WILDLABS.NET

[The conservation technology network]

ANNUAL REPORT 2017

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24

36

30

Cover image: Early testing of a thermopile sensor by the Arribada Initative's Alasdair Davies in Antarctica. Incubated in the **WILD**LABS community, this sensor was one of two winners of the WWF Human-Wildlife Conflict Technology Challenge in 2017. For more on this technology, and how it will be applied to prevent conflict with people and wildlife, see p30.

CONTENTS

WILDLABS was launched as a partnership of United for Wildlife to serve as a tool for the wider conservation and technology communities.

It is overseen by a Steering Committee comprised of representatives from Conservation International, Fauna & Flora International, The Royal Foundation, Wildlife Conservation Society, WWF and the Zoological Society of London.

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Photo: Aleksal VOLKOV / WWF

INTRODUCTION

WILDLABS is the first global, open online community dedicated to conservation technology

With seed funding from tech sector giants Arm and Google.org, the United for Wildlife partners launched the **WILD**LABS community platform in 2015 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.

The mission of **WILD**LABS is to resolve conservation issues through technology. The platform brings together a community of conservationists, technologists, engineers, data scientists, entrepreneurs and thought leaders.

WILDLABS aims to build and support an active cross-sector community of conservationists and technology experts who use the **WILD**LABS online platform to:

1 Share information to increase transparency and reduce replication of effort

2 Ask and answer questions to share best practice, to increase efficiency and effectiveness of technology deployment to address conservation challenges

3 Collaborate to improve existing technologies or develop new technologies that address identified conservation needs

The problems faced by our planet and the challenges facing conservation cannot be solved by any one sector working in silos. To find solutions will need new voices and new approaches. Together, we can build the solutions needed.

In 2017, our global Human-Wildlife Conflict Tech Challenge mobilised engineers, designers and makers to create new or improved tools to prevent conflict between humans and wildlife (p30)

ANNUAL SNAPSHOT

WILDLABS has evolved into a thriving platform for roughly 2,300 global members who are building community, crowd-sourcing ideas and information, and collaboratively developing solutions.

WILDLABS members are comprised of field-based practitioners (22%), tech sector professionals (21%), NGO staff (15%), academics (15%), early career conservationists (7%), and other users (20%). Ideas are being shared in over 25 active online groups with 450+ discussion threads; enabling tech users to crowd source questions and share resources of conservation benefit.

Responding to demand, **WILD**LABS also centralises current resources that range from case studies to conservation tech-related funding opportunities and job postings, to enhance the uptake of technical expertise in conservation practice. This content has been accessed from over 110 countries.

Seeded with support from tech sector giants Arm and Google.org, like any successful initiative **WILD**LABS continues to grow and requires resources to sustain our community and impact to keep the platform a free and open resource.

Among our most member-valued resources are our centralised job and grant opportunity postings, articles on lessons learned from users of tech in the field, active technology and conservation challenge groups and discussion threads.

In 2017, we leveraged the **WILD**LABS architecture to support initiatives ranging from WWF's Human-Wildlife Tech Challenge to the Zoohackathon and more.

2,276 registered members

**463 active conversations eliciting 1,718 replies from 319 members**

38,760 visitors from 110+ countries have viewed 199,530 pages

2 winners selected from 47 entries in our first Human-Wildlife Conflict Tech Challenge

Conservationists and geeks are currently using over 460 discussion threads in 25 groups to crowd-source advice from engineers and scientists, share information on emerging challenges and connect to help solve problems, together.
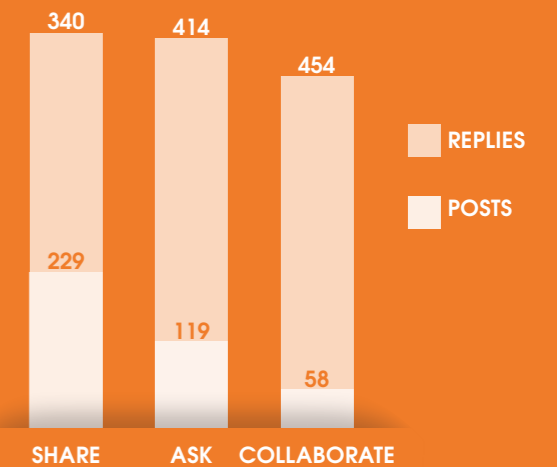
BY THE NUMBERS

DISCUSSION THEMES

- REPLIES
- POSTS

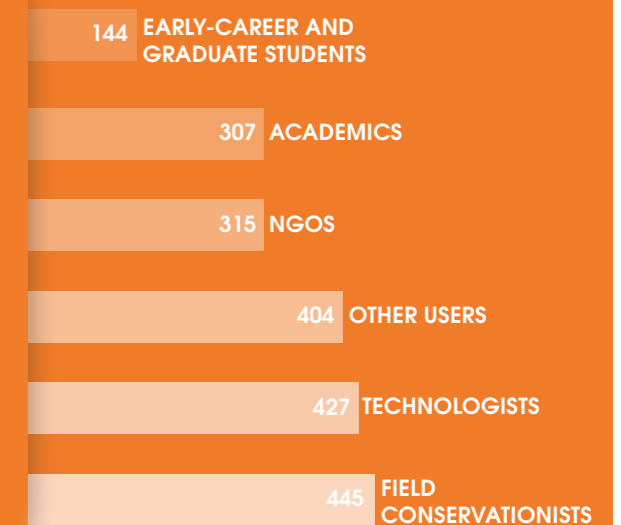|	SHARE	ASK	COLLABORATE
REPLIES	340	414	454
POSTS	229	119	58
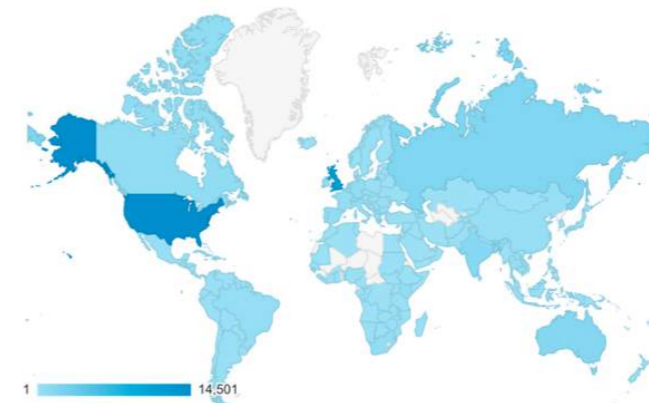
Q. What discoveries have you made through **WILD**LABS that have helped your work?

- "New collaborators. We've formed a non-profit together and are working towards our tech solutions more efficiently than we would have done before, seperately."

- "I found someone who was using photogrammetry to construct 3D cave surveys, a concept which my team and I had only conceptualised. We've also used **WILD**LABS to signpost our technical documentation."

- "It's been helpful to see how many directions people are going with AI, drones and other new technologies."

- "It keeps me current about the latest developments. This info has come in handy to give advice to others also. Thanks!"

- "I have learned a lot about UAV work flow and data processing, as well as mangaging data from camera trap studies."

MEMBER BACKGROUNDS

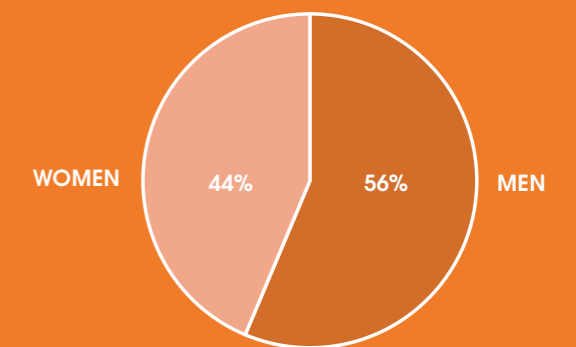|	
144	EARLY-CAREER AND GRADUATE STUDENTS
307	ACADEMICS
315	NGOS
404	OTHER USERS
427	TECHNOLOGISTS
445	FIELD CONSERVATIONISTS

MEMBER DEMOGRAPHICS

WOMEN 44%   MEN 56%

OUR COMMUNITY

WILDLABS is designed to connect conservationists, engineers, developers and tech experts around the world. Through these connections, our members are able to crowd-source answers, locate resources, discover information on challenges faced in the field, realise funding opportunities, and generally share ideas that can save wildlife.

At the end of 2017, the community had grown to roughly 2,300 active members, who were using over 460 discussion threads in tech and conservation challenge specific groups. These threads have been viewed over 38,000 times, helping to democratise access to lessons learned and crowd-source advice from engineers and scientists.

2015

Nov | **LAUNCH**

2016

Feb | MEMBER MEETUP, FIRST OF SIX IN 2016

May | EXHIBIT: WORLD RANGER CONGRESS

1000 MEMBERS

Sep | HOSTED MEMBER MEETUPS: IUCN WORLD CONSERVATION CONGRESS

Nov | TALK: WASHINGTON DC TECH MEETUP

Dec | TALK: ECOLOGICAL SOCIETY OF AUSTRALIA CONFERENCE

2017

Mar | TALK: CAPACITY BUILDING FOR ASIA CONFERENCE

Mar | EXHIBIT: STUDENT CONFERENCE FOR CONSERVATION SCIENCE

Apr | TALK: #EARTHOPTIMISM CONFERENCE

Jul | WORKSHOPS, TALKS, HOSTED MEMBER MEETUPS: SCB ICCB

2000 MEMBERS

Sep | TALK: LONDON TECH4GOOD MEETUP

Nov | HWC TECH CHALLENGE WINNERS ANNOUNCED

FIRST ANNUAL #TECH4WILDLIFE PHOTO CHALLENGE

Mar — In our first annual #tech4wildlife photo challenge, field users of conservation tech shared photos of their tools in action - from infrared cameras for tracking poachers and acoustic bat recorders in the middle of New York City, to mobile frog labs and portable DNA sequencers to save endangered amphibians.

ZOOHACKATHON 2016

Oct — The global winners of the 2016 Zoohackathon are working hard to develop their winning idea into a fully fledged platform that is ready for field deployment. Called SmartSkout, it will be one of the first systems of its kind to enable citizens to connect anonymously with wildlife rangers on the front lines.

SECOND ANNUAL #TECH4WILDLIFE PHOTO CHALLENGE

Mar — Our second #Tech4wildlife Photo Challenge saw members sharing open-source, cheap turtle tags under development, tech used to create 3D models of caves created to study endangered bats, and the ICARUS antenna ready to be launched to the International Space Station to transform animal tracking. (p16)

HUMAN-WILDLIFE CONFICT TECH CHALLENGE

July — In 2017, we partnered with WWF to launch the global Human-Wildlife Conflict Tech Challenge. Two prizes of €30K mobilised engineers, designers and makers to create new or improved tools to prevent conflict between humans and wildlife (p30)

ZOOHACKATHON 2017

Oct — Following the UK Government's landmark announcement of plans to introduce a complete ban on the domestic trade in ivory, it was fitting that a new machine learning product designed to tackle the supply end of this illicit trade emerged victorious at the 2017 London Zoohackathon event (p36).

Photo: Danielle Rivet / @grizzlygirl87

'I always recommend **WILD**LABS to people looking for expertise to help design projects (e.g. camera trapping) more effectively'
Anon feedback
WILDLABS Community Survey 2018

AIM 1: SHARE

Our members share information to increase transparency and reduce replication of effort

Technology has major potential to address threads to wildlife and wild places, if it's field-adapted, affordable and scalable.

However, information on technology tools with conservation value is often siloed within major tech and conservation organisations, research institutions and the private sector. Media stories, journal articles and other resources make some learning accessible, but these only tell part of the story - often focusing on successful outcomes and glossing over failures or challenges overcome along the way.

By centralising resources, information and expertise in a global online hub, **WILD**LABS is breaking down the information silos for the benefit of our 2,300 active community members, and the broader 38,000 users who have accessed information on the site.

'Through **WILD**LABS, I connected with a wildlife researcher which has helped to transition my 'toy project' into one that may have a real impact in wildlife conservation' – Ed Miller, Bear ID Project (p18)

SHARE

In 2017, we posted 126 resources, which included 28 funding opportunities, 30 job openings, 19 events and 49 in-depth case studies and interviews.

To support our members and the broader conservation tech users who visit the **WILD**LABS platform, our team actively curates career, learning and funding opportunities relating to conservation tech into a centralised hub and regular email digest that anyone can access.

To facilitate learning exchange and increased transparency around how technology is being used in the field, we also invite experienced members to contribute long-form case studies, thought pieces and interviews.

Our member-contributed articles not only put a spotlight on tech tools that are currently in action, they link to **WILD**LABS community groups for ongoing exchange. In these articles, members share honest accounts of their experiences developing and deploying tech under field conditions, with a particular emphasis on sharing not only the successful outcomes, but also exploring what went wrong and signposting the lessons learnt along the way for the benefit of others coming along behind.

The value of these resources was highlighted in our recent community survey, where respondents identified centralising information about funding and career opportunities as of particular value to their work.

> "I'm a geek and big fan of wildlife, so this lets me see how technology is being used in the field. It also lets me feel closer to the front lines of research. What you see in the general media (even WWF publications) is what has already gone through marketing teams and this is closer to raw, in the field, research.
>
> Anon tech industry member feedback
> WILDLABS Community Survey 2018

In 2017, the top 5 most visited resources were:

1. From the Field: Developing Camelot, a new camera trap data management tool
2. Naturewatch: Lessons from the field of app development
3. Getting SMART in Cambodia
4. Soundtrap: Developing low cost tools for acoustic ecology
5. How can technology reduce Human-Wildlife Conflict?

Our members shared news, events, learning opportunities and personal projects in 229 threads, receiving 340 replies.

WELCOME TO WILDLABS

74 replies, 722 reads
Our 'Welcome thread' is the first point of entry into **WILD**LABS community, and it offers an interesting cross section of our members. It is the place new users check in to introduce themselves, sharing what they're working on and flagging the skills they have to offer projects that might be looking for help.

E-SHEPHERD ANTI-PREDATION DEVICE

29 replies, 183 reads
In a great example of ideas transfer from Australia to Africa to the US, **WILD**LABS members in our Human-Wildlife Conflict group helped to identify a sheep collar used as a predator deterrent in Australia and also being explored in Southern Africa. Members in Namibia, USA, South Africa and Peru are now looking into field tests.

CITIZEN SCIENCE CONSERVATION APPS

14 replies, 84 reads
In this thread, members are using the power of the crowd to collate a list of apps developed for citizen science projects, sharing short explanations of the purpose of the various apps listed. To date, 25 apps have been shared.

SERVAL SENSOR PROJECT

12 replies, 206 reads
Jan Kees Schankel and his team are developing a full-circle and real time sound event recognition system which can be used for anti poaching. He has shared updates from his team's project throughout the year, flagging upcoming work and calling for collaborators to help solve specific challenges.

WHO WANTS TO LEARN PYTHON? COURSES TO GET YOU CODING

11 replies, 80 reads
Members are collating their go-to resources for learning about programming, innovation and statistical analysis. Thus far, 24 resources have been shared, including commentary about value of the learning opportunities put forward.

UAVS FOR MONITORING RIVER DOLPHINS IN THE AMAZON

9 replies , 178 reads
Marcello Costa is developing a new methodology for monitoring river dolphins in the Amazon, previously a time consuming and expensive task. He received support and detailed advice from experienced members of our Drones group.

EVENTS

Regional networking events for our members

In 2017, we continued to leverage regional meetings and international conferences to connect with our members and facilitate networking opportunities for them to meet each other in-person. Throughout the year, **WILD**LABS was present at the Student Conference for Conservation Science in Cambridge, the Capacity Building for Conservation in Asia conference in Pune, India, and the Society for Conservation Biology (SCB) International Congress for Conservation Biology in Cartagena, Columbia.

The SCB Congress was a fantastic opportunity to reach new members and connect with existing members from all over the world. In addition to leading two workshops and delivering three talks about **WILD**LABS, we hosted two tech happy hour networking events at the start and end of the conference. These two events were actively facilitated and successfully brought together 40 and 60 members respectively to meet others working with tech, share their work, discuss challenges, and discover new collaborators.

Photo: Ted Schmitt / Vulcan

#TECH4WILDLIFE
PHOTO CHALLENGE

"WE TRACK WILD WOLVES
IN #YELLOWSTONE
NATIONAL PARK BY
RECORDING THEIR HOWLS
AND TRIANGULATING
THEIR POSITIONS
#TECH4WILDLIFE
@WILDLABSNET"

ARIK KERSHENBAUM
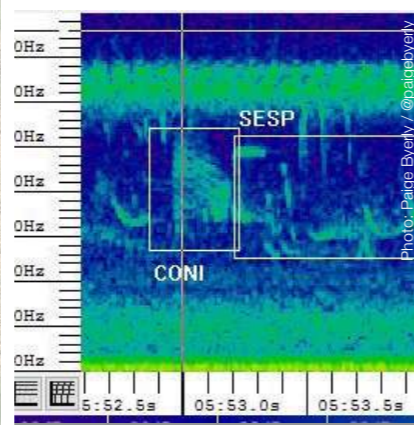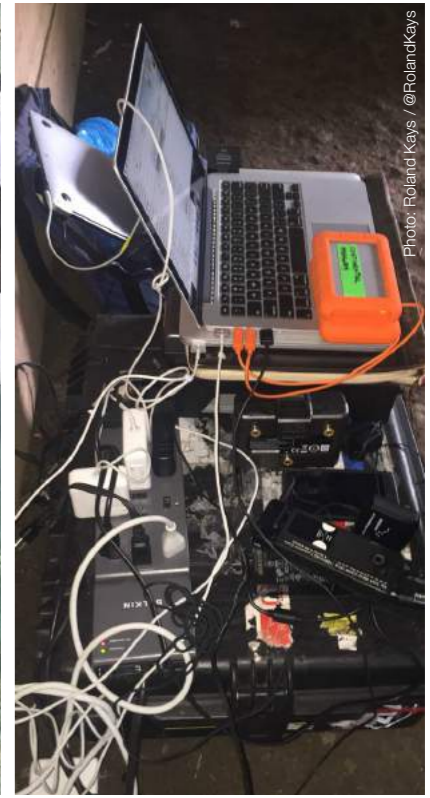
"WE'RE USING
#TECH4WILDLIFE TO
DO RESEARCH ON THE
POORLY KNOWN CUBAN
GREATER FUNNEL-
EARED BAT, A PRIORITY
@EDGEOFEXISTANCE
SPECIES #EDBE2017"

OLLIE WEARN

On 3rd March, we celebrate World Wildlife Day by asking our conservation tech community to share photos showing how they are using technology in the field or lab, using the #Tech4Wildlife hashtag.

Through the annual #Tech4Wildlfe Photo Challenges, we leverage social media to empower users of conservation technology to come out of the woodwork and share images of their tools in action.

In the first two years of the challenge, our community has shared hundreds of photos and videos from the field. We've had over 3,500 tweets around the hashtag, with more than 300 photos and videos posted. In our 2017 challenge, we had 239 users send 616 posts in the first three days, with more than 100 photos shared in the first 24 hours alone.

Our members have shared photos of acoustic recorders monitoring bats in the middle of New York City, a mobile lab for researching Chytridiomycosis disease in wild frog populations, apps for tracking ivory stocks in the Congo, specially designed cameras that are monitoring polar bear denning behaviour in the arctic, and an antenna destined for the international space station to improve our capacity to track animals.

The Bear ID Project

In April 2017, Ed Miller and Melanie Clapman joined the **WILD**LABS community within hours of each other. Both inspired to use machine learning to ID individual brown bears, their ideas sounded so eerily similar that we thought they might actually be working on the same project.

With a long a career in software and hardware development, especially in video and imaging products, Ed Miller recently began exploring machine learning and its applications for computer vision. Alongside his work in the tech industry ran a deep passion for the environment and wildlife. He often watched wildlife cameras like the Brooks Falls bear cam which viewers can tune into during the summer months to watch brown bears fishing for salmon.

For Ed, part of the fun of the bear cam was trying to figure out which bear was which. Since they don't use any for of tagging on the bears, it can be challenging. He began wondering if it were possible to teach a deep learning algorithm to differentiate between the individual brown bears. And in early 2017, Ed and Mary Nguyen started an open source project - hypraptive - to attempt exactly that.

They developed the initial code, but still needed a lot more data - labelled photos and videos. It was about this time that Ed joined the **WILD**LABS Community.

Through an exchange of messages with our **WILD**LABS Community Manager, Stephanie O'Donnell, Ed learned about a researcher studying grizzly bears in British Columbia...

Joining the **WILD**LABS community literally hours after Ed, Melanie Clapham was likewise welcomed with a message from our Community Manager. In this conversation, Melanie shared that she was the Founder and Director of the Brown Bear Research Network (BBRN). The BBRN is a multi-disciplinary group made up of international biologists, naturalists and eco-tourism operators. Their mission is to fund and facilitate innovative and progressive research on brown (grizzly) bears in British Columbia.

Melanie and her colleagues at BBRN had used camera traps primarily to study scent marking behaviour of bears, but were moving onto developing recognition systems relevant for biologists and citizen scientists, which was what brought her to the **WILD**LABS community.

It was a match made in heaven.

Shortly after they were connected, hypraptive and the BBRN joined forces to form a new non-profit: the BearID Project. They have the common goal of developing a new technology which can be used to assess and monitor populations, providing wildlife researchers with a new, non-invasive methodology to survey bears in the wild.

Hypraptive provides the computer science and deep learning experience and the BBRN provides brown bear expertise and connections to the bear viewing community. As well as being a vital research tool, the ability to automatically and confidently recognize individual bears has huge potential for public engagement in bear conservation.

In addition to their own research images, they have put out a call to researchers, bear tourists and citizen scientists to contribute photos and videos to the project.

In an exciting development, the team announced in 2018 that they have secured a two-year Collaborative Research and Development Grant from The Natural Sciences and Engineering Council of Canada to develop and implement facial recognition technology for monitoring brown bears.

We're looking forward to seeing this collaboration develop and tracking their progress developing a new tool for the conservation of bears.

WE ARE COMBINING ECOLOGICAL RESEARCH, CITIZEN SCIENCE, AND CUTTING-EDGE AI TO DEVELOP THE FIRST AUTOMATED FACE RECOGNITION SYSTEM FOR BROWN BEARS

WANT TO BECOME A BEAR CITIZEN SCIENTIST?

HELP US TO DEVELOP A NEW METHOD TO RECOGNISE, SURVEY, AND MONITOR BROWN BEARS WORLDWIDE

We need YOUR HELP to acquire:
Face-on photographs (or videos) of identified individual wild or captive brown/grizzly bears (both eyes visible)

Submit images to
photos@bearresearch.org
OR we can provide a USB/hard drive

BEARID PROJECT
WWW.BEARRESEARCH.ORG

AIM 2: ASK

Our members ask and answer questions to share best practice, to increase efficiency and effectiveness of technology deployment to address conservation challenges

Too often, funding limitations, time and organisational barriers mean that the data and lessons learned from research and field tests of technology tools are siloed and not shared between users effectively. Predictably, this leads to unnecessary duplication of effort as new technology users encounter the same challenges faced by others.

To address this challenge, field based colleagues told us that they needed a kind of Facebook-meets-Reddit on conservation tech, so that rangers using drones in Africa could share learning with biologists using quads for dolphin monitoring in Brazil, and obtain real-time advice straight from techies in Silicon Valley, USA.

With **WILD**LABS, we have built an online platform that support a global network of experts to connect and provide advice on technology tools for specific conservation needs. Through the community, conservationists are connecting directly with technology experts, explaining the challenges they face and sourcing support to solve these problems.

Elizabeth Spencer reveals the damage elephants can inflict upon camera traps in our annual #Tech4Wildlife Photo Challenge (p16)

ASK

Our members asked 119 questions, receiving 414 replies and a 79% answer rate. This dialogue enabled members to share best practice to increase efficiency and effectiveness of technology deployment to address conservation challenges.

Are there any methods that could be used for mark-recapture of turtles that don't require tagging?

8 replies
Kate West's question sparked a discussion where members from Malaysia shared their work to ID sea turtles with pattern matching software.

Moonshots - where we will be with acoustic monitoring in five years?

4 replies
Courtney Dunn threw this challenge out to the acoustic monitoring group and received thoughtful replies about emerging possibilities for low-power high frequency data acquisition, software improvements, pattern recognition and questions about storage and big data.

Do you have camera trap images of elephants that I could use for machine vision training?

9 replies
Neil Sheridan was offered 10,000+ images of elephants and 100,000+ images of other big animals by Snapshot Serengti to train his algorithm, and a number of other collaboration offers.

Can you recommend a decent GSM Camera Trap?

5 replies
Chloe Aust recieved recommendations with detailed feeedback on three new models that addressed her needs. She will test these cameras and share the results back with the community.

What lessons have you learnt along the way when developing apps or software for conservation?

9 replies
John Cornell's honest account of the development of a mobile app, Naturewatch, that ultimately did not deliver what was intended inspired a fascinating discussion about the challenges faced by members developing tech.

Do you know of any projects using 'networking technologies' for wildlife conservation?

13 replies
Anthony Vencatasamy was looking for advice about how to move into this field, and ended up with a member inviting him to join in collaborating on an anti-poaching sensor project.

Before we develop our own, Is there is an app out to identify commonly traded or poached raptors?

3 replies
Fleur Scheele recieved recommendations for a number of apps to look into before starting from scratch on a new anti-poaching bird-ID app.
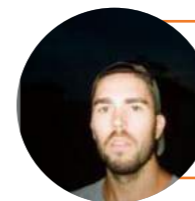
Can anyone provide advice about wireless camera traps that use a mesh-network type of architecture?

5 replies
Casey Slaught was looking for advice about mesh-network camera traps to deploy in challenging conditions in Virunga NP. He received advice from members developing their own systems and also using off-the shelf solutions.

EXPERIENCE
Steve Allain

The great thing is that whether you are using a new piece of kit that has already been built, or designing your own from the ground up, you should be able to find a member of the community who is able to help!

I have first-hand experience of this: I designed a passive acoustic monitoring system for amphibians, to use in Borneo. It had a few teething issues, and I was not sure if the components I tested the system with would stand up to the elements in the rainforest.

Thankfully, multiple members of the community were able to help and, if it were not for them, the project would probably not have gone ahead.

It is not just advice and guidance that the community provides, but also an opportunity to collaborate and network. Every scientist knows that the key to success is a combination of these two things, and networking with people from all over the world with the same technological problems or solutions is a great solution!

WILDLABS.NET provides the conservation community with a much-needed tool to facilitate future partnerships between individuals and groups.

Audiomoth
Who wants to join a group buy?

In 2017, our members began using **WILD**LABS to coordinate large group orders of the open-source Audiomoth acoustic recorder, bringing the cost down from $700 to $50 per device.

It's $50, the size of a credit card, and can record uncompressed audio at 384,000 samples per second. The AudioMoth, designed and developed by the Open Acoustic Devices team, offers researchers and acousticians access to high quality recording at an entry level price point.

In contrast to commercial devices, AudioMoth uses a low-cost sensitive MEMS microphone mounted directly on the printed circuit board to provide a single-board solution that requires minimal packaging prior to deployment. A low-power, 32-bit microcontroller provides sufficient computational resources to run acoustic detection algorithms to trigger recordings, and yet allows long-term deployments with just three AA batteries. These devices have been used in a number of deployments to record insects, bats and birds, and to detect gunshots from illegal hunting in tropical forests in Belize.

Today, if you wanted to have a single AudioMoth produced for you using on-demand manufacturers to fabricate the device, you'd be looking at a cost of around $700. That's because the amount of effort and preparation to load the components necessary to manufacture the device on the factory floor is time consuming, and therefore expensive.

If, on the other hand, you were to order 400 devices, you'd be looking at $27 per device. And there is the root problem – users who only need a few devices are priced out, and those wishing to buy many hundreds do so privately, as there isn't an efficient way to purchase devices together as a community of users.

Alasdair Davies and the Arribada Initiative saw a need to bring independent buyers together, so we could move forward as a community, resulting in everyone having access to an affordable device – and so, the first group purchase of the AudioMoth was crafted.

Photo: Open Acoustic Devices
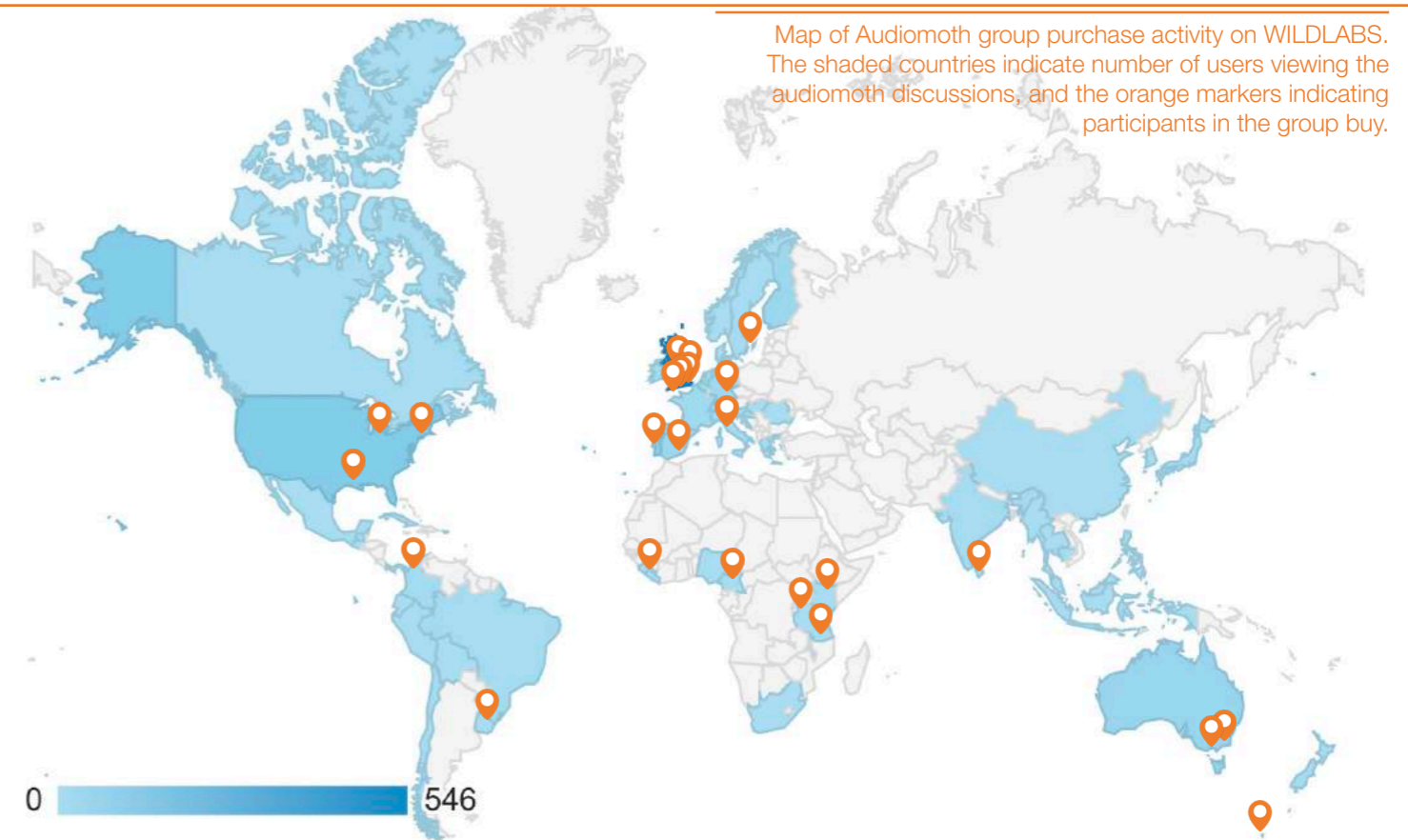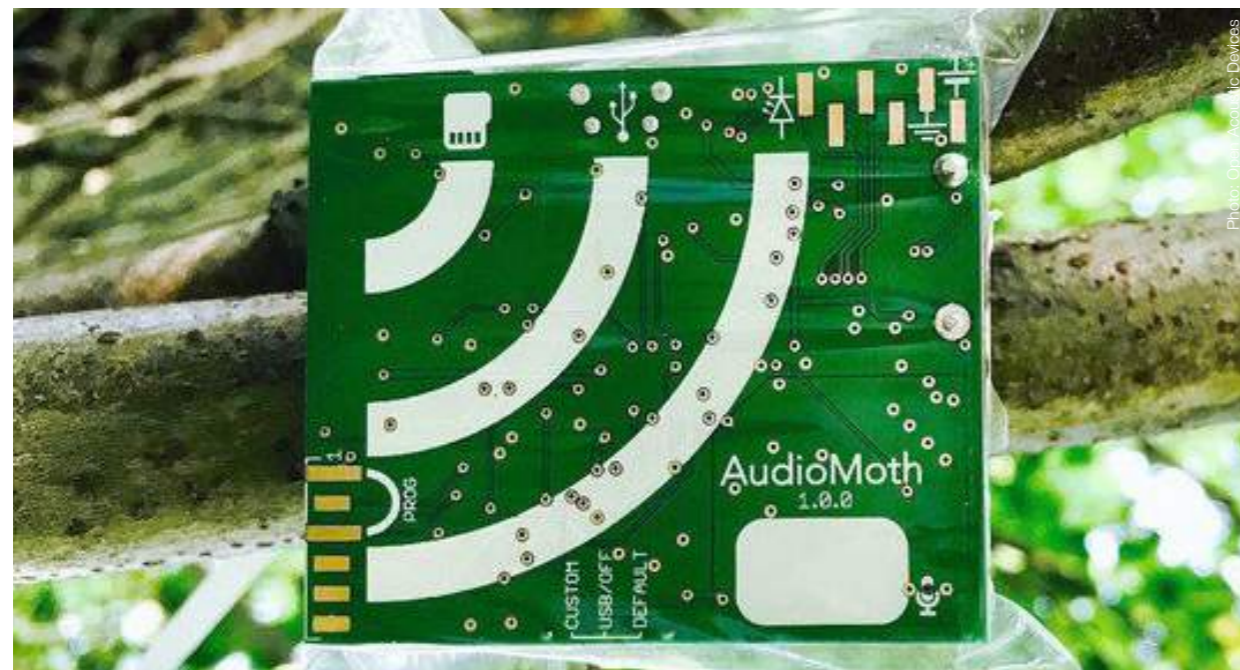
Map of Audiomoth group purchase activity on WILDLABS. The shaded countries indicate number of users viewing the audiomoth discussions, and the orange markers indicating participants in the group buy.

0   546

Photo: Alasdair Davies / The Arribada Initiative

GroupGets was selected as the payment service and distributor, and **WILD**LABS as the platform that enabled the Arribada team to get the word out beyond their immediate network to the wider conservation technology community to bring enough people together to make it viable. By word of mouth, the team knew of a handful of people who collectively wanted 100-200 devices, but through the **WILD**LABS network they connected to field conservationists all over the world keen to join the group buy.

The first group purchase round sold 400 devices to 50 users at $50 per device. This price included a small margin added to the manufacturing costs that generated proceeds of ~$4,500 that can be put back into development activities to refine existing hardware, and to help build a community of users by providing funding to technologists for small projects to develop new firmware and hardware for specific deployments.

To date, there have been four sell-out rounds with a total of 2,000 audiomoths sent around the world over the past six months. To put this in perspective, this time last year the same amount of money would have purchased roughly 100 commercial accoustic recorders. This is the start of something transformative for the conservation sector: leveraging community to get affordable tech into the hands of people that need it.

I'm looking at presence, population density, seasonal occurrence and burrow occupancy of petrels on Macquarie Island. All part of monitoring recovery post eradication of invasive species.

Huge thanks for developing such an in demand product, and disseminating it so well. Shows what a gap there's been for affordable #Tech4wildlife.

Jez Bird

AIM 3: COLLABORATE

Our members collaborate to improve existing technologies or develop new technologies that address identified conservation needs

"Matchmaking" between engineers, implementers and funders is essential to ensure that good ideas get a practical application in the field. This has been a pitfall of some previous competitions, where coders designed cool apps but they failed to accelerate and have practical applications. To ensure a prize competition or innovation process yields real world results, it is essential to ensure follow-up. We provide the infrastructure for this through our community platform.

In 2017, WWF and **WILD**LABS launched the first Human-Wildlife Conflict Tech Challenge to deliver on this identified gap. This initiative aimed to mobilise technology developers, engineers, designers and nature lovers to develop new or improved tools to prevent conflict between people and wildlife. We put the call out and our community responded, submitting 47 innovative ideas originating from 14 countries to help solve the increasing confrontations between people and wildlife.

The HWC Tech Challenge was a significant achievement for the collaborative WWF and **WILD**LABS team. It is an exciting transition from the first stage of establishing a community to the mature stages where we are exploring ways of mobilising this community to deliver new technology tools for conservation. It demonstrated the value of coupling a challenge with the community we've established, rather than running a challenge in isolation, and ensuring that field teams are involved and engaged right from the very start of the challenge process. This initiative was 18 months in the making, and the impact it had was huge in terms of growing our community, engaging tech folk in conservation and also delivering new and improved tools that are needed by the people actually working in the field.

In 2017, our global Human-Wildlife Conflict Tech Challenge mobilised engineers, designers and makers to create new and improved tools to prevent conflict between humans and wildlife (p30)
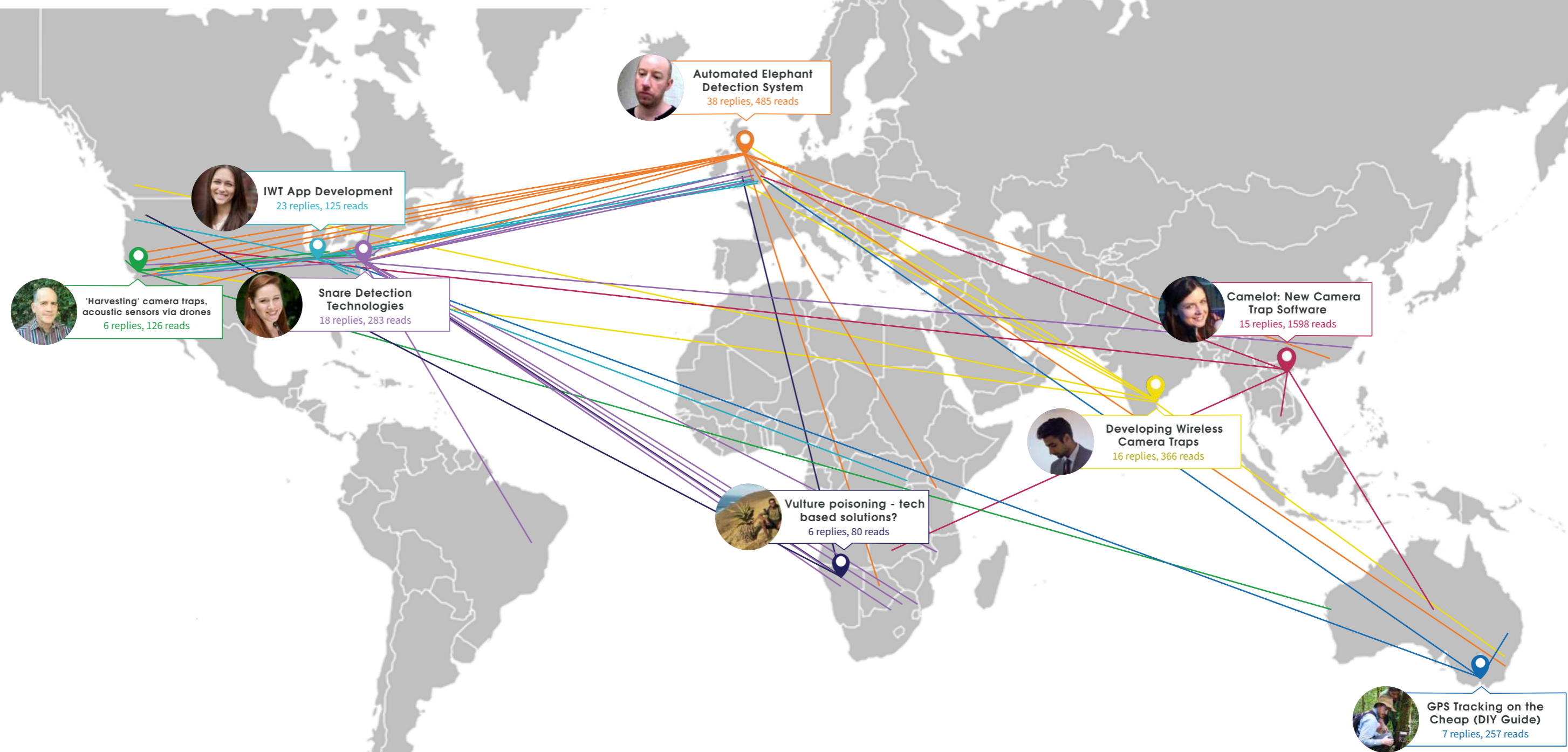
COLLABORATE

Our members used 58 discussions to identify outstanding needs, refine ideas, and connect with collaborators keen to get involved in developing solutions. Given the open-ended, exploratory nature of the discussions, these threads saw significant engagement, receiving 454 replies from members.

create

There are many engineers and experts who are eager to support conservation, and only a limited number of staff at our partner organisations to connect with them and advise on field uses that advance conservation.

In order to scale the application of appropriate technology tools, field users within and beyond large NGOs benefit from transparently accessing advisors and central resources. Given that much research and development of new technologies involves risk and high costs, networking on issues of shared interest may support pooling of resources across users.

To effectively address these challenges and capitalise on the opportunities, **WILD**LABS requires a wide range of experience, expertise and networks. The members of the **WILD**LABS Steering Committee recognise that by working together, sharing expertise and pooling resources, they can deliver programme objectives far more effectively than through separate efforts

Automated Elephant Detection System
38 replies, 485 reads

IWT App Development
23 replies, 125 reads

'Harvesting' camera traps, acoustic sensors via drones
6 replies, 126 reads

Snare Detection Technologies
18 replies, 283 reads

Camelot: New Camera Trap Software
15 replies, 1598 reads

Developing Wireless Camera Traps
16 replies, 366 reads

Vulture poisoning - tech based solutions?
6 replies, 80 reads

GPS Tracking on the Cheap (DIY Guide)
7 replies, 257 reads

Human Wildlife Conflict Tech Challenge

In India alone, an average of 400 people and 100 elephants are killed every year as a result of human-wildlife conflict. In the past four years, 101 people have also lost their lives to tigers in India. In the Arctic, hundreds of 'conflict polar bears' have been killed over the last two decades. These species are all listed as vulnerable or endangered on the IUCN Red List. We need better solutions for human-wildlife conflict, but we need help to create them.

In 2017, WWF and **WILD**LABS launched the first Human-Wildlife Conflict Tech Challenge. This initiative mobilising technology developers, engineers, designers and nature lovers to develop new or improved tools to prevent conflict between people and wildlife, offering two prizes of €30,000 for the best solutions.

We put the call out and our community responded tremendously. We received 47 innovative ideas originating from 14 countries to help solve the increasing confrontations between people and wildlife such as tigers, polar bears and elephants. An international panel of human wildlife conflict and technology experts assessed the feasibility of the proposals and selected the two winners.

In November, we announced that British conservation technologist Alasdair Davies and the Dutch team of Laurens de Groot and Tim van Dam as the winners of the first international Human Wildlife Conflict Tech Challenge. Each winner received €30,000 to further refine their solution and field test in 2018 in partnership with the WWF landscape teams.

Photo: Gary Van Wyk / The Ginkgo Agency / Whiskas / WWF-UK

WWF

WILDLABS.NET
[The conservation technology network]

Elephant Conflict Challenge
Improved Fences

Photo: naturepl.com / Kark Ammann / WWF

The Challenge

Design a smart and integrated system incorporating existing tools to enhance the effectiveness of electric fences. The system should:

- Detect when and where in electric fences power leaks away due to drought or obstructing vegetation that hamper full conductivity;
- Detect when and where an electric fence is broken by an elephant and identify the behaviour of that particular animal. This will foster learning and further improvement of fence design;
- Detect elephants approaching crop fields or villages in an early stage to allow people to respond appropriately and in a timely manner.

Why?

In Northeast-India, human-elephant conflicts are increasingly common. Electric fences were developed to prevent elephants from entering villages and crop fields. Effectiveness of electric fences directly depends on the time and effort invested in maintenance and monitoring, which should be done around the clock.

Elephants are intelligent animals and will eventually always find ways to break fences and enter crop fields. For example, tuskers learn how to break

wires and poles with their tusks and elephants have been observed throwing logs and other tools on the wires. Currently, to identify damaged fences and to understand how this happened, camera traps with motion sensors can be deployed. They send warning messages or trigger an alarm. However, camera traps are costly and their passive lasers can't differentiate between elephants and other wildlife (or people) and are thus constantly triggered by any movement.

Local farmers would benefit from one single system integrating the energizer and tools to monitor fence health and elephant presence. The information

generated by the system should pinpoint and inform people about the location along the fence that requires repair and improvement, and when and where to respond proactively to elephants. This system of tools should be affordable on a local level, easily accessible and operated and require little maintenance.

The Winning Solution

Laurens de Groot, Tim van Dam and the team from the ShadowView Foundation aim to reduce conflict between people and elephants using the wireless LoRaWAN™ (Long Range Wide Area Network) telecommunication technology. A variety of sensors

Photo: ShadowView Foundation

can be linked to this network that detect animal presence and power leaks in electric fences that are being used to keep out elephants. Alarms linked to the sensors alert people by setting off buzzer flashlights or sending SMS messages, to warn villagers when a fence has been damaged or broken by elephants.

Competition judge Mohanraj from India is enthusiastic about the possibilities in the field:
   "LoRaWAN™ based network technology is the future. It will enable us to integrate various systems monitoring species movement, voltage on fences and other important variables. Europe and especially the Netherlands are frontrunners in this technology and I'm very excited to see this applied in elephant conservation in India."

The Plan

Shadowview's project will deliver a low maintenance, low-cost monitoring system, allowing human beings to detect the presence of an elephant in time and take timely and appropriate measures to avoid human-elephant conflict. As a first step the team will set up a LoRaWAN infrastructure, including the installation of a LoRaWAN™ gateway, along the border of the Sonitpur District.

Once they have established a stable network, they can start with the deployment of fence monitoring sensors. The fence sensors measure power leaks in the electric fences, that will allow them to detect when the first line of defence is interrupted. When the fence is down, animals can easily cross the borders and this is what they aim to prevent. Finally, they will also be working closely with the other HWC Tech Challenge winner, the Arribada Initiative, who are delivering the sensors that will detect elephant presence.

Carnivore Conflict Challenge
Early Warning System

Photo: naturepl.com / Ashok Jain / WWF

The Challenge
Build and deploy an early detection system that will:
- Identify the target species
- Be cost effective
- Be easy to maintain
- Alert in real-time
- Work at small or large scales

Species identification and cost effectiveness are especially key. If you can't identify the species, you can't send an alert that it's nearby. If the system isn't cost effective, it will be limited to high income communities, which are a minority across the globe. Capturing an image of the animal is the easiest way to accurately identify the species, but many imaging techniques are expensive and require the species to be identified manually. However, new advances in infrared technology could provide a solution.

Why?
Early detection of animals nearing human settlements is an effective way to resolve the increasing conflict between humans and wildlife.

Electric fences, human patrols, and remote imaging are all popular methods of detection used many communities. They work well in many situations, but they can be expensive, labor intensive or difficult to maintain. Where appropriate, replacement with a low cost, automated monitoring solution can increase the scope and effectiveness of early detection systems. Although the winning solution focuses on early detections of elephants, polar bears and tigers, the stretch goal is to create a detection system that could be trained to detect many more species across the globe.

The Winning Solution
The Arribada Initative team will combine a series thermopile passive infrared (PIR) sensors with a computer recognition algorithm to automatically identify and send community alerts when a specific animal is detected.

To understand why thermopile PIR sensors were chosen, let's take a look at three commonly used detection techniques: Optical cameras, traditional PIR sensors and forward-looking infrared (FLIR) cameras.


Photo: Alastair Davies / The Arribada Initiative

Optical cameras produce excellent images for species identification, but they are expensive and difficult to maintain. They also often perform poorly in low light conditions and adverse weather, limiting their use. Infrared sensors detect animals through their heat signature and work regardless of light conditions. Traditional PIR sensors can detect an animal's presence by the change in heat as they pass by a sensor, but this is recorded as a pulse, not a pixel image. While they are cost-effective, they cannot be programmed to identify a certain species. High-resolution forward-looking infrared (FLIR) cameras produce very high resolution thermal images and are excellent for species identification, but that resolution comes at a cost that is unaffordable for many communities, especially if several cameras are needed to monitor large areas.

Thermopile PIR sensors are configured in an array, which can generate a pixel image. This combines the low cost of PIR sensors with the ability to identify a species. Thermopiles are small, easy to operate, easy to maintain and move and are power efficient. Though the resolution of a thermopile PIR sensor is lower than a FLIR camera, we believe it is sufficient to train a computer algorithm to recognize a target species and send an alert. The low cost of thermopile PIR sensors makes them suitable for deployment in a series, with several thermopiles detecting at different angles to increase confidence in species identification. This also makes them suitable for monitoring large areas that require many sensors.

The Plan
Preliminary testing was conducted in Antarctica, testing the ability of the sensor to detect penguins in cold temperatures. Testing for our target species began in spring 2018 in zoo habitats, where we can test different thermopile models and arrangements to determine what is best for recognizing each animal species. Data collected during zoo testing will also train the computer recognition algorithm. We will use optical cameras to check accuracy of the algorithm and identify times the sensor did not detect an animal. The final sensor will comprise of a thermopile array sensor, a microprocessor with the recognition algorithm, a ShadowView long range (LoRA) radio to send alerts and a li-ion rechargeable battery. Field tests will be started in the fall of 2018, beginning with polar bears and elephants.
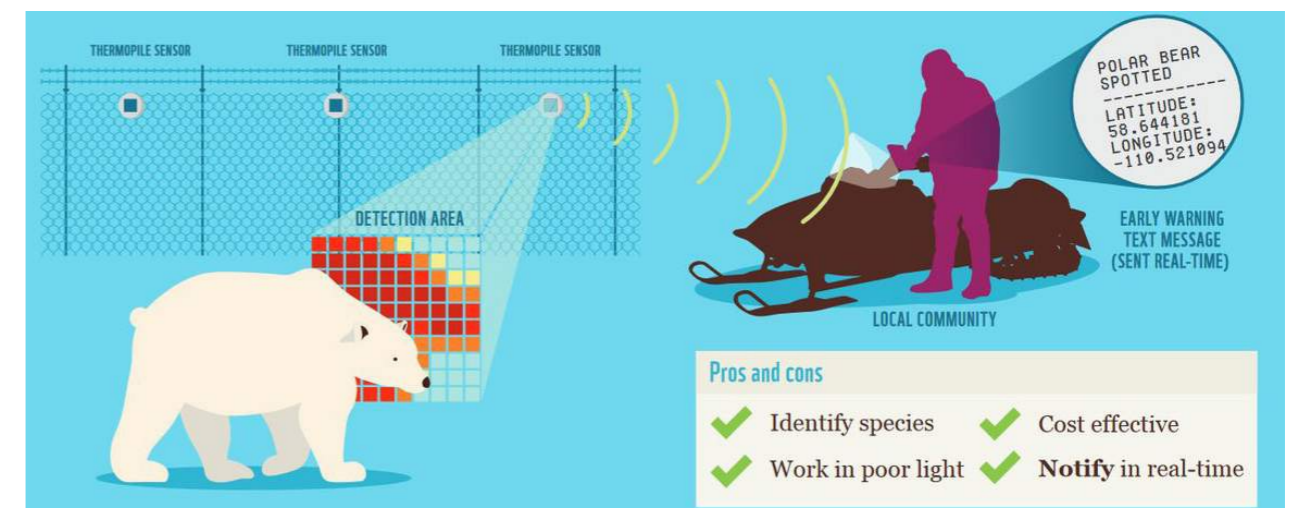
Zoohackathon

Coders, creatives and subject matter experts joined together at the second US State Department initated Zoohackathon to develop solutions to help reduce demand for wildlife products.

Team ODINN was announced as winner for their project, which intelligently processes images from camera traps in the field and immediately flags to rangers the presence of an elephant or human, allowing those protecting wildlife to identify poaching threats in real time and respond more immediately.

This could be a game changer in the fight against illegal trade, which has seen as many as 20,000 African elephants a year killed for their tusks.

Judges were particularly impressed that ODINN's hardware and software technology had potential to be easily integrated with existing camera traps.

Following inspiring talks by experts in curbing the Illegal wildlife trade, including John Mann MP, teams went on to produce a host of inventive solutions to the illegal wildlife trade, including an app that flags illegal wildlife products on foreign menus and technology to pull data from across social channels to find illegal sales of threatened species

Co-hosted by the U.S. Embassy London and ZSL (Zoological Society of London), this year's London Zoohackathon was attended by 80 coders, creatives and conservationists, and was generously supported by Bloomberg. Find out more about the projects developed in the Zoohackathon 2017 by visiting the Devpost Repository.

Following the UK Government's landmark announcement of plans to introduce a complete ban on the domestic trade in ivory, it was fitting that a new machine learning product designed to tackle the supply end of this illicit trade emerged victorious at the 2017 London Zoohackathon event. The team has also been announced as the global winner of this year's Zoohackathon.
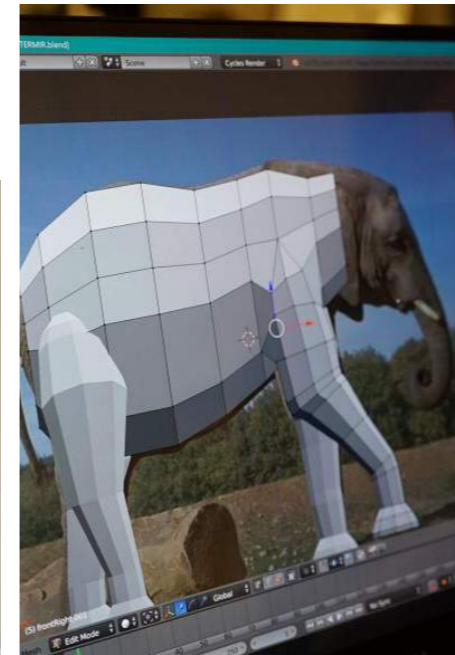
WHAT'S NEXT?

In 2017, we began exploring ways of mobilising our growing network to deliver real world results.

Throughout 2017 members of the **WILD**LABS community led initiatives that saw improvements in efficiency through reducing replication in work and effort, increasing access to and reducing the cost of technology-based solutions, and initiated projects that are developing new tools for conservation.

Looking ahead, **WILD**LABS will work to build on this strong foundation within three key areas of focus:

1   **Developing and optimising platform functionality**

Our first **WILD**LABS Community Survey in 2018 surfaced priorities for platform improvements to future proof and make the paltform more accessible and intuitive. These will be delivered in our phased upgrade plan.

2   **Supporting field tests of tech innovations**

To ensure ideas and solutions surfaced through initiatives like the HWC Tech Challenge have the support they need to deliver on-the-ground impact, we will continue to follow and provide community based support to these projects as they move beyond the challenge and inception phases into the more demanding testing phases.

3   **Engaging future private sector partners to provide technical experts to support conservation practitioners**

With an initial focus on tech solutions to tackle illegal wildlife trade, **WILD**LABS and its partners are working with the UK Government to engage the private sector and find solutions to the conservation challenges resulting from illegal wildlife trade.

Our top entry in the #Tech4Wildlife photo challenge in 2017 went to Roland Kays, who posted this photo of the ICARUS Initiative antenna. This antenna will be mounted on the International Space Station in 2018, transforming our capacity to track animals. (p16)