





RESEARCH. EDUCATION. COMMUNITY. 2021–2022 Annual Report

Tyson Research Center is the environmental field station for Washington University in St. Louis. Located just 20 miles from the Danforth Campus on 2,000 acres at the edge of the Ozark Highlands, Tyson provides opportunities for environmental research and education for students and faculty from Washington University and beyond. We facilitate multi-scale research and teaching opportunities and collaboration across disciplines, institutions, and levels of academic training.

On the cover

An aerial photo of Tyson taken by drone in autumn. This year, the Tyson community celebrated a return to fully in-person operations by focusing on our connection to place. Read more on pages 30-31.

Acknowledgements

As part of Tyson's commitment to experiential education, we are always looking for opportunities to center students in research and project leadership. This year's annual report was written and designed by Colleen McDermott, undergraduate communications associate.



Highlights

Tyson alum publishes study in *Ecology*

Jacqueline Reu, former Tyson research fellow and WashU graduate (2019), is the lead author of a study mapping the relationship between tree beta diversity, spatial scale, and biodiversity. The data used in this study was collected as part of a long-term forest monitoring project at Tyson led by Dr. Jonathan Myers, who served as Jacqueline's mentor alongside Dr. Christopher Catano.



Tyson student group collaborates with campus partners



The Tyson Conservation Corps, together with the WashU Bird Club, visited the Audubon Center at Riverlands to learn about their conservation efforts and watch the native birds during sunset. The group saw eagles, swans, pelicans, and more, and had a unique opportunity to meet students of another environmental group on campus through a shared interest and mission.

Tyson selected for global biodiversity study



Tyson scientists Dr. Solny
Adalsteinsson and Beth Biro,
along with student
researchers, began collecting
data for Project LIFEPLAN. Led
by the University of Helsinki
and the Swedish University of
Agricultural Sciences, LIFEPLAN
aims to measure the current
state of biodiversity worldwide
for use in future scenario

projections. Sampling conducted at Forest Park and Tyson Research Center joins data from 116 other locations to help s cientists better understand the species living in our world.

Soil temperature study breaks new ground

Tyson researchers Dr. Jonathan Myers and Dr. Rachel Penczykowski joined a worldwide list of authors for their contributions to "Global maps of soil temperatures" published in *Global Change Biology*. This study, which incorporated data from over 8,000 temperature sensors placed across the world's



major terrestrial biomes, shifts our thinking of global climate to include critical areas near the ground's surface, a microhabitat with important implications for ecological application.



Generator system supplies reliable power



Two generators were installed at Tyson, whirring to life any time power is cut off and sustaining critical lab functions. This newly secured backup electrical system represents a large step forward, not only as a way to safeguard the research process but as part of the larger goal to maximize the overall reliability of Tyson's infrastructure.

Tyson a key resource for WashU coursework

Students in Field Methods for Environmental Science (ENST364) and Applied Conservation Biology (ENST365) gathered at Tyson Research Center during



the fall and spring semesters to develop an invasive species assessment and detailed conservation action plan. For professor Doug Ladd, Tyson provides a site for his students to implement the skills they learn in class in a real-world setting. "Having access to a large block of available habitat so close to the university is an invaluable resource," says Ladd.

High school students complete first annual capstone project

A spring camping trip in Mark Twain National Forest marked the culmination of educational programming for Tyson's 2021-22 SIFT and TERA cohorts. Students met with 10 employees across different sectors of the US Forest Service to hear about their



career paths and gain hands-on experiences alongside the professionals. Closing out the weekend, the group carried out a restoration capstone project, complete with presentations and videos of their work.



Tick study takes off

This summer, Tyson scientists Dr. Solny Adalsteinsson, Beth Biro, Erin O'Connell, and University of Health Sciences and Pharmacy professor Whitney

Anthonysamy launched a study examining tick abundance and diversity across the St. Louis urbanization gradient. This study emerged from the framework of the established St. Louis Wildlife Project; together with several partner cities, the researchers use what the STLWP has taught them about mammal hosts to understand how that affects ticks and tick-borne disease risk for people in urban, suburban, and rural greenspaces.



Executive Summary: Humans at Tyson

We are so fortunate to celebrate the work of our amazing community of researchers, educators, students, and support staff through this annual report. One of our major accomplishments this year was simply to return to fully onsite research and operations as the COVID-19 pandemic slowed. Colleen McDermott, Tyson summer fellow '22, eloquently captured this moment in their project *Placemaking Tyson*, featured on pages 30-31:

"Places are made of people. People are shaped by places. At Tyson, this feedback loop was restarted during the summer of 2022, as our research teams gathered onsite for the first time in three years. Shaking off memories of remote learning forged through the COVID-19 pandemic, we quickly immersed ourselves all across Tyson - in its woods, labs, classrooms, roads...Beyond humans of Tyson, this summer we celebrate being humans at Tyson."

And these humans have done a lot both at Tyson and beyond. A new project led by Fernando Nájera, Living Earth Collaborative postdoc, examines the movement patterns and health of local carnivores at Tyson and the Saint Louis Zoo's WildCare Park, an exciting collaboration with new focal species (pages 14-15). Beth Biro, Solny Adalsteinsson, and Erin O'Connell have reinvigorated the study of bats at Tyson with the US Fish and Wildlife Service, with some very exciting discoveries to report (page 13). Katie Westby and Kim Medley published three papers examining regional patterns of invasion for the tiger mosquito in the St. Louis area (page 12). And our global-scale research has continued to thrive, with the establishment of a new biodiversity network, LIFEPLAN, and a highly collaborative publication on global soils co-authored by Rachel Penczykowski and Jonathan Myers, faculty in biology and Tyson researchers extraordinaire (page 4).

Importantly, we continue to ground our research in a framework that supports diversity, equity, accessibility, and inclusion. This year, Susan Flowers and Rachel Penczykowski established a St. Louis chapter of the ESA SEEDS program, SEEDS STL (pg. 30). This student-led group aims to provide undergraduates from minoritized backgrounds with hands-on opportunities in ecology and environmental sciences.

Thank you for supporting Tyson, and we look forward to a fabulous 2023!

- The Tyson Team

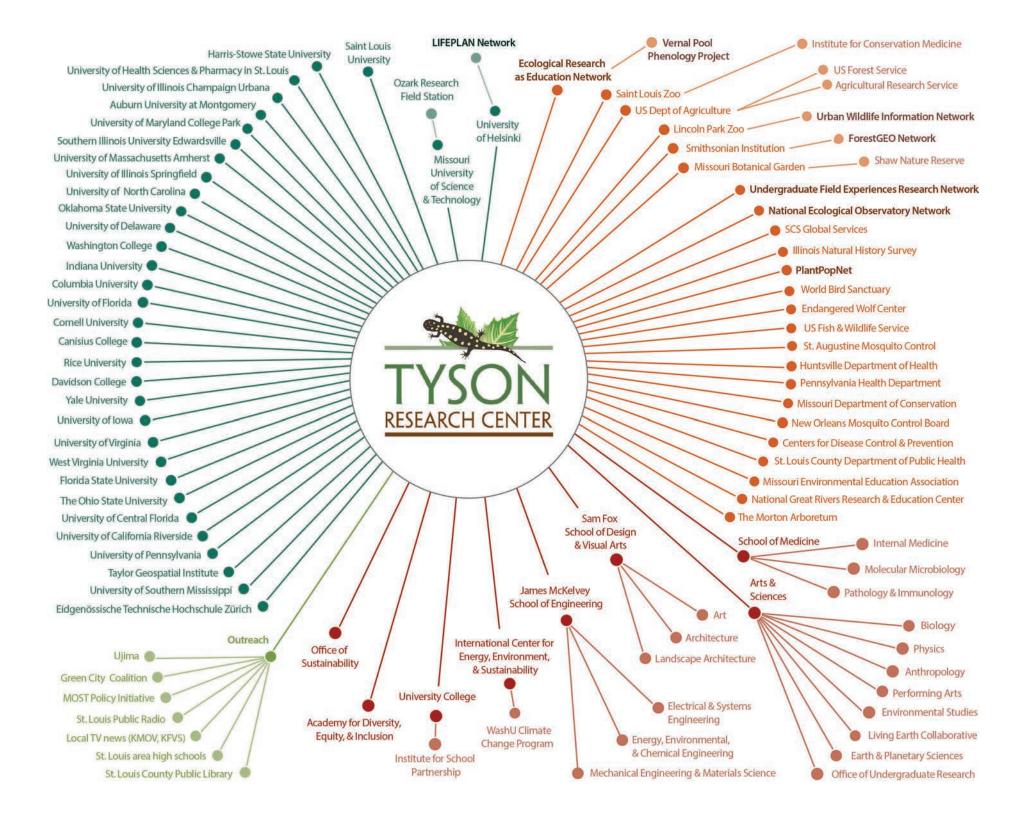


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RESEARCH

Advancing discovery of a changing world







In 2021-2022, Tyson supported

Researchers from

4

WashU schools and

11

departments

An additional

30

principal investigators from

21

external institutions

And Pls within

7

collaborative research networks

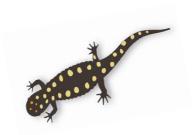
Tyson studies led to

27

peer-reviewed publications and

3,598

citations in academic journals



Trio of publications explain regional mosquito patterns



Katie Westby, PhD

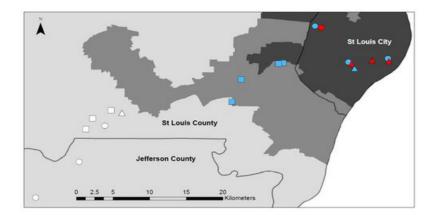


Kim Medley, PhD

From the Arch all the way out to the Ozark foothills, mosquitoes are a common sight - but which species dominate, and where? Tyson scientists Dr. Katie Westby and Dr. Kim Medley set out to explore the abundance of these insects across St. Louis, with a specific focus on the nonnative *Aedes albopictus*. Also known as the tiger mosquito, *Ae. albopictus* is one of the world's most globally invasive species, a significant disease vector, and the prevailing mosquito species of this region. A trio of publications from Tyson's Mosquito Lab study the complex interactions between *Ae. albopictus* and a competitor species *Ae. triseriatus* to determine how *Ae. albopictus* has come to rule - and to find the areas where it has fallen short.

A 2021 study published in *Insects* asks whether *Ae. albopictus* abundance differs based on land use type. Westby *et al.* found that in the St. Louis region, *Ae. albopictus* numbers were significantly higher among the urban and suburban sites compared to the rural sites. Where humans dominate, *Ae. albopictus* does too, in those areas characterized by roads and buildings, by asphalt and artificiality.

Westby, Juliano, and Medley started testing for an explanation for this trend in their *Journal of Medical Entomology* publication, narrowing their study scope to Tyson Research Center and the larval habitat. *Ae. albopictus* is an artificial container-breeding mosquito; it lays eggs in debris such as old car tires, flower pots, or at Tyson, large black breeding buckets dotted around the woods. On the other hand, the competitor species *Ae. triseriatus*, or the Eastern treehole mosquito, prefers to breed in natural spaces (such as treeholes, as the name would suggest) but can be found laying eggs in artificial containers as well. Generally, *Ae. albopictus* has been shown to outcompete resident species in areas where it becomes established - a fact made all the more interesting when Westby, Juliano, and Medley, using repurposed data collected from Tyson's artificial containers during 2007-2012, found that *Ae. albopictus* actually failed to dominate *Ae. triseriatus* in these larval habitats throughout the decade of study.



Map of mosquito breeding cups placed along the St. Louis urbanization gradient. (Rural: light gray, Suburban: medium gray, Urban: dark gray)



The final publication of the trio, appearing in *Biological Invasions*, pushes priority effect (PE) as an explanation why. PE operates like a race, wherein one species gets the advantage of a head start over another. Among St. Louis mosquitoes, *Ae. triseriatus* eggs naturally hatch earlier in the season than do *Ae. albopictus* eggs, giving them time to develop and increase their population numbers before their competitors emerge.

Through both laboratory and field experiments, Westby *et al.* concluded that PE reduced *Ae. albopictus* survival and therefore its rate of population increase. Such a result can help explain the pattern of regional mosquito inhabitation introduced in *Insects*. In urban and suburban areas, where artificial containers dominate the landscape, *Ae. albopictus* thrives virtually alone. In rural, forested areas, where both treeholes and artificial containers are found, priority effects brought on by otherwise "less competitive" species like *Ae. triseriatus* help keep the invader *Ae. albopictus* in check.

From a public health standpoint, these findings have big implications. The tiger mosquito is a vector of several diseases, demonstrated to prefer urban spaces in a world where more than 50% of the global human population now resides in cities. Protecting ourselves means understanding the movements of *Ae. albopictus* - where it is, and why it's there.



"There is no mosquito-transmitted disease where there are no mosquitoes, so it is crucial to understand how the landscape contributes to abundance patterns of important vector species."

- Dr. Katie Westby

Historical bat monitoring study revamped at Tyson



Solny Adalsteinsson, PhD



Beth Biro, MS



Erin O'Connell, MS

The study of bats at Tyson Research Center is no new endeavor; as far back as 1979, researchers were compiling data through occasional surveys of species present on the property. Since 2018, however, bat monitoring at Tyson has been revived through a more intensive effort, with a new focus on habitat restoration and population recovery.

Bats are significant contributors to their ecosystems - as insect predators, nutrient recyclers, plant pollinators, and seed dispersers. Unfortunately, their numbers are in decline across North America due to factors such as land use changes, pesticides, invasive species, climate change, and the widespread whitenose syndrome, a deadly fungal disease afflicting bats at an alarming rate. With its variety of suitable habitats, Tyson makes for an ideal place to collect data on bat diversity and abundance, as well as to implement conservation strategies.

The research team, composed of Beth Biro, Dr. Solny Adalsteinsson, and Erin O'Connell, along with numerous other collaborators and students, gathers data through visual surveys, infrared cameras, and audio monitors that record high-frequency bat echolocation calls. Research partners from the US Fish & Wildlife Service (USFWS) and Missouri Department of Conservation (MDC) capture bats annually during

the summer at Tyson to identify species and estimate their abundance. Historically, surveys took place only at Tyson's Mincke Quarry Cave; this data revealed the presence of endangered bat species onsite and inspired the reestablishment of a more formal research program.







Locations of acoustic monitoring sites across Tyson Research Center. Bat monitoring has expanded from its historic center at Mincke Quarry to include sites across Tyson's property.

The current monitoring team has expanded their focus from Mincke Quarry to include New Rankin Cave, as well as several non-cave sites near ponds and within the ForestGEO plot from spring through fall. Of the 14

Raftroad Pond

HQ Pond

Fox Den Pond

Fox Den Pond

ForestGEO Ridge

New Rankin

bat species known to live in Missouri, 12 have been identified thus far at Tyson, including the federally endangered gray bat, Indiana bat, and tricolored bat.

Tyson Research Center also has the unique opportunity to involve students in this research, hailing from groups such as the Tyson Conservation Corps, Tyson Undergraduate Fellows Program, Shaw Institute for Field Training, Tyson Environmental Research Apprenticeship, and the St. Louis-based chapter of the Ecological Society of America Strategies for Ecology Education, Diversity, and Sustainability. Along with training to become future bat biologists, these students have had opportunities to learn about careers from both government agency and conservation-nonprofit collaborators (e.g., USFWS, MDC, Bat Conservation International) and to network with conservation-focused researchers.

Thanks to the generous donation from Edith Jackson, we have been able to create the most complete dataset ever collected after COVID disruptions. Our goal is to create better habitats for bats through habitat and resource restoration.



Researchers track St. Louis carnivores



Fernando Nájera, PhD



How do you trap a wiley coyote? It may sound like the setup to a bad joke, but for Dr. Fernando Nájera, this question reflects an everyday reality. The lead researcher of a study on St. Louis canids, Fernando is hard at work navigating the unique challenge of capturing data on animals that are all too good at evading capture themselves.

The study investigates the spatial ecology and infectious disease dynamics of red foxes, gray foxes, coyotes, and bobcats. In other words, how do these animals behave and use land? What is the prevalence of disease among their populations, including those which can be spread to humans? According to Fernando, mesocarnivores such as these act as good indicators of

overall ecosystem health - some species may utilize large amounts of land, eat from a wide variety of food sources, and can live in close proximity to people, shedding light on the relationships between us.

Two main study sites encompass different land use types: for suburban study, the Saint Louis Zoo Wildcare Park in north St. Louis County, and for rural study, Tyson Research Center. The research team traps animals at Tyson from October to March so as not to disturb natural mating cycles or

"This study shows how important animals are in the landscape. Our hope is to make a healthy ecosystem for all of us - every piece of the puzzle is important when it comes to biodiversity."

- Dr. Fernando Najera

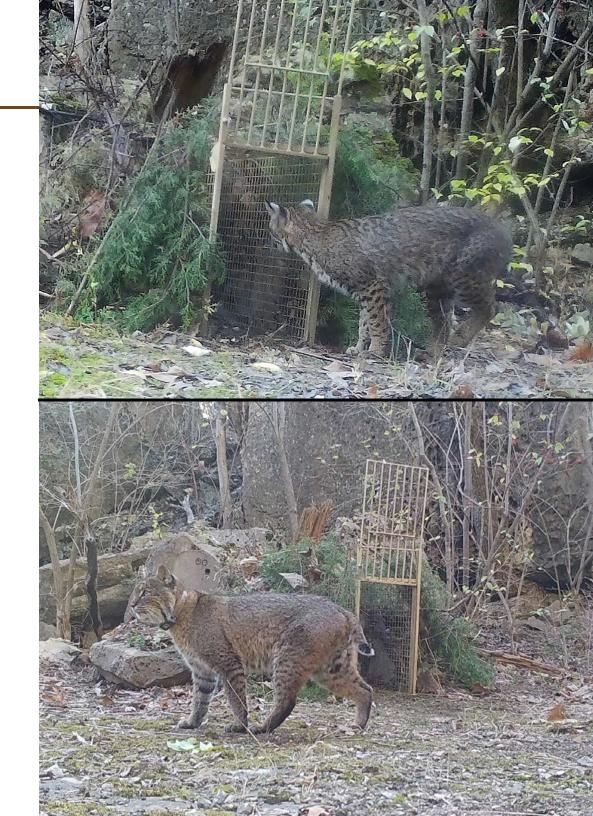
rearing young. When a trap is set, it signals Fernando's phone so he can get to the site immediately and minimize the stress of the animal. With the animal in safe hands, he and the team are then able to take samples, to check for disease or parasite presence, and put on radio collars, to track movements through GPS data. The hard part, however, is getting canids in the traps in the first place.

"These animals are so smart," says Fernando. "We have had to try several different methods to catch them."

Such methods include attracting the animals to traps with a strong-scented lure, sprays of bobcat urine, or audio of a squirrel in distress paired with a mechanically-moved tail. For coyotes specifically, far too intelligent to be tempted into a cage, the setup consists of a hidden cable restraint device, with a deer carcass laid out as bait. To date, the team has caught 1 coyote, 4 bobcats and 2 foxes, as well as 25 raccoons and 16 opossums - not the subjects of study, but valuable in bringing to light some of the diseases present in the landscape shared with the target species of the project. Having reassessed and improved the teams' trapping methods, Fernando's goal is to capture a larger sample size of the targeted species this time around. Despite the difficulties, he certainly has not lost any amount of passion for the job.

"Every day is different," he says, "and carnivores just teach you so much. I may have to work long days, work on weekends, but I absolutely love what I am doing!"

This project is a collaborative effort involving the Saint Louis Zoo's Institute for Conservation Medicine and WildCare Institute, the Living Earth Collaborative at Washington University in St. Louis, and the Endangered Wolf Center. Special thanks to Tyson staff scientist Dr. Solny Adalsteinsson and WashU professor Dr. Karen DeMatteo for their involvement, and to the Tyson facilities team for their help designing and building custom traps.



Peer-reviewed publications

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Davies, S.J., Abiem, I., Salim, K.A., Aguilar, S., Allen, D., Alonso, A., *et al*. (2021). ForestGEO: Understanding forest diversity and dynamics through a global observatory network. *Biological Conservation*, 253, 108907.

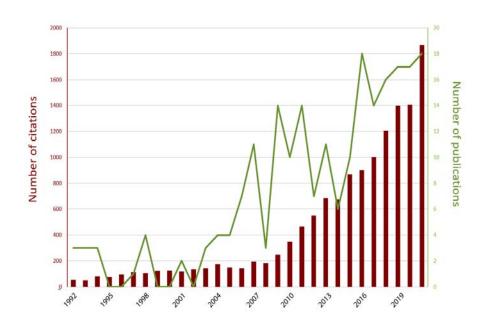
Flowers, S.K., O'Connell, K. & McDermott, V.M. (2021). Crafting field station and marine lab communities for undergraduate diversity, equity, and inclusion. *The Bulletin of the Ecological Society of America*, 102, e01908.

Keller, A.B., Brzostek, E.R., Craig, M.E., Fisher, J.B. & Phillips, R.P. (2021). Root-derived inputs are major contributors to soil carbon in temperate forests, but vary by mycorrhizal type. *Ecology Letters*, 24, 626–635.

Koltz, A.M., Civitello, D.J., Becker, D.J., Deem, S.L., Classen, A.T., Barton, B., et al. (2022). Sublethal effects of parasitism on ruminants can have cascading consequences for ecosystems. *Proceedings of the National Academy of Sciences*, 119, e2117381119.

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Magle, S.B., Fidino, M., Sander, H.A., Rohnke, A.T., Larson, K.L., Gallo, T., *et al.* (2021). Wealth and urbanization shape medium and large terrestrial mammal communities. *Global Change Biology*, 27, 5446–5459.

Marquis, R.J., Baer, C.S., Lill, J.T. & Wang, H.G. (2022). The Impact of Construct Building by Caterpillars on Arthropod Colonists in a World of Climate Change. In: *Caterpillars in the Middle*. Springer, pp. 509–537.

McIntire, K.M. & Juliano, S.A. (2021). Detrimental effects of a failed infection by a co-invasive parasite on a native congeneric parasite and its native host. *Biological Invasions*, 23, 1637–1648.



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Sedio, B.E., Spasojevic, M.J., Myers, J.A., Wright, S.J., Person, M.D., Chandrasekaran, H., *et al.* (2021). Chemical Similarity of Co-occurring Trees Decreases With Precipitation and Temperature in North American Forests. *Frontiers in Ecology and Evolution*, 317.

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Westby, K.M., Juliano, S.A. & Medley, K.A. (2021b). *Aedes albopictus* (Diptera: Culicidae) has not become the dominant species in artificial container habitats in a temperate forest more than a decade after establishment. *Journal of Medical Entomology*, 58, 950–955.

Westby, K.M., Medley, K.A., Beckermann, A.J., White, A.C. & Costanzo, K.S. (2022). The role of priority effects in limiting the success of the invasive tiger mosquito, *Aedes albopictus. Biological Invasions*, 1–15.

Wright, S.J., Goad, D.M., Gross, B.L., Muñoz, P.R. & Olsen, K.M. (2022). Genetic trade-offs underlie divergent life history strategies for local adaptation in white clover. *Molecular Ecology*, 31, 3742–3760.

EDUCATION

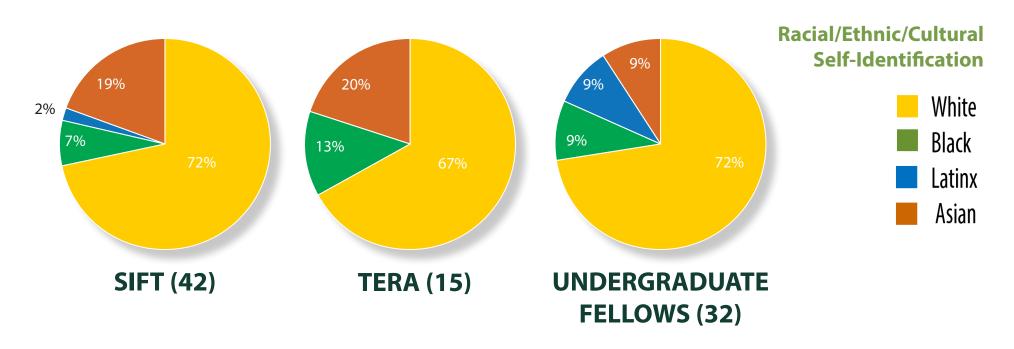
Learning through science in action





2021-2022 Education programs participants





54%

of high school program participants identified as female

53%

of undergraduate program participants identified as female

11%

of high school program participants
identified as transgender or
gender expansive

19%

of undergraduate program participants identified as transgender or gender expansive

Participants represented

21

high schools in the St. Louis area and

7

colleges/universities

Learn more about Tyson education programs at https://tyson.wustl.edu/edu-cation-overview

Colloquium tackles tough topics



COLLOQUIUM TOPICS

Week 1: Tour de Tyson Challenge

Week 2: Introduction to Environmental Racism and Justice

Week 3: Ableism, Accessibility, and Accommodations for Neurodiversity Inclusion

Week 4: Instigating Systemic Change Within a Scientific Discipline

Week 5: Intersection of Art and Science

Week 6: Critique and Peer Review

Week 7: Authorship Policy, How Peer Review Works, and the "Better Poster" Concept

Week 8: Manifestation of White Supremacy Culture Within Science

Week 9: Career Panel

Week 10: 5-Minute Presentation Work Session

Tuesday afternoons at Tyson were a time for summer undergraduate fellows and high school apprentices to come together for professional development beyond their mentored research work. Colloquium covered important scientific research cultural practices, such as formal oral presentation, understanding authorship, and the peer review process. However, it also included discussion of tough topics like the intersection of systemic racism and colonialism with science, as well as the creative expression of science as art. Scientific research is a human endeavor taking place within the dynamic socio-political culture of the time. Tyson is working to craft colloquium sessions that are reflective of community values and a commitment to social justice.

At the end of summer 2022, program participants shared their thoughts about the dedication of several colloquium sessions to the intersection of DEAI (diversity, equity, accessibility, and inclusion) and social justice topics with science:

"I thought this was super important, especially since we are all beginning in this field and need to know these things from the outset."

"I think it is important to talk about these issues, and I think you should definitely continue talking about them in the future. It has made me more aware of the human factors that need to be considered when doing research."

"I think I learned a lot about terms that I had heard for a really long time but didn't know what they really meant or why they were so important."

"I thought they were incredibly beneficial! Maybe more of an emphasis of how we can apply what we learned to other workplaces and WashU."

"There were very eye-opening discussions about topics I was unfamiliar with, and I felt like I learned a lot about important issues in the scientific community!"

Alumni spotlight: Lexie Beckermann



Lexie Beckermann is a former Tyson programs participant and mosquito lab technician. We caught up with Lexie to learn how her experience at Tyson launched her into a career in science.

How did you get your start at Tyson, and what did your path look like from there?

It all started my freshman year of high school. My biology teacher recommended SIFT [Shaw Institute for Field Training] to me because I was really excited about science and was doing well in her class. I applied, got in, and fell in love with the program. There was this part in the training week where we got to go to a creek and catch all sorts of little water bugs, and that was right up my alley. It always stuck with me.

"Kim and Katie showed me how a lab should be run, how the fostering of collaboration works. Tyson never really felt like a job, since I loved it so much!"



I reapplied for the TERA [Tyson Environmental Research Apprenticeship] program and ended up on the mosquito team, which was a perfect fit because I had an interest in healthcare and got to learn all about OneHealth - the intersection of animal, human, and ecosystem health. I did two posters and presented at the WashU Undergraduate Research Symposium.

After TERA, I did one year of the Undergraduate Fellows program. I did an experiment that summer that Katie [Westby] and I wrote a paper on and actually just sent off for publication! Then I stayed for another three years as a technician. Basically I was at Tyson forever, and I can't stress enough how much that has helped my career after college.

What do you remember about the environment of the mosquito lab and your relationship with your mentors?

Kim [Medley] and Katie have helped me at every step of the way, really. They definitely gave me my own space to come up with the things that I was interested in exploring. They believe in students' ideas and give us freedom, and that in turn creates an environment where we're publishing interesting papers because it's not just coming from the minds at the top - it's from everyone working in the lab.





What did the day-to-day experience look like during your time at Tyson?

Depending on which summer it was, it definitely changed up a lot. With mosquito work, there's a huge diversity of what we can do. Some summers it was mainly working on bucket experiments - minimum three days a week, we were out getting buckets from the woods, counting up every single mosquito larvae inside, and then returning them at the end of the day. Another thing we did for multiple years was an urban to rural gradient study of *Aedes albopictus* [tiger mosquito]. We would go out to these urban, suburban, and rural sites, collect the mosquito larvae in the cups we'd set out, then identify them and gather data on the differences between them. Then during my later years there we were looking more at adult mosquitoes, using this laser technology to record their wing beat frequencies.

It was rough going at some points but always really interesting. I always really appreciated the work because within a summer you could train a high school student to become really good at mosquito identification, which as an outsider you would think isn't possible, but it totally is!



I graduated from Southeast Missouri State University in 2021 with a degree in environmental science and environmental health. I first worked at SUNY Upstate Medical University, and now I work in a hospital rapid response lab. Tyson has helped me a lot in terms of learning lab protocols. Also, my science communication skills were developed a lot at Tyson. These days I often have to explain problems to doctors and nurses over the phone, which they are not usually happy to hear, so having that confidence in myself is really important!

Even at my first job out of college, Tyson prepared me pretty much perfectly. I was helping the lab review stuff for papers, helping them rear mosquitoes, all of which I knew how to do very well at that point.

I think looking forward, my big plan is to stay in this job for a couple years, save some money, and probably go back and get my master's. Then we'll see where that takes mesomewhere like Tyson would be my biggest dream!





COMMUNITY

Diverse ideas, diverse people, one community





















The Tyson Team



Solny Adalsteinsson, PhDTick and wildlife ecologist
and network coordinator



Tim DertonMaintenance technician



Erin O'Connell, MSResearch and conservation project coordinator



Beth Biro, MSStaff scientist and natural resources coordinator



Susan Flowers, MAEducation, outreach, and DEAI coordinator



Dan WaltonMaintenance technician



Ruth Ann BizoffAdministrative coordinator



Pete JamersonFacilities manager



Katie Westby, PhDDisease and vector ecologist



Kim Medley, PhD
Director

Feng Sheng Hu, PhD

Dean of the Faculty of Arts and Sciences
Professor of Biology and of Earth and
Planetary Sciences

Lucille P. Markey Distinguished Professor in Arts and Sciences





Humans of Tyson 2022: *Placemaking Tyson*

"I've learned a lot about science, especially that it's not all super-duper complicated technical stuff. That is definitely a big part of it, and it's very important. But there are lots of moments in science that are very real and human and organic."

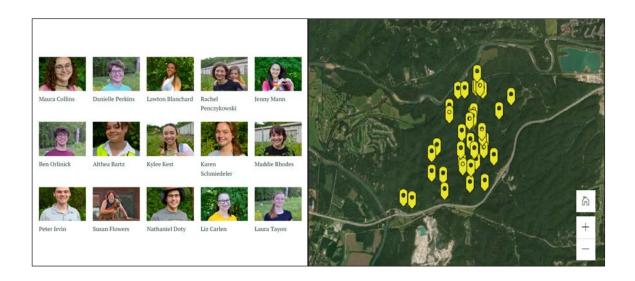
- Blue Schade, 2022 TERA

Profiles: The two-panel layout here presents classic Humans of Tyson profiles beside new innovations. The left half of the screen contains interview excerpts from each community member, paired with headshots and candid photos taken by Undergraduate Fellow Lawton Blanchard. The right half of the screen shows a map of Tyson marked with pins, each one corresponding to a person and a location they visited over the course of the summer.

"Places are made of people. People are shaped by places." Such is the line that starts off *Placemaking Tyson*, the 2022 contribution to the annual Humans of Tyson project. Broadly speaking, these words remind us of the unique connections humans forge with the locations they inhabit. In the context of Tyson specifically, they represent our shift from the Zoom room back to the physical field station - including all the joys, challenges, and surprises that came with hosting in-person student programs for the first time since 2019.

Humans of Tyson originated as a way to humanize the scientific work conducted at Tyson Research Center. Through photos and interview excerpts, each member of the summer community is profiled, with insights ranging from their favorite plant to what motivates them to persevere when field conditions get rough. Undergraduate Fellow Colleen McDermott took on Humans of Tyson 2022 as an independent project with this tradition in mind, along with some new ideas about the ways humanities can be mapped across digital media.

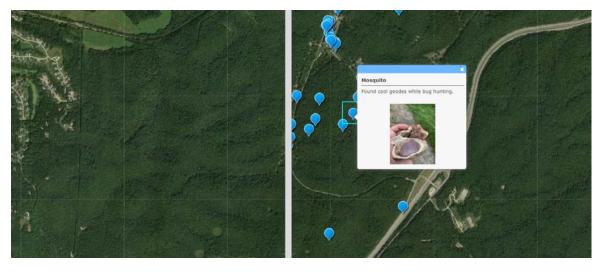
"Mapped," in this sense, is meant literally. *Placemaking Tyson* takes the form of an ArcGIS StoryMap, split into three main sections that detail our researchers' connection to science, to each other, and especially to Tyson as a physical site.





Tyson's Invisible Landscape: "Invisible landscape" refers to the notion that every place on Earth has a human history connected to it - the stories, history, and culture tied to the land. In this section, the invisible landscape of Tyson is made visible through a map of community data. Researchers used the app Map Marker to keep track of noteworthy experiences from the field and the locations where they took place. The final result was a map of over 50 pins dropped across Tyson, documenting research teams' day-to-day highs and lows.

Points of Interest: Community members were asked about favorite spots at Tyson, places that held important memories. Fifteen points of interest were then integrated into an interactive slideshow. At each location, a quote box reveals the human connection to the site, while the image itself provides a 360-degree view; viewers can click and drag on their computer screen to virtually immerse themselves across Tyson.





Placemaking Tyson was officially launched in a presentation to the community at the end-of-summer symposium on August 4, 2022. Following the close of the symposium, computers and phones were out, everybody looking at each other's profiles and laughing at pins dropped in the invisible landscape. As the Humans of Tyson webpage explains, the project works doubly - participation in the project gives researchers opportunity to reflect more deeply upon their work in science, while exploration of the resulting gallery enhances the sense of community at Tyson. Explore the webpage at https://tyson.wustl.edu/humans-of-tyson



New student group uplifts underrepresented ecologists

Ecology is a field based in interactions - within members of a population, within and between species, and between organisms and their environments. However, ecology is a discipline shaped by human interactions as well. Long dominated by white, cisheteronormative culture and colonialism, ecology has historically enabled the participation of a privileged few while maintaining barriers to participation for others. As part of our commitment to social justice, Tyson is working to change this landscape through establishment of a new undergraduate student group.

In 2021, ESA SEEDS STL emerged as a way to dismantle such barriers. The Ecological Society of America's SEEDS [Strategies for Ecology Education, Diversity and Sustainability] program operates through a network of regional chapters to engage BIPOC, LGBTQIA+, and other underrepresented students with hands-on experiences in ecology and environmental sciences. In January 2021, Tyson Education, Outreach, and DEAI Coordinator Susan Flowers proposed to Harris-Stowe State University and SEEDS National the creation of a St. Louis-based chapter. With their agreement and buy-in, Susan then nominated former Tyson Undergraduate Fellows Kayla Wallace and Lawton Blanchard to attend the 2021 SEEDS Virtual Leadership Meeting Workshop Series through April and May. In early August, Kayla and Lawton began mapping out their vision for ESA SEEDS STL, Susan and Dr. Rachel Penczykowski joining in as chapter sponsors. That same month, Kayla and Lawton were ready to invite students to be a part of the new group.



"Ecology is not a very diverse field. We want to support students from marginalized backgrounds in their undergraduate career, provide them the resources, training, and experiences they need to feel welcome in the field."

- Lawton Blanchard

ESA SEEDS STL reached several significant milestones in its first year. The chapter was officially recognized by SEEDS National and incorporated into the country's expansive network. SEEDS STL also achieved status as a WashU student group, though it by no means intends to confine itself to the Danforth campus.

"It's SEEDS St. Louis, not SEEDS WashU," says co-founder Lawton Blanchard. "We are trying to branch out so that every St. Louis school with students interested in ecology can get involved."

Kayla and Lawton tabled alongside other environmental groups at WashU's fall and spring activities fairs, engaging with an estimated 300 students. Semester events included educational and social gatherings, such as film screenings, discussions, and a hike in collaboration with the WashU Outing Club, as well as professional development and networking opportunities. A Summer Opportunities in Ecology Workshop, for example, allowed students to talk closely with four panelists about resumes, applications, and upcoming projects of interest. A spring Meet and Greet brought together students, faculty, and staff from local universities (WashU, Saint Louis University, University of Missouri-St. Louis, Southern Illinois University Edwardsville, and Harris-Stowe State University) and organizations (Saint Louis Zoo, Missouri Botanical Garden, Tyson Research Center) for a first step in inter-community connections.



Appendix A: Courses, events, and outreach

COURSES HELD AT TYSON

All courses include an introductory lecture presented by Tyson staff

Biology 4193: Experimental Ecology Laboratory Andrés López-Sepulcre - Spring 2022

Biological and Physical Sciences for PBPM 4811: Advanced Wilderness Medicine *Stan Braude - Fall 2021, Spring 2022*

Environmental Studies 121: A Sense of Place: Disovering Missouri's Natural Heritage Stan Braude - Fall 2021

Environmental Studies 215: Introduction to Environmental Humanities *Suzanne Loui - Fall 2021*

Environmental Studies 364: Field Methods for Environmental Science Douglas Ladd - Fall 2021

Environmental Studies 365: Applied Conservation Biology *Douglas Ladd - Spring 2022*

OUTREACH EVENTS

We share what we do with the broader St. Louis community

First Annual Tyson Bonfire (November 2021)

LLC tour with student engineers (May 2022)

Tyson tour for Ecology, Evolution, and Population Biology students (March 2022)

Tyson tour for Eureka High School research class (March 2022)

Tyson tour for Patty Heyda (September 2021)

US State Department Climate Change Fellows visit (August 2022)

EVENTS HELD AT TYSON

We provide retreat space for a variety of WashU groups and our Living Learning Center continues to be of interest to architects

American Institue of Architects

LLC Architecture Tour - March 2022

Hellmuth + Bicknese Architects
LLC Architecture Tour - November 2021, December 2021, August 2022

Mackey Mitchell Architects
LLC Architecture Tour - February 2022

WashU Emergency Management Retreat - December 2021

WashU Office of Sustainability Retreat - May 2022

WashU University Libraries Retreat - June 2022

Appendix B: Professional presentations and service



PROFESSIONAL PRESENTATIONS

Tyson staff regularly share their expertise as invited speakers and at conferences

Applied Conservation Biology class lecture Beth Biro, Kim Medley, Solny Adalsteinsson

Anthropogenetically driven environmental changes alter host-parasite dynamics between a mosquito and its obligate parasite

Katie Westby - Entomological Society of America Annual Meeting

Research and conservation at Tyson Research Center and the greater St. Louis region: an overview of experimental tick-borne disease research, data networks, and monitoring programs for mammals, birds, and amphibians

Solny Adalsteinsson - Illinois Natural History Survey Seminar

Exploring environmental biology as a career path
Susan Flowers - Missouri Environmental Education Association Annual Conference

Field Methods for Environmental Science class lecture Beth Biro, Kim Medley, Solny Adalsteinsson

Tick-borne Diseases in Missouri Roundtable Solny Adalsteinsson - MOST Policy Initiative Panel

The effects of prescribed fire on tick-borne disease risk Solny Adalsteinsson - Murray State University

Mosquitoes in the anthropocene: Studying the impacts of human-induced environmental changes on mosquito ecology and evolution Katie Westby - Ohio State University

One Health: Linking the Health of Humans, Animals, and the Environment class lecture *Solny Adalsteinsson*

Diversity, Equity, Accessibility, and Inclusion in Undergraduate Field Learning
Susan Flowers - UFERN Informal Water Cooler Chat

Invited panelist for external partner perspective on integrated mission delivery Susan Flowers - US Forest Service Regional Meeting

The Climate Change Refugia Project at Tyson Research Center Kim Medley - Webster Groves Nature Study Society

SERVICE

Tyson staff members provide strategic support at WashU and also with colleagues in our broader professional communities

Danforth Campus Arboretum Committee

Ecological Society of America SEEDS STL chapter sponsorship

Ecology technology customer for MEMS 312: Multidisciplinary Design and Prototyping

Endangered Wolf Center DEAI Committee

Missouri Environmental Education Association JEDIA Committee

National Ecological Observatory Network Tick Technical Working Group

Organization of Biological Field Stations IDEA+ Committee

Pre-College Programs Working Group

Student project evaluators for ENST 365: Applied Conservation Biology

Student project evaluators for ENST 364: Field Methods for Environmental Science

Student project evaluators for ENST 405: Sustainability Exchange: Community and University Practicums

Student proposal review for BIOL 2010: Ampersand: The Science of Biotechnology

ThurtenE Carnival and Honorary

Appendix C: 2022 summer seminar series

June 2: David Jenkins - University of Central Florida

One thing leads to another: from zooplankton to global human resource consumption

June 9: Nick Speed - Ujima

Justice and Healing through Urban Agriculture

June 16: Erynn Maynard-Bean - SCS Global Services

Shedding light on invasive shrubs in eastern deciduous forests

June 23: Danielle Lee - Southern Illinois University Edwardsville

Evaluating and working along environmental gradients to develop frameworks to understand nuisance rodent ecology

June 30: Brett Scheffers - University of Florida

Using studies across space and time to inform the ecology of climate change

July 7: Owen Sexton Seminar: David Reznick - University of California Riverside

Chapter 3: The Struggle for Existence

July 14: Camille Delavaux - Eidgenössische Technische Hochschule Zürich

Mycorrhizal fungi mediate plant species interactions: consequences for forest structure

July 21: Kaylee Arnold - University of Georgia

Investigating the gut microbial communities of a disease vector across fragmented landscapes

July 28: Desirée L. Narango - University of Massachussetts Amherst

Using plant-animal interactions to inform habitat management and conservation in human-dominated ecosystems

Appendix D: Education program participants



SUMMER 2022: HIGH SCHOOL APPRENTICES AND UNDERGRADUATE FELLOWS BY TEAM

Tick and wildlife ecology (Solny Adalsteinsson, Beth Biro, Erin O'Connell, Tyson; Liz Carlen, WashU LEC)

Althea Bartz Willis, Lindbergh High School '23 Carol Ge, WashU, Biology '24 Logan Lacy, WashU, Environmental Biology '23 Jenny Mann, WashU, Anthropology: Global Health and Environment '25 Karen Schmiedeler*, St. Louis University, Environmental Science '25

Pawpaw foundation species and forest biodiversity (Anna Wassel, Jonathan Myers, WashU Biology)

Maura Collins*, Washington College, Environmental Science '26 Ari Djemal Rukin, WashU, Biology '26 Nathaniel Doty*, University of Virginia, Environmental Science '25 Peter Irvin, Christian Brothers College High School '23 Samm Kaiser, WashU, Math & Computer Science, Environmental Analysis '23 Nicole Schade, Parkway West High School '23

Education and science communication (Susan Flowers, Tyson)

Lawton Blanchard, WashU, Environmental Biology '22 Colleen McDermott, WashU, Environmental Analysis '24

Plant host-pathogen coevolution (Rachel Penczykowski, WashU Biology)

Annika Fischer, Harris-Stowe State University, Biology '23 Alana Herr, WashU, Biology '24 Hanna Jachna, St. Joseph's Academy '23 Kylee Kest*, WashU, Biology '26 Allison Rea, WashU, Biology - Ecology and Evolution '24 Maddie Rhodes, Rockwood Summit High School '23

Mosquito disease vector ecology (Katie Westby, Kim Medley, Angela Smith, Tyson)

Bryce Moulton, Tulane University '22 Ben Orlinick1, WashU, Biology '23 Danielle Perkins, Marquette High School '23 Laura Tayon*, St. Louis Community College, General Transfer Studies '23 Emma Wiley, St. Clair High School '22

1 Tyson Lennette Fellow

^{*} SIFT and TERA alumni

Appendix E: Education program posters

HIGH SCHOOL AUTHORS

Identifying and analyzing male *Odocoileus virginianus* home range at Tyson Research Center

Althea Bartz Willis, Lindbergh High School '23 Elizabeth Biro, MS, Tyson Research Center, WashU Solny Adalsteinsson, PhD, Tyson Research Center, WashU

Does relative humidity differ within and between land use types?

Maura Collins, Parkway West High School '22 Katie Westby, PhD, Tyson Research Center, WashU Lexie Beckermann, Tyson Research Center, WashU Kim A. Medley, PhD, Tyson Research Center, WashU

Using community science to determine research sites for mature seeds of *Plantago*

Jacob Cummings, Maplewood-Richmond Heights High School '22 Rachel Penczykowski, PhD, Biology Department, WashU

Survival of Plantago lanceolata rosettes at Tyson Research Center PlantPopNet plot between census years

Fyle, Rockwood Summit High School '22 Rachel Penczykowski, PhD, Biology Department, WashU

How has bat diversity changed at Mincke Quarry over the last 30 years?

Kylee Kest, Clayton High School '22 Elizabeth Biro, MS, Tyson Research Center, WashU Solny Adalsteinsson, PhD, Tyson Research Center, WashU

UNDERGRADUATE AUTHORS

Research implications of the relationship between traditional urbanization descriptors and socioeconomic variables

Will Slatin, WashU '23 Elizabeth Biro, MS, Tyson Research Center, WashU Solny Adalsteinsson, PhD, Tyson Research Center, WashU Sacha Heath, PhD, Living Earth Collaborative, WashU

COVID-19 lockdown impacts on raccoons in St. Louis

Angela Yokley, WashU '24 Elizabeth Biro, MS, Tyson Research Center, WashU Solny Adalsteinsson, PhD, Tyson Research Center, WashU Whitney Anthonysamy, PhD, University of Health Sciences and Pharmacy in St. Louis

Hot Topic: Fire and biodiversity in the Missouri Ozarks

Evan Lundstrom, WashU '21 Suzanne Loui, PhD, Environmental Studies, WashU





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