



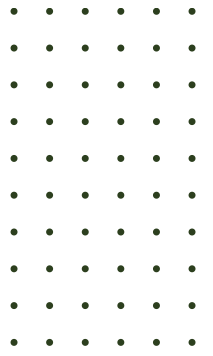
2024

RESEARCH &  
CONSERVATION ANNUAL REPORT

*Safari West*



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- Publish, start new projects, collaborate, spread the word.





# Blue Oak Research

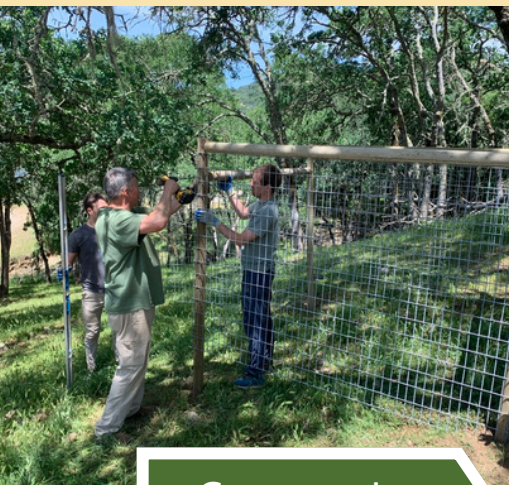


Isabella Boggio is a M.S. candidate at Sonoma State University. Her project focuses on the effects of exotic grazing on blue oak trees at Safari West, with the goal of enhancing & protecting Safari West's oak woodlands.

In our two 100 acre animal habitats, we have built 'exclosure' areas where blue oak seedlings are planted and monitored by our team of researchers.

Each exclosure has 24 blue oak seedlings planted inside the protected area, with 12 more seedlings planted outside. We added a second layer of protection inside for some of the seedlings to prevent small mammals, such as gophers and ground squirrels, from snacking on these young oaks.

Building these exclosures took a lot of work. We designed these exclosures to withstand our African hoofstock species such as Cape buffalo, wildebeest, zebra, and eland.



Constructing  
exclosures



Battling the  
elements



Finishing all  
20



# Planting oaks takes many steps...

Our oak team collected acorns from adult trees in the animal habitats.



Spread acorns on wet soil.



Give them time to sprout.



Stabilize temperature and watch them grow.





# Protecting Oak Seedlings



Oak predators such as this ground squirrel are documented with camera traps.

After planting more than 700 oak seedlings, we are now collecting data on their survival. We measure each individual seedling's height, stem diameter, and number of leaves. Any seedlings that are predated are also recorded. We note if exhibit animals or our native small mammals predated seedlings.

Using this information, along with environmental data such as tree canopy cover and soil compaction, we hope to determine what conditions are necessary for seedlings to survive on our unique property.



# Next Steps

## Continue Data Collection



- We plan to continue tracking our blue oak seedlings for the next year to determine which seedlings survive.
- All our data will be compiled and analyzed to determine significant differences in our seedlings' survival rates.



- Using the information collected from this study, we hope to develop a forest management plan at Safari West that will help our seedlings grow into adult trees.
- Many native species co-occur with our African hoofstock, and both groups benefit from our oak woodland habitats and rely on these amazing trees.
- This work is critical for maintaining our native oak woodland and preserving biodiversity for generations to come.



## Goals for the Future

- Once we finish our data collection and analysis, we hope to publish our findings to spread the word about the unique topic of maintaining exotic species collections in zoological facilities that are intertwined with the native landscape.







# Thank You!

This project has been made possible through the hard work of our blue oak research team, led by Isabella Boggio, Mark Pressler, Victoria Brunal-Byrd, and Dr. Derek Girman.

This project was originally proposed by Mark Pressler and Denise Cadman, who recognized the importance of Safari West's blue oak trees and helped initiate this project.

We have also received significant support from the Sonoma State University Biology Department, and have received funding from the California Native Plant Society.



CALIFORNIA  
NATIVE PLANT SOCIETY





# Monitoring Pregnancy in Rhinos Using Thermography



Breeding rhinos in captivity can be challenging due to their long gestation (16-18 months), and it can be difficult to detect pregnancy without invasive techniques such as internal ultrasounding.

Safari West has been developing a technique that uses a thermal imaging camera to document body surface temperature changes throughout our rhino's pregnancy.



# How does body temperature change with pregnancy?



Eesha

Our Southern White Rhino, Eesha, became pregnant with her first calf in 2023.

Throughout her pregnancy, our research team collected weekly thermograms focusing on her abdomen and teats, to determine changes in temperature related to a developing fetus and milk production.



Ongava



We photographed our male rhino Ongava, to compare to our female.

Using thermal imaging can be tricky. Ambient temperature and direct sun exposure can affect body surface temperature readings. We took thermal images in the early morning to prevent excess environmental influences.

We employed similar methods to thermography research conducted on female horses, where researchers compared areas of pregnancy, such as the abdomen, to areas not related to pregnancy, such as the legs, to create a relative difference measure between the areas.

Using these values, we looked at the difference in body surface temperature change between pregnancy related and other areas. We identified changes in temperature through each trimester, and also looked at how teat temperature changed as Eesha's due date approached.



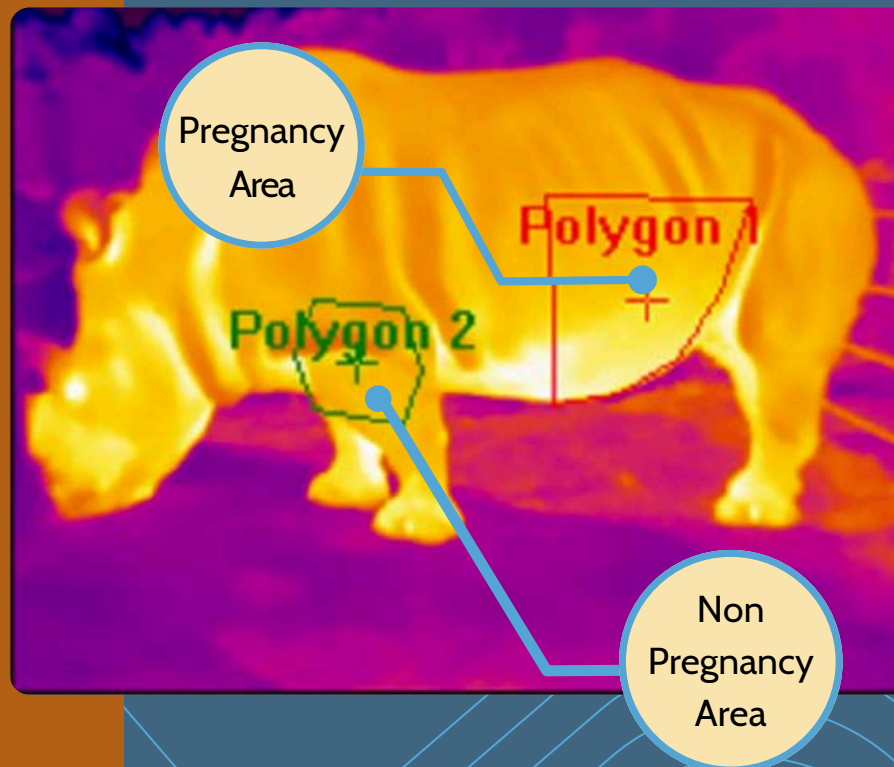
# Thermographic Imaging Methodology



- Thermograms were collected weekly throughout Eesha's pregnancy.
- We analyzed average and maximum temperature values to determine changes throughout the pregnancy.

## Pregnancy Area Analyses

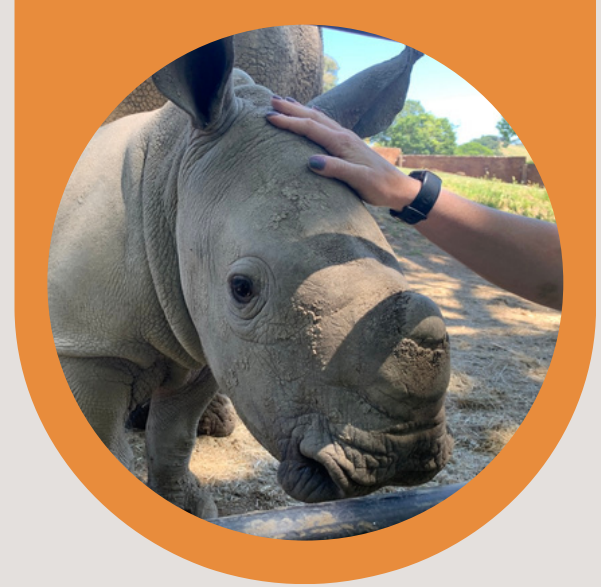
- We focused on the abdomen to identify a pregnancy field and the teats to determine signs of milk production.
- Thermograms taken in the field were then uploaded to our FLIR software and temperature values in our areas of interest were extracted.
- Pregnancy areas (Polygon 1) are compared to nonpregnancy areas (Polygon 2).





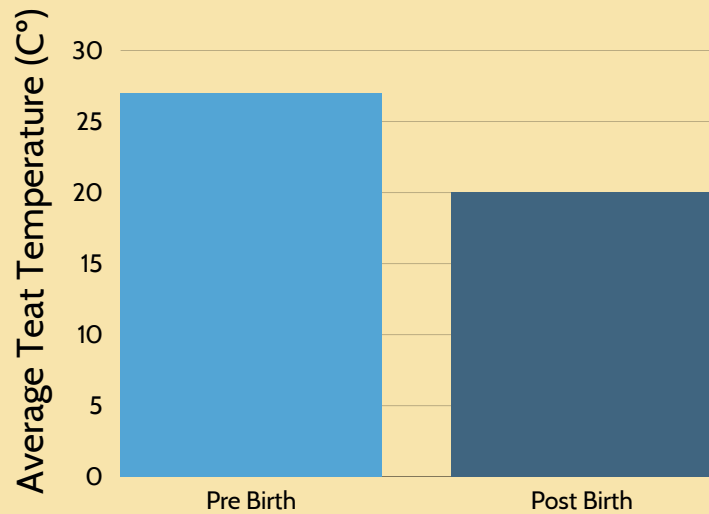


# Preliminary Results

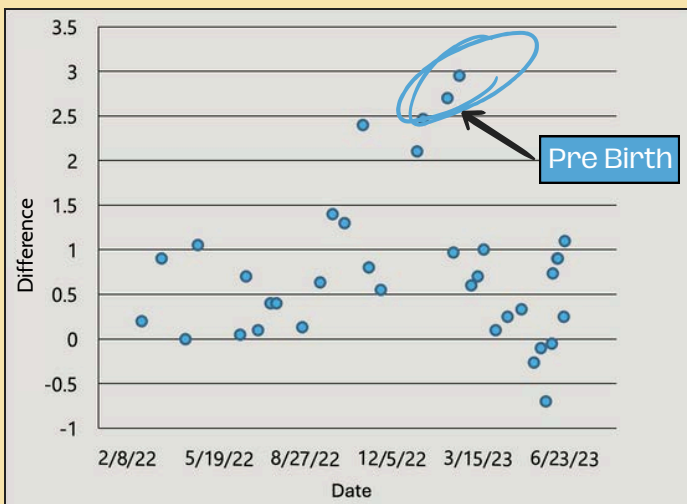


## Teat Analysis

- The mean temperature of Eesha's teats rose significantly ( $\sim 7^{\circ}\text{C}$  on average) just prior to giving birth.
- This increase in temperature after the birth event indicates that teat temperature increased, in part, due to milk production.
- We noticed this increase in temperature around the teats about a week before she gave birth.
- This data may be useful as an indicator of imminent birth, which can help zoological facilities monitor pregnant rhinos more accurately.



## Pregnancy Field Analysis



- The mean temperature difference between the pregnancy and non-pregnancy areas showed changes over time.
- The difference value peaked during the third trimester, just before birth.
- However, in our male rhino Ongava, no rise in temperature during the third trimester period was observed.
- This indicates that differences in pregnancy vs. nonpregnancy areas peak during the third trimester, potentially as a sign of a developing rhino calf.





# What's Next?

- We are continuing to document our rhinos for changes in body temperature.
- Future research may include additional rhino pregnancies at Safari West and at collaborating facilities.
- This work was made possible through our collaborator at SSU, Dr. Derek Girman, plus many Safari West staff members including Erika Defer, Victoria Brunal-Byrd, Kate Fox, and Lori McNeal.





# Giraffe Locomotion, Gait, and Thermography



Kate Fox is a M.S. Candidate at SSU, but she is also an animal caretaker & the conservation specialist at Safari West.



Kate is investigating the variation in giraffe locomotion and gait across individuals of different ages and sizes.

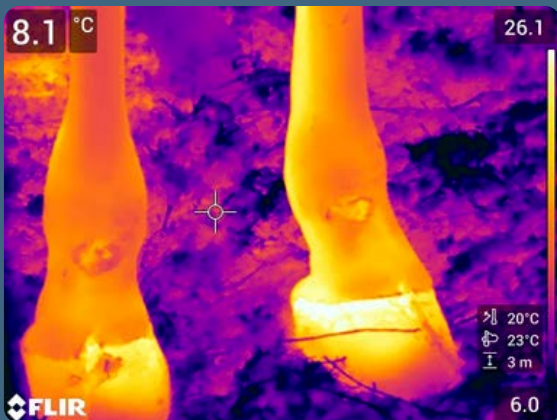
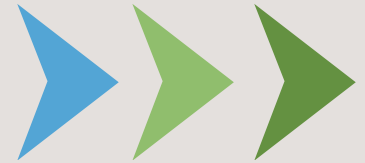
She is comparing changes in variables such as stride length to determine movement pattern trends in our giraffe herd.

She is also collecting thermographic imagery data to link these changes in locomotion with possible signs of inflammation.





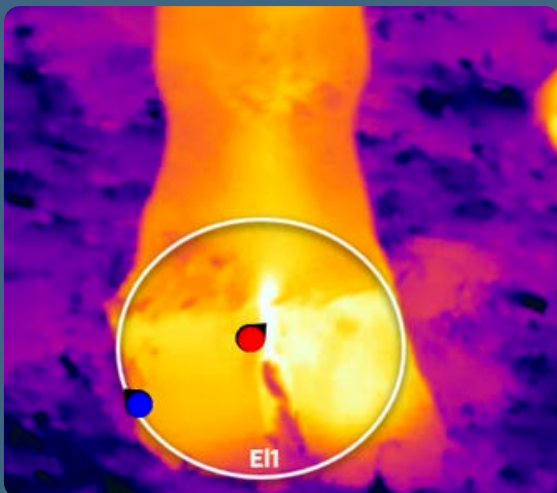
# Stride Lengths vs. Thermal Imaging



Working with our research team, Kate has been recording videos of each individual giraffe at Safari West as they walk through their habitats to measure their stride lengths. She collects thermographic images on the same day, to determine any signs of inflammation.

Each giraffe walking video is processed in a program called Image J, where we can measure the distance between individual strides within the videos themselves. This is done by using a known distance measurement of an object within the video, such as a fence post, which then allows the program to measure the giraffe's stride length with high accuracy.

We then compare the stride length measurements to their paired thermographic images taken the same day.





How far do our giraffes walk on average?



## Tracking giraffe movements

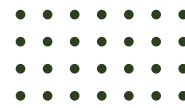
We are also using the behavior monitoring application Zoomonitor to track basic locomotion behaviors and total distances our giraffes move across their habitat.

- Interns are trained to identify individual giraffes (each giraffe has a unique spot pattern) so they can record how far they are moving.
- We record locomotion related behaviors such as running, walking, or how often they lie down.
- Using Zoomonitor, pixel coordinates of our giraffe habitat are produced, which are then converted to Latitude & Longitude coordinates using ArcGIS, allowing us to measure how far a giraffe moves through its habitat during an observation session.





# Next Steps



Kate is continuing to collect data for this project, and will be visiting additional facilities that house giraffes to expand the project's sample size of unique individuals.

She has started data collection at B Bryan Preserve in Point Arena, and she plans to visit more zoos throughout this year.



This project will have highly beneficial applications for giraffe management under human care, helping us understand how gait and locomotion trends change over time as our giraffes get older. This will allow animal caregivers to identify changes in normal trends in gait and locomotion, which can also be supported by thermal imaging temperature readings.

We hope to publish this study once our analyses are complete, so keep an eye out for updates on this project later this year.





# INTERN PROJECTS

We work with a variety of interns from near and far. During our behavior internship program, interns get the opportunity to design and implement their own mini research project. They work closely with our research staff, who guide them and help develop their projects using the scientific method.



## What kind of projects?

Our behavior internship projects vary based on the intern's interests. Past projects have looked at behavior changes between different rhino breeding pairs, bird reactions to UV painted objects, and acoustic enrichment used to determine behavior changes in our ring-tailed lemurs. These projects help interns develop research skills through project design, behavior recording, and statistical analyses.



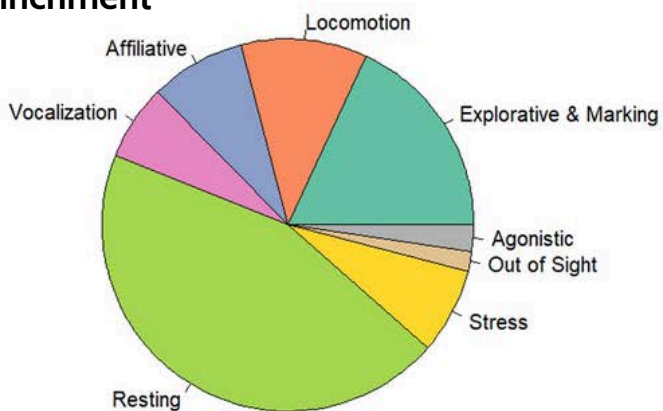


# Ring-tailed Lemurs: Acoustic Enrichment

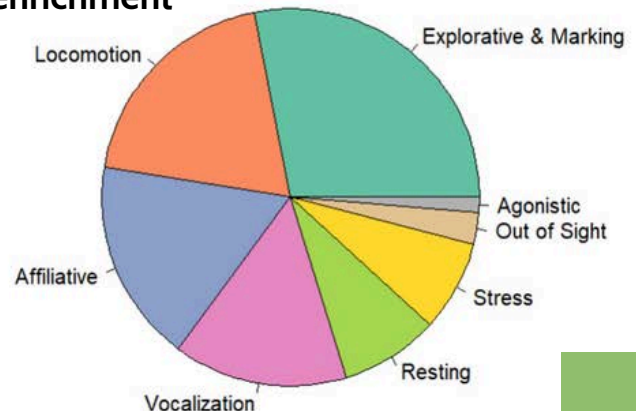


- Fernanda Lechugan from National Autonomous University of Mexico (UNAM) recorded behaviors of our two ring-tailed lemur troops to determine how they responded to different playback calls. These playback calls were used as acoustic enrichment that aimed to change the lemurs' soundscape, promote more active behaviors, and decrease inactive behaviors. Fernanda recorded 184 observation sessions over the course of 4 months.
- Her study found that by doing acoustic enrichment, we can increase overall lemur activity levels. She saw dramatic increases in locomotion, vocalization, explorative and marking, and affiliative behaviors when playing the sounds, compared to control sessions where no sound was played. She also saw a sharp decrease in time spent resting.
- This project demonstrates how changes in the soundscape can diversify behavior in ring-tailed lemurs. We are currently working on publishing these results.

**Behavior patterns without acoustic enrichment**



**Behavior patterns with acoustic enrichment**





# Upcoming Project

## Western Pond Turtles & Native Herpetofauna



Our Research and Conservation Departments are collaborating to start a project that will focus on population trends of some of the native species on our property.

Specifically, we will focus on collecting data on our Western Pond Turtles (WPT), a candidate species for an endangered species listing in California.

## Project Goals and Methods

- Using hoop traps, WPT at Watusi Lake will be captured to determine size, sex, and age.
- For WPT that are big enough, we will attach radio telemetry devices to their shells to collect data on their movements around the pool and find nest locations.
- Data will continue to be collected using coverboards for native herpetofauna species to determine species abundance and diversity.
- This project will help us learn about native species at Watusi Lake, with the goal of bolstering their populations.
- This project is funded, in part, by the Fish and Wildlife Sonoma Commission with support from Sonoma State University.





# Upcoming Project

## DeBrazza Monkey Behavior and Sound Effects

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Our DeBrazza habitat is currently under construction, with our maintenance team working on almost doubling their habitat's size. We are interested in learning about the effects of habitat size and sound on our pair of DeBrazza monkeys. We have developed an ethogram that details the different behaviors of our pair. This will help us determine their general patterns of behavior. Using this information, we hope to determine how changes in habitat size and sound may influence our DeBrazza monkeys' behaviors.

We are also collecting fecal samples from both individuals to analyze their cortisol levels to determine any correlation between heightened periods of sound and cortisol levels.



We are collaborating with Sonoma State University on this project. SSU will assist us with the cortisol analysis and behavior observations. We are also accepting applications for interns interested in helping us collect behavior data for this project.



# Conservation Management at Safari West



Safari West is committed to engaging in active conservation on our property. We monitor native species that co-occur on the property and enhance habitat to benefit certain native species. We also collaborate and donate to a variety of non-profit organizations.





# Our Bird Boxes

In California, there are approximately 23 species of secondary cavity-nesting birds. These birds cannot excavate their own cavities and instead rely on naturally formed hollows or abandoned cavities created by other species. Competition for these prime nesting sites has intensified due to factors such as habitat loss from urbanization and increasingly intense wildfires, as well as invasive species outcompeting native ones. The introduction of bird boxes aids in offering additional nesting options to support declining bird populations.



## — Western Bluebirds *Sialia mexicana*



In 2019, we installed nest boxes with the support of the California Bluebird Recovery Program. A total of 17 boxes were strategically placed across our 200-acre conservation easement, primarily within oak savannah habitat. The boxes were positioned near the edge of the tree canopy, adjacent to open grasslands.



# The Progression of a Bluebird Nest



Western Bluebirds have 4 to 6 eggs per clutch. Nests are primarily made up of grasses. Yes, their eggs are also blue.



Bluebirds, like most other songbirds, have altricial chicks. This means they require a lot of parental care as they are virtually helpless.



It takes approximately 19 days after hatching for the chicks to fledge, or leave the nest.



While the primary goal was to provide nesting sites for Western Bluebirds, other bird species also utilize the boxes. In past years, we've observed Oak Titmice (pictured on the left) and Tree Swallows using the boxes, but the most frequent nester, aside from bluebirds, has been the Violet-Green Swallow (pictured on the right).







**Last year we had a total of 110 birds fledge from our boxes.**

This adds to the over 400 birds already fledged since the installation of the boxes. We collaborate with the California Bluebird Recovery Program by contributing our nesting data to their efforts.

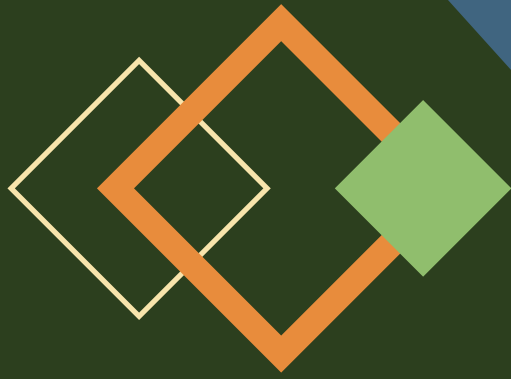
If you live in an area with secondary cavity-nesting birds, you can help too. Visit Cornell Lab's Nest Watch for information on how to build and place a nest box suited to your local species.

## Future for Nest Boxes at Safari West

This year, we're launching a new nest box monitoring program. We've installed three nest boxes around our man-made lake to support the American Wood Duck population and help ensure these beautiful birds thrive.







# MONITORING ANIMALS LARGE AND SMALL

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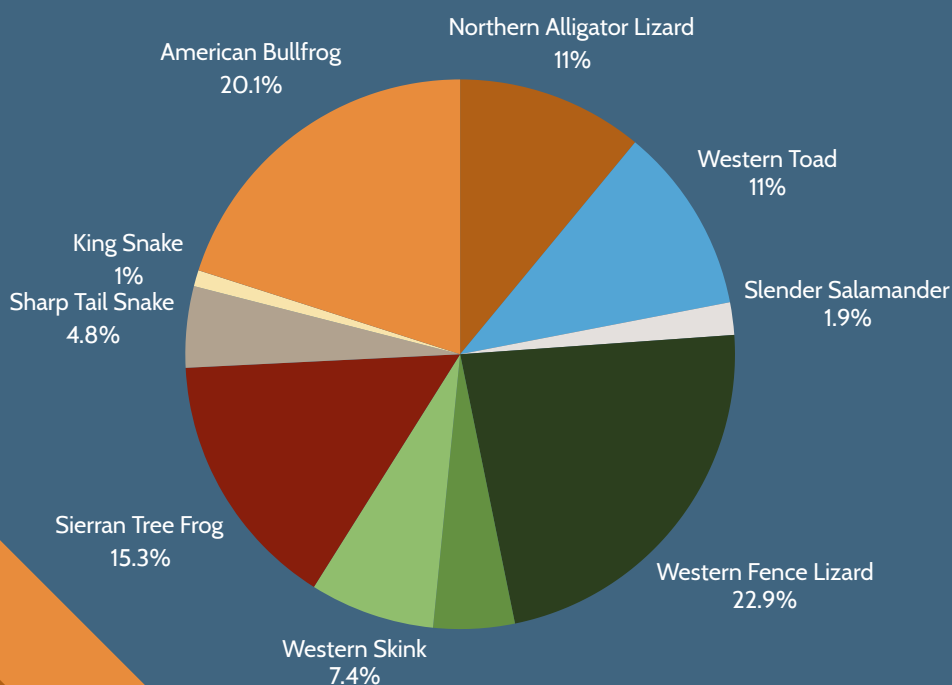
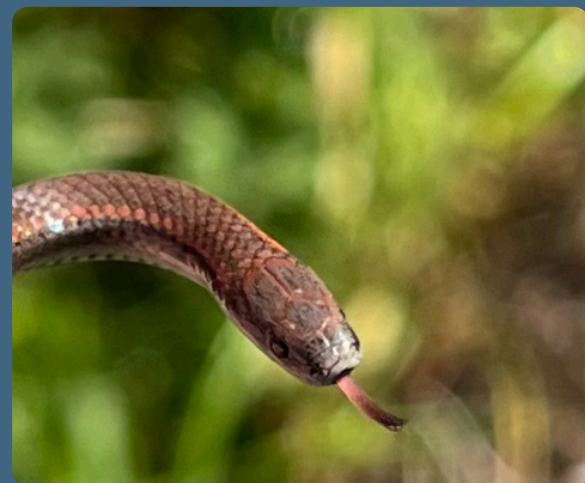
Monitoring the wildlife on our property allows us to track population trends including growth, decline, and stability. We use two key tools for this: camera traps to observe mammals and birds, and coverboards to survey herpetofauna.





# COVERBOARDS

Cover boards are flat structures placed on the ground that serve as artificial habitats for amphibians and reptiles, making them an effective tool for monitoring local herpetofauna. We have placed 30 boards, split between an oak savanna transect and a transect circling Lake Watusi, allowing us to gather valuable data on our local herpetofauna's distribution and habitat preferences. Our study focuses on both native and invasive species, providing insights into population trends over time.





# CAMERA TRAPS

Camera traps provide valuable data on both common and elusive species by capturing images and videos of animals in their natural environment with minimal disturbance. These motion-activated cameras are strategically placed throughout our property, allowing for non-invasive monitoring, especially of nocturnal and hard-to-spot species.



Common Raccoon



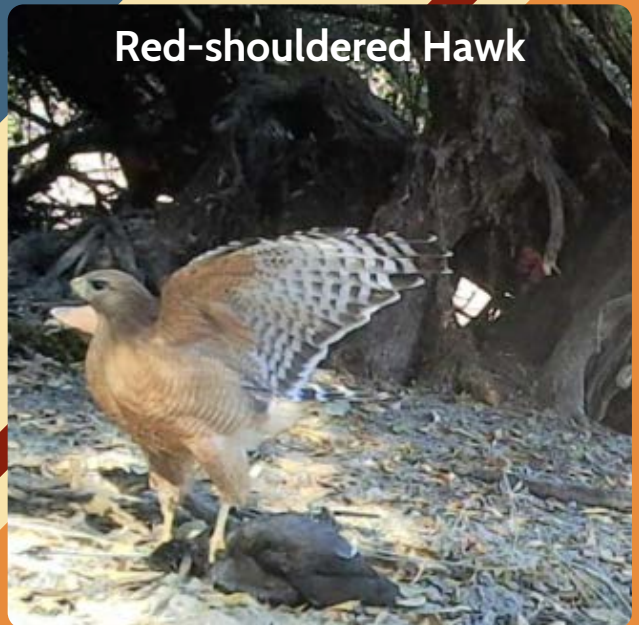
Striped Skunk



North American River Otter



Red-shouldered Hawk





# CONSERVATION COLLABORATION

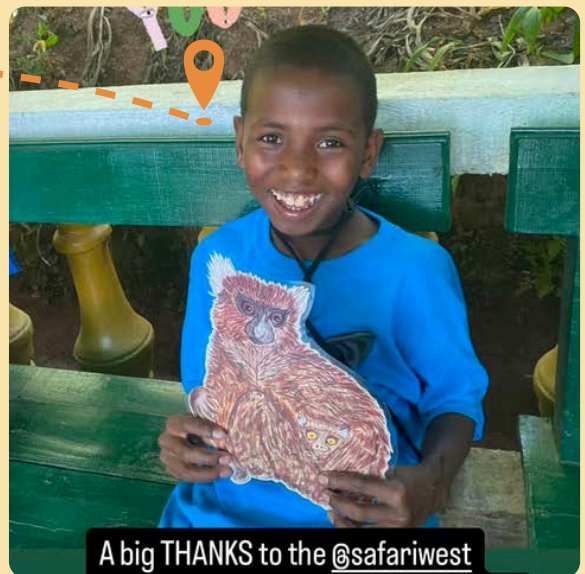


Safari West collaborates with a variety of different organizations on conservation projects. One organization, Conservation Fusion, is an initiative dedicated to empowering communities and preserving ecosystems in Madagascar. By combining education, local engagement, and hands-on action, the organization promotes environmental stewardship.

Safari West Junior Keeper Program offers young people a chance to engage and gain practical skills with animal husbandry and conservation. Through the program, they learned about Conservation Fusion and lemurs in Kianjavato, Madagascar. They created educational materials for the conservation organization. These materials were sent to Conservation Fusion, which distributed them to 12 schools in Madagascar, inspiring future conservationists locally and abroad.



Junior Keepers creating conservation materials to send off.



A big THANKS to the @safariwest

Student receives conservation material in Madagascar.



# Events at Safari West

Every year we celebrate Earth Day, World Ocean Day, Halloween and more by hosting various conservation organizations dedicated to protecting species and ecosystems worldwide. Those special events offers guests the chance to connect with groups working on the frontlines of conservation and learn how they can make a difference. Join us this year for an inspiring day focused on preserving our planet's future on April 26th from 10 AM to 3 PM at Safari West.



Staff from The Bird  
Rescue Center  
showing off a great  
horned owl and a  
common raven.





# Conservation Speaker Series



Marie Martinez

Each year our Conservation & Outreach Manager, Marie Martinez invites experts from around the world to share their insights on their conservation efforts. She works closely with local and global organizations, fostering partnerships and raising awareness through educational outreach.

Marie has started our Conservation Speaker Series — from March to October, where we host talks nearly every Friday and Saturday featuring scientists and conservationists. Topics covered range from native species conservation in California to primate rehabilitation in the Congo.

Save Giraffes Now



Save The Frogs





# Speaker Highlights



**Classroom Safari**

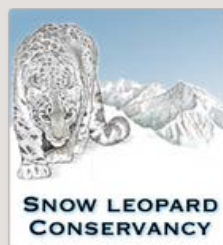
Safari West makes a donation to support a nonprofit organization of the speaker's choice, helping support active conservation efforts. Last year we hosted 64 speakers. This included organizations near and far, such as Friends of Bonobos but also local groups such as Classroom Safari.

We even had some of our Safari West staff speak — including Kate Fox and our research coordinator Victoria Brunal-Byrd.

Visit our website for more details on upcoming speakers and how you can attend these informative and inspiring talks.



**Victoria, Safari West Research Coordinator**





# 2025 Research & Conservation Goals



## Publish our Work

Finish data collection on our Blue Oak Restoration project and begin work to publish findings.  
Finalize temperature data results from Rhino Thermography project and begin work to publish case study.  
Finalize draft for Lemur Acoustic Enrichment case study.

## Continue to Collaborate

Collaborate with new facilities to collect data on Giraffe Locomotion, Gait, and Thermography.  
Reach out to facilities interested in Rhino Thermography work.  
Continue collaborative work with other facilities.

## Begin New Projects

Begin data collection on our Native Herpetofauna project and De Brazza's project.  
Investigate new study avenues.

## Spread the Word

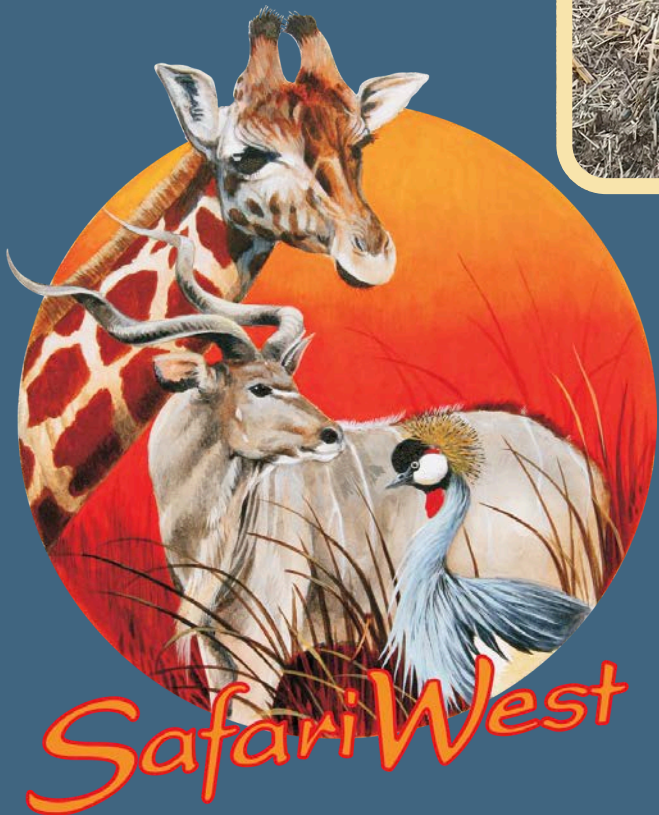
Present findings at more conferences and organizations to share research.  
Develop a project through Zoolife TV and/or share our research through their organization.





# THANK YOU!

Please reach out if you are interested in learning more or getting involved with our research and conservation programs. Safari West aims to continue developing projects this coming year, and sharing our updates along the way.



## Contact us :



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