WildTrack™

Non-invasive Wildlife Monitoring

Footprint Identification Technology FiT™

Annual Report 2024-5

OUR MISSION

To protect endangered species using a unique combination of advanced data analytics, artificial intelligence and traditional ecological knowledge

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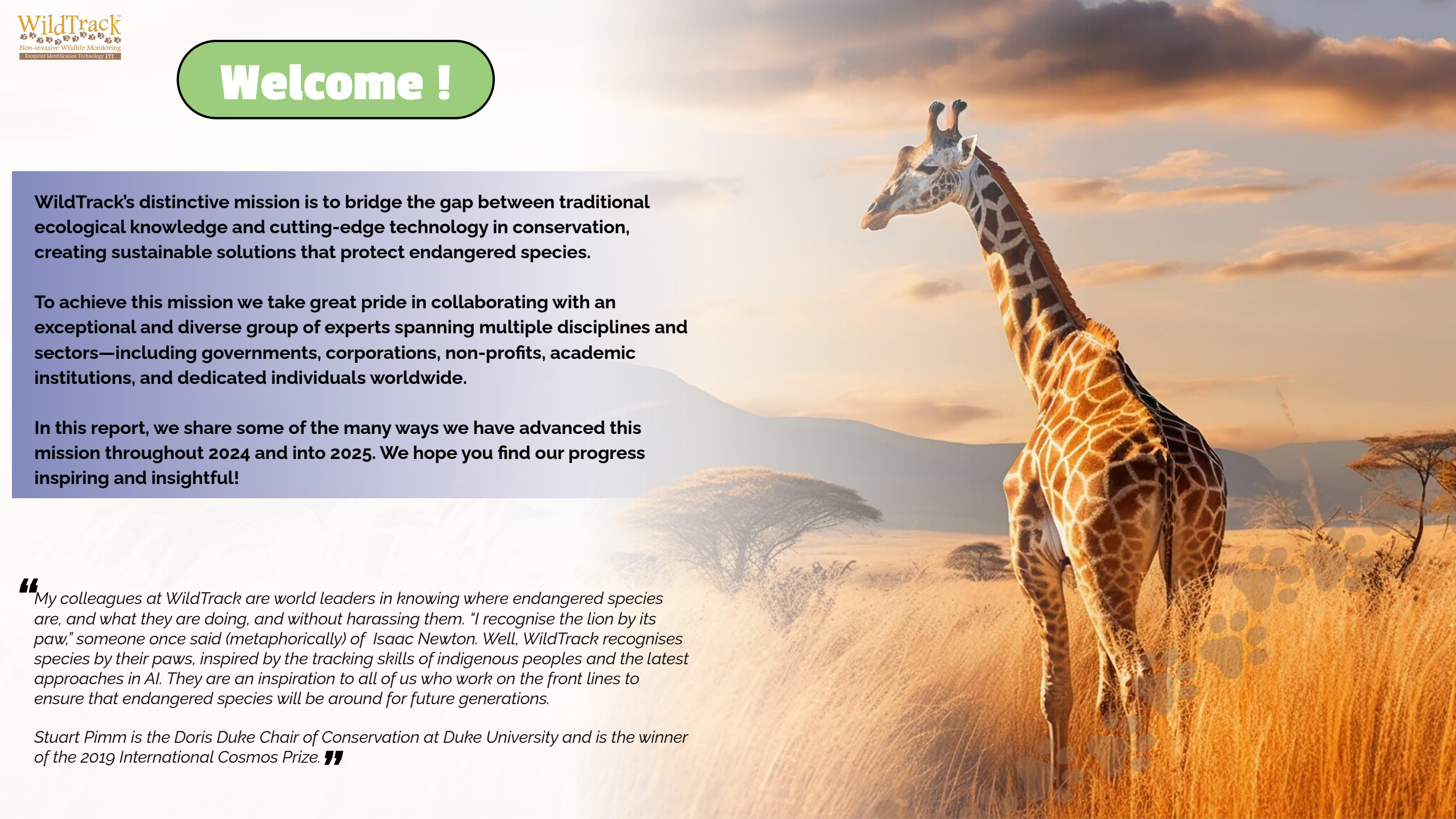
Adjunct Faculty, Duke University, USA

Welcome !

WildTrack's distinctive mission is to bridge the gap between traditional ecological knowledge and cutting-edge technology in conservation, creating sustainable solutions that protect endangered species.

To achieve this mission we take great pride in collaborating with an exceptional and diverse group of experts spanning multiple disciplines and sectors—including governments, corporations, non-profits, academic institutions, and dedicated individuals worldwide.

In this report, we share some of the many ways we have advanced this mission throughout 2024 and into 2025. We hope you find our progress inspiring and insightful!



"My colleagues at WildTrack are world leaders in knowing where endangered species are, and what they are doing, and without harassing them. "I recognise the lion by its paw," someone once said (metaphorically) of Isaac Newton. Well, WildTrack recognises species by their paws, inspired by the tracking skills of indigenous peoples and the latest approaches in AI. They are an inspiration to all of us who work on the front lines to ensure that endangered species will be around for future generations.

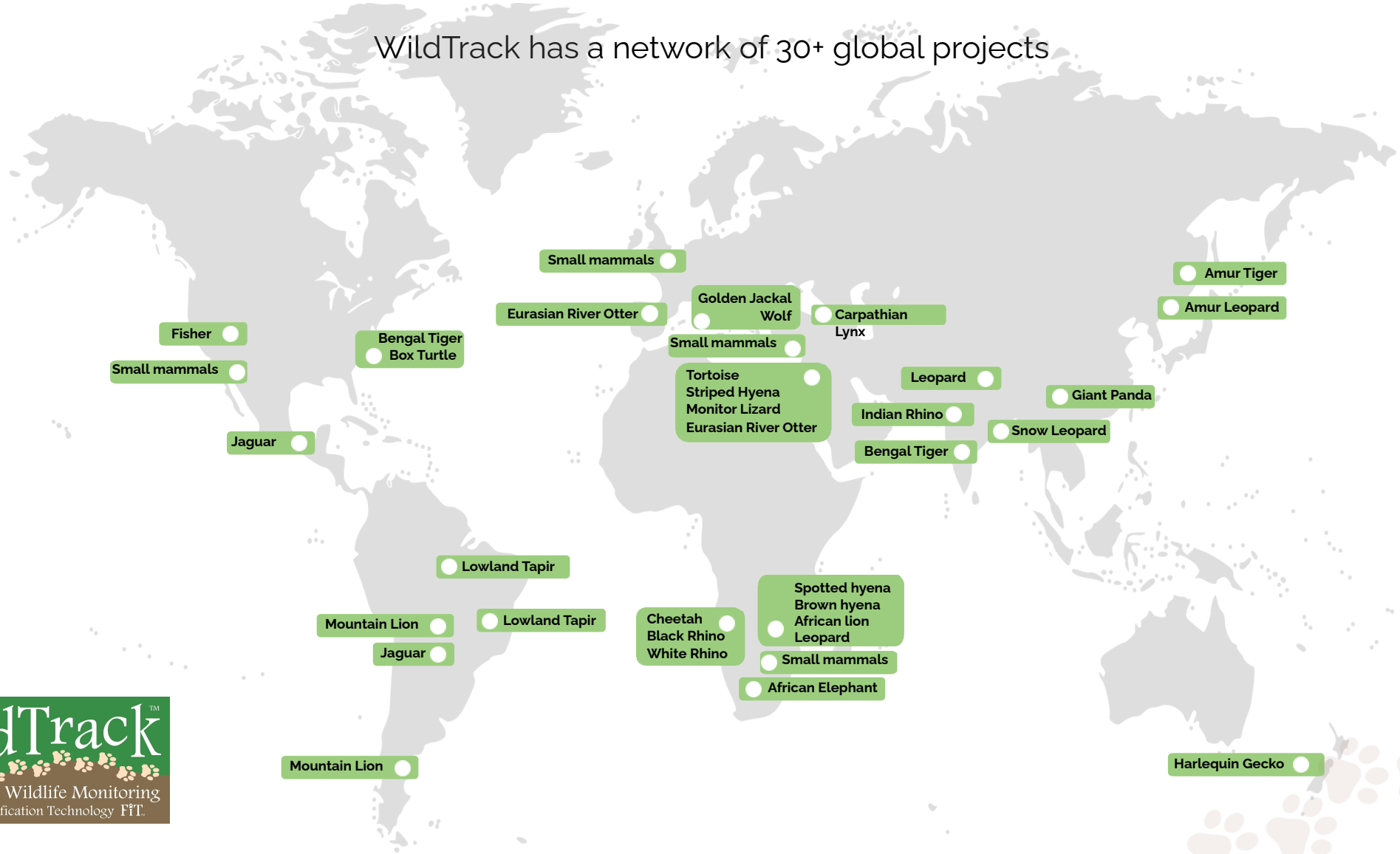
Stuart Pimm is the Doris Duke Chair of Conservation at Duke University and is the winner of the 2019 International Cosmos Prize."

Our Objectives

- To develop and apply non-invasive and objective censusing and monitoring techniques as a fundamental resource for wildlife conservation
- To revive, value and engage expert local ecological knowledge in communities who have lived with endangered species over generations
- To use the power of scientific networking to augment data collection from endangered species around the world

Our Projects

WildTrack has a network of 30+ global projects

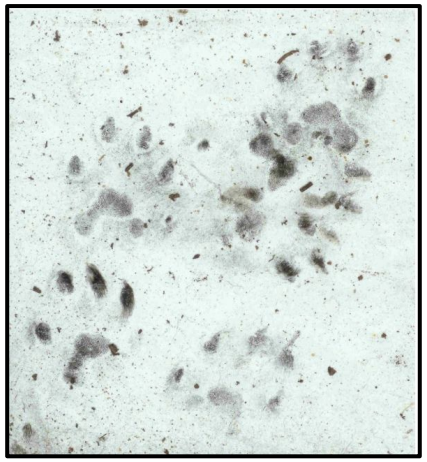


Our Vision

Footprint Identification Technology (FIT) can deliver high volumes of reliable, inexpensive, real-time global data for conservation

WildTrack's Footprint Identification Technology (FIT)

Offers a Transformative Solution



We have developed the world's first end-to-end solution to monitor species, using a novel data form: footprints.

Footprints are a rich source of data, and a transformative solution for conservation monitoring. They're much easier to find than animals themselves, they're easy to collect with a smartphone app, and they're rich in information (Jewell et al, 2020)

Footprint Identification Technology	Other commonly used techniques
Footprints are ubiquitous data	Locating endangered species is difficult, and sometimes dangerous
Footprint images are inexpensive and easy to collect. RHS: Instrumenting animals is expensive.	Fitting Instrumenting animals is expensive so can only be undertaken with small subsets of populations.
Collection is non-invasive, no impact on data quality	Tagging/collaring requires immobilization and can be harmful
FIT engages local communities through tracking	Rarely engage traditional ecological knowledge
FIT provides objective rapid footprint classification by species, individual, sex and age.	Often dependent on subjective assessment especially for individuals.

Our technology is used in a wide range of Wildlife Conservation Applications

Amur tiger

Data-driven scientific conservation strategies

Black rhino

Trade in endangered species funding terrorism

Mountain Lion

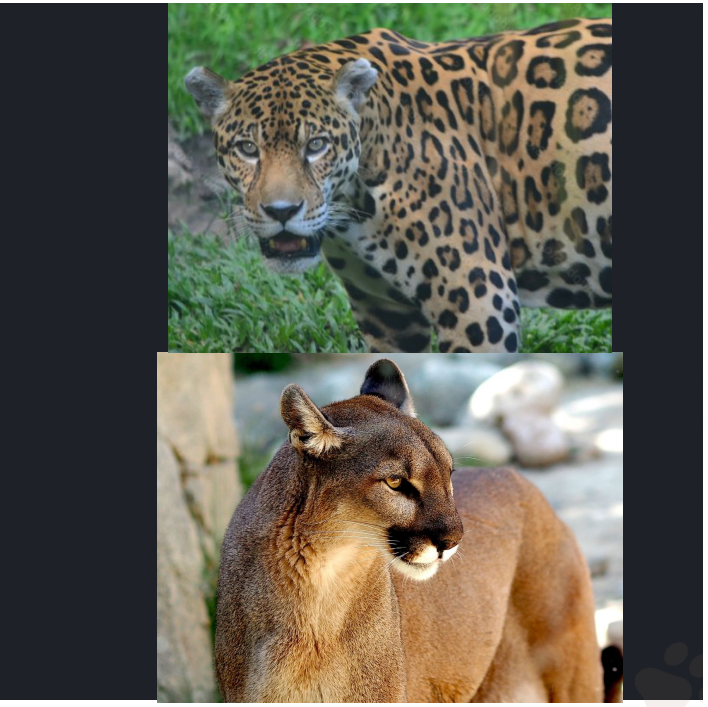
Human/animal conflict mitigation

Snapshots from the field: 2024-5

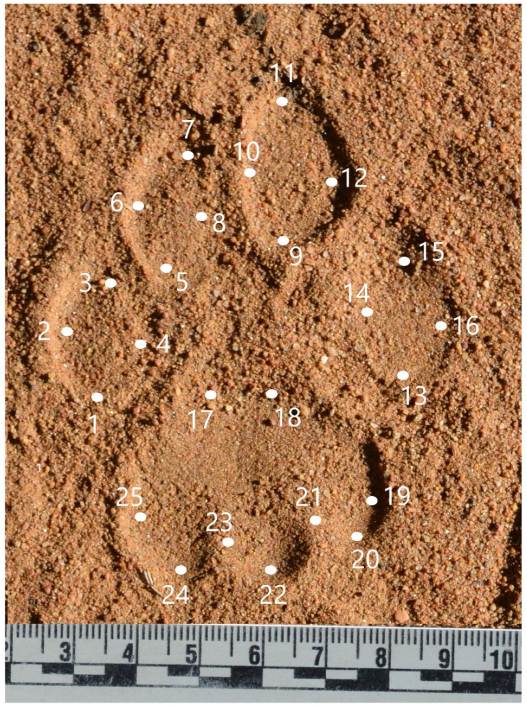
Credit: Solly Levi

Identifying: Jaguar from Puma by their tracks

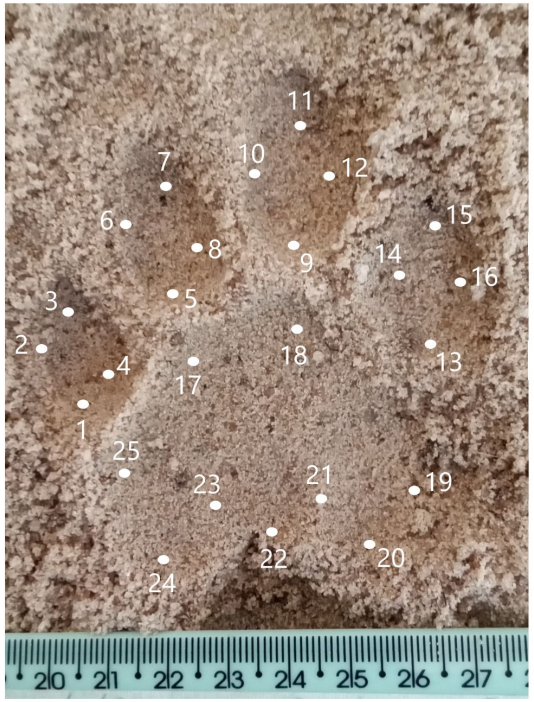
Our new model in JMP statistical software helps field biologists identify where jaguar and puma roam and focus on protecting their different environmental needs



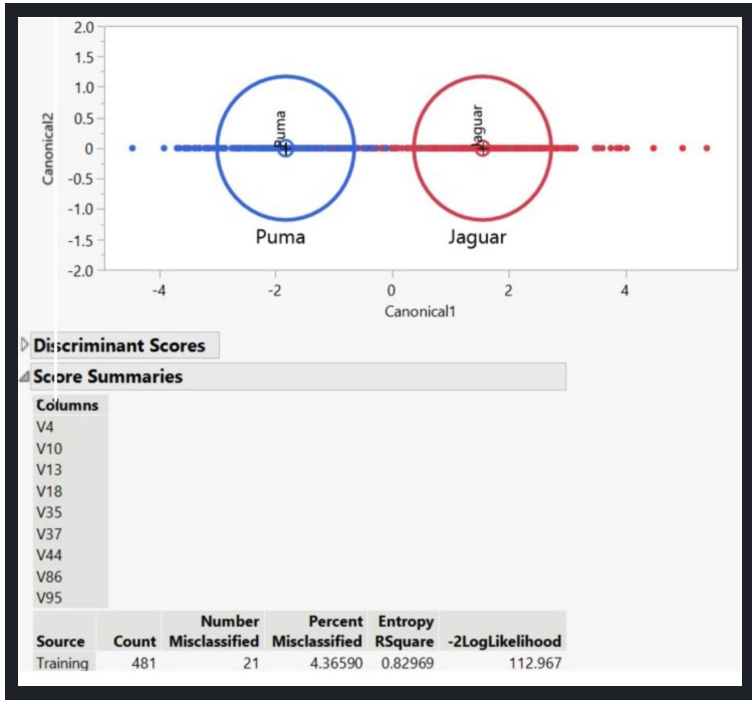
Top: Jaguar (*Panthera onca*)
Below: Puma (*Puma concolor*)



Puma (*Puma concolor*)
(Left hind footprint image)



Jaguar (*Panthera onca*)
(Left hind footprint image)



95.6% Species classification accuracy using Linear Discriminant Analysis in JMP

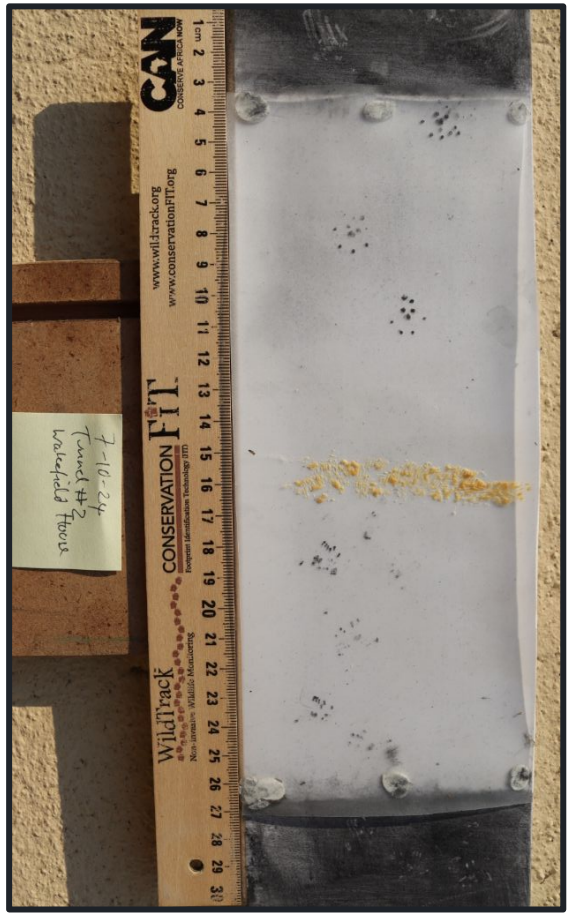
Small mammal monitoring in Southern Africa

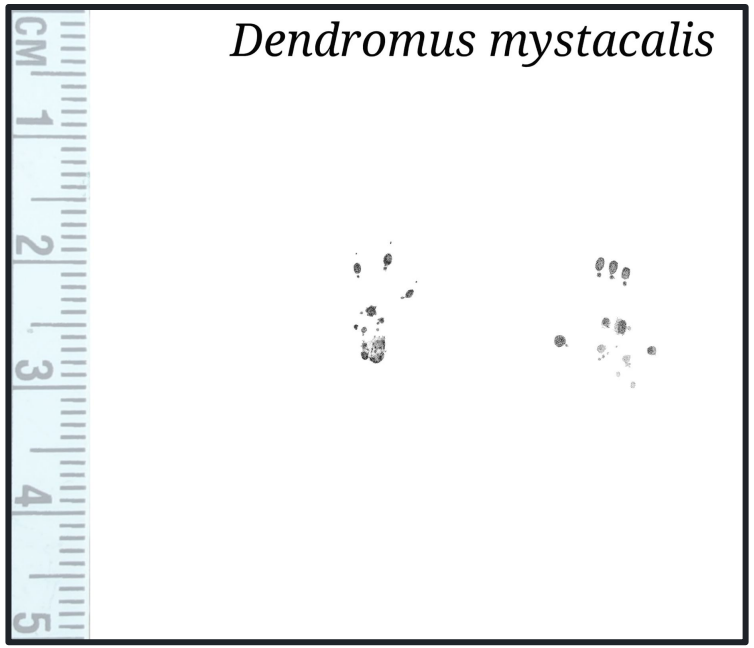
Small mammals are the engines of global ecosystems. Understanding their species distributions informs us how environmental challenges such as climate change and habitat disturbances of all kinds impact on all species. We collected tracks from 25 species of small mammals over 4 field sessions, and successfully built the first machine learning model to discriminate with 95% accuracy all five groups: mice, rats, gerbils, Sengis (formerly elephant shrews) and true shrews.

Local biologists learning from an expert tracker

Elephantulus myurus (Eastern Rock Sengi). This species is indistinguishable in hand from the Elephantulus intufi (Bushveld Sengi) but our footprint AI model delivered 94% accuracy in discriminating the two.

Better Data Quality : With Non-Invasive Methods

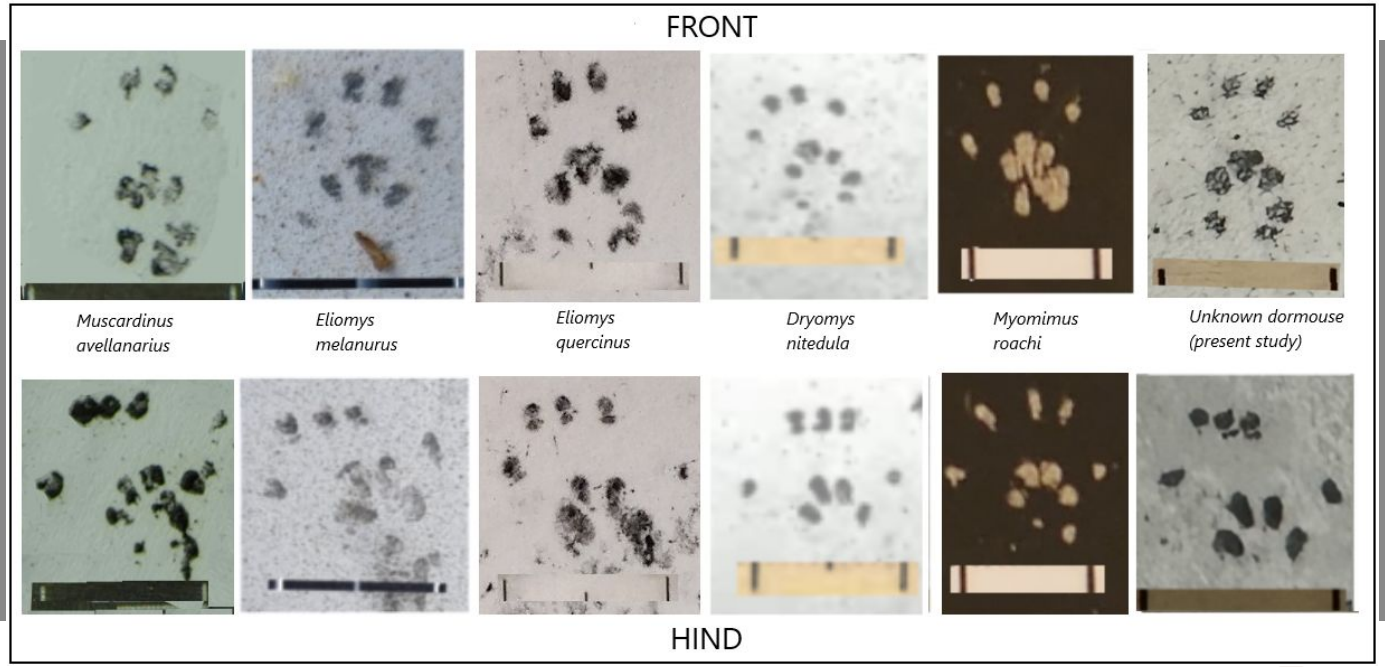




A track tunnel, open at both ends, captured tracks of a mouse. We checked with records,, and identified the species as the Chestnut Climbing mouse (Dendromus mystacalis). What made this discovery so interesting was that we had rarely found this trap-shy species using conventional closed traps. Working with wildlife artist and tracker David Wege we translated the tracks to be included in a field guide for biologists in Southern Africa.

Finding a New Species of Dormouse in Lebanon?

With colleagues from the Lebanon Reforestation Initiative (LRI) we collected dormouse tracks in Lebanon and demonstrated, with help from JMP statistical software that the tracks did not belong to any known species of dormouse. The LRI is applying for funding to collect more data and install cameras in field tunnels to match the animal to the tracks.



Left front and hind footprint examples for 5 known species of dormouse and the unidentified dormouse species in the present study

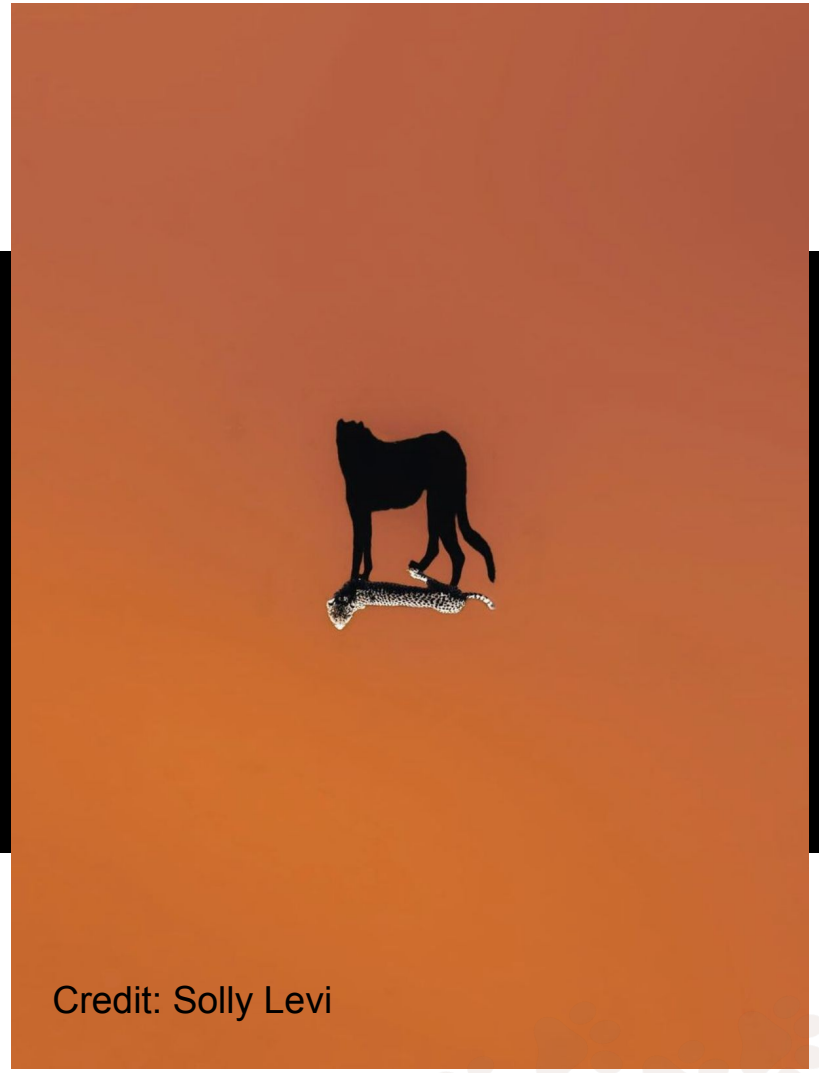
Endangered Species Security in Botswana

We developed AI models to classify 6 at-risk species of ungulates, including Black and White rhino, from their tracks so that their movements can be followed without having to see them. This work, currently in review for publication, is ongoing in partnership with the US Army and the Botswana Defence Force (BDF). The BDF is a major force in protecting Botswana's wildlife and this technology will help them quickly identify where ungulates need protection

Major Tinao Petso, our PhD student, guiding trackers to review and label data.
Credit: Major Tinao Petso, all rights reserved.

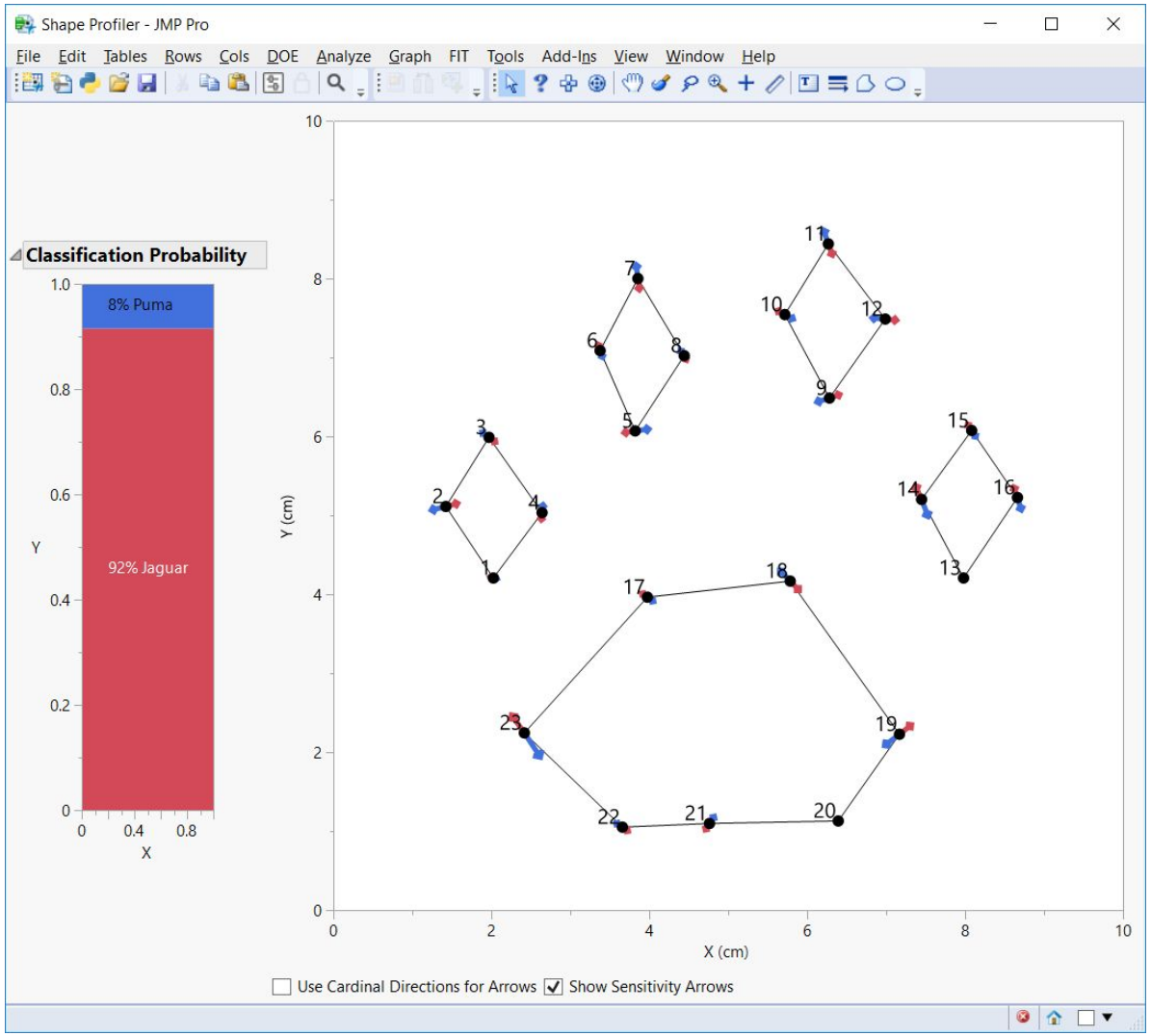
Major Tinao Petso with her field team in Botswana, collecting ungulate tracks.
Credit: Major Tinao Petso, all rights reserved.

Focal technology development projects 2024-5



Credit: Solly Levi

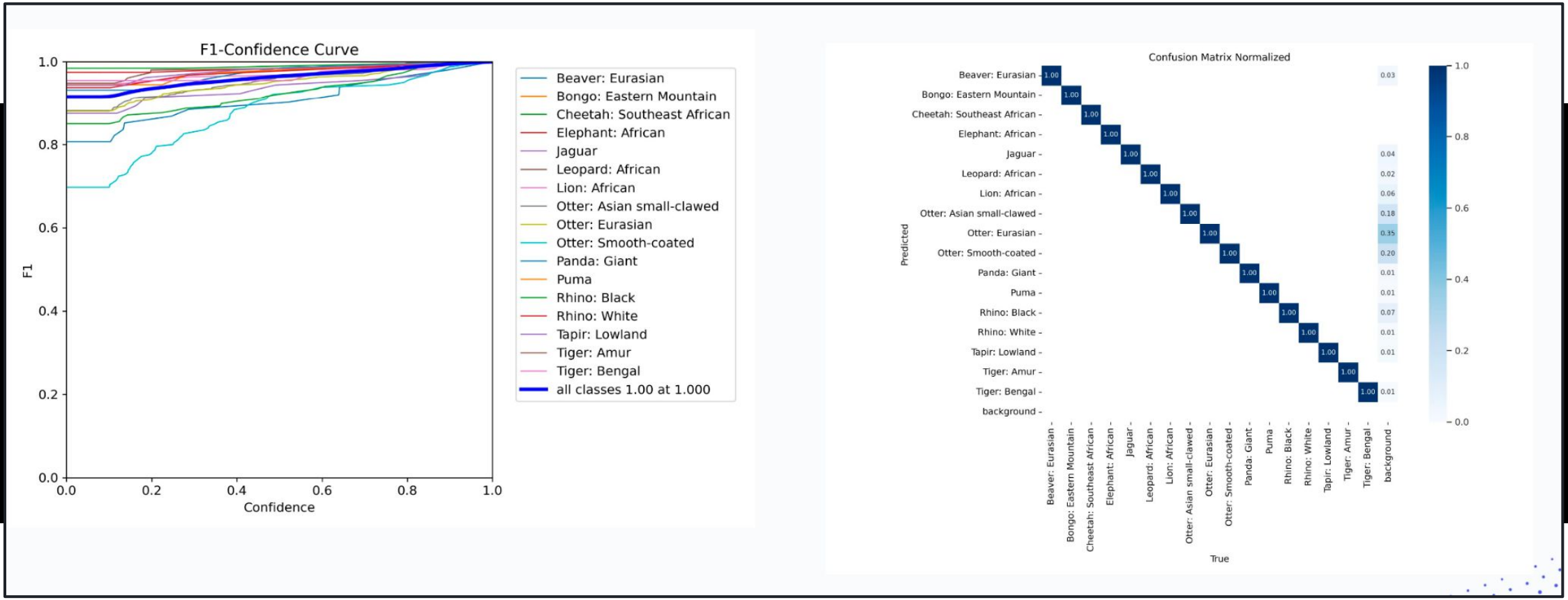
Rapid field identification for similar species: The Shape Profiler in JMP



The Shape Profiler, designed in collaboration with Caleb King from JMP Statistical software, could provide a quick and easy interface for field biologists to identify similar species that occupy the same area. Jaguar and Puma are an example. They both occupy large ranges of Central and South America, yet are rarely seen. Their footprints, however, can tell us where they roam and thus help us protect these areas.

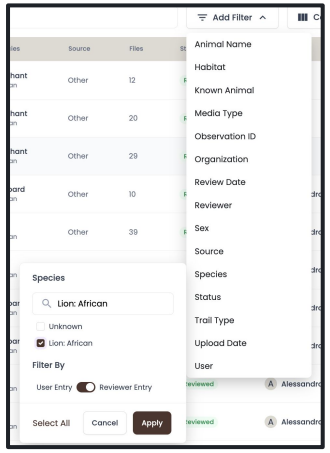
The shape profiler allows a field biologist to pull a series of shape points to match a footprint image, and using a shape identification model, a classification is immediately seen on the left side.

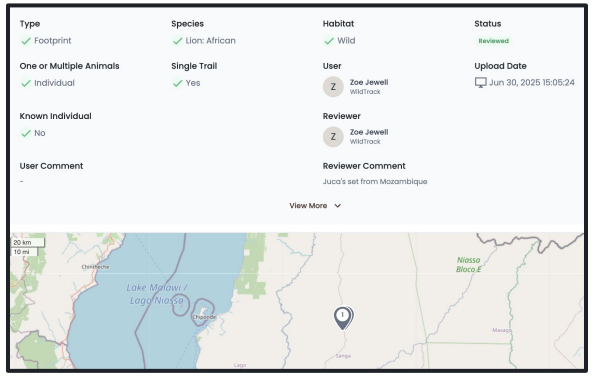
AI to Model Footprints: Identifying 17 Endangered Species

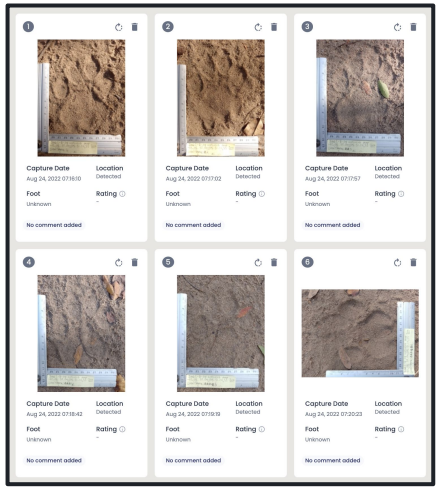


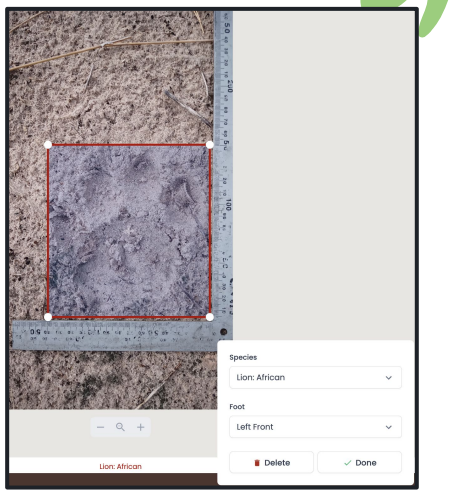
This is the first large-scale model for endangered species built on our WildTrackAI platform and will be used to develop in inference interfaces for rapid identification of these species in the field.

Faster data processing: New streamlined data review process









Stage 1

Species Search

The WildTrackAI database has extensive search options allowing the user to quickly filter by any one of 15 variables, including species

Stage 2

Review Observation

Each Observation uploaded may have multiple footprint images from one individual, or one species. The Observation as a collective is reviewed for accuracy and consistency

Stage 3

Review Each Image in Observation

Observations uploaded may have multiple footprint images from one individual, or one species. The Observation as a collective is reviewed for accuracy and consistency

Stage 4

Label Images for ML modelling

An integrated image-labelling platform enables the footprint(s) within the image to be boxed, labelled and saved prior to entry into the modelling process.

2024-5 Key Technology Milestones

Tech: Image labelling tool integrated into platform
Platform fully migrated from Flask to faster, dynamic React
Mobile App V2.1 released
Better designed tables and filters
New Observation and Media pages
New Species table
Platform and mobile full compatibility
New data review flow and labeling enhancements

Technology Partnerships: JMP Statistical Software, the US Army, US Air Force, Edge Impulse, JRS Biodiversity, AWS, Sentry, Later, MailChimp, Google non-profits, 1% for the Planet Community, The Climate Collective group.

Media Coverage: A snapshot

The Atlantic

SCIENCE

Animal Tracking Is Getting a Makeover

Paw-print scanning technology could help researchers better protect wildlife.

MONGABAY

Tracking footprints to monitor wildlife: Interview with WildTrack's Zoe Jewell

Smithsonian magazine

Even as A.I. Technology Races Ahead, the Prehistoric Science of Wildlife Tracking Is Making a Comeback

Smithsonian magazine

Artificial Intelligence Could Soon Match Footprints to the Animals That Made Them

Scientists are working on a machine learning tool that could turn anyone with a camera into an expert tracker

DAILY MAVERICK

OUR BURNING PLANET

PIONEERING TECH

Paws and effect — how mouse footprints could give clues to climate change

Hakai magazine Coastal science and societies

Artificial Intelligence Could Soon Turn Anyone into an Expert Tracker

Scientists are working on a machine learning tool that could, one day, identify individual animals from photographs of their footprints.

Hakai magazine: Monitoring brown hyenas; Daily Maverick, South Africa: Paws and Effect - how mouse footprints could give clues to climate change; Smithsonian magazine - Even as AI technology races ahead, the prehistoric science of wildlife tracking is making a comeback. Written by award-winning journalist Ben Goldfarb; Smithsonian magazine: AI could soon match footprints to the animals that made them; The Atlantic: Animal tracking is getting a makeover; Diversity in Action feature (p.34) and blog; Mongaby - interview with WildTrack

Awards & Nominations 2024-2025

THE EARTHSHOT PRIZE

The Earthshot Prize finds, supports and celebrates those who turn bold ideas into real solutions to repair our planet.

WildTrack has been nominated by The Climate Collective for the 2025 Earthshot Prize

Climate Collective

Accelerating early stage climate and nature tech innovations

WildTrack has been invited to join the Climate Collective community

https://climatecollective.org/

Selected Presentations

jmp | DISCOVERY SUMMIT

Wind Wildlife
RESEARCH MEETING
NOVEMBER 12–15, 2024 | CORPUS CHRISTI, TEXAS
REWI Renewable Energy Wildlife Institute

13th OPPENHEIMER RESEARCH CONFERENCE

USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

VIRGINIA TECH®
DEPARTMENT OF STATISTICS

Virginia Tech Conference, December 2024. 75th Anniversary. Presented on FIT in JMP with the Shape Profiler (Caleb King(; **JMP Discovery Americas, 2024**; **I know the Jaguar by his Paw; Oppenheimer Research Conference,** Johannesburg. Oct 2024 Small mammal monitoring for ecological integrity; **Renewable Energy Wildlife Institute,** November 2024. A rapid, inexpensive, biodiversity metric to assess ecological integrity at terrestrial wind sites; **US Forest Service presentation:,** Missoula, MT. June 2024. Using FIT to monitor wildlife with particular reference to field applications.

Sharing our Work with International Communities

The Oppenheimer Conference, Johannesburg, October 2024

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WildTrack website
www.wildtrack.org

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ai.wildtrack.org

Email contact
zoe@wildtrack.org

Our Team:
www.wildtrack.org/about/team

We are grateful for your support of our Mission in 2024-5