WRITTEN TESTIMONY OF CARTER ROBERTS
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INNOVATION SOLUTIONS TO PROMOTE WILDLIFE CONSERVATION

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Chairman Barrasso, Ranking Member Carper, and members of the committee, thank you for the opportunity to testify on behalf of World Wildlife Fund (WWF) regarding innovative solutions to promote wildlife conservation. WWF is the largest private conservation organization working internationally to protect wildlife and wildlife habitats. We currently sponsor conservation programs in more than 100 countries with the support of over 1.2 million members in the United States and more than 5 million members worldwide.

INTRODUCTION
We live in a time of rapid technological change, which is transforming our society across almost all facets of life. The United States has long been at the forefront of this transformation. We have brought our considerable technological might to the world since the days of Samuel Morse, Thomas Edison and Alexander Graham Bell, and have continued innovating ever since with the advent of wireless technologies, machine learning, the internet and beyond. This collection of technological opportunism is probably best encapsulated in the concept of the Internet of Things (IoT): the collection of devices and sensors that share data and enable analysis and improved efficiency. Today, smart homes, wearable technology and connected cars are all built on the notion of the IoT, and the United States remains a leader in its application and expansion. One area that is ripe with opportunities for the development of the IoT is another discipline where the US has long been a leader: wildlife conservation. In the past 5-10 years, we have seen some notable progress in better mapping of our environment and advancing our conservation efforts; tools such as smart collars and smart camera traps have introduced new ways for tracking wildlife. Innovative solutions are much needed in our line of work—particularly now when we are in the midst of the greatest wildlife poaching crisis in recent memory—and the US is well-positioned to lead the way.

THE GLOBAL POACHING CRISIS & RESPONSE
Illegal wildlife trafficking, and poaching to supply this illegal trade, is a primary threat to many of our planet's most charismatic and ecologically important species. It also poses significant threats to security, good governance and economic development objectives around the globe. Wildlife trafficking is now a transnational criminal enterprise worth tens of billions of dollars annually, is strongly connected to other transnational organized crimes, such as drug and arms trafficking, and is helping to finance agents of instability and corruption in many developing countries. The threat to the US is very real as well.

The value of the illegal wildlife trade is estimated at $8-10 billion per year,[1] a figure which puts it in the top illicit transnational activities worldwide, along with counterfeiting and the illegal trades in drugs, people and weapons. In terms of size, wildlife trade outranks the small arms trade. It also has strong connections to other illegal activities—guns, drugs and ivory may be smuggled by the same criminal networks and using the same techniques and smuggling routes. If the illegal trades in timber and fish are included, then the total estimated value of illegal wildlife trafficking rises substantially: the value of illegal, unreported and unregulated (IUU) fisheries alone has been estimated at between $10-23 billion per year, while the value of the illegal international timber trade has been estimated at $7 billion annually.

At the root of the wildlife trafficking and poaching crisis is the growing demand, primarily in Asia, for high-end products made from wildlife parts, such as elephant ivory, rhino horn and tiger skins and bones. Products made from these and other increasingly rare species command high prices on Asian black markets as purported medicinal cures and tonics (e.g. rhino horn powder and tiger bone wine), culinary delicacies (e.g. shark fins) or demonstrations of wealth and status (e.g. ivory carvings). Growing wealth in countries such as China and Vietnam has resulted in a steep increase in Asian consumers with the means to purchase such products. However, the criminal networks feeding Asia's growing demand are global in nature, reaching across oceans and continents and operating in many countries—including the U.S. Middlemen often direct poaching activities and engage in targeted efforts to corrupt law enforcement, border inspection and wildlife protection efforts. In some cases, organized Asian criminal syndicates, which are now increasingly active in Africa, work with local economic and political elites to subvert control systems and operate with relative impunity. It is on the ground, primarily in developing countries and rural regions, where large-scale illegal trade in wildlife and wildlife products has its most devastating effects on local communities, undermining regional security and economic growth while exacerbating corruption and instability. Many developing countries are witnessing the rapid decimation of their wildlife, a potentially valuable resource on which to build sustainable growth and bring greater stability to impoverished and often conflict-torn regions. Wildlife crime is taking a profound toll on ecological systems while also robbing some of the poorest communities of their natural wealth.

But this unprecedented crisis has also provoked an unprecedented global response, with the public and private sectors coming together with civil society to tackle this challenge and working to protect wildlife populations and end the global poaching crisis. The US government has been a major leader in this respect, through Administrative actions such as the creation of the National Strategy to Combat Wildlife Trafficking in 2013, including a whole-of-government task force co-chaired by the Departments of State, Interior and Justice, as well as through Congressional actions such as the passage last year of the END Wildlife Trafficking Act and strong funding support for US government programs that support these official policies and the agencies implementing them. In recent weeks, the Trump Administration reaffirmed these efforts with the release of an Executive Order on Transnational Organized Crime that explicitly mentioned wildlife trafficking as an area of focus.

Non-governmental organizations, such as WWF, have also stepped up to face the current challenge, focusing our efforts, marshalling new resources and forging new partnerships,

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[1] http://transcrime.gfintegrity.org/

including in the private sector. Technological innovation to combat poaching and wildlife trafficking is one of the areas of greatest potential for such private-sector partnerships, and WWF has been a leader in piloting such new approaches.

Thanks to a $5 million donation from Google.org in 2012, WWF has committed to advancing ideas, techniques and opportunities to drive the deployment of technology from boots on-the-ground to data in the cloud, to help stop and deter poaching and trafficking of wildlife. WWF has also led the way in combining technology, partnerships and innovations to build, test and scale ideas that will reduce poaching, disrupt criminal networks and save our wildlife heritage for generations to come. Below we highlight some areas where technology is helping us make progress and how we are working with partners to achieve conservation objectives.

CHALLENGE: STOPPING POACHING
Wildlife crime is the most immediate threat to wild rhinos, elephants and tigers. Africa's elephant population has crashed by an estimated 111,000 in the past decade, primarily due to poaching, according to the IUCN's 2016 African Elephant Status Report, which estimates that there are 415,000 elephants across the 37 range states in Africa—a huge drop since the last full update in 2006. The surge in poaching for ivory that began approximately a decade ago—the worst that Africa has experienced since the 1970s and 1980s—has been the main driver of the decline, while habitat loss poses an increasingly serious, long-term threat to the species. In 2016 alone, 1,054 rhinos were reported killed in South Africa**.** This is a slight decline from the peak of 1,215 in 2014, but still unacceptably high in a country which has seen the poaching rate increase roughly 9,000 percent since 2007, when only 13 rhinos were illegally killed for their horns. The 2016 figure still represents a loss of approximately six percent of rhinos in South Africa, close to the birth rate, meaning the population is perilously close to a downward tipping point. Criminals kill rhinos for their horns, which they then market to willing buyers as a cure for a variety of ailments from fevers to blood disorders to hangovers, in spite of the fact they have no proven medicinal value. Other major rhino range states in Africa have also reported declines, with 61 rhinos reported killed in Namibia this past year, down from 91 in 2015. South Africa, Namibia, and Zimbabwe are home to nearly 95 percent of all remaining African rhinos, and while South Africa's Kruger National Park, home to the world's largest white rhino population, successfully achieved a decline in the number of poached rhinos last year, Africa overall continues to lose an average of three rhinos a day.

WWF Wildlife Crime Technology Project
WWF recognizes the importance of innovative monitoring and enforcement systems as part of an effective 21st-century response to these conservation challenges. The WWF Wildlife Crime Technology Project, initially made possible by our Google.org grant, is a key component of the WWF-TRAFFIC Wildlife Crime Program and is helping us create an umbrella of technologies that not only protect wildlife, but also provide vital resources to wildlife rangers. With an innovative approach that can be easily adapted around the world, WWF is enhancing ongoing efforts to monitor and safeguard vulnerable species. As a science-based organization, WWF spearheads research, development and the integration of technologies in collaboration with governments, private- and public-sector partners. Our partners include African Parks, Cisco, Cornell Lab of Ornithology's Bioacoustics Research Program, Falcon Unmanned, FLIR Systems Inc., Fluidmesh Inc., Google, Kenya Wildlife Service, Mara Conservancy, Namibia's Ministry of

Environment and Tourism, Ohio State University, UAV and Drone Solutions, Unilux and Wildlife Protection Solutions.

Active in Kenya, Namibia, Nepal, Malawi, Zambia and Zimbabwe, WWF's Wildlife Crime Technology Project provides on-the-ground technology support against wildlife poachers and has successfully field-tested a suite of technologies, including:

- Unmanned Aerial Vehicles (UAVs) for rapid response
- Digital monitoring systems that monitor high-risk areas and boundaries of protected areas
- Affordable wildlife/patrol tracking devices connected through mesh networks
- Acoustic detection software
- Micro-radar for monitoring and detection
- Thermal cameras and human detection software
- Data integration and analysis through Spatial Monitoring and Reporting Tool (SMART)

KEY PROBLEMS AND SOLUTIONS

There are two over-arching technology limitations to stopping the poaching of elephants, rhinos and other wildlife across Africa and Asia: the inability of rangers to see at night, when most poaching happens; and the lack of wireless connectivity across the vast, remote landscapes in which the poaching occurs, which impedes the ability of rangers to communicate.

Seeing At Night

To help solve the challenge of stopping poaching at night, WWF explored a wide variety of technologies that would help rangers feel confident and safe at night. The technology we felt offered the best opportunity was the use of cameras and video cameras that detect heat. People and animals can be detected in a pitch-black environment based on their heat signatures against the much cooler air and ambient environment around them. WWF began using thermal cameras made by the infrared optics company FLIR. After a year of testing in the United States, in March 2016 we piloted both a static and mobile FLIR set up in Kenya. Working with the Kenya Wildlife Service, we deployed several static FLIR cameras to guard the perimeter of a national park that was the focus of past poaching events,

Fig. 1. Installing FLIR cameras with solar panels, Avigilon software, batteries, and radios to send the data to an operations center in Kenya.

helping rangers scan a part of the park's boundary for illegal human intrusion around the clock. These cameras were equipped with Avigilon software, which allowed them to detect human movement across their field of view on the parks boundary and send alerts to rangers in real-time. This will allow for scaling—without burdening KWS personnel—so that a single person could oversee many additional cameras with no additional time cost.

Nearly eight miles of the park's boundary are now under the watchful eye of cameras. Units are powered entirely by tower-mounted solar panels which, in the arid Kenyan climate, are unlikely to ever dwindle in reserves (Fig. 1). Within the first week, the camera system helped KWS authorities apprehend a potential poacher (Fig. 2). Over the course of the past year, three more intrusions were detected and potential poaching thwarted. Unfortunately, two park rhinos were poached in December 2016 when the poachers gained entrance through another section of the park that lacked surveillance cameras.

Fig. 2. FLIR thermal video camera system, with Avigilon human detection software in use in Kenya. The red box indicates that the cameras identified the object as a human and an alert was sent to rangers of an intrusion. The fence line to the left represents the perimeter of the park, with the road and right side of the image being inside the park.

In addition to the static cameras installed in the national park, WWF worked with the Mara Conservancy in the Maasai Mara, Kenya to install FLIR video cameras atop a ranger vehicle (Fig. 3). In the Maasai Mara, rangers wait for poachers coming from Tanzania who are mostly on the hunt for bush meat. While not specifically hunting for rhinos and elephants, most poachers would not miss an opportunity to seize a valuable kill. The mobile unit will complement existing anti-poaching operations, including ranger foot patrols and a sniffer dog team. The cameras have visibility and are able to detect humans from nearly one mile away. Using the FLIR cameras, the rangers of the Mara Conservancy have greatly enhanced the effectivness and efficiency of their anti-poaching tactics. They are now able to scan a greater field of view to find and better direct rangers to the poachers.

Further, once an ambush is sprung, the poachers are often unable to hide in the darkness as the FLIR cameras are able to see them hiding in the grass, and direct the rangers to their hiding spot (Fig. 4).

Fig. 3. FLIR thermal video camera mounted on a Mara Conservancy rangers' vehicle. The camera is connected to a video screen and joystick to enable panning of the open Mara landscape in search of poachers.

In the December 2016 Mara Conservancy's annual update of their work they highlight the seriousness of the poaching problem, and the impact that the FLIR cameras have had on their work:

> "A total of 434 people were arrested by our rangers in 2016 – even if we remove the 115 people arrested for illegal logging and charcoal burning we still broke the record, set last year, of 318 arrests. The great majority – over 95% - of the arrests for poaching were made in the Serengeti. The remainder were arrests on the escarpment, a few along the River on the Narok side of the Reserve and one or two as they escaped after eluding arrest on the river. The FLIR thermal imaging camera greatly helped in apprehending poachers at night and this equipment is now indispensable in our ambushes. We also smashed the record for the number of snares collected: 7,781 against our previous record of 5,337."

In September 2016, FLIR made an in-kind donation in equipment to WWF to use to support the efforts of our partners across the globe to stop the poaching of wildlife. FLIR has also offered to

Fig. 4. A still capture from a FLIR thermal camera video showing the apprehension of a poacher in the Maasai Mara, Kenya by Mara Conservancy rangers. The poacher was just flushed from his hiding spot by rangers after the FLIR camera detected the poacher and told the rangers where to find him.

assist with training the new users how to best use and care for their equipment. FLIR's donation is a potential game-changer, giving rangers the capacity to see at night and enhancing their safety by allowing them to avoid poacher ambushes while also steering clear of accidental encounters with buffalos, lions and other potentially dangerous species.

Another use of FLIR has been with Unmanned Aerial Vehicles (UAVs), or drones. WWF has been a leader in testing and evaluating the use of drones for conservation and to detect and deter poaching. Early testing of drones occurred in Namibia in 2013-2014, but was curtailed when Namibia and many other countries banned the use of drones until the laws governing their use could catch up with the technology. In 2015, WWF re-engaged its UAV work to test the technology and determine how best it can assist with anti-poaching. With our partners, we continue to test a variety of drones, as well as FLIR thermal sensors, to gain insight into their capabilities, including finding and identifying poachers. WWF has found that UAVs best function as reactionary eyes in the sky, deployed when an alarm is sounded by another sensor. To that end, WWF is evaluating civilian-grade UAVs for conservation applications with plans to rigorously test the technology in protected areas in southern Africa. For the flight testing, WWF is partnering with UAV and Drone Solutions Ltd (UDS), a licensed UAV operator, and their US-based subsidiary, Cool Ideas Ltd. Our initial work is taking place in Hwange National Park in Zimbabwe and Liwonde National Park in Malawi. We are testing the efficacy of UAV platforms, sensors and protocols for use in conjunction with rangers on the ground and are working to enhance the various sensors that can be used to improve human recognition and data transmission with digital encryption.

Sensors and Connectivity – Improving the ability to move data in real-time
As the costs of Internet of Things sensors become cheaper, we envision a future where a vast array of networked sensors feed data into a central control and management center, within a national park or protected area. WWF is investing in the development of these sensors and partnering with private companies to determine how to move vast amounts of data cost-effectively in real-time. While there are potentially expensive, security-restricted technology solutions developed by research entities in the Department of Defense, military-grade sensors are not required for wildlife conservation purposes. Instead, WWF has focused on leveraging these advancements to design and power lower-cost sensors to assist in detecting intrusions and potential poachers. Other innovation projects currently underway include:

- WWF and Cornell University are working together to gather data on a recently developed gunshot detector which, if successfully rendered, would be a great asset to rangers in the field, allowing alerts to be sent to a ranger control center whenever a gunshot is detected. We envision setting up gunshot detectors in vulnerable but unpatrolled areas where wildlife congregate, such as remote water holes.

- In Nepal, we are piloting a vehicle tracking system for authorized vehicles used by private agencies conducting safari tours. WWF is partnering with the Nepali Army to outfit vehicles with GSM-based tracking devices and develop a custom-built application that can locate and visualize all vehicles in the park. An alert system will ensure all vehicles leave the park within the permitted hours and notify security units if vehicle stop times exceed the allowed limit.

- WWF is exploring the capabilities of radar to detect wire snares, which are set illegally by the tens of thousands throughout wildlife habitat around the world, constituting one of the greatest threats to wildlife. WWF and our partners are exploring Impulse Radar, a relatively simple, low-power circuit that sends short radio pulses from an antenna and listens for echoes from radio pulses bouncing off a target—in this case the wire snare.

Anti-poaching efforts can be thwarted by the poor communications connectivity common in most large protected areas, where perimeter security is also a key challenge. The lack of secure, reliable connectivity between central operations, sensors deployed in key wildlife areas and field rangers inevitably impedes efforts to coordinate and respond to poaching incidents. To address this challenge, WWF and Cisco Systems (Cisco) formed a collaboration in 2016 to drive innovative technology solutions to diminish the threat of poaching and mitigate human-wildlife conflict. Dimension Data (DD), a communications business leader across Africa, is also a partner on the project and has worked with Cisco to pilot technologies for conservation in South Africa where we have been able to reduce the poaching of rhinos by 90% over the last 2 years. WWF, Cisco and Dimension Data plan to invest in and install technology in Africa and Asia to improve two-way communication between operations headquarters and rangers and sensors in the field, using of low power, long range wireless networks (LoRa) and cellular networks to enable wider-scale communication. Such connectivity will allow park management to track vehicles, rangers, and tagged animals, and to connect to unattended sensors such as camera traps, cameras, gunshot detectors, radar detectors, etc.

We will also assess UAVs, night vision thermal scopes and cameras to improve operation and safety of night time ranger anti-poaching patrols.

Ranger Analytics: Data Analysis to Deter Poaching
As the Internet of Things continues to grow in size and productivity, there will be massive amounts of data from sensors that can be analyzed to improve efficiency of anti-poaching management. SMART (Spatial Monitoring and Reporting Tool) is an innovative management tool to assist rangers on the ground in curbing poaching and illegal trade of wildlife. SMART was developed with the recognition that traditional tools, technologies and resources were not effective enough at stemming these problems for a number of reasons. One critical issue is the growing gap between the sophistication of the criminals involved and the number, skill levels and motivation of the ranger force. SMART was designed to help bridge this gap. Its combination of software and training materials provides enforcement authorities and community groups with the ability to empower staff, boost motivation, increase efficiency and promote effective monitoring of anti-poaching efforts. SMART can do this because it is more adaptive and intuitive to use than other monitoring technologies, and because it has more advanced analytical and reporting functions.

SMART is free, open-source data storage and analysis software that incorporates intelligence gathering and patrolling data to aid in strategic planning of enforcement activities. SMART also allows accountability in anti-poaching efforts by offering government agencies, managers and donors the ability to assess the effectiveness of protection efforts and investments. SMART is now used in more than 30 countries and is supported by a partnership that includes the Zoological Society of London, Peace Parks Foundation, Panthera, Global Wildlife Conservation, the North Carolina Zoo, Wildlife Conservation Society, Frankfurt Zoological Society and World Wildlife Fund.

STOPPING WILDLIFE TRAFFICKING
It is estimated that 3,000 kg. of illicit rhino horn reaches Asian markets each year (an average horn weighs 1-3 kg. depending on the species). Evidence indicates that horn smuggled from South Africa will go directly to consumer markets in Asia, to traders in Vietnam, Laos and China. The spike in rhino poaching has surged due largely to rising demand for rhino horn in Vietnam, where some believe it cures cancer and others employ it as an aphrodisiac or hangover cure doubling as a status symbol due to its exorbitant cost. A new trend is demand for carved rhino horns and rhino horn beads to be worn in bracelets. Wealthy buyers have driven up prices and demand for rhino horn to a level where it is now being sourced not just from live rhinos in Africa and Asia, but also from live captive animals, trophies, antiques and museum specimens in the U.S. and Europe. One need only look to the very recent killing by poachers of a white rhino living in a zoo outside Paris as clear evidence of the continued global thirst for animal parts; the criminals hacked off the rhino's horn before escaping.

In terms of ivory trade flows from Africa to Asia, East African Indian Ocean seaports remain the paramount exit point for illegal consignments of ivory today, with Kenya and Tanzania as the two most prominent countries of export in the trade. This development stands in sharp contrast to ivory trade patterns previously seen, whereby large consignments of ivory were also moving out of West and Central Africa seaports.

Poaching is now seriously affecting all parts of Africa where elephants are found, and large bulky shipments are often exported via the shortest routes or paths of least resistance where the large volume of sea containers or air freight helps to make it more challenging to detect, or where corruption easily allows movement of illicit cargo.

China and Thailand are the two primary destinations for illegal ivory consignments from Africa. While repeated seizures of large consignments of ivory have occurred in Malaysia, the Philippines and Vietnam since 2009, these countries essentially play the role of transit countries to China or Thailand. In the case of Vietnam, which shares a long terrestrial border with China, ivory is being smuggled overland into China.

Without any doubt, ivory consumption in China is the primary driver of illegal trade in ivory today, and China remains the key for stopping the growing poaching crisis facing Africa's elephants. The Chinese government recognizes ivory trafficking as the country's greatest wildlife trade problem, and law enforcement officials are making almost two ivory seizures every day, more than any other country in the world. Various observers to China, including TRAFFIC monitors, have found government-accredited ivory trading retail outlets persistently selling ivory products without the benefit of product identification certificates, which are an essential feature in the Chinese control system. This circumvention creates the opportunity to substitute products from illicit sources of ivory into the legal control system. In light of these challenges the Chinese government has announced that it will close the legal trade in ivory domestically by the end of 2017. In the US ivory trade has largely been banned, with some exceptions, but increasingly illegal ivory trade has gone online, often disguised as mammoth ivory or ox bone to avoid detection. The same may happen in China when its domestic trade ban comes into effect.

Rhino DNA Technology Links Crime Scenes to Criminals
Technology has many roles to play in stemming and reducing the trafficking of illegal wildlife products, as well as invasive wildlife species. For example, the Veterinary Genetics Laboratory at the Faculty of Veterinary Science (VGL) of the University of Pretoria, South Africa has been at the forefront of providing genetic profiling of Black (*Diceros bicornis*) and White (*Ceratotherium simum*) rhinos for the South African government since 2010. The DNA system registered as RhoDIS® has established a rhino DNA database for rhino profiles, which allows rhino range states access to share data and information for combating rhino crime.

DNA is a traceability tool. In application, DNA profiles from rhino horn directly match recovered horn to individual rhinos and poached rhinos and can link poachers, traffickers and horn from consumer countries or individually identify stockpiled horns. The advantage of this technique is that DNA cannot be removed, changed or destroyed. DNA profiles provide information unique to each individual, telling you the species and sex. RhODIS® can therefore be powerful at identifying 'linkages' between any two or more rhinoceros samples from an investigation (e.g. rhinoceros horn and an animal carcass; blood stained clothing and an animal carcass, etc.), providing irrefutable evidence in courts and linking crime scenes to suspected criminals. This means more successful prosecutions of poachers and traffickers.

To date, RhoDIS® has over 7,000 rhino samples and has contributed toward about 700 rhino investigative cases from east and southern African regions.

It has set the platform for new global forensic initiatives, investigations, and standards that enhances conservation efforts in the fight against global rhino crimes. It also promises to enhance rhino conservation and management in Asia: the Wildlife Institute of India (WII) is currently setting up a RhODIS® laboratory and a national Rhino DNA database for the greater one-horned rhino (*Rhinoceros unicornis*). In June 2016, the RhODIS® Rhino DNA Scientific workshop in South Africa, funded by USAID through the Wildlife-TRAPS Project and the WWF African Rhino Program, brought together wildlife DNA forensic scientists, enforcement officers and investigators from rhino horn source, transit and consumer countries. The meeting resulted in a simplified method to facilitate sharing and roll out of an improved RhODIS® compatible analysis system to laboratories across the world, which can become the international standard for producing comparable DNA profiles.

Tech Companies Collaborating to End Wildlife Trafficking Online
With increased global access to technology and connectivity along supply chain routes, the internet has become a thriving platform for buyers and sellers trading endangered wildlife products. As the United States and other countries ramp up regulations and enforcement to prohibit trade and raid physical wildlife markets, traditional shop and stall sellers are shifting their operations to the relative anonymity of web-based sales platforms internationally. There is an urgent need for a global illegal wildlife firewall, established by e-commerce and social media companies in partnership with conservation and law enforcement.

In April 2016 WWF, TRAFFIC and the International Fund for Animal Welfare (IFAW) brought together representatives from leading global tech companies to brainstorm solutions to illegal wildlife trade online. On August 12, 2016, seven partners, including eBay, Etsy, Gumtree, Microsoft, Pinterest, Tencent and Yahoo!, publically adopted a standardized wildlife policy framework to simplify shopping guidelines for consumers, identify prohibited products, eliminate the loopholes that make it easy for criminals to traffic wildlife online and present a united front from the tech sector. Several other companies aligned their policies internally to match this framework. In February 2017 Twitter also signed onto the global standardized wildlife policy framework.

The focus of this coalition is on eradicating illegal ads; working with online companies across the globe to enforce a unified, standardized policy framework that prohibits the trade in and promotion of illegal wildlife products on the web; partnering with online companies, their user networks, academia and conservation communities to mobilize millions of citizens to assist companies in detecting and reporting illegal wildlife products; and creating a global wildlife trafficking "Kill Switch." The Kill Switch will prevent illegal advertisements going live before they can be posted by targeting violators with a detection initiative between tech companies. Through new technologies, machine learning and data sharing, the e-commerce, social media, and online payment institutions will be able to identify and block criminals before they are able to list their product for sale. With regular, unwitting buyers out of the trade, criminals will be restricted to a much smaller marketplace on the dark web, the hidden part of the internet that exists on what is known as "darknets," which are overlay networks using the public internet but requiring specific software, configurations or authorization to access. The coalition efforts will actively target a shift from the surface web to the dark web, at which point law enforcement can deal with wildlife criminals operating there.

EXPANDING THE CONSERVATION TECHNOLOGY COMMUNITY
Technology offers enormous potential in securing a sustainable future for the planet. However, the conservation community faces a significant challenge in making sure these technologies are affordable and available to users around the world, and ensuring that people have the knowledge to use these tools properly. Even technologies that have already demonstrated their worth in the field must be adapted to specific social and environmental conditions, and require local buy-in and ownership. Ensuring that technologies can be adopted more widely requires resources, training and testing on the ground, often in challenging situations. However, too often the data and lessons learned from research and field tests are kept within NGOs, academic institutions or the private sector and are rarely shared effectively through peer-reviewed publications and media articles. Predictably, this leads to unnecessary duplication of effort as new technology users encounter the same challenges faced by others.

In November 2015, United for Wildlife, a partnership of Flora and Fauna International, IUCN, Conservation International, the Nature Conservancy, Wildlife Conservation Society, the Zoological Society of London, the Royal Foundation and World Wildlife Fund, with support from Google.org and ARM, launched a collaborative initiative called WILDLABS.NET to encourage and enable more open sharing of information about the use of technology to fight against illegal wildlife trade and the myriad other pressing issues facing our planet. It brings together a community of conservationists, technologists, engineers, data scientists, entrepreneurs and thought leaders. Community members share problems and successes, give and receive guidance, and access the resources needed to discover or collaboratively create technology to solve big conservation challenges. This online platform is enabling conservationists (including those based in the field) to connect directly with technology experts, explain the challenges they face and source technological solutions to these problems. Connecting with users on the ground will also help technologists test their ideas in field environments, and adapt them to ensure maximum possible impact. The WILDLABS.NET community has grown rapidly to over 1,300 global participating members. Members have been sharing ideas on a range of topics including new predator deterrents, using seismic detection technology to prevent human-wildlife conflict and tackling illegal logging with technology. They are collaboratively developing new hardware prototypes, including a new open-source acoustic monitoring device for tracking wolves and an automatic elephant detector using machine learning. They have also been crowd-sourcing answers to questions about low-cost tracking tags, integrating wildlife tracking with other technologies and self-powered camera traps, all the while sharing interesting conservation tech news and projects. By connecting people, WILDLABS.NET is putting knowledge and innovative solutions in the hands of the people working on the frontlines of conservation.

SCALING UP: A ROLE FOR THE PUBLIC AND PRIVATE SECTORS
Faced with increasingly sophisticated conservation challenges, 21st-century conservationists are being pressed to keep up, and technology and innovations are becoming increasingly essential tools in their toolbox. While exciting new innovations like the ones discussed in this testimony are already helping enhance our work, there is a world of innovation yet to explore in the field of conservation. And then there is the challenge of getting to scale: while WWF and its partners have been successful in testing and piloting new technological approaches, the conservation community alone will never have the resources needed to take these new technological tools to the level that is needed to have truly broad and transformational impact where it is needed most.

This will require the private sector to step in and step up in a big way, working with NGO partners.

It will also require continued investment by the US government, including maintaining robust congressional funding for current programs to combat wildlife trafficking, including the END Wildlife Trafficking Act and the National Strategy on Combatting Wildlife Trafficking, as well as support for biodiversity conservation around the globe through agencies including USAID, the US Fish and Wildlife Service and the Department of State. The US government should also explore potential new investments by non-traditional partner agencies, such as the Department of Defense, which may be able to repurpose new or existing technologies to aid in efforts to stop poachers and wildlife traffickers. More could be done to enable conservation groups to access or benefit from DARPA investments, Department of Defense research labs for anti-poaching or dual use technologies, and the downgrading of non-lethal military technologies to commercial use, allowing private sector ownership in the effort. The US government can also continue to spur innovation by expanding or building off of lessons learned from programs such as the USAID Wildlife Crime Technology Challenge and State Department-sponsored "hackathons" designed to crowd-source technological solutions to conservation challenges, including illegal wildlife trafficking and illegal fishing.

With continued commitment and additional investment from the public and private sectors, there are a range of priority conservation challenges we might tackle via technology and innovation, including:

- Leverage US technology experts and experts at the Defense Advanced Research Projects Agency to help solve the problem of "the needle in the haystack" when it comes to technology solutions used in the field and illegal wildlife being trafficked in shipping containers.

- Develop a technology to physically identify real horn or elephant ivory from alternatives or fakes, including hand-held scanners.

- Explore new technologies to generate visual recognition software that can identify and specify types of ivory from images in online sales.

- Continue to explore the most effective uses of UAVs, sensors and other remote technologies to create sophisticated, integrated systems for ranger patrols and anti-poaching efforts.

- Piloting the research and development of Internet of Things sensors to help stop poaching

CONCLUSION
In the end, technology is only a tool, not a silver bullet, and a tool is only as valuable as its user. Meeting our conservation goals will require sustained support and training for rangers, resource managers and community-based conservation activities. It will also require strong legal and regulatory structures that ensure wildlife is well-managed and that laws against poaching and illegal trade are well-enforced.

Without human resources behind them, not even the most advanced technologies can save species. And in our world of increasing technological sophistication, it is not just wildlife protectors but also wildlife poachers who are employing technology to make their work more effective and more efficient—which means that relying solely on traditional methods isn't just standing still, it's falling behind. But if we have the power of innovation backed by the resources of the public and private sectors, it is a race we can still win.