Forest Park Living Lab Activity Report

2024-2025

FOREST PARK
LIVING LAB

Summary

The Forest Park Living Lab (FPLL) is a collaboration among six institutions in the Greater St. Louis region that brings together experts in data science, conservation, movement ecology, ecosystem science, wildlife disease, and urban park management. The overarching goals of the FPLL are to better understand the movement of biodiversity, both hosts and pathogens, in an urban food web, to teach students and the broader public about biodiversity in their local neighborhoods, and to contribute to the management of Forest Park for the coexistence of people and biodiversity. We achieve this by tracking the movement of a diverse suite of reptile, avian, and mammal species; conducting wildlife health assessments; building geospatial models of the urban environment; and analyzing how animal movement and health interact with the urban footprint of the park, city, and beyond. We attempt to inspire and educate the public through nature-based and classroom experiences for young people, undergraduate and graduate training, and information sharing through local media and scientific publications. In this report, we present the key activities and accomplishments for 2024-2025.

We successfully:

- Tracked the movements of 78 individuals from fifteen species
- Completed health assessment of 71 individuals from nine species
- Conducted 15 field trips to the park for local K-12 students, trained 23 undergraduate research assistants, twice implemented a field ecology course for 28 students, and were highlighted in multiple features on the radio and other news media
- Published three scientific papers
- Participated in numerous urban biodiversity and planning working groups

Cover photo: Heather Seaver

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Wildlife Tracking

Since the inception of the project, we have fitted VHF or GPS telemetry tags to 78 individuals from 15 species of birds, mammals and reptiles of which 27 were deployed during this reporting period. All animal capture, handling, and tag deployment procedures are supervised by Saint Louis Zoo Institute for Conservation Medicine veterinarians. All procedures are authorized through a Saint Louis Zoo IACUC, and with all relevant permits at city, state and national levels.

Table 1. Number of individuals tagged by class and species since 2021

Class	Common name	Number Tracked
Birds	Barred owl	1
	Great horned owl	1
	Red-tailed hawk	5
	Red-shouldered hawk	1
	Cooper's hawk	1
	Wild turkey	1
	Mallard duck	3
	Wood duck	2
	Canada goose	3
Reptiles	Snapping turtle	4
	Three-toed box turtle	>40
	Eastern box turtle	2
Mammals	Opossum	2
	Raccoon	12
	Coyote	2

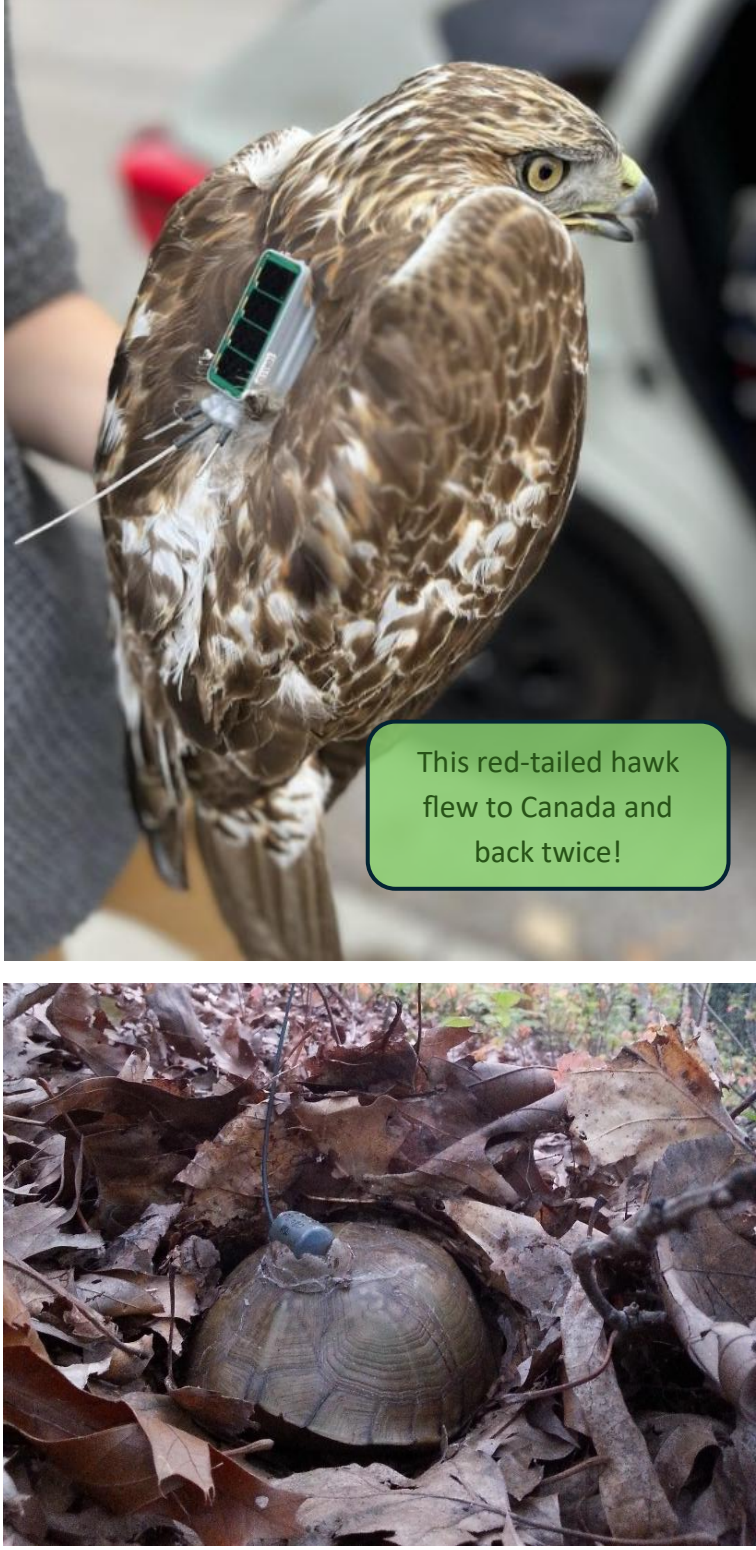


Figure 1. A wide diversity of animals has been tracked

The animal movement database has a total of >103,000 relocations from GPS and >1,400,000 tri-axial accelerometry records. The entire dataset is available to the public at www.movebank.org. The differences in the spatial extent of animal movement within and across species recorded have been remarkable. One red-tailed hawk went on two long-distance annual migrations between St. Louis and Canada (Fig. 2), whereas another operated within a home range of less than two square miles from a nest at the corner of Skinker and Lindell Boulevards (Fig. 2 inset).

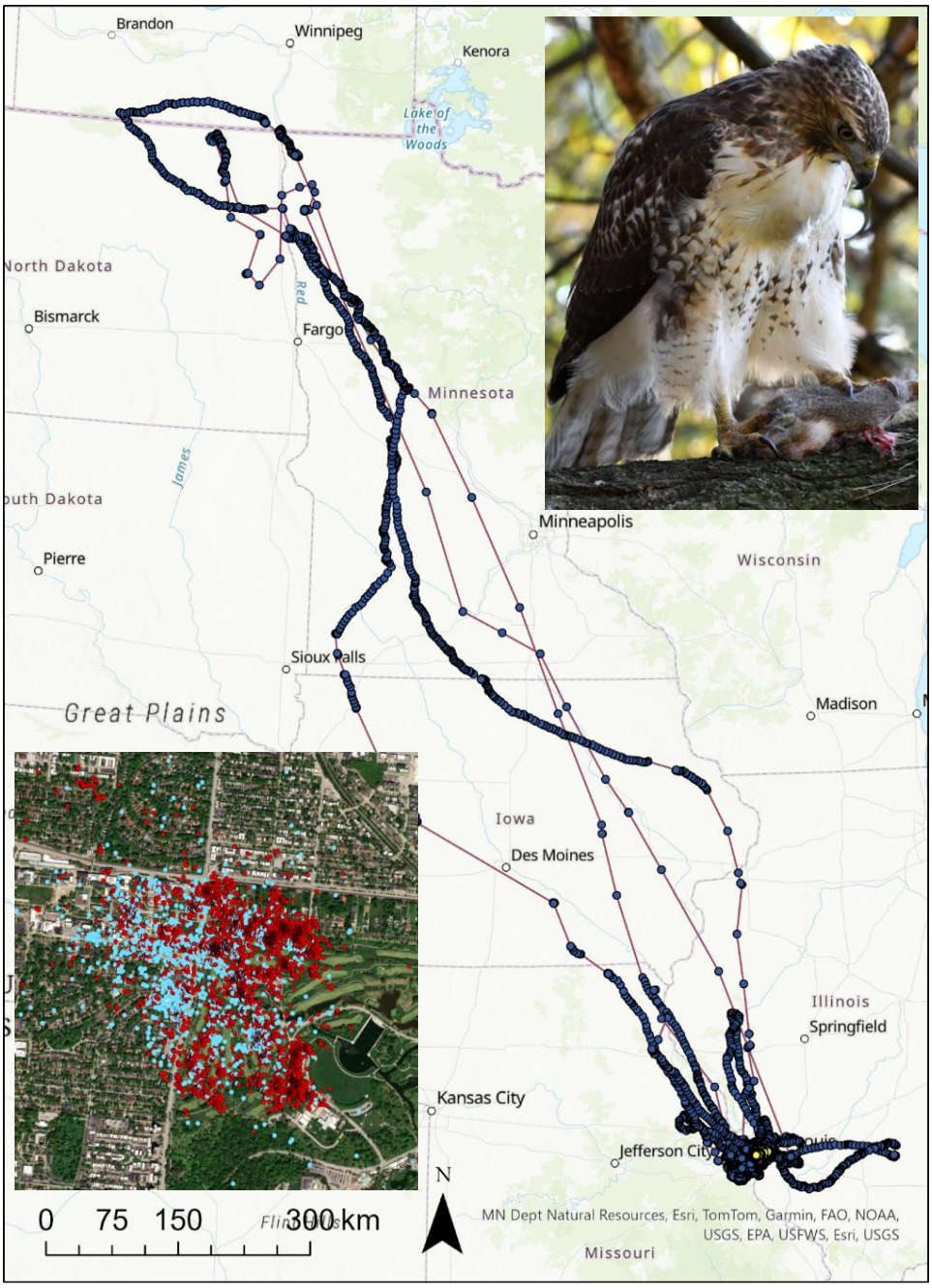


Figure 2. The full extent of the Forest Park Living Lab extends into Canada thanks to Herrmann, a red-tailed hawk, who has now made two successful complete migrations between Saint Louis and Canada. By contrast, a mating pair of red-tails never fly further than 2km from their nesting tree at Skinker and Lindell Boulevards (inset).

Similarly, within Forest Park, there is substantial variation in movement metrics, such as home range size and daily travel distance (Fig. 3 and 4). We have also observed extreme spatial heterogeneity in animal distributions (Fig. 3). These data are currently being used as we develop an analysis to examine spatial relationships among individuals and species, as well as the human footprint, across scales ranging from the park and neighborhood to the continent.

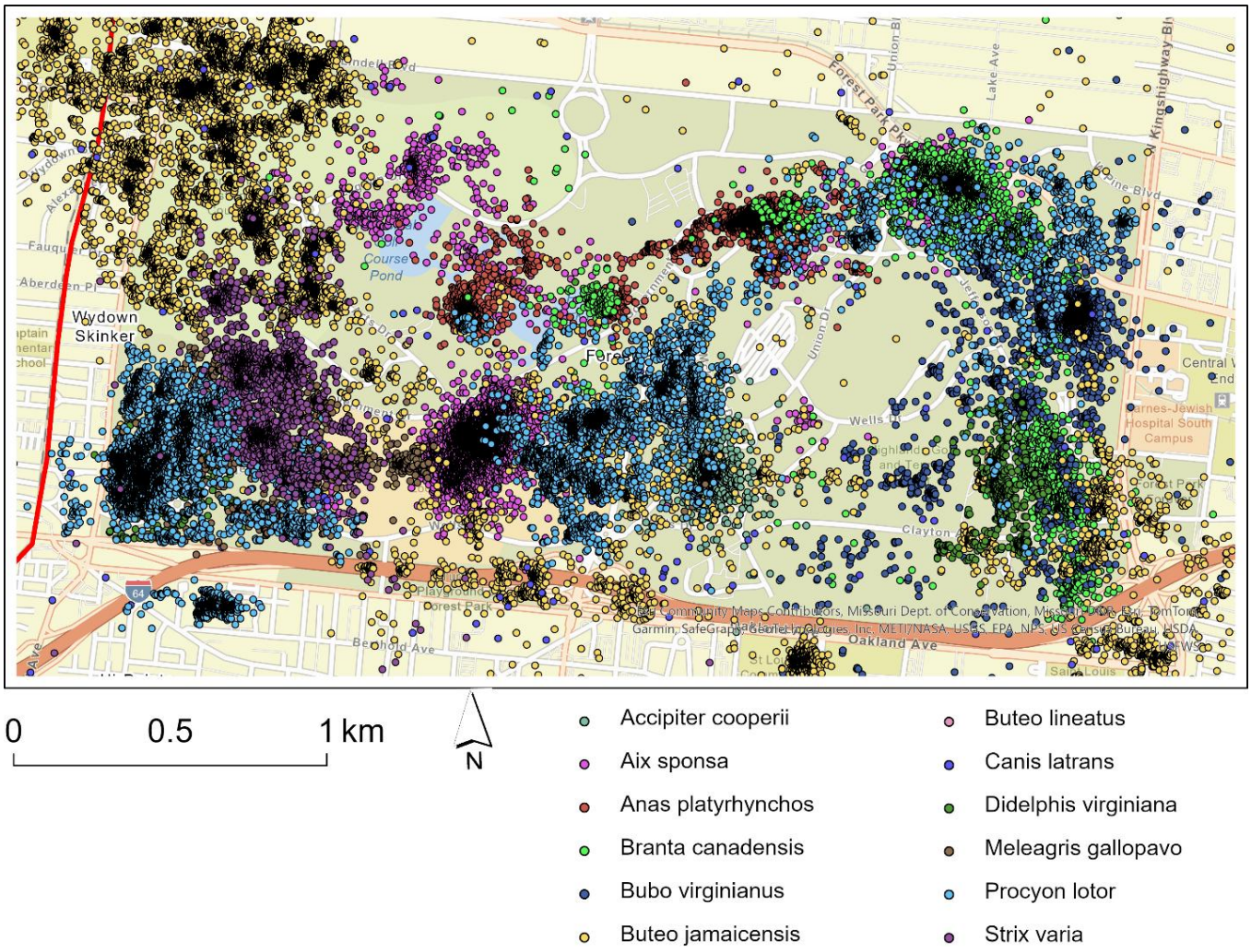


Figure 3. Animal movements in Forest Park (three turtle species not shown for clarity).

Within Forest Park, several general trends on animal space use have emerged:

1. Terrestrial species select most strongly for forest habitats and non-recreational land.
2. All species except for turtles and opossums frequently leave the park. Raccoons use culverts to cross Skinker Boulevard to access Clayton and I-64 to Dogtown.
3. Wildlife of several species has the core of their home ranges near some of the busiest areas peripheral to the park. For example, the Great-horned owl, Astrid, roosts immediately opposite the Barnes Jewish Children's Hospital on Kings Highway Blvd, and she successfully fledged two chicks in spring 2025.

Of great interest is the extent to which more mobile animals, like red-tailed and cooper's hawks, select urban habitats, and which urban configurations support their coexistence.

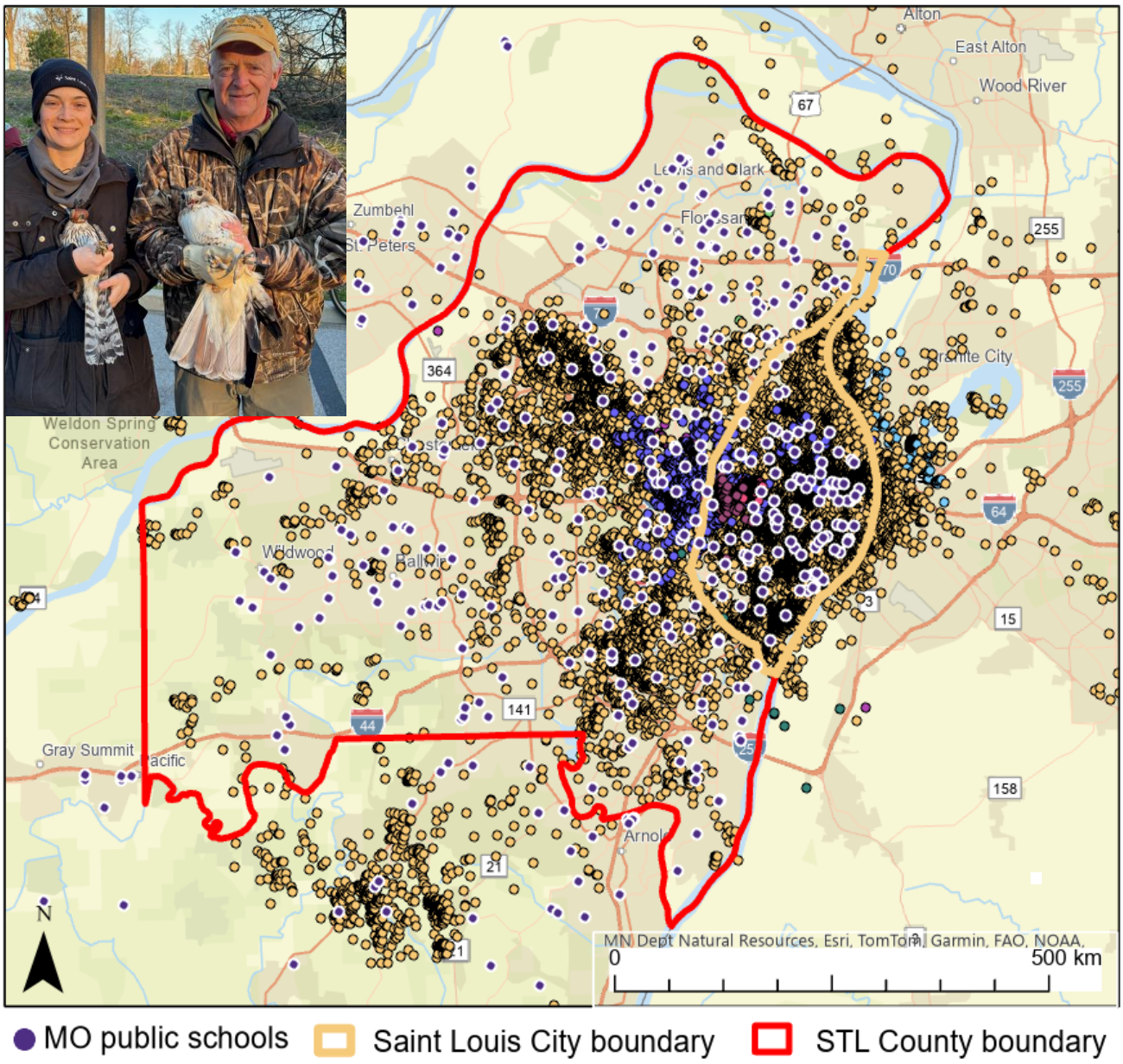


Figure 4. Movements of hawks fitted with GPS tags in Forest Park in Saint Louis County. Many public schools in the county are visited multiple times by one or more of these hawks, creating exceptional opportunities to use them as ambassadors for biodiversity with local young people. Inset: FPLL post-doctoral fellow (left) and FPLL raptor specialist (right) with hawks for GPS tagging and health assessments.

Wildlife Health

In general, urbanization has overwhelmingly negative impacts on biodiversity. However, depending on species characteristics, urban environments can have positive, negative, or mixed effects on their health. Species are often categorized as urban exploiters, urban adaptors, or urban avoiders. Urban exploiters, like raccoons, often thrive in cities compared to rural areas. Urban adaptors, such as red-tailed hawks, utilize urban areas but do not usually prefer them as habitats. Urban avoiders, including large reptiles, tend to decline or disappear as urbanization progresses. Despite this range of species, little is known about how urbanization affects wildlife health. To address this, we are conducting wildlife health studies in St. Louis, focusing on health impacts on wildlife. These studies also provide data important for human health and the health of domestic animals that use the park as wildlife may serve as sentinels of diseases (i.e., pollutants, emerging infectious diseases) and as reservoirs of infectious diseases (i.e., leptospirosis, Chagas, West Nile virus) that may spill over to humans and our domestic animals. We have collected and banked biomaterials that we will perform diagnostic testing on in 2026 (Table 2).

Figure 5. FPLL and Saint Louis Zoo ICM vets, technicians, and post-docs anesthetize, perform physical exams and collect biomaterials from Forest Park wildlife (coyote, opossum, and raccoon pictured).

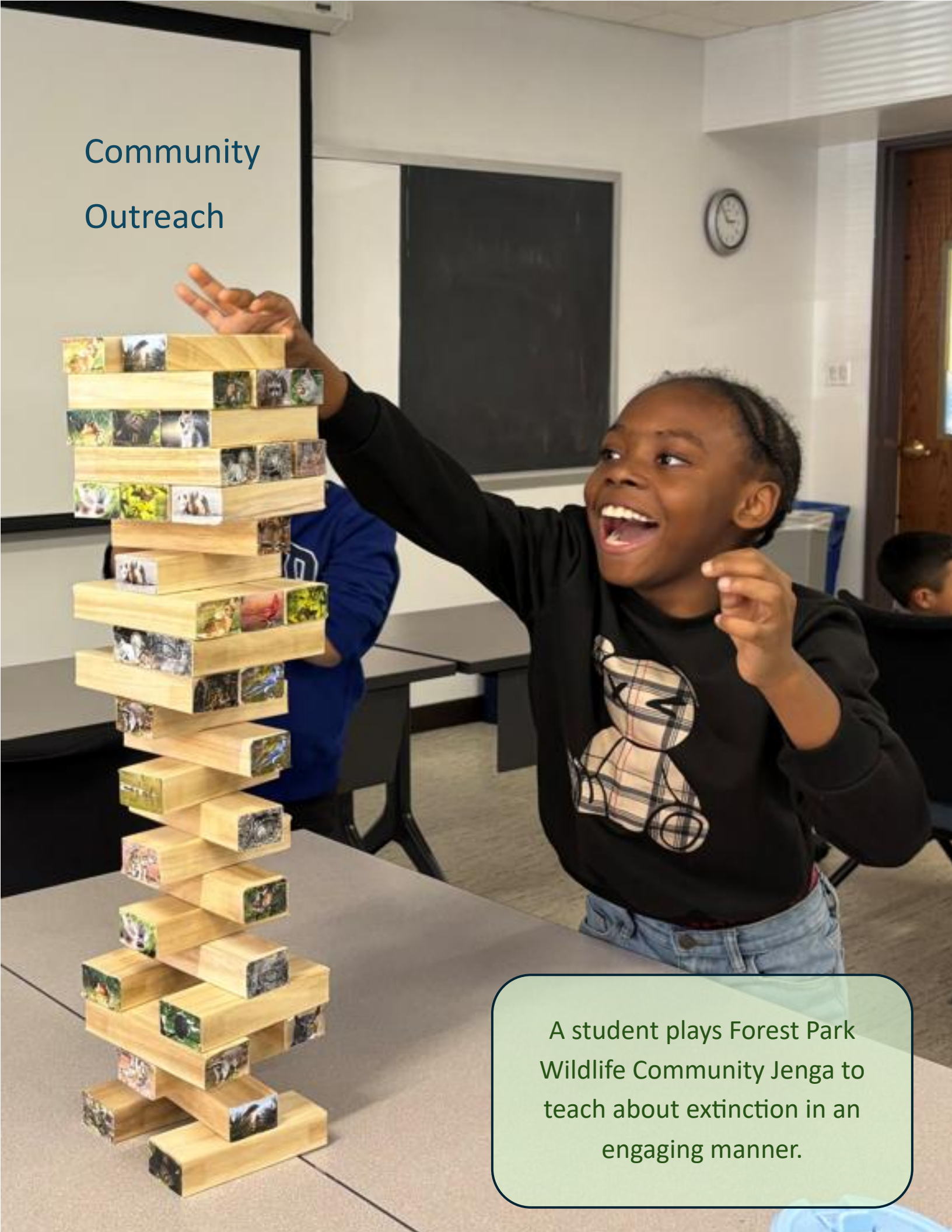
Table 2. Demographic data and health assessments for Forest Park wildlife between 2024 and 2025.

		Raccoon	Opossum	Coyote	Turkey	Mallard	Red-Tailed Hawk	Wood Duck	Cooper's Hawk	Snapping Turtle	Three-toed Box Turtle	Total
Year	**2024**	13	14	2	1	1	2	2	1	1	21	58
	2025	16	8	0	0	0	0	0	0	0	16	40
Age Class	**Adult**	23	22	2	0	1	2	2	0	1	28	81
	Subadult	2	0	0	0	0	0	0	0	0	0	2
	Juvenile	3	1	0	1	0	0	0	1	0	1	7
Sex	**Female**	15	14	1	1	0	0	2	1	0	13	47
	Male	13	8	1	0	1	2	0	0	1	11	37
	Unknown	1	0	0	0	0	0	0	0	0	5	6
Total		**29**	**22**	**2**	**1**	**1**	**2**	**2**	**1**	**1**	**29**	**90**
Collared / Tagged		8	2	2	1	1	1	2	1	0	9	27
Diagnostics	**Physical Exam[1]**	23	18	2	1	1	2	1	1	0	22	71
	Clinical Pathology[2]	24	18	2	1	1	0	1	0	0	24	71
	Disease Survey	0	0	2	0	0	0	0	0	0	24	26
	Rodenticide Test	0	0	2	0	0	0	0	0	0	0	2

[1]At the time of physical exams, we collected biomaterials for further diagnostic testing in 2026.

[2]Hematology is used in conjunction with other tests to evaluate the host response to infectious and non-infectious disease processes, including complete blood counts (CBC) to assess red and white blood cell number and morphology and biochemical analysis to assess organ function.

Community Outreach



A student plays Forest Park Wildlife Community Jenga to teach about extinction in an engaging manner.

K-12 Education and Beyond

- **Zoo Education Programs.** Over the last 2 years, the Zoo education held 21 different programs that highlighted the FPLL in their activity. These included some classroom and some field-based activities.

- **Two master's students** at SLU performed their thesis research with the FPLL. One student has successfully defended their thesis and one will in January 2026.

- **FPLL activity book** developed for children visiting Forest Park. We piloted this activity book at the Children's Hospital during our annual outreach to the hospital. In spring of 2026, these booklets will be available at the Forest Park visitor's center. You can download the booklet from our FPLL website at the bottom of a recent blog post.

Figure 6. Cover and first page of the activity booklet.

- **Fifteen field trips and classroom sessions** implemented for elementary and middle school students through the SLU iSCORE program (Institute for STEM Collaboration, Outreach, Research, and Education).

- **Twelve undergraduate students participated in research projects**: Project themes have included waterbird foraging ecology, soil chemistry and microbial communities across the restoration gradient, distribution surveys of white-tailed deer, owl surveys, and bird habitat quality assessment.

- **Forest Park Living Lab Field Ecology Techniques course** (BIOL4115): This undergraduate course, developed at SLU, is now in its sixth year. To date, 78 students have participated, including students from Harris-Stowe, Washington University, and SLU. Student evaluation reports suggest that the course is among the most popular taught at SLU.

Figure 7. Undergraduate students in the Forest Park Living Lab Field Ecology Techniques course at SLU.

Staff Academic Achievements

- **One Living Earth Collaborative Post-Doctoral** fellow completed a two-year fellowship.
- **A Forest Park Living Lab wildlife veterinary fellow** was hired through the Zoo in September 2025 for a two-year position.
- **Two research grants** were submitted at the end of 2025 to secure funding for health and movement studies in 2026.

Public Events

- Earth Day Festival in Forest Park – FPLL outreach booth (Fig. 8A)
- Green Earth Festival at Missouri Botanical Gardens – FPLL outreach booth (Fig. 8B)
- Annual STEM week open house at Barnes-Jewish Children's Hospital – This is where we debuted the Forest Park activity book (Fig. 8C and 8D)
- American Ornithology Symposium at the Saint Louis Zoo – FPLL outreach booth (Fig. 8E)
- Saint Louis Zoo One Health Fair – FPLL outreach booth (Fig. 8F)

Figure 8. Public outreach events.

News Media

Since 2024, FPLL work has been featured through the following media outlets:

- St. Louis Public Radio
  - Avian Influenza
  - Raccoon movement in Forest Park
- St. Louis Magazine
  - Wildlife Tracking in Forest Park
- STLToday Post-Dispatch
  - Coyote Tracking in Forest Park
  - Wildlife Movement in Forest Park
- KMOX radio and website
  - Coyotes in Forest Park
- WashU The Source and SLU Research Report
  - Coyote Genetics in Forest Park
  - Red-tailed Hawks in Forest Park
- SLU Research Report
  - Fred the Goose
- Saint Louis Zoo Journeys Magazine
  - Urban Biodiversity Conservation
- Saint Louis Zoo website
  - Wildlife Tracking in St. Louis
- FHNtoday (Francis Howell High School News) article and video
  - Conservation in Forest Park

Scientific Communications

Publications

See our photo on the journal cover on the next page!

Journal of Mammalogy, 2025, 00, 1–11
https://doi.org/10.1093/jmammal/gyaf077
Research Article

Research Article

Space use and environmental drivers of Northern Raccoon (*Procyon lotor*) activity in an urban park: evidence for avoidance of road crossings

Stella F. Uiterwaal[*,1,2,3,4,5], Sharon L. Deem[2], Stanton H. Braude[†,1], Anthony I. Dell[3,6], Megan O'Shea[4], Jamie Palmer[2], Sara Parikh[4], August Wise[4,7], Stephen Blake[4,8,9]

Contents lists available at ScienceDirect

Journal of Thermal Biology

journal homepage: www.elsevier.com/locate/jtherbio

Reduced thermoregulatory ability contributes to increased mortality in urban box turtles (*Terrapene* spp.)

Stella F. Uiterwaal [a,b,c,d,*], Jamie L. Palmer [b], Saima Farook [c], Sharon L. Deem [b], Catherine Taylor [c], Stephen Blake [c,e]

Urban Ecosystems
https://doi.org/10.1007/s11252-024-01576-4

A deep dive into the waterbird community of an urban oasis: implications for park management

August Wise[1] · Anya Rosener[1] · Arina Martin[1] · Melissa Cote[1] · Christopher D. Hopwood[1] · Elizabeth Schwartz[1] · Riley Tharp[1] · Stephen Blake[1,2,3,4]

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FPLL staff conference presentations

- Stella F. Uiterwaal, Anthony I. Dell, Sharon L. Deem, Jamie Palmer, Stephen Blake. 2024. Movement ecology of an urban wildlife community: Cross-species movement is linked to spatial variation in community composition. Gordon Research Conferences.
- Stella F. Uiterwaal. 2025. Avian biodiversity across spatiotemporal habitat gradients. The Wildlife Society.
- Jamie Palmer, K. Apakupakul, S. L. Deem. 2025. Ranavirus (Frog Virus 3) identified in Missouri turtle species, with a focus on the Three-toed box turtle. Turtle Survival Annual conference.
- Stephen Blake. Biophilic Cities - Presentation and student poster at the Making Saint Louis the Nature City of the 21st Century Symposium.
- Jamie Palmer, S. Uiterwaal, S. L. Deem and S. Blake. 2024. Poor hibernaculum quality associated with Mortality in Urban Box Turtles (*Terrapene mexicana triunguis*). Turtle Survival Annual Conference.

Student conference/symposium posters

Bowman, J., Goldschmidt, R., Deem, S.L., Meshach, J., Palmer, J., Uiterwaal, S.F., Witt, A., Blake, S. 2025. Diverse movement strategies within an urban wildlife community. Sigma Xi Research Symposium and Saint Louis University Biology Department Undergraduate Research Symposium.

Howard Nguyen, Ava Nierva, Nikky Omole-Ohonsi, Sabita Ghimire, Stephen Blake, Laibin Huang. 2025. Assessing Restoration Effects on Soil Health in Forest Park. Sigma Xi Research Symposium and Saint Louis University Biology Department Undergraduate Research Symposium.

Isabella Camba, Keren Mathew, Zachary Reyes, Stephen Blake. 2025. Student Driven Research and Outreach in Forest Park. Sigma Xi Research Symposium and Saint Louis University Biology Department Undergraduate Research Symposium.

N Dahmen, Fiona Carton, Justin Dobry, Adam Henderson, Elijah Hubler-Marti, Ian Henderson, Sam Anderson, Stephen Blake. 2025. Predation Success of Wading Waterbirds in a Semi-Natural Environment. LEC Biophilic Cities Symposium.

Student conference/symposium presentations

Dennis, S., Uiterwaal, S., Carlen, E., Reyes, Z., Hardy, S., Blake, S. 2025. Rodents in an urban forest: Exploring small mammal ecology and the impact of restoration. Midwest Fish and Wildlife Conference.

Saint Louis Tornado

The tornado of May 16th 2025 was perhaps the greatest ecological disaster to hit Forest Park since its inception. The devastation of Kennedy Forest and the exposed trees of the golf courses and Lindell Boulevard caused enormous habitat loss that will take many decades to repair. The FPLL was set up in part to understand the ecological responses of wildlife to environmental change, be they caused by land use, restoration management, evolving public use of the park, climate, or catastrophic events such as the tornado. Unfortunately, our ability to document the impact of the tornado for wildlife movement ecology is limited because at the time of the tornado we had few animals with GPS tags due to temporary funding limitations. With short-term disaster mitigation and long-term management strategies underway by FPLL, we are committed to generating the funds needed to document the recovery and resilience of urban wildlife as the new generation of trees of Forest Park begin their centuries long commitment to ecological restoration.

Figure 9. Dr. Stephen Blake (co-PI of FPLL) stands with an 82 year old tree lost in the May 16th, 2025 tornado.

Photo of buck in Forest Park by Stephen Blake

Thank you for your interest in the FPLL and all things wild in Forest Park. We invite you to stay up to date on our work by visiting the FPLL website (www.forestparklivinglab.org) and by following us on Instagram (@forestparklivinglab).

FPLL is a collaboration of these partners:

Saint Louis University — Est. 1818

Saint Louis Zoo Institute for Conservation Medicine — Healthy Animals, Healthy People

World Bird Sanctuary

Forest Park Forever

The National Great Rivers Research & Education Center

Washington University in St. Louis