 20 years (2000 – 2019) and central tendency in current conditions over the last five (2015-2019). Focus variables were dissolved oxygen (DO) saturation, nitrate+nitrite-nitrogen, total nitrogen and total phosphorus. Directional change over time was examined using the seasonal Kendall test. For all sites with an available flow record, trend analysis was conducted on flow-adjusted values (FAVs), or the residuals of the locally estimated scatterplot smoothing (LOESS) relationship between log-transformed values of water quality variables and streamflow. Park-scale synthesis of these results shows a eutrophication gradient among the river's tributaries and potentially in the river itself. Land use histories and algal bloom reports from 2017 and 2018 growing seasons will be integrated to further explore the where and when of eutrophication at the Buffalo National River. Understanding these connections is necessary for planning future conservation investments in the watershed and can inform monitoring strategies to best capture variability and change in water quality in the park.

Conserving Military Lands in Arkansas: Implementing the Sikes Act on Little Rock AFB

Kimbrell[1], Carice, Fisher[2], Seth, and Hardy[3], Sarahi
1 U.S. Fish and Wildlife Service, Wildlife Biologist/Air Force Liaison, 2 Little Rock Air Force Base, Cultural and Natural Resources Program Manager; 3 Little Rock Air Force Base, Biological Scientist

The conservation of public lands is of high importance for the utilization of those lands by future generations, and DOD-owned lands are of little exception. The Sikes Act promotes the effectual planning, development, maintenance, and coordination of wildlife, fish, and game conservation and rehabilitation on military reservations. Each military installation's program is carried out by an Integrated Natural Resources Management Plan (INRMP) in cooperation

with its' State's fish and wildlife agency and the U.S. Fish and Wildlife Service (FWS). This act requires the cooperation of the Department of Defense and Department of Interior to enter into agreements to utilize services, personnel, equipment, and facilities to the greatest extent practicable to achieve the goals of an INRMP. In Arkansas, the FWS Ecological Field Office heads these conservation services for military installations, primarily as management of Little Rock Air Force Base (LRAFB) projects. These projects allow the continued maintenance of recreation areas, like Pat Wilson Lake, as well as designated hunting areas. Simultaneously, they support the conservation of rare or at-risk species, like the interior least tern that nests on facility rooftops or the tricolored bat that inhabits base forestlands. FWS supported LRAFB's INRMP in 2023 through the implementation of five main projects: water quality analysis, invasive species management, wetland monitoring, pollinator habitat management, and timber inventory. As cooperative federal partners, we intend to educate our fellow conservationists about the Sikes Act and update our partners on the success of current and upcoming projects.

Building the Leadership Capacity We Need for the Natural State We Love

Lewis, Sarah
Edgewater Coaching & Consulting

Leadership requires the courage to say to people, "I don't know where we are supposed to be heading, but it isn't in the direction we're going now."" - Eric Martin, Your Leadership Moment. An important skill for those working to conserve the Natural State is the leadership it takes to courageously work to protect nature and the ecosystem services on which we all rely. This work requires courage and the ability to successfully navigate complex, or adaptive, challenges that often have no clear or obvious solution. These adaptive challenges require adaptive leadership skills, and they can be developed and practiced to build our capacity to lead the type of change we want to see in the world. Through this interactive session, we will explore the art and science of leading consequential adaptive change that brings about more conservation and sustainability into the decision-making that affects our communities every day. Participants will leave feeling more confident in their ability to mobilize others, more hopeful about the future of conserving the Natural State, and have more clarity about the next steps they want to take to achieve their goals. Join us!

Streamside Protection in the Natural State

Lewis, Sarah
Edgewater Coaching & Consulting

"It is much more cost-efficient to prevent pollutants from entering stormwater than it is to remove pollutants once they are in the system." This statement made by the US Environmental Protection Agency underscores the economic reasoning behind the Streamside Protection Ordinance established in the City of Fayetteville in 2011. Ecological services are processes such as water filtration, temperature management, flood management, erosion control, flow attenuation, wildlife habitat, recreation, and aesthetic beauty. These services are provided by

intact, functional ecosystems, such as those affiliated with healthy vegetated riparian zones along streams. When riparian zones are deforested and water is piped directly into streams, disconnecting stormwater from the riparian zones, communities spend more money on flood control, water filtration, and bank stabilization projects as a result of increased erosion and pollutant levels. Water districts around the country see the value in preventing non-point source pollution within the watershed. The Beaver Water District (BWD), for example, helps to fund the regional Nutrient Management Plans (NMPs) in order to reduce sediment and nutrients contributed by non-point source pollution to the White River and eventually Beaver Lake, the region's drinking water source. In response to ecological and economic concerns from water districts and residents, the City of Fayetteville staff, city council members, and community volunteers developed a project team, reviewed scientific literature, and reviewed riparian zone ordinances from other communities around the country to develop the state's first Streamside Protection Ordinance in 2011. The ordinance, a best management practices manual, and a streamside protection zone map are available on the City of Fayetteville's website. This presentation will focus on a description of the ordinance, the progress since the establishment of the ordinance, and how to extend this type of effort to other communities around the Natural State.

The River Commons and Institute, Reconnecting People with Cultural and Natural Heritage

Lewis, Sarah
Edgewater Coaching & Consulting, Watershed Conservation Resource Center

This session will highlight the efforts of the Watershed Conservation Resource Center to achieve their vision to create the River Commons & Institute (RC&I), a public space that connects people as a means to enhance community leadership in resiliency, cultural vibrancy, and inclusivity. To date they have worked with partners to set aside over 320 acres of land, 35 acres of which are wetlands and a section of the West Fork of the White River (WFWR). The site is envisioned to be a destination that offers opportunities for conservation, education, gathering, and placemaking for the greater Arkansas community. The WCRC partnered with the City of Fayetteville, AR and Beaver Water District to purchase over 300 acres of property in Fayetteville to protect and restore wetlands, floodplain, and other natural features, and to develop public access. Based on research by the Arkansas Archeological Society, historically, African American people were enslaved on this site and the Osage Native Americans used the site as an important destination and passageway to cross the WFWR. The space is envisioned to reconnect people with nature and will highlight the diverse cultural history by revealing Native-American, African American, and Euro-American lifeways and foodways and their distinct connection to the landscape. The RC&I is envisioned to incorporate a natural site design that integrates ecology and cultural history through interactive exhibitions and cultural gardens. During this session, we will share about the process that was required to conserve the land in an urban setting, the progress to date to make the vision of the RC&I come to life, and describe the programs underway that are already reconnecting people with the natural and cultural heritage of the site.

Metrics for Watershed Success

Lewis[1], Sarah Elaine, Grantz[2], Erin, and Roark[3], Becky
1Edgewater Coaching & Consulting, 2 Arkansas Water Resources Center, 3 Beaver Watershed Alliance

Watershed management organizations need success metrics that provide benchmarks for progress, support programming needs, and help prioritize work. Metrics also serve as communication tools and reporting mechanisms for evaluating impacts and services that these organizations provide. There is a broader need for a centralized, holistic resource of metrics that encompass a full suite of components of watershed success with the potential for standardization of these types of measurements across the many sectors that work together to protect watersheds.
The Watershed Success Metrics Framework brings together diverse resources on watershed science, building on existing tools and metrics, in a single comprehensive framework. The Watershed Success Metrics are organized based on three target outcomes:

- SOCIAL: PUBLIC AND POLICY-MAKER PRIORITIZATION OF HEALTHY WATERSHEDS
- MITIGATION: RESILIENT HUMAN FOOTPRINT THAT DOES NOT DIMINISH WATERSHED FUNCTION
- ECOLOGICAL: INTACT AND FUNCTIONAL ECOLOGICAL SYSTEMS

For each of the target outcomes, drivers, indicators, and metrics are identified. Thirteen drivers, which are the actions that "drive" watershed success, are included in the framework. Five are social drivers: education, outreach, community building, legislative encouragement, and address knowledge gaps. Four drivers focus on mitigation of the human footprint: rural land best management practices, low-impact development in urban and urbanizing areas, urban forestry and green spaces, and infrastructure improvements. The remaining four are focused on the ecological function of watersheds: land conservation, nature and cultural preserves, restored ecological function, and synergistic planning.
This framework was developed for the Beaver Watershed Alliance, a non-profit watershed organization with a mission to proactively protect, enhance and sustain Beaver Lake and the integrity of its watershed. The framework is intended to apply broadly to any watershed management group. The project included a stakeholder-led process, consultation, and academic support. During this interactive session, we will present the framework and discuss use cases for integrating the framework.

Sprouting Arkansas Passion: Using Children's Book to Introduce Conservation Basics

Littrell, Rita L.
Arkansas Master Naturalist

Children's book authors specialize in compacting relevant information into concise, often engaging reads. When sprouting new knowledge, children's books provide basic concepts about the Natural State flora and fauna. Dr. Rita Littrell, after 40 years as an educator in grades

K to graduate, is spearheading an Arkansas Master Naturalist project identifying the most impactful children's books on environmental understandings. These include introductions to famous change makers including Rachel Carson, Maria Merian, Wangari Maathai, and Chales Darwin. Peter Wohlleben's children's book describes the underground internet used by trees and mushrooms promoting conservation. Doug Tallamy's book describes how to save the world in your own backyard by using native trees that support insects at the bottom of the food web. Dragonflies by Aimee M. Bissonnette, teaches that they are naiads – meaning 'of the water'. Narrative coupled with impressive facts such as they fly with their mouths open and can eat their own weight in insects in 30 minutes impress the reader. For interpretation, kids can enjoy dragonfly role play. When learning about walking sticks, Sheri Mabry Bestor introduces autotomy, which means they can grow a new appendage. Female stick insects can produce eggs without a mate – parthenogenesis. Books on dirt and soil explain the value of soil and the eco diversity in our state. Animal Architects by Amy Cherrix describes the variety of construction created by animals as diverse as reef builders, penguins, prairie dogs, and termites. A Nest is Noisy by Dianna Hutts Aston describes nests around the world and the ingenuity to construct them. Institutions such as Arkansas Parks, Game and Fish Commission, and others promoting education that will hopefully lead to conservation can promote these books in gift shops and utilize them in interpretive programs.
The presentation will include introduction of some of the books and a list created on topics relevant to nature lovers in Arkansas.

A Model for Determining Tree Species to Train Oaks in Arkansas Bottomland Hardwood Afforestation

Lockhart, Brian Roy
Hardwood Silviculture LLC (retired)

Forested floodplains, commonly referred to as bottomland hardwoods, provide a unique connection between upland and riverine ecosystems. The combination of overland flooding and associated sediment deposition create a highly productive environment for biotic communities. Due to these nutrient rich alluvial soils much of the Arkansas Delta floodplain forests have been cleared for agricultural row crops. Interest in converting these agricultural fields back to forests has gained considerably over the past 30 years, especially with the advent of the Conservation Reserve Program and Wetlands Reserve Program that provide financial support to landowners to afforested these fields. Early afforestation involved planting a monoculture of oaks on a 12 foot by 12 foot spacing. Early intraspecific competition between oaks is resulting in stems of low bole quality and small crowns that limit management options. Stand development research has shown that high-quality oak boles with large crowns often result from early interspecific competition with non-oak species that "train" oaks. Using sweetgum as the model trainer species (score = 100), five silvical characteristics were evaluated for 23 non-oak species that can grow into an overstory canopy. Six species scored 90 or 95 as potential species to plant in intimate mixtures with oaks and an additional six species scored an 85. Eight species scored 60 or less due to being able to outcompete oaks in early interspecific competition or would have little effect as a trainer species due to slow early height growth. Planting non-oak species in intimate mixtures with oaks in Arkansas bottomland hardwood afforestation is a good first

step towards restoration of floodplain forests and provides managers with more options for forest management.

Ecological forestry: a new paradigm to manage Arkansas' bottomland hardwood resource

Lockhart, Brian Roy
Hardwood Silviculture LLC (retired)

Ecological forestry is an emerging perspective that encompasses a holistic view to the management of forests. It emulates natural disturbance regimes and subsequent stand development patterns to formulate silvicultural prescriptions. Four guiding principles to ecological forestry are continuity, complexity/diversity, timing and context. Continuity constitutes structure, biota and function that existed in the pre-disturbance forest to the post-disturbance forest, i.e., biological legacies in the form of large trees and dead wood. Complexity involves heterogeneity in forest structure, such as tree sizes, while diversity takes into account a wide array of floral and fauna species. Timing is the application of silvicultural treatments to coincide with intervals necessary for recovery and development of structure following a disturbance, and context involves coordinating activities with the landscape scale in mind. In this presentation I will give specific examples of how ecological forestry can be implemented in Arkansas' bottomland hardwood forests and suggestions on future research needs.

Building Forest Literacy – The Whipple Family Forest Education Center at Garvan Woodland Gardens

McCown, Kenneth, MacKeith, Peter, and Ohman, Rebecca
University of Arkansas

In this presentation, the authors will discuss the forthcoming Whipple Center at the Garvan Woodland Gardens. The Whipple Center will be a locus for forest education, research, and outreach. The Garvan Woodland Gardens are part of the Fay Jones School of Architecture and Design. Forests are a key area of study and practice for the disciplines in the School: architecture, landscape architecture, and interior design. Forest products and sustainable and regenerative watershed forest management are vital to design, planning, and building. The Whipple Center, in the process of construction, will be a locus of research, outreach, teaching, and action. The Whipple Center can be a knowledge hub, research lab, and outreach center. The Whipple Center's agenda is to convene and connect people through teaching, research, and outreach around forest themes: -Forest Ecology -Forestry and Forest Products -Forest Stewardship -Forest Futures The four-part framework above organizes activities and events at the Whipple Center. Conferences and symposiums will increase stakeholder connections, build knowledge capacity, and foster forest-focused interdisciplinary activity to create a research portfolio within the four topic areas noted above. Educational programming will also focus on public education for all ages. This programming includes permanent and temporary exhibitions and nature-based outdoor learning activities for all ages. Forests cover almost

two-thirds of Arkansas, and private landowners own about two-thirds of those areas. The Whipple Center can help increase the conservation of the forests of Arkansas and help to incite a meaningful public understanding and dialogue about the importance of forests in the state.

Achieving Conservation Priorities for Migratory Birds in the Lower Mississippi Valley Region

Mini[1], Anne, Antalffy[1], Janine, Bartush[1], Bill, Klais[1], Austin, McKnight[2], Keith
1 Lower Mississippi Valley Joint Venture American Bird Conservancy; 2 Lower Mississippi Valley Joint Venture US Fish and Wildlife Service

The Lower Mississippi Valley Joint Venture (LMVJV) functions as the forum in which the conservation community develops a shared vision of bird conservation for the Lower Mississippi Valley region. This region is composed of the Mississippi Alluvial Valley (MAV) and West Gulf Coastal Plain/Ouachitas (WGCPO). Each of these ecoregions presents unique conservation opportunities and challenges that the LMVJV addresses through strategic habitat conservation, applying biological planning, conservation design, habitat delivery and research to benefit high priority bird species. Increasing our understanding of the potential magnitude of large-scale threats, stressors, and influences on habitat condition will improve our efforts to support a landscape capable of sustaining healthy bird populations. In the MAV, our partnership is addressing bottomland hardwood restoration and management priorities through several planning efforts and decision support tools. Importantly, decades long conservation efforts through partners have increased the amount of forest within the MAV for forest-breeding birds. Additionally, we are working to improve our understanding of floodplain forest hydrology and tree health to improve restoration and management efforts. In the WGCPO, our partnership is addressing the needs of open pine bird species through strategically targeted habitat management. We currently have a multi-partner project aimed at improving habitat conditions for species such as Northern Bobwhite, Eastern Wild Turkey, and Brown-headed Nuthatch through forest thinning and prescribed fire in Arkansas and Louisiana. Through this effort, we are monitoring bird and vegetative response to habitat treatments, and coordinating research to understand landowner motivations for improving wildlife habitat. The LMVJV partnership has achieved positive impact on bird populations and habitat condition that provides a model for achieving future conservation success across large ecoregions. Continued and increased collaboration with the science community in Arkansas regarding important research and information needs is essential for our sustained success into the future.

Pathways toward sustainable rice production in Arkansas

Runkle[1], Benjamin, Moreno-García[1], Beatriz, and Reba[2], Michele L.
1 University of Arkansas, Biological & Agricultural Engineering, 2 USDA-ARS, Delta Water Management Research Unit

Recent attention on climate-smart agricultural practices in U.S. rice production and other agricultural systems create opportunities for conservation co-benefits amidst the sustainable

intensification of agricultural production. As rice cultivation is responsible for 8-10% of the world's anthropogenic methane emissions, reducing this source is important in generating a climate-friendly food system. An irrigation practice that saves water, known as alternate wetting and drying (AWD), introduces deliberate soil aerobic conditions of 3-10 days each that can also reduce methane emissions. My group and collaborators use a variety of techniques over the rice field landscape to better quantify these dynamics at the production scale, and we have demonstrated both the methane emissions reductions and water savings possible through AWD implementation or related techniques. New agronomic methods such as the use of fish in the field as a fallow-season opportunity are also being tested to generate stronger emissions reductions and other co-benefits. These findings will be contextualized in a discussion about sustainability and opportunities for farmer adaption for aspects of rice production in the U.S. Mid-South.

The University of Arkansas Environmental Dynamics Program (ENDY): Three graduate programs providing advanced degree train with MS and PhD options

Ungar, Peter S.
Environmental Dynamics Program and Department of Anthropology at the University of Arkansas - Fayetteville

This presentation introduces the University of Arkansas Environmental Dynamics graduate programs (ENDY). Environmental Dynamics, as broadly defined, involves the study of human-environmental interactions. The University of Arkansas in Fayetteville has three graduate degree options in its ENDY program, an online MS (Environmental Resiliency, ENRE), and in person MS and PhD. The ENDY program is the first interdisciplinary graduate program on the UAF campus. It boasts nearly 100 affiliated faculty members from the Colleges of Arts and Sciences to Architecture, Engineering, Education and Health Professions, Architecture, the Law School, and other units across campus. Participating faculty are associated with research centers on campus and have world-class R1 laboratory facilities available to graduate students. The ENDY program is unique in its approach, combining a deep-time perspective on climate and the environment to give context to Earth systems today with resilience and sustainability elements to give relevance to the study of environmental dynamics. There are four required core courses, but students can otherwise tailor their studies to meet their needs within the ENDY umbrella, and research components are of incredibly broad scope. Our new ENRE program is a collaboration with the School of Architecture, and is designed to meet the career advancement needs of those employed full time and in need of an on-line graduate degree.

Do Similarly Sized Domestic and Indigenous Mammals Affect the Landscape Differently?

Villasenor, Amelia
Department of Anthropology at the University of Arkansas - Fayetteville

Mammals are fundamental units of nutrient distribution through processes such as excretion and decay. This was also true in the past, though the composition and diversity of mammals

has changed significantly on the landscape. Today, in settings such as sub-Saharan Africa, grasslands are home to an incredibly biodiverse mammal ecosystem. Similarly, savanna-like ecosystems (e.g., prairies) were extensive throughout North America, including portions of Arkansas, from approximately 7 million years ago until the last 200 years. They are nearly absent today. Today, prairies have been transformed through agriculture or urban development, while the large mammals that help maintain them have been extirpated from large swaths of the Midwest. We use the experimental structure of the Joseph H. Williams Tallgrass Prairie (TGP) Preserve in Pawhuska, OK, to explore the relationship between nutrients, landscapes, and mammals. The Williams TGP preserve has exclusion areas for cows and bison and performs yearly burning. Large mammals (particularly indigenous large mammals, such as bison) affect the landscape, including the presence of other animals by influencing the types of forbes and grasses available. We ask whether bison and cows affect the surrounding landscape differently through their landscape use, specifically by examining the results of stable isotopes from hair and feces. We predict regions where bison graze year-round will have higher levels of nitrogen cycling and, thus, higher levels of nitrogen will be present in bison feces compared to exclusion plots where bison or cows are only permitted in certain parts of the year. The results will have implications for modern conservation, rewilding in the US, and for understanding past ecosystems.

Resource Selection of Bull Elk in the Central Interior Highlands, Arkansas

Don White, Jr.[1], Christopher L. Watt[1], Christopher T. Rota[2], and Wesley Wright[3]
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Successful wildlife management depends in part on our ability to assess and understand wildlife-habitat relationships. Modeling habitat selection using resource selection functions offers the ability to rank areas by their relative probability of selection. Mapping these relative probabilities in a GIS can identify regions with low- and high-quality habitats providing managers with a meaningful tool for prioritizing areas of management and conservation importance. Our objectives were to 1) model annual habitat selection for bull elk as a function of 15 habitat-related covariates using a hierarchical Bayesian discrete choice model, and 2) spatially depict habitat suitability to identify areas with low and high probabilities of selection. To study age-specific survival of bull elk, in March 2003, we placed VHF collars on 56 bull elk and aerially relocated each animal 2-3 times per month during daylight hours from March 2003 through May 2006. We used the bull elk location data from our survival study to model annual resource selection. We evaluated the predictive ability of our most supported discrete-choice model using 2 methods. First, we visually compared our habitat suitability map to our bull elk location data. Frequent spatial overlap between elk locations and areas of high probability of selection were interpreted as model confirmation. Second, we evaluated model fit using 5-fold cross-validation and the Spearman-rank correlation (ρ). We found a positive correlation between area-adjusted frequencies of predicted relative probability of use with prediction bin rank ($\rho = 0.75$, $p < 0.01$) indicating an adequate model fit. Bull elk selected the Shrub/Scrub landcover type at higher rates than were available in the study area. In contrast,

bull elk used open water and developed/barren landcover types at lower rates than they were available. Bull elk used all other landcover types in proportion to their availability in the study area. Bull elk were more likely to use north aspects with gentle slopes, greater spring and winter NDVI, greater tree canopy cover, and areas with lower road density. Neither elevation, summer or fall NDVI, distance to edge, distance to paved or unpaved road, distance to water, nor Interspersion/Juxtaposition Index influenced bull elk resource selection. Managers of elk populations in similar oak-hickory/hardwood ecosystems in eastern North America should ensure the availability of shrub/scrub and open lands, including wildlife openings created and managed for wildlife.

The First Generation of a Regional-scale 1-m² Forest Canopy Cover Dataset Using Machine Learning and Google Earth Engine Cloud Computing Platform: A Case Study of Arkansas, USA

Zuqani, Hamid
University of Arkansas at Monticello

The Forest Canopy Cover (FCC) is an important factor in the health and functioning of forests, as it plays a role in ecosystem services such as carbon sequestration, wildlife habitat, and water regulation. Techniques for accurately and efficiently mapping and extracting FCC information are evolving quickly, and it is of interest to evaluate their validity and reliability. The primary objectives of this study are to: 1) develop a large-scale FCC dataset with a spatial resolution of 1-m², 2) assess the spatial distribution of the FCC at a regional scale, and 3) examine the discrepancies in the FCC areas within the existing data from the Tree Canopy Cover (TCC) percent data by Hansen et al. (2013) and U.S. Forest Service TCC products at different spatial scales within the state of Arkansas (i.e., county and city levels). The produced FCC dataset was validated using one-third of the observations (i.e., reference locations) obtained from the TCC percent data by Hansen et al. (2013) dataset and the 0.6-m spatial resolution National Agriculture Imagery Program (NAIP) aerial imagery. The results showed that the dataset successfully identified the FCC at a 1-m resolution in the study area, with an overall accuracy ranging between 83.31% and 94.35% per county. The spatial comparison results between the produced FCC dataset and both the Hansen et al. (2013) and USFS products also indicate a strong positive correlation, with the R^2 values ranging between 0.94 and 0.98 for the county and the city levels. This dataset provides valuable information for monitoring, forecasting, and managing forest resources in Arkansas and other regions. Furthermore, the results of this study provide evidence that the use of machine learning and cloud computing technologies can produce high-resolution forest cover datasets and can be applied to other areas around the world.

ABSTRACTS
poster presentations

Spatiotemporal Dynamics in Winter Harvest Distribution of Mallards Banded in Arkansas

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Band encounter data has been used to draw inferences about dynamics in distribution patterns of mallards (Anas platyrhynchos) since the 1950s. Based on these data, rapid yet enduring shifts in wintering locations of mallards were observed in the Pacific Flyway during the 1950s and Central Flyway during the 1960s. Despite well-known biases in these data types, inferences made about harvest distribution can be informative to management and policy personnel. We used encounter data from mallards banded during winter in Arkansas from 1950-2019 to describe short- and long-term patterns in distribution. We found high homing rates of mallards banded during winter in Arkansas relative to most waterfowl. We used kernel density estimation to quantify the center of winter harvest distribution and found significant overlap between historical and present distributions. However, the centroid harvest latitude differed among decades and that not all range shifts were in a northerly direction. For example, models suggest center of mallard harvest in September is now 3.5 degrees more southerly than in the 1960s. Inversely, center of mallard harvest in December and January are 1 degree and 0.5 degrees further north than historically. In the long term, it seems likely that extreme climate events are constricting migration behavior and constraining wintering habitat selection. In the short term, we observed extensive inter-annual variation in harvest distribution for Arkansas mallards. Finally, we present these data with the caveat that mallards banded in Arkansas may not be representative of the entire Mississippi Flyway population. A sample of mallards banded in other Mississippi Flyway states had a further northerly and easterly wintering distribution. The mean winter harvest (December – February) latitude of Arkansas banded mallards was 34.52° N (SD ± 2.32°) while the mean winter harvest latitude for all Mississippi Flyway banded mallards was 36.01 ° N (SD ± 3.13°).

The Relationship Between Climate Anxiety and Pro-Environmental Behaviors of Arkansans: Implications for Conservation

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Because of the increasingly apparent impacts of changing climate patterns, the capacity for Arkansan communities to be resilient has become even more paramount. Such resilience requires both mental well-being and often behavioral changes of community residents and

visitors. Mental health challenges related to climate change include climate anxiety or eco-anxiety. Assessing the climate anxiety of a community's residents and visitors, their reported pro-environmental behaviors, and the relationship between the two are important aspects to consider when efforts are being designed to converse natural resources and build community resilience. The objective of the study is to investigate climate anxiety and pro-environmental behavior, beginning with college students who become the leaders of subsequent generations. Students in selected classes at the University of Arkansas completed an online survey during the fall 2023 semester (n=328). Three sub-scales of Climate Change Anxiety Scale were used to measure climate anxiety: Cognitive-emotional impairment, functional impairment, and experience of climate change. The Pro-Environmental Behavior Index was used to measure sustainable consumption actions. Preliminary results indicate that the respondents were not mentally or functionally impaired by climate change anxiety; nor did they report having experienced climate change personally. They did report, however, some pro-environmental behaviors, including saving energy and avoiding food waste. Bi-variate analysis will be conducted. Implications, including about conservation, for an array of stakeholders will also be made.

Examining Seasonal Patterns of Root Growth and Respiration in Mature Willow Oak (Quercus phellos) Trees and Implications for Greentree Reservoir Flood Management

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Greentree reservoirs (GTRs) are forests that are artificially flooded to attract ducks, but the current flood management of GTRs is negatively impacting the health of mature trees in the red oak group, including willow oak (Quercus phellos). Flood that occurs in the fall and spring when roots are very active, stresses trees by limiting root growth and increasing root mortality, which has negative impacts on the overall health of the trees. Therefore, late fall and winter patterns of root activity need to be understood so that the flood regime can be appropriately timed. Root growth was analyzed from minirhizotron photos taken in clear tubes beneath the soil surface weekly over the course of one year. Root metabolic activity was quantified by measuring the respiration of coarse and fine roots at ambient soil temperature over the course of a year. Root respiration was also measured at 15°C to determine whether there are periods during the year when root respiration is reduced regardless of soil temperature. We tested whether reduced root activity is associated with air temperature, soil temperature, and leaf phenology, which may be practical indicators for GTR managers to time flood. Soil and air temperature were recorded using dataloggers and leaf phenology data was collected from canopy photos taken over the course of the year. Our results will be discussed within the context of conserving red oaks in GTRs and other bottomland hardwood forest restoration situations. If the timing of flooding in GTRs is restricted to when the roots of mature willow oaks are the least active, this may minimize stress and limit flood damage to the root system.

Five Oaks Ag Research & Education Center: A Graduate Certificate Program and Training Program for Early-Career Waterfowl Habitat and Wetland Management Professionals

Hood, Brendan1, Van Der Veer, Emily, Wick, Tyler, Askren Ryan J. 1,2, and Osborne, Douglas C. ,1,2
1 University of Arkansas at Monticello, College of Forestry, Agriculture, and Natural Resources, Five Oaks Ag Research and Education Center; 2 University of Arkansas Division of Agriculture, Arkansas Forest Resources Center

While universities across North America provide excellent academic training in ecology and natural resources, undergraduate students are often ill-prepared to engage in real world, land management after graduating. In order to provide students with the skill to meet land management needs, the Five Oaks Ag Research and Education Center (FOAgREC) provides post-baccalaureate students with applied learning opportunities for transferring principles learned in the classroom to on-the-ground land management. To administer this training, the University of Arkansas at Monticello offers a two-semester, Graduate Certificate in Waterfowl Habitat and Wetland Management. This program offers a full scholarship to four students annually. Students spend on average 75% of their time in the field working with FOAgREC land managers. They choose 18 credit hours from a list of graduate field courses in wetland ecology, science-based decision making, land and lodge management, farm applications in land management, among others. Five Oaks provides 8,000 acres of outdoor laboratory space for teaching and research, including a 12-bedroom dormitory, with full living accommodations, computer stations, and a research lab. The next generation of wetland managers will face unprecedented challenges as demands for improved wetland health and associated ecosystem services increase in the face of climate change and other environmental stressors. Therefore, the principal objective of FOAgREC is to help develop the next generation of land managers by refining and improving their technical skills needed for successfully managing our wetland resources.

Spring Migration Habitat Selection of Hen Mallards Wintering in the Mississippi Flyway

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Mallards (Anus platyrhynchos) are economically, ecologically, and socially important in North America due to their popularity as a game species. While mallards are the most populous dabbling duck species in North America, recent population declines, and related habitat conditions have led to concerns for waterfowl managers. A clear understanding of the relationship between movement and resources is critical for understanding population level changes. Resource availability during spring migration is crucial to maintain and improve body condition to maximize success upon arrival at the breeding grounds. We aim to investigate resource selection of hen mallards during the spring migration to understand vital landcover types. The objectives of this study are to assess 1) landcover selection of hen mallards during spring migration, and 2) site selection of nesting attempts identified using accelerometer and location data. Ornitella transmitters (n = 96 annually) were deployed on hen mallards in Arkansas

and Missouri during February 2023 and 2024. Habitat selection will be assessed using hourly locations with aerial imagery and land use layers in ArcGIS and R, utilizing Brownian Bridge Movement Models. We aim to assess private and public land usage, selection of landcover types (e.g., agriculture, forested, upland grassland, emergent wetland, woody wetland, and open water), and the influence of wetland complex size. The information gained from this study will allow us to make recommendations informing both public and private land managers in supporting the breeding stock of mallards during spring migration.

Impact of Climate Change on Vector Species Suitability in Arkansas

Williams, Dalton
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Ticks are the most prevalent vector species in the United States (Beard, Eisen, and Eisen, 2021). They are a common parasitic insect, which bite humans to receive sustenance from our blood. When they bite a human, they leave behind bacteria, viruses, and parasites, which can cause secondary infections and illnesses (Parola and Raoult, 2001). Despite knowing the impact that ticks can have on human and animal health, there is little information regarding how the lifecycle and range of ticks has been impacted by a locally changing climate. The term "ecological niche shift" explains the renegotiated patterns that fauna integrates when impacted by new external stressors. Due to climate change, progressive warming has expanded the tick's temporal range, allowing it to have more days per year to feed and to mate (Alkishe, Raghavan, and Peterson, 2021). This study's purpose is to evaluate the impact of vector borne disease in Arkansas across time. Understanding the changing temporal and spatial scale of ticks will be vital to future public health efforts, as their status as the United States' primary vector species speaks to their prolific status in everyday life, and their potential detriment to the health and wellbeing of the nation. To date, there is a wealth of information regarding vector borne diseases, but there is a lack of consolidated information regarding the changing ecological niche of disease vectors in Arkansas across temporal scale. While the climate changes globally, all species will need to adapt to prepare for ecological stress, including insects which can spread zoonotic diseases. Though this poster's scope would be to address a knowledge gap in Arkansas, the tools and background information detailed will hopefully have more national or global applicability.

Mallard-Bottomland Hardwood Relationship in the Bayou Meto Basin, AR

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The Mississippi Alluvial Valley of Arkansas supports a large proportion of the wintering midcontinent mallard (Anas platyrhynchos) population, providing hunter opportunity and bolstering local economies. Bottomland hardwood forests are an important traditional

wintering habitat for mallards in this region however, altered hydrology and poor water management has shifted forest composition away from favorable red oaks oak (Quercus spp.) species. GPS transmitters allow for fine-scale movement analysis of mallards. We deployed 220 GPS transmitters on mallards during November 2021 and 2023 to track movements across the MAV through hunting seasons. We extracted canopy height and stem density from LiDAR data and wetland classification from the National Wetlands Inventory. We used step selection functions in a use-available framework to model field and site level selection with land cover type and remotely sensed model covariates. Selection was greatest for managed moist-soil wetlands (= 0.34 ± 0.02 SE) and emergent wetlands (0.27 ± 0.02) with lower selection intensity for scrub shrub (= 0.13 ± 0.02) and forested (= 0.02 ± 0.00) within the Bayou Meto Basin. Within forested wetlands, mallards selected for low to intermediate stem density (0 - 15 trees per .1 acre) and low to intermediate canopy height (0 – 20 m). There is evidence that ducks avoid public hunt areas, influencing land cover selection based on stand characteristics in forested sites in the region. These results provide insights of habitat selection for future management of bottomland hardwood forests and highlights the need for future research to evaluate fine scale patterns in mallard diets and land cover selection.

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