WildTrack™

Non-invasive Wildlife Monitoring

Footprint Identification Technology FIT™

Annual Report 2023-4

OUR MISSION

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

Dr Zoë Jewell, Dr Sky Alibhai
Co-Founders, WildTrack
Adjunct Faculty, Duke University, USA

Welcome, and thank you for joining us!

WildTrack is proud to work with an extraordinary variety of talented people across a range of disciplines and organizations, from governments, to corporations, non–profits, academia, and individuals in many different parts of this world.

Together we work to deliver WildTrack's unique mission, to bridge the gulf between traditional ecological knowledge and cutting-edge technology for conservation, and deliver sustainable solutions for the protection of endangered species.

Here we report on the many ways we have advanced our mission in the last year. We hope you enjoy!

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.
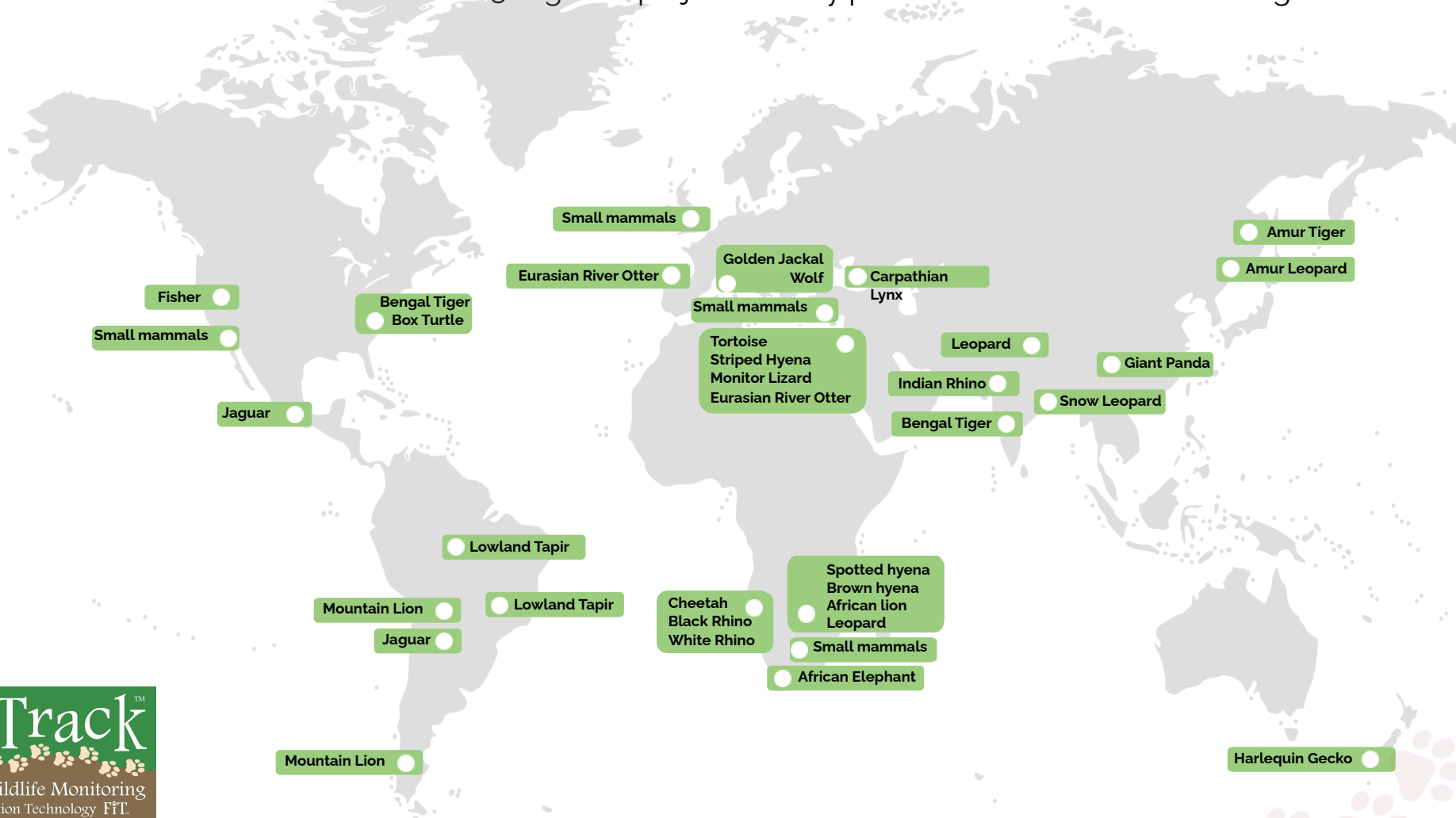
Our Objectives

✔ 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 run by professional conservation biologists.

Small mammals
Eurasian River Otter
Golden Jackal
Wolf
Carpathian Lynx
Small mammals
Amur Tiger
Amur Leopard
Fisher
Bengal Tiger
Box Turtle
Tortoise
Striped Hyena
Monitor Lizard
Eurasian River Otter
Leopard
Giant Panda
Small mammals
Indian Rhino
Snow Leopard
Jaguar
Bengal Tiger
Lowland Tapir
Mountain Lion
Lowland Tapir
Jaguar
Cheetah
Black Rhino
White Rhino
Spotted hyena
Brown hyena
African lion
Leopard
Small mammals
African Elephant
Mountain Lion
Harlequin Gecko

OUR VISION

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

WILDTRACK'S FOOTPRINT IDENTIFICATION TECHNOLOGY (FIT)
OFFERS A TRANSFORMATIVE SOLUTION
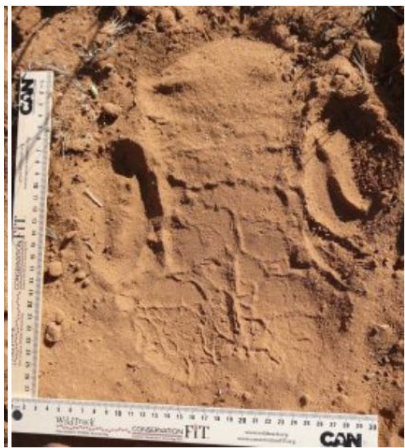
We have developed the world's first end-to-end solution to monitor species, using a novel data form: footprints.

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.

WILDTRACK DATA IS USED IN A WIDE RANGE OF WILDLIFE CONSERVATION APPLICATIONS

Baseline data on animal count and distribution informs

Amur tiger

Data-driven scientific conservation strategies

Black rhino

Trade in endangered species funding terrorism

Mountain Lion

Human/animal conflict mitigation

A sample of field conservation projects 2023-4

Credit: Solly Levi

Hyena monitoring in Southern Africa

Working with Dr Walter Musakwa (U. Johannesburg) and Marie Lemerle (U. Pretoria) to address human:wildlife conflict issues in Gonarhezhou National Park, and sustainability in coastal Namibia.

A brown hyena carries away a seal pup. Credit: Marie Lemerle

Brown hyena front (top) and hind (bottom) footprints in the sand on the Namibian coast. Note how much bigger the front prints are - the power and weight of the hyena are carried up front!

Developing a new metric to measure environmental integrity

Developing a rapid, inexpensive biodiversity metric to assess environmental integrity, using small mammal footprints. In collaboration with the National Museum of South Africa, Oppenheimer Generations Research and Conservation (OCRG) and the JRS Biodiversity Foundation.
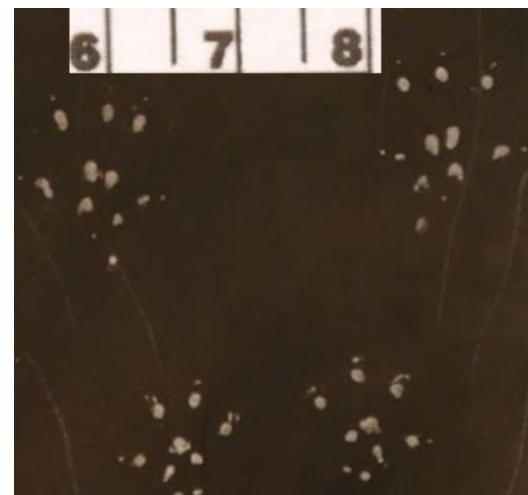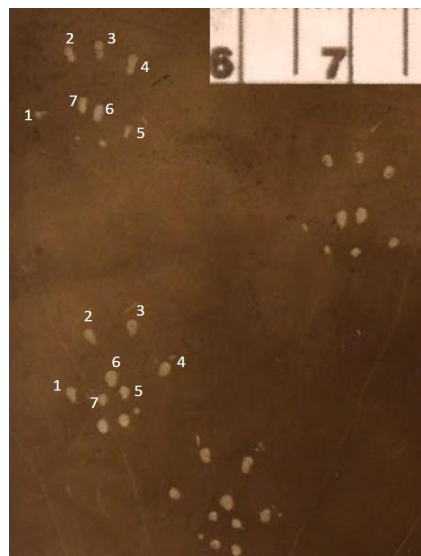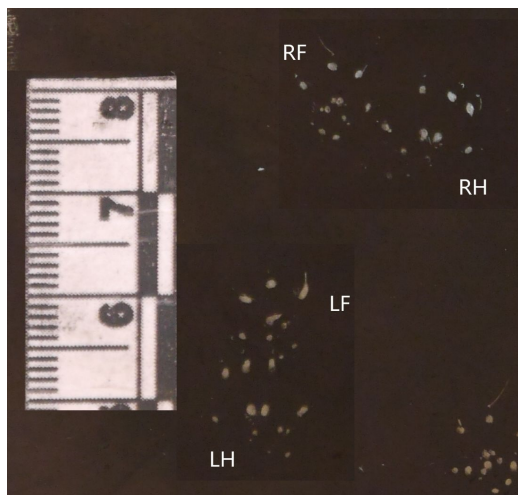
Endangered species security in Botswana

Using morphometrics and AI to identify at-risk species from their footprints in partnership with the US Army and the Botswana Defence Force (BDF)
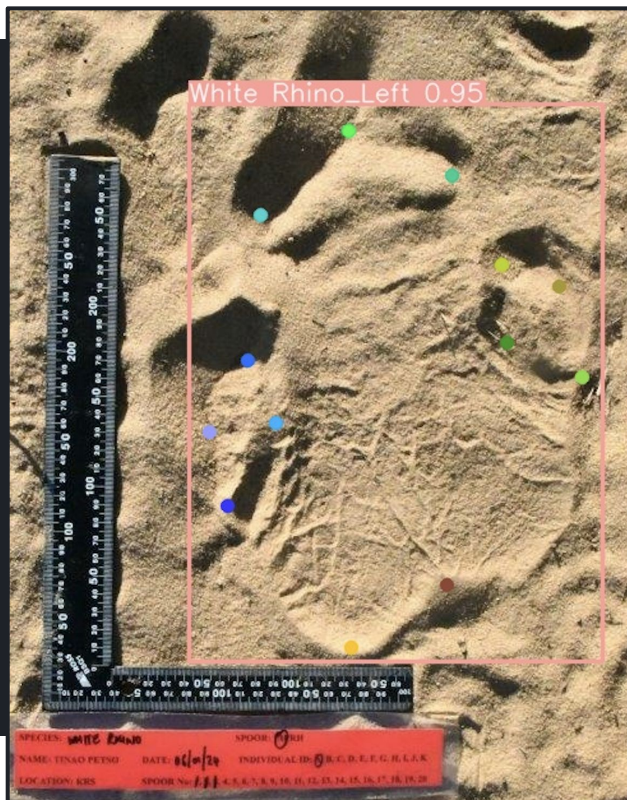
AI boxing rhino footprint.
Credit: Capt. Tinao Petso,
all rights reserved

From L to R: Mr Montiredi Lebopo (Tracker 1), Capt. Tinao Petso (research student), Pvt. Adder Mate (Tracker 2). Credit: Capt. Tinao Petso, all rights reserved.
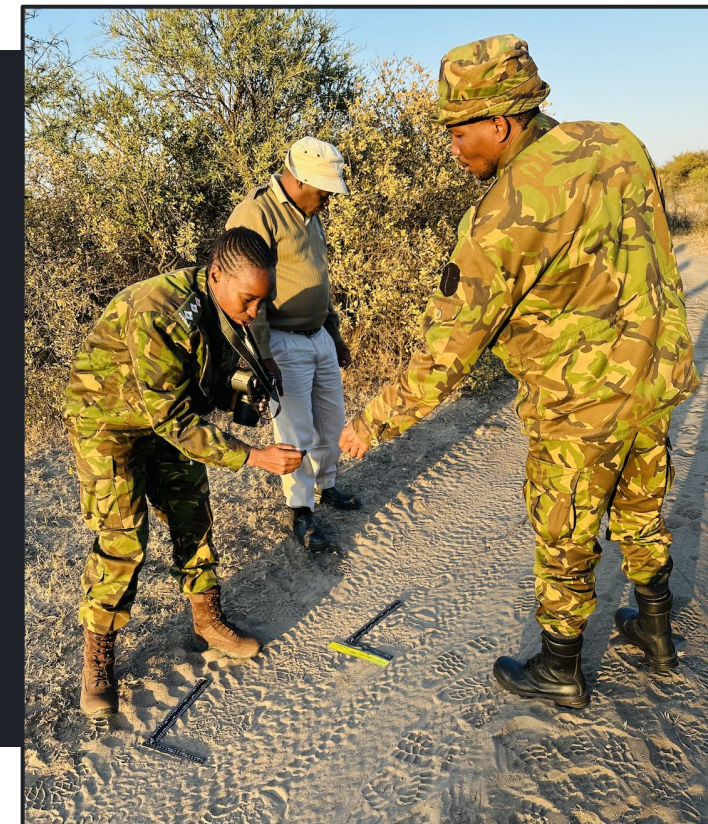
From L to R: Capt. Tinao Petso (research student), Pvt. Adder Mate (Tracker 2), Mr Montiredi Lebopo (Tracker 1). Credit: Capt. Tinao Petso, all rights reserved.

Disrupting the trade in endangered tortoises in Madagascar

Developing a mobile AI-powered app to identify and enable confiscation of illegally trafficked Chelonians taken from Madagascar for the pet trade

Radiated tortoise (*Astrochelys radiata*)

Side-necked tortoise (*Erymnochelys madagascariensis*)

Eastern Hinged-back Tortoise (*Kinixys zombensis*)

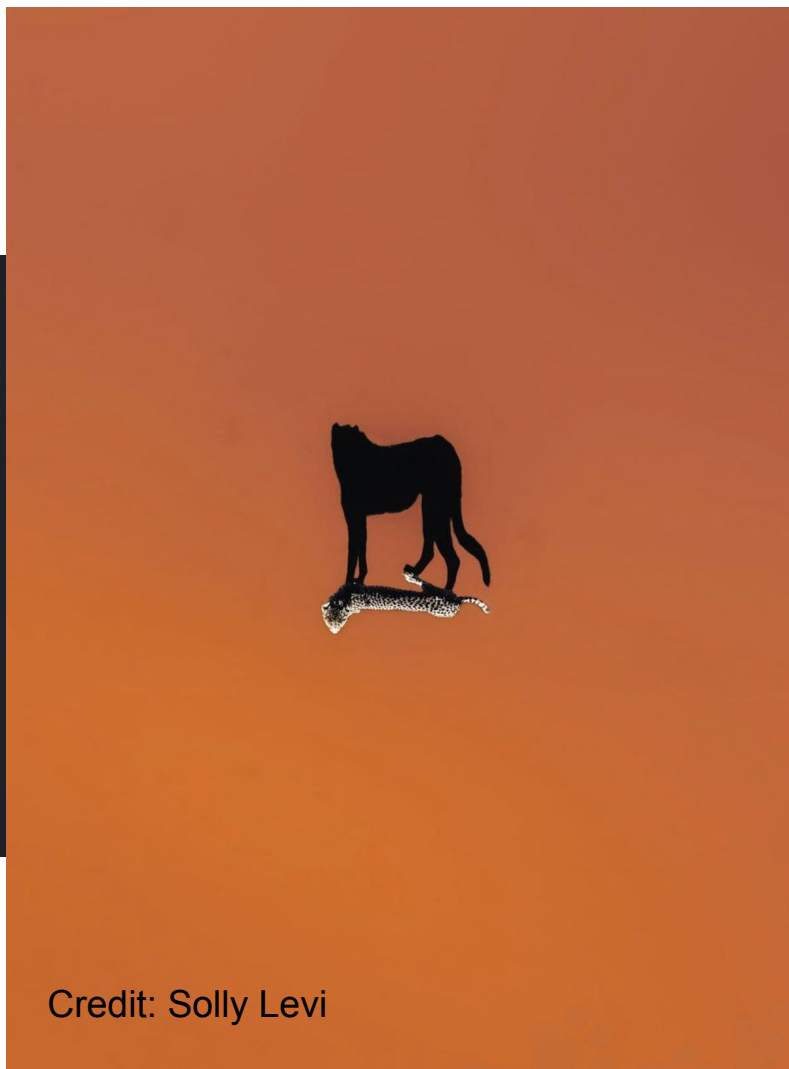Ploughshare tortoise (*Astrochelys yniphora*)

Spider tortoise (*Pyxis arachnoides*)

Flat tailed tortoise (*Pyxis planicauda*)

# Focal technology development projects 2023-4

Credit: Solly Levi

TECHNOLOGY TOOLS
AND METHODS

✔ WildTrack's Footprint Identification Technology (FIT) combines morphometrics and AI

✔ FIT can predict the species, individual, sex and age-class of the animal from a footprint. This is key data for conservation - telling us where endangered species are and their population demographics.

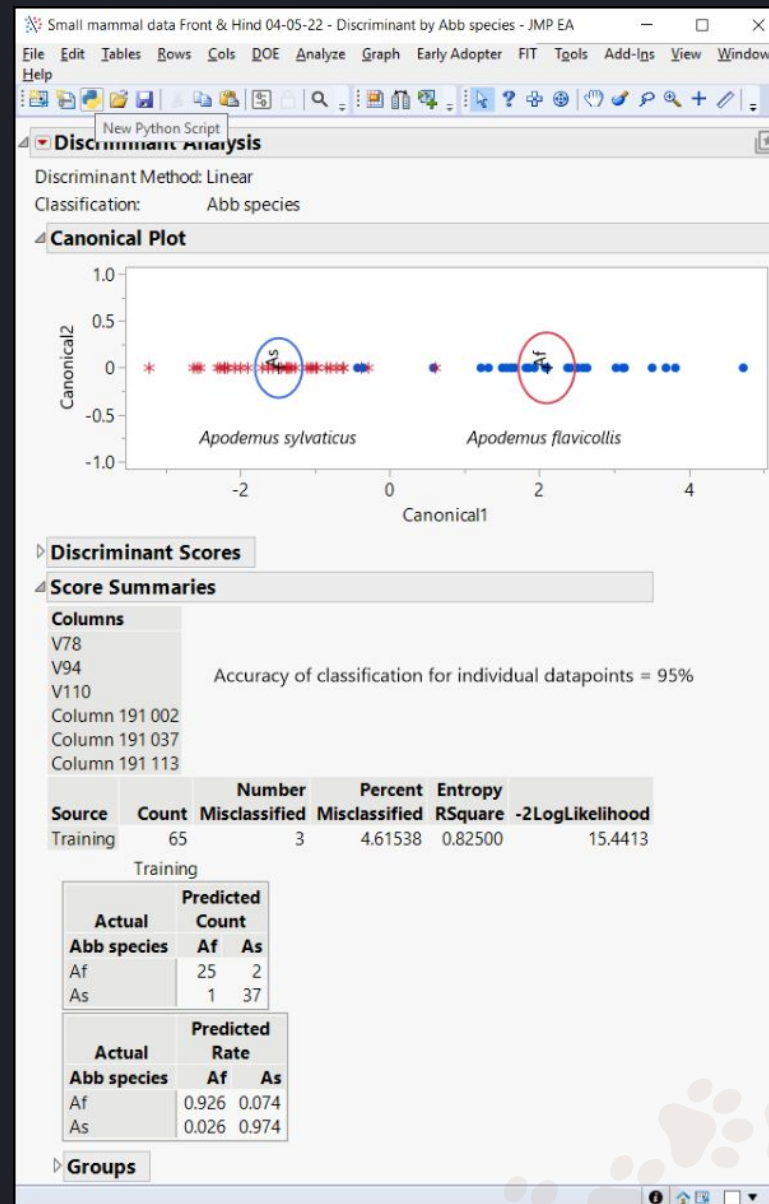✔ The beauty is that we don't need to disturb sensitive natural populations to do this. FIT is entirely non-invasive.
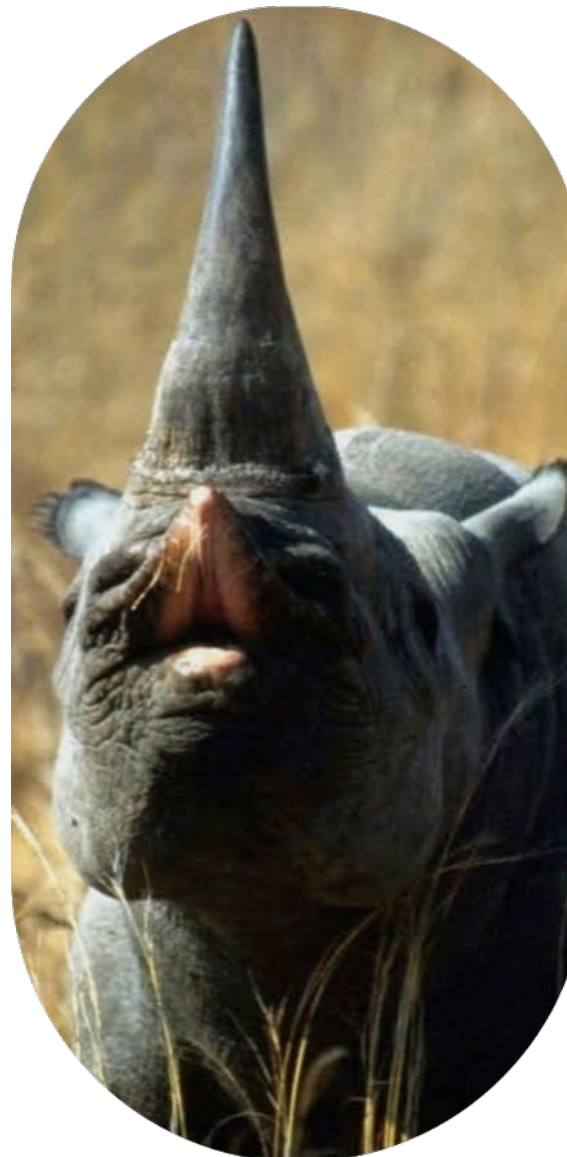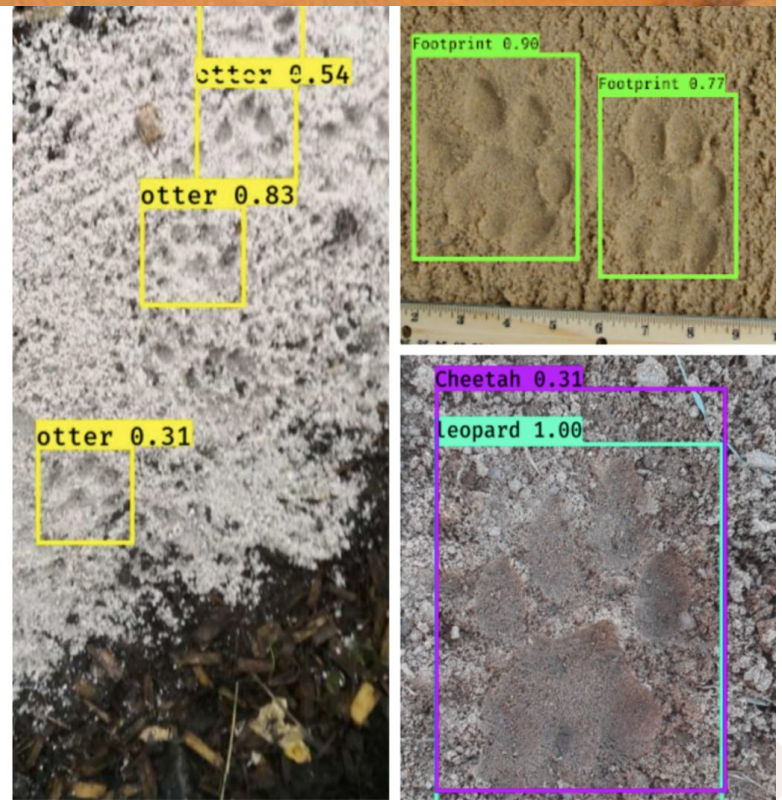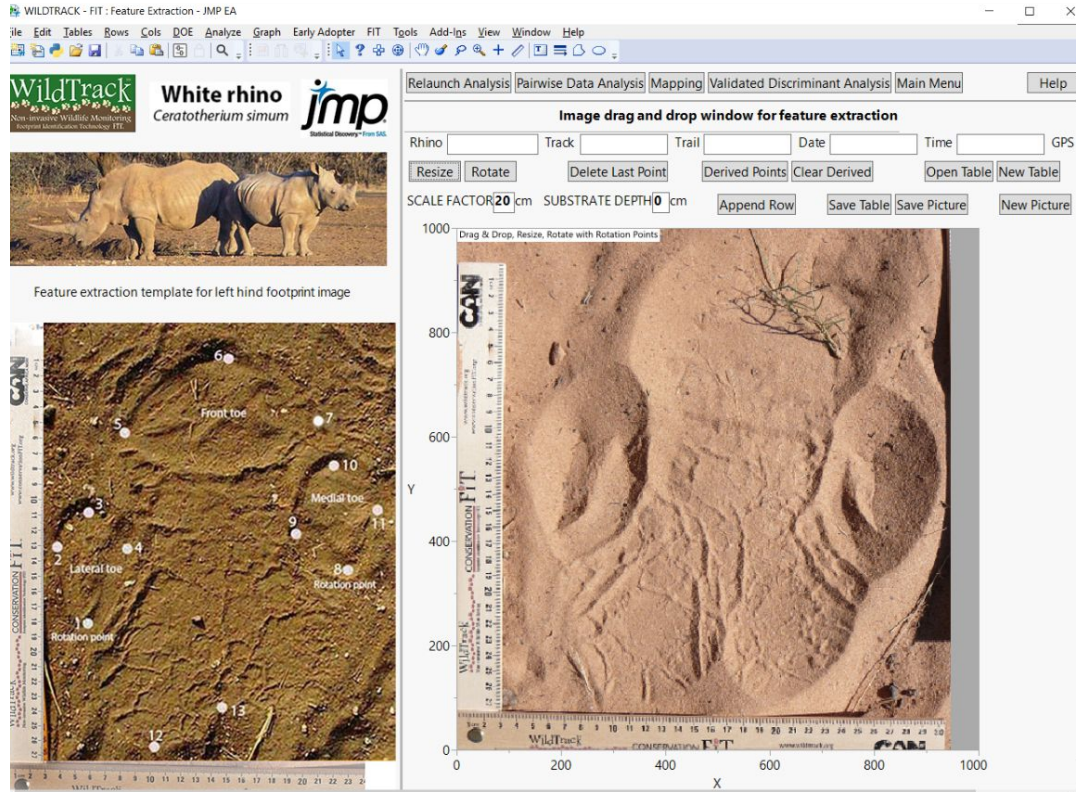
MORPHOMETRICS: IDENTIFYING SPECIES FROM MICE TO RHINO!
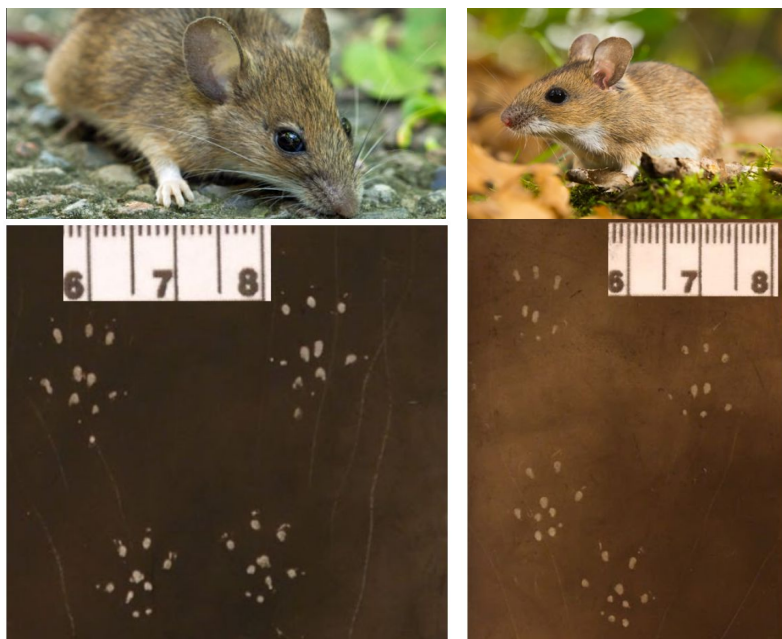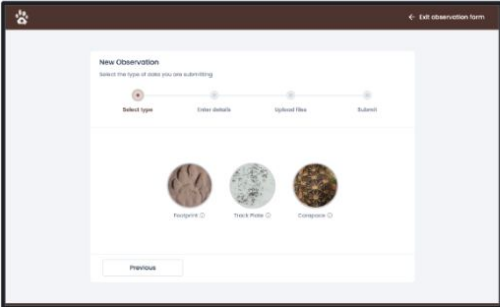

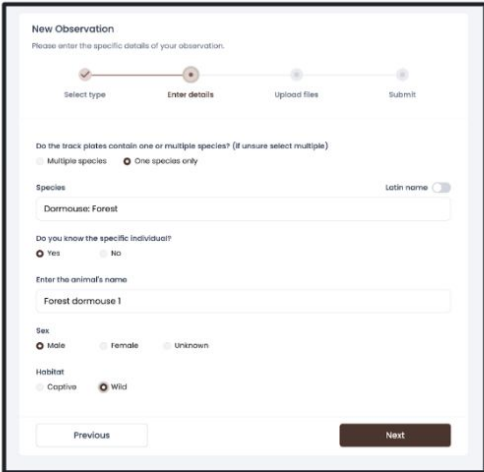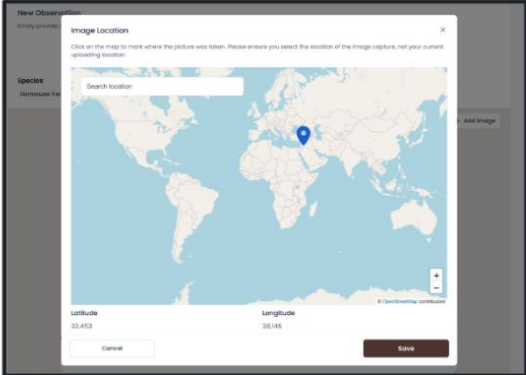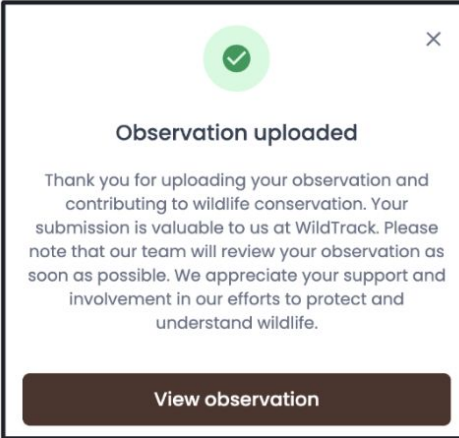*Apodemus sylvaticus*

Apodemus flavicollis

Distinguishing two very similar species of woodmouse using footprints collected on track plates in the field

Engaging users: New WildTrackAI upload interface

1	2	3	4
Select an image modality	**Complete the details of your observation**	**Where did you make this observation?**	**Thank you for helping us protect endangered species!**
Choose to upload footprints on natural substrate, or footprints on a track plate, or a tortoise or turtle shell image	Complete as many details as you can to accompany your image, eg the species or individual identity, the sex and habitat.	If your phone app records the GPS this can be completed automatically. If not, you can enter the location manually on the map	Each footprint you send to us is a step towards a non-invasive and cost-effective future for conservation monitoring!

AI PLATFORM GROWTH ACHIEVED IN 2023

DATA OVERVIEW

Category	Total	2023	Increase
Observations	3,800	+1,227	+47.69%
Images	20,888	+3,159	+17,82%
Users	502	+309	+160.10%

Source	Observations		Images	
	Total	2023	Total	2023
Mobile App	974	+952	2,132	+2,108
Web Platform	2,826	+275	18,756	+1,051

SCALING UP TECHNOLOGY

WildTrack partners with AWS & Provectus to refine and scale CI/CD and ML Ops pipelines as the first step towards a multi-year plan to serve conservation across the globe
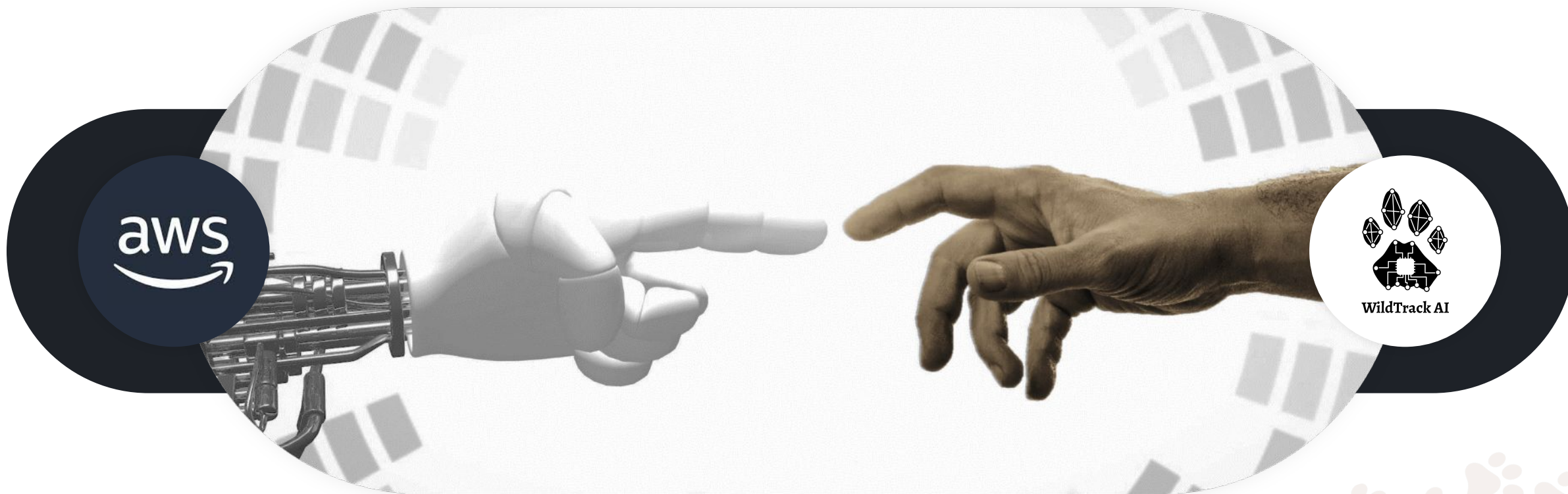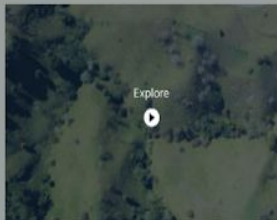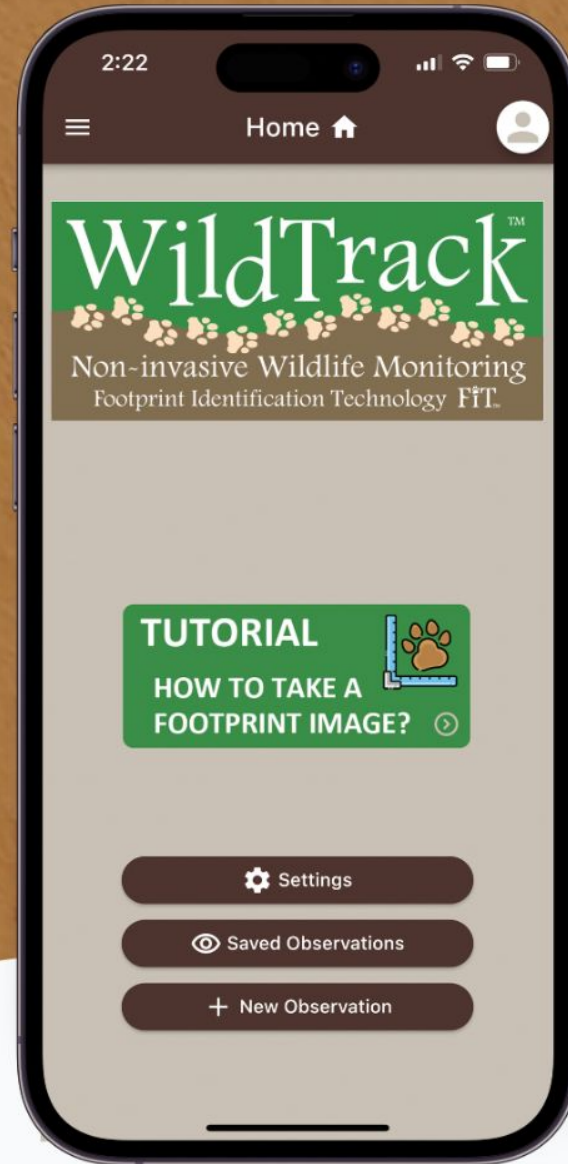
Manage all your observations in one place

WildTrackAI mobile app is available on Android and iOS

[APP STORE] [GOOGLE PLAY]

2023-4 KEY MILESTONES

Tech: Completed AWS migration
Launched Android mobile app.
Unveiled new WildTrack.org website
Released iOS mobile app
Finalized new platform UI design
Finalized v2.0 mobile app UI design
Deployed updated web platform

Technology Partnerships: JMP Statistical Software, the US Army, Edge Impulse, JRS Biodiversity, AWS, Sentry, Later, MailChimp, Google non-profits
Admitted to 1% for the Planet Community.

5 peer-reviewed research papers published
AI for otter species ID
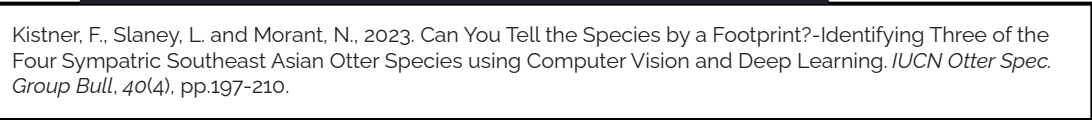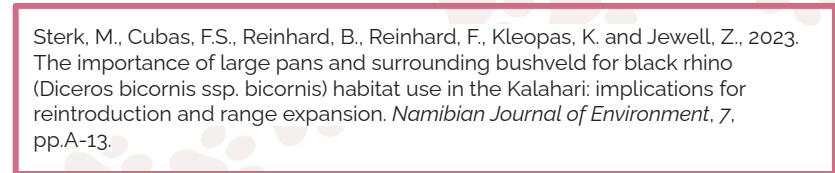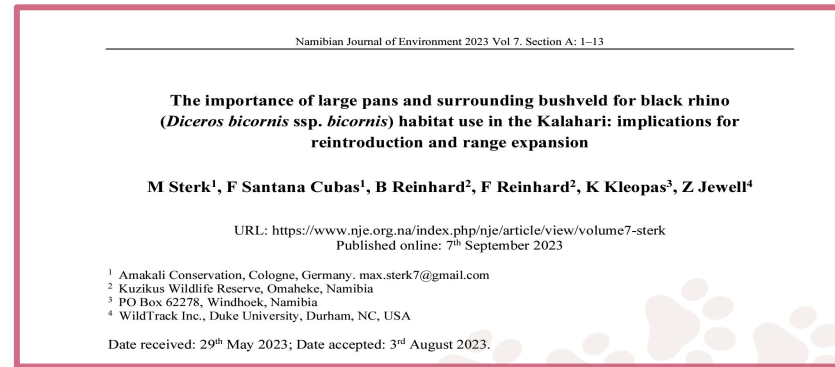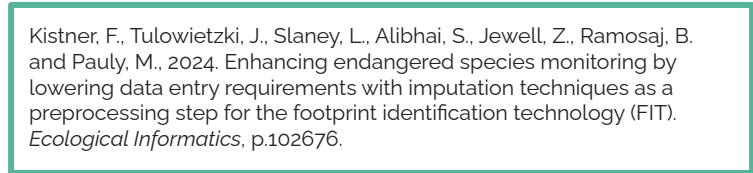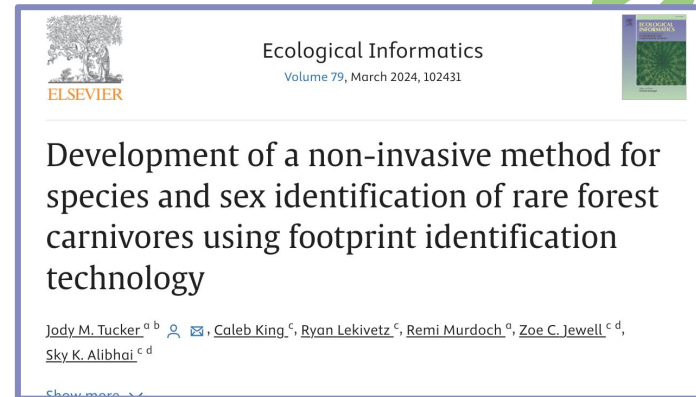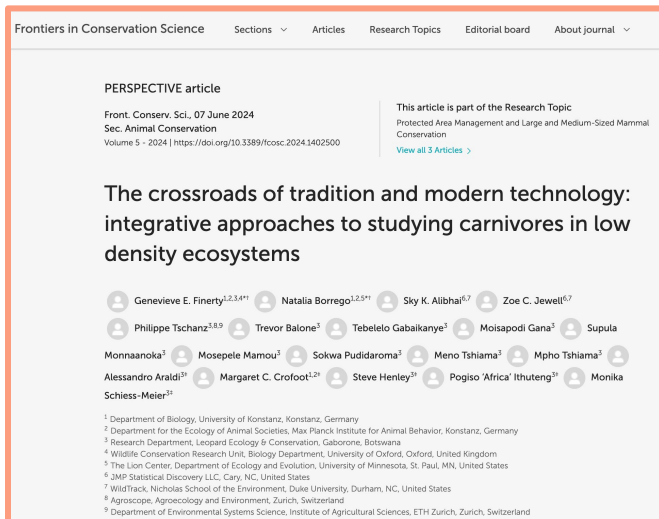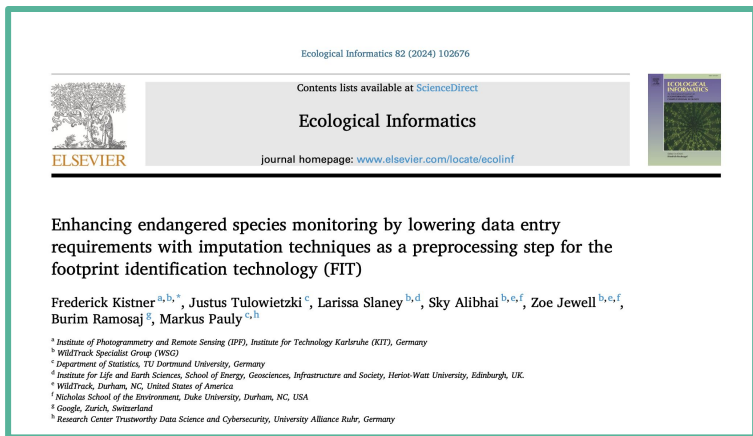Rare forest carnivore monitoring using FIT
Rhino habitat in Namibia
Data imputation for FIT
Lion monitoring in the Kalahari

2023-4 Peer-reviewed publications

WildTrack
Non-invasive Wildlife Monitoring
Footprint Identification Technology FIT

Kistner, F., Tulowietzki, J., Slaney, L., Alibhai, S., Jewell, Z., Ramosaj, B. and Pauly, M., 2024. Enhancing endangered species monitoring by lowering data entry requirements with imputation techniques as a preprocessing step for the footprint identification technology (FIT). *Ecological Informatics*, p.102676.

Kistner, F., Slaney, L. and Morant, N., 2023. Can You Tell the Species by a Footprint?-Identifying Three of the Four Sympatric Southeast Asian Otter Species using Computer Vision and Deep Learning. *IUCN Otter Spec. Group Bull*, 40(4), pp.197-210.

Finerty, G.E., Borrego, N., Alibhai, S.K., Jewell, Z.C., Tschanz, P., Balone, T., Gabaikanye, T., Gana, M., Monnaanoka, S., Mamou, M. and Pudidaroma, S., 2024. The Crossroads of Tradition and Modern Technology: Integrative Approaches to Studying Carnivores in Low Density Ecosystems. *Frontiers in Conservation Science*, 5, p.1402500.

Tucker, J.M., King, C., Lekivetz, R., Murdoch, R., Jewell, Z.C. and Alibhai, S.K., 2024. Development of a non-invasive method for species and sex identification of rare forest carnivores using footprint identification technology. *Ecological Informatics*, 79, p.102431

Sterk, M., Cubas, F.S., Reinhard, B., Reinhard, F., Kleopas, K. and Jewell, Z., 2023. The importance of large pans and surrounding bushveld for black rhino (Diceros bicornis ssp. bicornis) habitat use in the Kalahari: implications for reintroduction and range expansion. *Namibian Journal of Environment*, 7, pp.A-13.

OUR USER COMMUNITIES INCLUDE

- ✔ Indigenous expert trackers
- ✔ Scientists
- ✔ Recreational hikers
- ✔ Ecotourists
- ✔ Students

Our Southern African workshop colleagues in the field

L. Diederiks

WildTrack™

Non~invasive Wildlife Monitoring

Footprint Identification Technology FiT™

WildTrack website
www.wildtrack.org

WildTrackAI website
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 2023-4