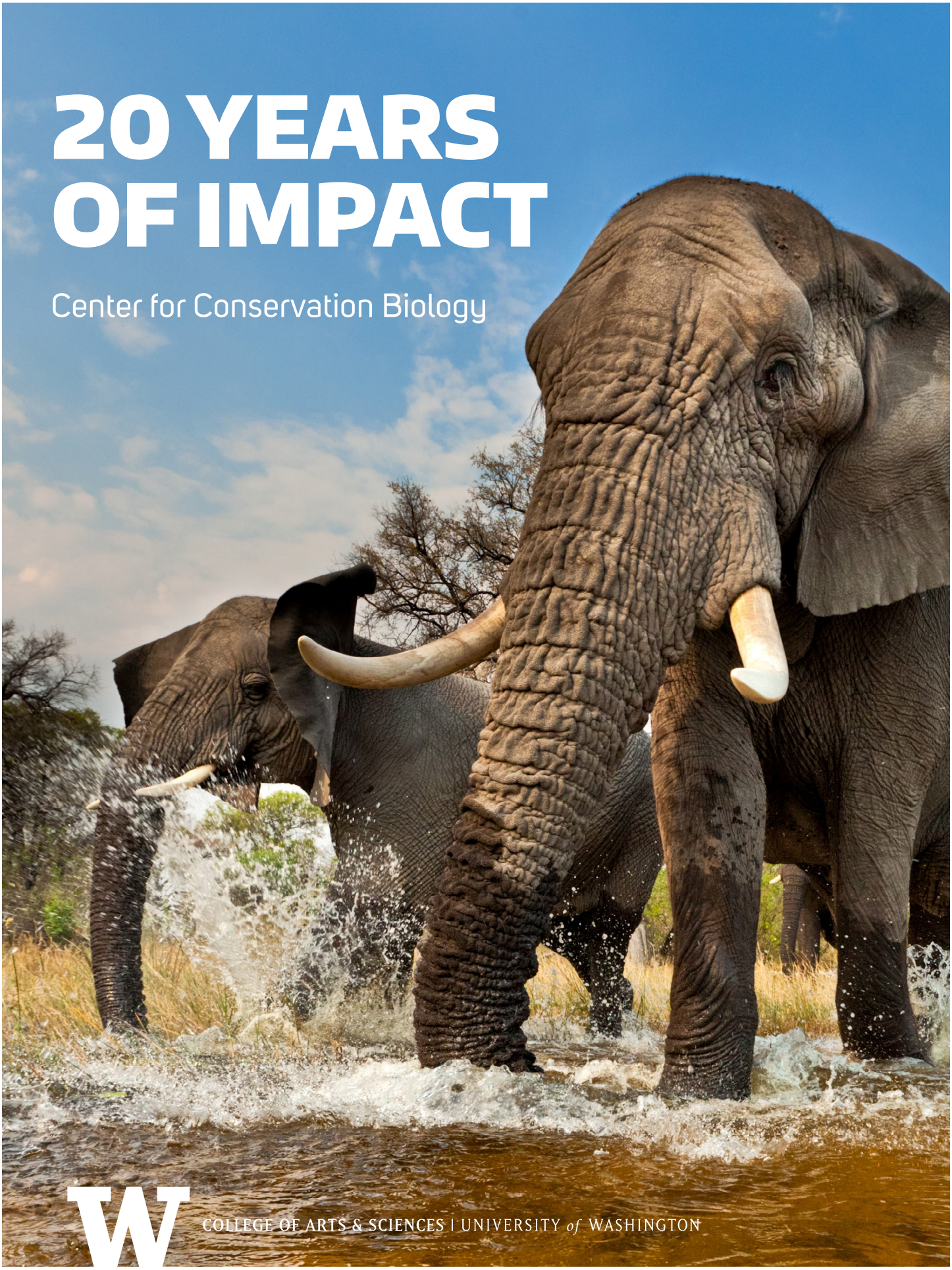
20 YEARS OF IMPACT

Center for Conservation Biology



COLLEGE OF ARTS & SCIENCES | UNIVERSITY of WASHINGTON

MAKING A DIFFERENCE

Since its founding in 2001, the Center for Conservation Biology has stayed true to one mission: developing and applying noninvasive field, lab and analytical methods to address conservation challenges around the world. The Center's wildlife monitoring research helps identify causes of population decline in different species and what mitigation approaches may be most effective. In addition, our team combats illegal species trade through wildlife forensics that pinpoint poaching hotspots and help authorities direct law enforcement efforts.

Under the leadership of Sam Wasser, the Center is a driving force for positive change in a number of research areas. But he'll be the first to tell you that he hasn't done it alone. "Our fantastic staff is one of the reasons our program is so successful," he says. "We are eager to collaborate with other people who bring special expertise. We also rely on incredible undergraduate and graduate students to help make this research possible."

Thanks to collaborations with government agencies, policy makers, colleagues, and committed funding partners, Wasser has taken on a much greater range of challenges than he imagined when he first founded the Center. Donor contributions play a critical role, particularly in terms of the degree to which Wasser and his team can put their research into action. For example, one of the Center's most important projects—combating the illegal ivory trade in Africa—simply can't succeed without donor support.

"Whenever there is a large seizure of ivory, it costs thousands of dollars to analyze it. Even though we have good partnerships with governments and law enforcement, those groups don't pay for those costs. In order to get timely access to the ivory, we have to cover those costs up front. Having those resources in hand allows us to move quickly and gather the data we need."

From wolves to whales, from elephants to pangolins, the story of the Center's first two decades includes many species and many corners of the globe. The milestones and accomplishments aren't for show. This is a story about making a difference—and not being afraid to embrace a bold vision for the future.

> "Over the years, we have tried to chase the issues where we feel we can have the biggest impact. The tools we've developed are already being used all over the world. "
>
> — Sam Wasser

Researchers Sam Wasser, Deborah Giles, and Sadie Youngstrom show whale scat samples located with the help of detection dog Eba. / Fred Felleman

TEAM EFFORT

The Center for Conservation Biology relies on support from our funding organizations and external partners.

PRIVATE FOUNDATION SUPPORT

- Animal Welfare Institute
- Arthur L. & Elaine V. Johnson Foundation
- Craig and Susan McCaw Foundation
- Dawkins Charitable Trust
- Gordon and Betty Moore Foundation
- International Fund for Animal Welfare
- Leonard X. Bosack and Bette M. Kruger Foundation
- Maritz Family Foundation
- Mohamed bin Zayed Species Conservation Fund
- Morris Animal Foundation
- Paul G. Allen Family Foundation
- Rose Foundation
- Wallis Foundation
- Whale & Dolphin Conservation
- Wildcat Foundation
- Wildlife Conservation Network
- Woodtiger Fund
- World Wildlife Fund

EXTERNAL PARTNERS

- California Department of Fish and Wildlife
- City of Seattle
- Environmental Protection Agency
- Intelligence Advanced Research Projects
- International Consortium on Combating Wildlife Crime
- INTERPOL
- Kenya Wildlife Service
- Lusaka Agreement Task Force
- National Oceanic and Atmospheric Administration
- National Park Service
- National Science Foundation
- Singapore Center for Wildlife Forensics
- United Nations Development Program
- United Nations Office on Drugs and Crime
- U.S. Agency for International Development
- U.S. Bureau of Land Management
- U.S. Department of Homeland Security, Homeland Security Investigations
- U.S. Fish and Wildlife Service
- U.S. Forest Service Dept of Agriculture
- U.S. Geological Survey
- U.S. State Department
- Washington State
- World Bank

Gwen Ellis

BUILDING CONFIDENCE IN THE LAB

Near the end of her freshman year at the University of Washington, Gwen Ellis ’21 was walking around campus when she noticed a poster for the Center for Conservation Biology. She was immediately hooked.

“I thought, wow, that’s such cool research they’re doing,” she recalls. “I had to contact them to see if they were still looking for undergraduates to join their team. Unfortunately, they had already filled the spots, but I was determined to stay in touch.”

Her chance arrived a year later. Ellis joined the Center as a sophomore, and Wasser became her mentor. “Building those relationships with the faculty and staff helped me understand what it means to be a scientist and researcher,” she says. Empowered by the Center’s supportive culture, she embarked on a multi-year project using molecular techniques to discern the American black bear’s diet in the state of Washington.

“Knowing the full composition of the American black bear’s diet will inform us on what they are eating and when, either in the form of prey or vegetation,” she explains. “This information can be used to inform environmental management and wildlife conservation guidelines in Washington.”

Looking back, it was exactly this kind of opportunity for hands-on research that led Ellis, an East Coast native, to choose the University of Washington. “It was clear how much this university values research experiences for undergraduates,” she says. “Those experiences made me a better student because I was able to think about concepts introduced in lectures and apply them in the lab. Being responsible for my own research has built my confidence, grown my critical thinking skills, and fostered a sense of scientific curiosity.”

RESEARCH HIGHLIGHTS

1997-PRESENT: CONSERVATION CANINES

The Conservation Canines program was pioneered in 1997 through collaboration between Sam Wasser and Sgt. Barbara Davenport, a master canine trainer with the Washington State Department of Corrections. By modifying methods used by narcotics detection dogs, the program has been non-invasively monitoring a diverse array of threatened and endangered species around the world, including tigers, orcas, fishers, spotted owls, bears, wolves, jaguars, and even Pacific pocket mice.

Conservation Canines addresses this need by combining the precision and efficiency of detection dogs to readily locate wildlife scat samples over large remote areas. The Center then analyzes these samples for a wide variety of genetic, physiological, toxicological and dietary indicators. These indicators enable us to ascertain species abundance, distribution, resource use, toxin loads, and physiological health—all in relation to the environmental pressure or pressures the species is encountering.

These scat detection dogs are able to locate samples from multiple species simultaneously across large, remote areas repeatedly over time. Sampling with detection dogs also tends to be far less biased compared to traditional wildlife detection methods (remote cameras, radio-collaring, hair snags, and trapping). These dogs also detect invasive species, identify sources of toxins in the environment, and are part of a new Center project developing high throughput methods to detect contraband in shipping containers at the port.

1997, 2002, 2011: NORTHERN SPOTTED OWLS

The 1997 findings of the Northern Spotted Owl study revealed that hormone levels tied to stress were clearly higher in the owls’ fecal samples the closer they were to human disturbances—clear cut sites and logging roads—in their environment. As a result, the Washington Department of Fish and Wildlife broadened rules to the Washington State Forest Practices Board to further support and protect the Northern Spotted Owl population. These effects were extended to off-road vehicles in 2011. Then, in 2012, the Center showed that detection dogs were actually better able to locate Northern Spotted Owls and the Barred Owls that are threatening them, compared to professionally trained federal owl crews. The federal crews locate owls with hooting surveys. However, Barred Owls occasionally attacked spotted owls that responded to the hoots. Dogs proved a more efficient and less-threatening option for these surveys.

Handler Rachel Katz works with detection dog Davy. / Center for Conservation Biology

2001: JASPER GRIZZLY AND BLACK BEAR

The Jasper Grizzly and Black Bear research effort was the first multi-year field project using the scent detection dogs in the field. Samples were collected at a record pace in the National Park and surrounding multi-use hunting area. DNA was extracted for individual, species and sex identification, and hormones extracted to measure pregnancy, stress and nutritional health. Bears in the multi-use area had higher pregnancy rates, better nutrition and less stress than bears in the national park, where bears sometimes can’t get a break from tourists. However, the multi-use area had no old bears, suggesting the multi-use area might be acting as a sink.

2004-PRESENT: DNA ANALYSIS OF LARGE IVORY SEIZURES

The Center has been conducting genetic analyses of large ivory seizures to determine where the ivory was poached and to link individual traffickers to multiple ivory shipments. Our team has identified Africa’s largest poaching hotspots as well as the major Transnational Criminal Organizations (TCOs) smuggling ivory out of Africa. “Our whole goal is to stop the ivory from leaving Africa,” says Wasser. “Because once it leaves Africa, it becomes hugely expensive and almost impossible to track.”

Thanks to research methods pioneered by the Center to extract DNA from ivory and elephant dung, our team was able to use dung samples collected across Africa to build a comprehensive DNA reference map. Now, whenever countries make a large ivory seizure, we’re able to select a representative portion of the tusks and remove a small piece of ivory from the base. DNA extracted from those samples are then compared to our DNA reference map to determine where the ivory was poached.

The Center is able to link multiple shipments to the same cartel by matching the genotypes of the tusk pairs from the same individual or from close relatives found in separate consignments. These linkages enabled us to identify the three largest TCOs moving ivory out of Africa, as well as connect the major TCOs to one another.

A large ivory seizure is laid out for analysis. / Center for Conservation Biology

By the Numbers

3
Major ivory trafficking cartels prosecuted using Center data

70+
Large ivory seizures analyzed since 2005

42
Dogs rescued from shelters and trained for the Conservation Canines program

13,000
Square kilometers covered as part of the Wolf Recovery in the South Cascades study

30,000+
K-12 students engaged through the Center's outreach programs

We are continually working to advance the breadth and effectiveness of our forensic tools. The Center has collaborated with many law enforcement agencies, as well as government and non-government organizations worldwide throughout this process. Our closest partner is the Homeland Security Investigations Division of the United States Department of Homeland Security. Other agency partners have included the International Consortium on Combating Wildlife Crime (INTERPOL, UNODC, WCO, CITES Secretariat and World Bank) and the U.S. Fish and Wildlife Service, as well as numerous countries across Africa and SE Asia that are seizing the ivory.

2006, 2012: NORTH ATLANTIC RIGHT WHALE

North Atlantic Right Whales (NARW) are among the world's most endangered whales. Strikes from large ships and entanglement in fishing gear are the major pressures they face. The Center developed the first pregnancy test for free-living NARWs using fecal progesterone and estrogen measures, and subsequently expanded those to include stress hormones. We also developed the first-ever test for the age of sexual maturity in baleen whales. We applied the scat detection dog method to this project, training detection dogs to locate right whale scat off the bow of the small boat. Dogs detected samples as far as a nautical mile from the source, and located 3-5 times the number of samples per unit effort than were collected by human observers. This was the first application of the dogs to a marine setting. The whales were sampled before and after 9/11, enabling us to show that reduced ship traffic post-9/11, significantly reduced the stress levels in these whales.

2006-PRESENT: SOUTHERN RESIDENT KILLER WHALES

Fish-eating Southern Resident Killer Whales (SRKWs) face many threats, including lack of their major prey, endangered Chinook salmon, bioaccumulation of toxins like PCBs and disturbance from commercial and private vessel traffic. Partitioning these pressures is key to effectively manage these challenges. We were able to do that by training dogs to locate SRKW scat, which are then extracted for DNA, stress, reproductive and nutrition hormones, and several toxins.

We found that the whales were miscarrying over 69% of their pregnancies and the cause was largely due nutritional stress from lack of prey. However, these other stressors also play a role. Fat loving toxins bio-accumulated throughout the whale's lifetimes are released in excess from fat stores when nutritional stress increases, causing a cumulative effect that exacerbates the miscarriage rates. Similarly, when prey is scarce, impaired echolocation from vessels can also have an impact, making the already scarce prey even harder to catch.

2008: EFFECTS OF POACHING ON AFRICAN ELEPHANTS

Our team examined long-term impacts of poaching on elephants of the Mikumi-Selous Ecosystem, Tanzania—one of the largest and most heavily poached elephant populations on the continent. The Center's study focused on Mikumi National Park in the northern part of this ecosystem. Many family groups lost their matriarchs, compromising their social, competitive and physiological functioning. The youngest offspring often perished with their mothers, causing a disrupted age structure. Many older offspring were orphaned, only to range solitarily or in atypical groups of unrelated females.

Thirty percent of all adult females were solitary in Mikumi, changing little from what was observed at the time of the 1989 ivory ban, despite increased protections. There was also high variance in adult relatedness among the most poached groups, with some families consisting entirely of loosely bonded, non-kin. This is unusual for a species characterized by close family units of several related adult females, and quite consistent with our predictions of long-term impacts on this heavily poached elephant population. Stress levels were highest in groups that lacked an old matriarch, had few closely related adult females, and weak social bonds. Stress was particularly high in groups still ranging in areas where poaching was historically high—areas nearest villages, farthest from park headquarters that had high carcass counts during the peak-poaching era of the 1980s. Females from genetically disrupted groups, many in their reproductive prime, also had fewer young calves.

Controversy continues to surround management and trade policies for African elephants. Results of this study bear directly on this controversy. The impacts of renewed illegal trade in elephant ivory or culling as a means of population control in this highly intelligent, tightly knit social species appear to be far more grave than predicted by economic models alone.

2011: ALBERTA OIL SANDS

We worked in collaboration with the Chipewyan Prairie Dene First Nation, Statoil Canada and the Alberta provincial government to monitor impacts of oil exploration on the caribou, moose and wolf living on oil sands in northeast Alberta. The Alberta government proposed killing up to 60-80% of the wolves in the oil sands, believing the wolves were responsible for the decline of threatened caribou. The soft terrain in the oil sands restricted oil extractions to winter, when the ground was frozen. Otherwise, their heavy equipment would sink. We used detection dogs to study the caribou, moose and wolf in the dead of winter, with temperatures averaging -10°C and snow depths up to 8 feet.

We found that wolves were eating very few caribou, putting a stop to the wolf culls. The wolves were largely depredating moose, and more recently deer as climate change and habitat disturbance enabled the deer to move north.

We also found that the ice roads built by the oil companies to access their oil wells in winter were being placed on dry sandy soil, which is precisely where lichen, the primary food of caribou, like to grow. The increased human activity in these caribou foraging areas was increasing caribou vigilance and reducing their foraging efficiency.

Our findings suggested that modifying landscape-level human-use patterns may be more effective at managing this ecosystem than intentional removal of wolves. Moreover, owing to the preference of wolves for deer, removing wolves from the population to protect caribou could actually place the ecosystem at markedly greater risk by accelerating the expansion of deer into this ecosystem.

2015-PRESENT: WASHINGTON WOLF RECOVERY

Wolves were extirpated from Washington State in the 1920's but started to naturally return in 2008, following an 80-year absence. However, recovery can be complicated by the many changes in human land use that occurred during the predator's absence. We began studying the impacts of wolf recovery on the medium to large carnivores in Washington in 2015. Detection dogs quickly located thousands of scat samples from wolf, coyote, bobcat, cougar and black bear, providing effective tools to study how changes in wolf abundance impact the distribution and prey choices of these other carnivores.

Up to now, wolf recovery in the state has been restricted to areas north of interstate-90. However, a southern extension south of I-90 is inevitable over time. This prompted state legislators in 2018 to fund the Center to monitor the distributions and diets of medium to large carnivores along the east side of the Cascade range, from I-90 to the Columbia River. We are now entering our fourth year of that study, which is providing a baseline to measure change in the habits of these other carnivores and their prey as wolves begin populating the area. Of particular interest is the degree to which wolf recovery impacts human-wildlife conflict involving all of these carnivores.

We have strong partners in this research. In the second year of the Central Washington study, we welcomed a collaboration with Yakama Nation, one of the state's largest land holders. Our teams became the first non-Natives given access to their sacred lands. Impressed by our dog teams, the Yakama Nation has continued to invite us back to sample their lands. In addition to gaining access to some of the best wolf habitat in Washington, this partnership allows us to provide important capacity building among Yakama Wildlife managers.

The Washington Department of Fish and Wildlife ensures that our findings are translated into effective policy for use in the conservation and management of large mammals in Washington state. This research explores whether an apex predator returning after a long absence can still fit in, how the established ecological community—including humans—impacts the recovery of apex predators such as wolves, and how distributions and habits of other predators and prey species are impacted by wolf recovery.

2017-PRESENT: DETECTING THE SOURCE OF PCBS USING DETECTION DOGS

Seattle Public Utilities (SPU) in Washington are responsible for cleaning up the highly toxic industrial compounds known as polychlorinated biphenyls (PCBs), along with other toxins in the environment. This created a strong interest in detecting PCBs in the environment and especially locating the sources of these contaminants. In 2017, SPU formed a partnership with the Center's Conservation Canines to train dogs to assist in these efforts. Dogs were able to detect PCBs in the environment at levels as low as 100 parts per billion. Field testing revealed a remarkable ability to identify new areas of contamination and are now working with SPU to fine-tune this method, enabling dogs to work back to the contaminant source.

2018-PRESENT: CONTRABAND DETECTION

Transnational Criminal Organizations (TCOs) are capitalizing on the difficulty and expense of detecting containerized contraband once in transit, due to huge increases in the volume of "legal" containers shipped worldwide and pressure to keep commerce moving. Our Center was funded by the Department of Homeland Security Center of Excellence in Cross-Border Threat Screening and Supply Chain Defense to develop a low-cost, high-throughput method for detection dogs to examine air samples in shipping containers for contraband. These methods avoid breaking security seals and allow inspection of containers while they remain stacked.

We use an apparatus that draws air from the outside

Conservation Canine handler Collette Yee and student researcher James Leifer with detection dog Dio. / Center for Conservation Biology

vents at the top of each container, through a canister containing an inexpensive, widely available odor-collection material to capture the contraband scent. The canister is sealed and labeled, and the process repeated for as many containers as desired. The sealed sample canisters are then presented in sequence to one or more detection dogs, outside public view, trained to alert to specific contraband scent.

This transferable detection dog training method can detect contraband among scent mixtures and greatly reduce the time, effort, and disruption required to search containers for a variety of contraband. We expect this tool to improve detection rates of targeted illegal timber species, which is currently valued at $50-$150 billion dollars annually. We anticipate extending these methods to detect a variety of contraband, including elephant ivory, pangolin scales, and other smuggled products both in source and end-user countries. Ultimately, this will help reduce high-risk materials from entering ports in the U.S. and abroad, simultaneously increasing available intelligence to pursue TCOs.

2021: SPLIT-SPECIES DESIGNATION FOR AFRICAN ELEPHANTS

African elephants are made up of savannah elephants and forest elephants, listed as a single species until recently. While both species have been heavily impacted by poaching, forest elephants have been far more impacted due to preference in Asia for the denser tusks. Currently, forest elephants make up only 6% of the remaining 400,000 elephants in Africa, causing many conservation groups to call for forest and savannah elephants to be listed as separate species. The International Union for Conservation of Nature (IUCN) African Elephants Specialist Group commissioned the Center to use their extensive dataset of elephant genetics across the continent to determine whether such a split listing is biologically warranted. Partly as a result of this work, the IUCN has now listed forest and savannah African elephants as separate species, greatly empowering managers across the country to more effectively conserve both species.

Dr. Kathleen Gobush

FROM GRADUATE STUDENT TO CONSERVATION LEADER

In addition to her role as Affiliate Associate Professor of Biology at the University of Washington, Kathleen Gobush serves as Northwest Director of Defenders of Wildlife, an organization employing innovative approaches to protect imperiled wildlife and habitats. Her career has included leadership roles with Conservation Northwest, Vulcan, Save the Elephants, and the National Oceanic & Atmospheric Administration. Before she held those titles, she pursued her zoology PhD with Sam Wasser as her advisor.

"Immediately in my career, I saw the value in the project design and field work execution I learned with Sam," she says. "A point he made about scientific writing also stuck with me: Don't dilute your main points. Sam has a talent for stepping back from research results to see the big picture, what can be done, and how to communicate the opportunity. Of course he's delivering on the science, but he's also making sure he's in the right rooms talking to the right people."

Often when Gobush finds herself in conversation with a fellow researcher or advocate, Wasser's name will come up. "What's interesting is that these people may know about Sam for one area of his research, but they usually don't understand how much his team is doing," she says. "The Center is involved with so many different species and parts of the world."

When asked why the Center's work remains vital after 20 years, she says, "Because the team is always a half step ahead. There's an ability at the Center to see the whole context of important conservation challenges and be imaginative and predictive about what's needed to solve big problems. Ultimately, the Center's studies have enabled powerful decision makers to make better decisions."

Julianne Ubigau, a Conservation Canine handler, discusses research with students.

INSPIRING A NEW GENERATION OF SCIENTISTS

One important part of preparing for the future of conservation science is generating interest and enthusiasm in young students. The Center has dedicated time and resources to outreach efforts in K-12 classrooms, particularly in communities that are underrepresented and have fewer opportunities to explore cutting edge science.

"We can change the world this way," says Wasser. "By starting with kids when they're in their formative years, we're able to inspire them with the work we're doing. We do really cool stuff!"

One of the most effective ways to grab the attention of younger students is to introduce them to the Conservation Canines program. Wasser and his team will typically share stories about their research with the students and perform a demonstration. Someone will hide a scat sample in the room somewhere, and then it's the dogs' turn to shine. "One of our dogs will come into the room and find the poop within a few seconds," says Wasser. "The kids love it."

The teachers are also thrilled with the results, reporting that students who had never before shown interest in science were suddenly engaged in an entirely different way. "When these kids understand that science can be fun, can involve working with dogs, and can be useful in a way they understand, it's like a light goes on," says Wasser. "Sometimes their parents get interested and want to participate, too. It's an opportunity to educate multiple generations and look to the future."

THE NEXT CHAPTER

Building upon the accomplishments of the past 20 years, we're ready to take a strategic step forward. The Center for Conservation Biology will become the Center for Environmental Forensic Science.

"We are refocusing on forensic science because we believe it's our best path to transformative change in the areas of environmental crime and environmental health," Wasser says. "For example, you look at these pandemics—COVID, SARS, Ebola, H1N1, even AIDS—they all started from unregulated consumption of wildlife. If smugglers are successfully sneaking shipments through borders, that's how everything becomes untraceable. If we can stop the shipments and track down the criminals, we can reduce the environmental damage that increases exposure to problems like zoonotic diseases."

Wasser recognizes that the surest strategy for developing successful solutions involves working with the top minds in different fields. The new Center will regularly call upon the considerable expertise, research, and resources available within the UW. The Center also includes key players in local, national and international law enforcement. We aim to support a "whole-of-government" approach, collectively highlighting the most important gaps faced by law enforcement and using the numerous skills among UW and other scientists, as well as NGOs to deliver the methods to achieve these objectives.

"Many of the tools that you see in biomedicine and forensic science, they're all developed by scientists at universities," explains Wasser. "For the last couple of years, we've been working toward a collaboration among a large number of scientists at the University of Washington who are interested in combating transnational crime. This could include experts in genetics, law, isotope analyses, you name it—anything that could be used to improve detection of contraband. Together, we can figure out things like where the contraband came from and how to make these newly developed methods and tools more admissible in a court of law."

Before launching the new Center, it's important to understand how we got here. The Center for Conservation Biology's achievements over the last 20 years simply would not have been possible without the support from individual donors and donor organizations. In order to establish the Center for Environmental Forensic Science and build stronger partnerships with law enforcement, government agencies, and scientific leaders, we will need support from donors again.

"With the right funding behind us, we can work together to identify the biggest problems, set the scientists in motion to develop tools and solutions, and then turn them over to law enforcement to apply the new methods," he says. "This is a chance to make a big difference."

If you're interested in learning more about the Center for Environmental Forensic Science and how you can support this important work moving forward, we would love to talk with you.

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