

# ANNUAL**REPORT**





#### ANNUAL REPORT // 2023–2024

# MESSAGE FROM THE CO-DIRECTORS

Launched in 2019, the Wildlife Futures Program is a novel partnership between the Pennsylvania Game Commission (PGC) and the University of Pennsylvania's School of Veterinary Medicine (Penn Vet) aimed at strengthening the resilience of the Commonwealth's 480 species of birds and mammals. By combining PGC's vast experience and resources with Pennsylvania's only veterinary school, this program implements a forward-thinking approach to ensuring that Pennsylvania's wild species thrive for generations to come.

Wildlife Futures personnel, working with two newly hired postdoctoral researchers and ten summer research students, presented over 20 posters and talks at state, regional, and international conferences. Our team also published several peer-reviewed journal articles on applied research projects, with topics including the identification of fecal microbiome markers for chronic wasting disease, the application of metagenomic techniques to search for novel pathogens during a songbird mortality event, and the use of community-sourced data to estimate ruffed grouse populations in Pennsylvania.

Wildlife Futures veterinarians and wildlife health technicians provided crucial field support for a variety of research and surveillance projects. To meet the growing demand for these services, Wildlife Futures hired a seventh technician this past year, based in Harrisburg, to assist with field responses.

With our collaborators at PGC and the Pennsylvania Fish and Boat Commission, we launched the new Integrating Health in the Pennsylvania Wildlife Action Plan, which will identify priority health threats, potential management actions, and key knowledge gaps for over 600 Species of Greatest Conservation Need (SGCN) in Pennsylvania.

We greatly bolstered our outreach activities by assisting with biodiversity surveys in Philadelphia's Kaskey Park, participating in public events such as the Elk Expo, and hosting our first outreach event, All about Barn Owls, at New Bolton Center. Wildlife Futures also provided outreach to a Pennsylvania middle school, where students learned about barn owl conservation, and then assembled ten nest boxes that will be placed in appropriate habitats to support this SGCN.

We extend our deepest gratitude to our team members, partners, and supporters for their unwavering commitment and contributions to our shared mission. Together, we will continue to make strides toward a future where wildlife thrives throughout Pennsylvania and beyond.

JULIE C. ELLIS, MS, PhD AND LISA MURPHY, VMD, DABT

Co-Directors, Wildlife Futures Program

# MISSION

The Wildlife Futures Program is committed to discovering innovative and proactive solutions to a variety of complex wildlife health challenges. We are a collaborative. supportive, and inclusive team that educates the next generation of wildlife professionals and empowers our stakeholders to make educated management decisions.

# PROFESSIONAL SERVICES

The Wildlife Futures Program is a team of highly trained and passionate **WILDLIFE HEALTH PROFESSIONALS**. Enlisting experts from a wide array of backgrounds and disciplines, Wildlife Futures is strongly equipped to respond to wildlife health concerns, conduct groundbreaking research, help inform management decisions, and educate the next generation of wildlife professionals.

#### **1** WILDLIFE HEALTH TECHNICIANS

Stationed in every region in Pennsylvania, our wildlife health technicians are our boots on the ground, responding to wildlife health events across the Commonwealth.

#### 2 VETERINARY SUPPORT

Wildlife Futures' veterinarians offer a wide array of veterinary support to Pennsylvania and beyond. Our veterinarians assist PGC with the safe capture, immobilization, and monitoring of wildlife. They also train field personnel in the proper collection of biological samples, provide diagnostic expertise, offer guidance on wildlife mortality events, and collaborate in establishing protocols and best practices to safeguard wildlife health.

# **3** WILDLIFE PATHOLOGY SERVICE

Since its inception in August 2022, the Wildlife Pathology Service has examined over 600 wildlife mortality cases, giving expert insights into the causes of wildlife death in the Commonwealth and beyond.

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Wildlife Futures and New Bolton Center's Pennsylvania Animal Diagnostic Laboratory System (PADLS) perform critical diagnostic testing for wildlife disease, including chronic wasting disease, highly pathogenic avian influenza, rabbit hemorrhagic disease virus-2, canine distemper virus, SARS-CoV-2, epizootic hemorrhagic disease virus, and more.

# 5 EXPERTISE

Employing a diverse team of veterinarians, wildlife health researchers, ecologists, and technicians, Wildlife Futures is well suited to offer expertise on a variety of wildlife health issues. Our scientists are members of multiple wildlife health boards, including the USDA's National Wildlife Services Advisory Committee, the Pennsylvania Governor's Invasive Species Council, the Regional Partnership for One Health, and the Chronic Wasting Disease Research Consortium, among others.

# SURVEILLANCE & DIAGNOSTICS

To provide comprehensive **SURVEILLANCE AND DIAGNOSTICS**, the Wildlife Futures Program relies on a suite of trained technicians, state-of-the-art laboratory equipment, and broad research expertise to analyze samples, review data, and accurately report results. Our findings inform the strategic allocation of resources for priority wildlife health issues.

## CHRONIC WASTING DISEASE

Chronic wasting disease (CWD) is a contagious, alwaysfatal disorder that has been affecting Pennsylvania's wild deer population since 2012. Wildlife Futures continues to conduct and improve critical CWD testing for the state, utilizing the "gold standard" process of enzymelinked immunosorbent assay (ELISA) as the initial test, and confirmatory testing via immunohistochemistry (IHC).

This fiscal year, Wildlife Futures performed **8,160 ELISA tests** and **2,969 IHC tests** for Pennsylvania and surrounding states. Most of these tests were processed in the span of a few months, during hunting season. Turnaround times for individual tests continue to be excellent, with an average of only four to five days from receipt of a sample in the lab to reporting preliminary results.





## SHARED WILDLIFE HEALTH INFORMATION SYSTEM

The Shared Wildlife Health Information System (SWHIS) is an online database designed to facilitate the management, analysis, and reporting of wildlife health data. Since the launch of the SWHIS, state agencies have been onboarded from Texas, Delaware, Maine, New Jersey, Washington, North Carolina, Arkansas, Colorado, and Nebraska. Vermont, Virginia, Pennsylvania, Oregon, and Idaho are currently testing the system.

This year, the SWHIS project team continued outreach activities, including directly engaging state wildlife agencies across the United States and attending regional conferences to increase SWHIS awareness. The SWHIS team has made progress on several new enhancements to the system in response to user feedback and agency priorities. These include the development of a bulk import tool to facilitate the entry of historical data, and a feature service allowing for geospatial data entered in the SWHIS to be consumed by ArcGIS, enabling agencies to create additional visualizations.

## WILDLIFE PATHOLOGY SERVICE

With a dedicated wildlife pathologist on the team, Wildlife Futures provides in-depth analyses and diagnostics for submitted wildlife cases, giving agencies key insights into the health concerns of the region's wildlife.

Notable cases examined in the Wildlife Pathology Service this year include rain rot in deer, brainworm in elk, mange in porcupines, lymphoproliferative disease in wild turkeys, canine distemper in gray foxes and fisher, barbiturate toxicosis in bald eagles, and West Nile virus– associated mortality in a Cooper's hawk, among many others.



▲ Wildlife Pathologist Kevin Niedringhaus (right), assisted by two vet students, performs a necropsy on a deceased peregrine falcon to determine the cause of mortality.

## WILDLIFE HEALTH TECHNICIANS

Working in the field, our wildlife health technicians (WHTs) are integral to our wildlife health surveillance efforts. They respond to wildlife health concerns across the Commonwealth, gather samples for CWD and other diagnostic testing, and contribute to a repository of samples for future research in our biobank. This team of field experts has been instrumental in investigating causes of wildlife mortality and collecting samples for multiple research projects conducted by Wildlife Futures and its partners.

## STATEWIDE SURVEILLANCE

Comprehensive surveillance begins with boots on the ground. With seven WHTs now working out of every region in Pennsylvania, Wildlife Futures has a finger on the pulse of wildlife health across the Commonwealth. Below is a graphic representing the number of wildlife sampled and investigated from July 2023 to June 2024.



\*The southwest WHT was on paternity leave in April 2024

\*\*The northcentral WHT position was vacant during July–September 2023 and June 2024

\*\*\*The Greater Harrisburg area WHT position did not begin until November 2023.



The Wildlife Futures Program conducts **RESEARCH** to improve diagnostic capacities, understand disease effects on wildlife populations, and guide disease management efforts. Our team leverages innovative approaches and collaboration with expertise across the University of Pennsylvania and beyond to take a proactive approach to wildlife health threats.

### WHITE-TAILED DEER Chronic Wasting Disease

#### **Collaring Study**

The deer collaring study wrapped up its second field capture season in early April 2024. The study, done in collaboration with the Pennsylvania Game Commission (PGC) and the USGS Cooperative Fish and Wildlife Research Unit at Penn State University, aims to inform models of chronic wasting disease (CWD) spread and better understand CWD-associated deer mortality in Pennsylvania. This year, the field teams captured, sampled, and collared over 95 deer in Fulton and Bedford Counties, which are in Disease Management Area 2. Samples taken from the study deer are also being used for additional research projects.

#### Real-Time Quaking-Induced Conversion

Real-time quaking-induced conversion (RT-QuIC) is a diagnostic tool that can detect CWD in a wide variety of sample types beyond the cervid lymph nodes and obex routinely used for CWD testing. The goal of this work is to identify sample types that are easy to collect, can be obtained from live animals, and can be pooled to facilitate rapid testing of larger numbers of animals. Wildlife Futures is optimizing the ability to detect CWD using RT-QuIC on ear punches, third eyelids, and feces. This novel testing approach will facilitate increased CWD surveillance and monitoring in the Commonwealth and surrounding regions.

#### Microbiome

In collaboration with Wildlife Futures, Penn Vet Professor of Microbiology Dr. Anna Kashina recently published work on the effects of CWD on the gut microbiome of infected whitetailed deer. The study analyzed fecal samples from 100 deer across the United States; 50 were known to be positive for CWD, and 50 were negative. The analysis showed evidence that CWD alters the gut microbiome and indicates that there may be specific "biomarkers" present in the fecal matter of CWD-infected deer. These findings support the



▲ Casey Maynard, sample resource manager, prepares deer fecal samples for the microbiome study; a study on the effects of chronic wasting disease on the gut microbiome of infected white-tailed deer.

potential use of deer feces as a noninvasive CWD detection method, adding to our disease surveillance and management toolkit.

#### **Volatile Organic Compounds**

Feces are readily found on landscapes inhabited by cervids and are an ideal, noninvasive surveillance sample in areas of concern for CWD. In conjunction with the John Laboratory at the Children's Hospital of Philadelphia, Wildlife Futures is working to characterize the volatile organic compound (VOC) composition of fecal samples from wild and farm-raised deer and to evaluate the capability of VOCs to discriminate CWD-positive from CWD-negative samples.

#### **Metagenomics**

Management of diseases of whitetailed deer has become increasingly important. Wildlife Futures is part of a national effort to build a novel surveillance framework for emerging infectious diseases in deer, where we are developing a metagenomics approach to characterizing known and novel viruses.

Wildlife Futures is part of a large research team led by the USDA National Wildlife Research Center that includes top experts from ten other universities. The project aims to characterize viral communities in deer respiratory tracts across ten states and in various landscapes, using metagenomics to shed light on previously unknown, potentially infectious viral pathogens. The findings will assist wildlife agencies in making informed decisions about targeted disease surveillance and management.

#### CONSERVATION K9s CWD Detection

#### **USDA Study**

Wildlife Futures' conservation K9s are participating in a USDA study with the Penn Vet Working Dog Center to determine the traits of the best biodetection dogs. This study is occurring in two parts: the first is a validated survey of detection dog handlers; the second is testing of the dogs' ability to discriminate CWDpositive from CWD-negative deer feces in both a controlled laboratory setting and in the field.



▲ Robyn Strong, conservation K9 handler, rewards their K9, Victoria, after a successful field scent detection alert.

#### **Detection Rates Studies**

Additionally, the conservation K9 teams are currently running two studies looking at the dogs' detection rates. The first is examining how weather affects the dogs' ability to detect CWD, and the second is looking at how terrain affects their detection capability.

#### **Additional Species**

Allegheny Woodrat Detection Two of the conservation K9s are currently being trained to detect Allegheny woodrat feces to assist with PGC surveillance efforts.

## WILD TURKEYS

Wildlife Futures has partnered with PGC and Penn State University on the Wild Turkey Project, a fiveyear health study of wild turkey populations in Pennsylvania. This project involves the live capture of turkeys, obtaining biological samples for testing, and tagging the birds with radio transmitters to record their movements, habitat use, nest success, and survival rates. Wildlife Futures is leading the effort to determine the effects of pathogens on turkey populations.

Spring 2024 marked year three of field captures, sampling, and molecular work. We have completed the first three years of viral testing and collated the preliminary results. An additional year of sampling and incorporation of demographic data will allow us to robustly determine the burdens of two viruses (reticuloendotheliosis virus and lymphoproliferative disease virus) across varying landscapes and link these to individual and populationlevel outcomes.

#### **MESOCARNIVORES**

Anticoagulant rodenticide (AR) exposure from prey can cause illness and death in wild carnivores. However, few studies have quantified AR exposure in carnivores of the Northeastern United States or evaluated associations with specific habitat types. Wildlife Futures collaborated with PGC and the PADLS New Bolton Center Toxicology Laboratory to test for AR exposure in three mesocarnivores (river otters, bobcats, and fisher) in Pennsylvania. Results revealed that



▲ Wildlife Futures' study on anticoagulant rodenticide (AR) exposure in mesocarnivores was the first to document AR exposure in North American river otters.

# RESEARCH

exposure was relatively common and that the highest rates occurred in areas with higher levels of human development and agriculture, areas where rodenticides are most likely to be used and result in contact with wildlife species. Our study, published in two scientific journals—*Canadian Journal of Zoology* and *Frontiers in Ecology and Evolution*—was the first to document AR exposure in North American river otters.

#### **BARN OWLS**

Barn owls are a Species of Greatest Conservation Need, having faced a 53% population decline in recent years. Wildlife Futures is conducting a multiyear study to investigate the effects of pesticides on the Pennsylvania barn owl population. Preliminary results from year one yielded useful data about dietary exposures of nestlings to anticoagulant rodenticides. Moving into year two we are further refining our sampling strategies and developing analytical methods for additional chemicals of concern, including neonicotinoids.

#### **BEARS**

To safely monitor the health of the Pennsylvania bear population, hundreds of black bears are anesthetized by PGC staff every year. Wildlife Futures initiated a study to determine if a new combination of anesthetic drugs would benefit PGC in its bear-handling activities. The safety and efficacy of the new combination will be assessed during late spring and summer bear captures when ear tags and tracking collars are being placed.

## BIRD POPULATIONS West Nile Virus

West Nile virus (WNV) has driven declines in many avian populations since arriving in the United States, but its more recent impacts are less well-understood. Bird responses to WNV in the United States have not been assessed from a multispecies perspective in over 15 years, and a more thorough understanding of its persistent effects from a landscape perspective is needed to improve future health outcomes for wildlife and humans.

Wildlife Futures is using 20 years of data from state mosquito surveillance and North American Breeding Bird Survey programs to assess the relationship between West Nile virus occurrence and avian population trends on the Pennsylvania landscape. We have developed collaborative relationships with quantitative experts at the National Audubon Society and Canadian Wildlife Service, building on their newest methodologies to disentangle local WNV effects from other potential impacts on birds, such as habitat loss.

#### ALL SPECIES Biorepository

Wildlife Futures is working to establish a biorepository that will contribute to research and facilitate interinstitutional collaboration. This year, the biorepository has made significant progress in establishing best practices for sampling, storing, and organizing samples and identifying long-term sample storage solutions. Standard operating procedures have been developed and will soon be piloted with PGC biologists.

#### SPECIES OF GREATEST CONSERVATION NEED Pennsylvania Wildlife Action Plan



The Pennsylvania Wildlife Action Plan (PA-WAP) is a proactive conservation blueprint for over 600 of Pennsylvania's Species of Greatest Conservation Need (SGCN), a list that includes bird, mammal, fish. herptile, and invertebrate species. Threats to wildlife health may directly impact SGCN, with the potential to cause ecosystem-wide disruptions and additional stress on already imperiled wildlife populations. Wildlife Futures will identify and prioritize existing and emerging health threats and management actions through literature searches, semi-structured interviews, and surveys of agency and wildlife health professionals. A summary of this health threat assessment will be included in the 2025–2035 PA-WAP. with the identification of priorities for research, surveillance, and management actions.

# EDUCATION, TRAINING AND OUTREACH

Uniquely positioned within Pennsylvania's only veterinary school, the Wildlife Futures Program provides **EDUCATION**, **TRAINING**, **AND OUTREACH** opportunities for the public and future wildlife researchers, veterinary practitioners, and other stakeholders. Training the next generation of wildlife health professionals is crucial for preserving biodiversity and safeguarding ecosystems against emerging diseases.

#### SUMMER STUDENTS

In summer 2023, ten students worked on research projects with Wildlife Futures team members. The students, who were from Penn Vet, Penn Medicine, Millersville University, and the University of Pittsburgh, were able to gain handson lab and field experience and contribute to impactful research. Their project topics included wild turkey health assessment, real-time quaking-induced conversion (RT-QuIC) assay validation for chronic wasting disease, diversity of gastrointestinal parasites, malaria infection in Pennsylvania deer, tick-borne pathogens in deer, phylogenetic analyses of canine distemper virus in wildlife, and testing bat samples for the causative agent of white-nose syndrome.



Shelby Monnin, V'26, assisting with barn owl banding in the Southcentral region of Pennsylvania. Shelby was one of our ten summer students, and received hands-on wildlife field experience while also conducting research with Wildlife Futures.



▲ Erica Miller, field operations manager and wildlife veterinarian, giving a wildlife-focused lecture to Penn Vet students.

## **VETERINARY CURRICULUM**

Wildlife health is being integrated into the new curriculum for veterinary students at Penn Vet. In the new curriculum, first-year students participate in a lab showcasing proper handling and stabilization of injured wildlife, and secondyear students receive a lecture focusing on wildlife diseases that might have domestic animal or human impacts.

In May 2024, Wildlife Futures hosted three first-year Capstone students interested in wildlife health as a career. The students shadowed our wildlife pathologist and participated in necropsies and diagnostic testing of wildlife cases.

Starting in 2025, Wildlife Futures will offer two elective courses for third- and fourth-year students. These courses will introduce students to veterinary careers in a variety of wildlife health-related areas and provide hands-on opportunities for students to learn about wildlife medicine and disease.

#### STUDENT RESEARCH FUND

Lindsay Dwyer, V'25, was the first recipient of funding from the newly established Wildlife Futures Program Student Research Fund for her project titled, "Wildlife Rehabilitation Centers Avian Admission Trends as a Reflection of the Highly Pathogenic Avian Influenza (HPAI) Landscape." The fund provides financial support for student investigations and projects to advance the knowledge of wildlife disease through surveillance and detection.

## PENNSYLVANIA COLLEGES

In addition to training Penn students, wildlife disease and necropsy technique lectures and labs have been taught by Wildlife Futures personnel at numerous other institutions of higher learning, including Allegheny College, Juniata College, Grove City College, and Penn State DuBois.

#### PENNSYLVANIA GAME COMMISSION STAFF

Wildlife Futures continues to assist the Wildlife Health Division of the Pennsylvania Game Commission (PGC) in the training and continuing education of wardens, biologists, interns, and other staff. Wildlife health topics covered this year included field necropsy techniques, black bear immobilization, wild turkey sampling protocols, and more.

Three wildlife health video modules were developed for PGC wildlife professionals, covering diseases of deer and personal protective equipment. These videos were provided to the PGC Bureau of Wildlife Protection for ongoing training of cadets, deputies, and wardens.

## NATIONAL DEER ASSOCIATION

In collaboration with the National Deer Association, three podcasts and three videos were produced to promote wildlife health and provide research updates to a broad audience. The podcasts covered conservation K9s, RT-QuIC research, and a day in the life of a wildlife health technician. The videos showed the chronic wasting disease testing process, addressed frequently asked questions about our conservation K9s, and took viewers on the road with one of our wildlife health technicians.

## COMMUNITY AND SCHOOL EVENTS

Wildlife Futures participated in multiple educational outreach activities for the public this year, including the Pennsylvania Trappers Association's Rendezvous, the Elk Expo, and the PA Farm Show. Wildlife health technicians provided wildlife education to their regions through disease presentations, speaking with students at career days, and assisting with wildlife health lessons at the Wildlife Leadership Academy.

Wildlife Futures assisted with Penn Vet's Fall and Spring BioBlitzes, two-hour wildlife surveys in Philadelphia's James G. Kaskey Memorial Park and BioPond. Using fishing nets and waders, the team engaged with students, community members, and park stewards to share expertise and knowledge about the park and pond ecosystems.

In April 2024, Wildlife Futures hosted "All about Barn Owls," an event that educated 50 attendees on the importance of barn owls, their declining populations, and our research investigating exposure of this species to anticoagulant rodenticides. Presentations were followed by a hands-on pellet dissection lab. Event partners included Millersville University, the Delaware Nature Society, and ZooAmerica.

In June, Wildlife Futures gave a barn owl biology and conservation presentation at Wallenpaupack Area Middle School. The students constructed ten barn owl nest boxes that were donated to the PGC for use throughout the state.



▲ Left: Ten barn owl nest boxes, constructed by students at Wallenpaupack Area Middle School, were delivered to PGC's Northeast Regional Office so they may be placed in suitable habitats across the state. **Right:** Cara Brennan, wildlife accessioning technician, holds a crayfish captured during the Spring 2024 BioBlitz.

# 2023–2024 PUBLICATIONS

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▲ Lane Potts, wildlife health technician for the Northwest region, assists the Pennsylvania Game Commission with piping plover chick capture, banding, and sampling. The piping plover is an extremely rare and imperiled species in North America, with Pennsylvania's breeding population on Lake Erie being the smallest of the three recognized populations.

#### Wildlife Futures Program

- University of Pennsylvania School of Veterinary Medicine
- Pennsylvania Game Commission

## **NEW STAFF**



#### **Madeline Vile**

Madeline Vile, wildlife prosector, holds a B.S. in wildlife management with special interests in ornithology, evolution, and comparative anatomy; she is pursuing an M.S. in biology with a focus on ornithology. She brings a unique skill set to Wildlife Futures, having worked and volunteered in multiple facets of wildlife conservation and spent over a year honing her dissection skills as prosector for Penn Vet's Large Animal Pathology service. At Wildlife Futures, she assists with necropsy of wild animals and manages diagnostic samples, while also brainstorming methods to improve and grow the Wildlife Pathology Service.



#### Emma Kring

Emma Kring, wildlife health technician, brings her extensive background in both field and laboratory settings for wildlife disease research and surveillance. She also has experience in conservation outreach and wildlife capture methods. Working closely with the Pennsylvania Game Commission, she responds to reports of sick wildlife and conducts wildlife disease surveillance in the Southcentral region of Pennsylvania.

