THE WILD FELID MONITOR

The Newsletter of the Wild Felid Research and Management Association

Winter 2022, Volume 15, Issue 1

WFA website: *www.wildfelid.org*

~ Content ~

Council News

Tools of the Trade

Notes from the Field

*denotes article in both Spanish and English
WFA logo designed by Ben Wright, *ben@bwrightimages.com*
Front cover: by David Lugo *dal0826@vt.edu:* A curious jaguar *(Panthera onca)* checking out a DSLR camera trap in Belize, Central America.

The Wild Felid Monitor

is the biannual newsletter of the Wild Felid Research and Management Association.

The publication is provided to current Association members. To join, renew your membership, or to obtain back issues of the newsletter, please visit our website at *www.wildfelid.org*.

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VIRGINIA TECH™

The Edna Bailey Sussman Fund

EDITORIAL POLICY

The Wild Felid Monitor encourages submission of articles and information on ecology, research, management and conservation of wild felid species, and particularly of those species native to the Western Hemisphere. Preferred length of submissions is about 750 words. Submissions of photos, drawings and charts are encouraged. **Please send photos, graphics and tables as separate files suitable for portrait page formatting. Graphics must be suitable for grayscale reproduction.** Electronic submissions to *wfawildfelidmonitor@gmail.com* are preferred; otherwise mail to the address above. For more information on formatting requirements, go to http://www.wildfelid.org/monitor.php. The WFA reserves the right to accept, reject and edit submissions. The photos and artwork are copyrighted – please do not reproduce without permission.

~ From the President ~

As I sit down to write, the James Webb Space Telescope is being deployed. Space fascinates me. I'm guessing various aspects of science and nature fascinate us all. We want to discover how things work and interact. When it comes to studying wildlife, many of us are intrigued by what animals do, and how and why they do it. Sometimes the simple joy of knowing is enough. But usually, we apply that knowledge to manage a species, its habitat or, ideally, our own behaviors. The Webb telescope, 100x more powerful than the Hubble, will be looking billions of years into the past, altering our understanding of the universe. On a finer scale, that's why we study wild cats… to gain insights, improve our understanding, and act on our new knowledge.

The results of our summer election are in (page 4), and I would like to congratulate our elected officers: Veronica Yovovich, Yamel Rubio Rocha and Alex Ochoa. Additionally, I'd like to welcome two new councilors: Susana Ilescas Furter and Brett Blum. I appreciate and extend my thanks to all the candidates that ran for office and to everyone that voted. I also want to thank our outgoing officers and councilors for serving: Ron Thompson, Sandra Ortiz, and Lisa Haynes. I appreciated your input and guidance. Be on the lookout for our next election this summer where we'll be electing President, Treasurer and three General Council positions. Voting is one way to show your support for WFA.

After being postponed due to COVID, all indications are that the 13th Mountain Lion Workshop will be held in Hood River, OR April 4-7, 2022. I hope to see you there!

In this issue: Brown et al. (page 12) report on a novel technique using epiphyseal cartilage to determine bobcat age classes. Although they base their findings on the growth characteristics of one bobcat, the technique merits further study. New methods that help more accurately determine age classes greatly assist sound management. Stitzer et al. (page 14) report on a novel application of spatially explicit capture-recapture methods to estimate jaguar space use in Belize using camera trap data. Their techniques show promise to predict space use and movement patterns similar to Dart's examination of space/time overlap by coyotes and bobcats (page 19). Such information can help managers when planning corridor and reserve designs as well as highlight the need for international cooperation to protect jaguars. I'm fascinated by the reports of melanistic cats, such as the oncilla photographed by Acevedo-Loria, et. al. (page 16). I've received numerous false reports of "black panthers" in my career. The confusion that Florida panthers are black may be affected by our local nomenclature. People often associate "panthers" with melanistic leopards or jaguars. Costa Rica ranks among the top countries in the world having the greatest biodiversity. Acevedo-Loria et al. (page 18) discuss the country's wild cat richness, specifically that of the Monteverde Cloud Forest Preserve – where there's the possibility of seeing six different species of cats! Closing out our newsletter are two articles about jaguar reintroductions. Each is different but both end with jaguars being returned to the wild. Rosas et al. (page 20) describe a program in Argentina that raises jaguars for eventual release into the wild. It shows promise as a method to reestablish jaguars in areas where they previously occurred. And Rampim et al. (page 22) explain how rehabilitated jaguars were successfully released in Brazil.

In "Research Highlights" Caravaggi et al. (page 29) respond to a paper published in 2020 on the use of foot snares to capture large felids. Over 20 years ago, Logan et al. (1999) published a paper on capturing pumas with foot-hold snares. They provided all of the details requested by Caravaggi et al., including detailed methodology, animal welfare concerns (e.g., documented injuries, non-target animal captures) and post-release behavior. Their intent was to help other researchers make informed choices in the use of potentially dangerous methods to capture animals for study. Caravaggi et al. provide a much appreciated reminder to researchers to provide details on the effects of capture methodologies on study animals.

The focus of our next issue (summer 2022) issue will be on human – wild felid interactions. Contributions to the issue are due to our editor by April 30. If you are planning on submitting an article, please inform our editor of your intent and provide a working title by March 30.

-Mark Lotz

~ WFA Election Results and Council 2022 ~

This past summer, the WFA membership voted for new council members, including 3 officer positions (VP North America, VP Latin America, Secretary) and two General Council positions. Each elected member will serve on Council for a 3-year term, 2022-2024.

Veronica Yovovich was elected to a second term as VP North America and Yamel Rubio Rocha, after serving as a General Councilor 2019-2021, will serve her first term as VP Latin America. Alex Ochoa will replace Ron Thompson as Secretary. Because of multiple commitments Lisa Haynes decided to step down from running for Council midway through the election, therefore, Susana Ilescas Furter and Brett Blum were elected to the two open General Councilor positions. Luckily, Lisa will continue to serve on WFA's newsletter committee.

~Congratulations to all of WFA's newly elected Councilors!~

Our next election will be this coming summer and will include candidates for President, Treasurer, and 3 General Council positions. If you think you might be interested in running for elected office, please contact our election committee (see details on our website at *wildfelid.org*).

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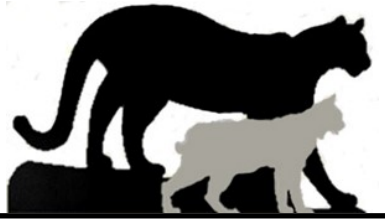

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WFA Committees & Coordinators

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Election – Melanie Culver, Ron Thompson

Membership – Linda Sweanor, Sharon Negri

Newsletter – Darby McPhail, Marcella Kelly, Lisa Haynes, Cheryl Mollohan, Chris Papouchis, Suzie Prange, Harley Shaw, Linda Sweanor, Kyle Thompson

Scholarship – Anthony Giordano (chair), Ivonne Cassaigne, Marcella Kelly, Patricia Harveson, Mauro Lucherini, Toni Ruth, Veronica Yovovich

Website – Linda Sweanor (chair), Mark Lotz, Sandra Ortiz, Brian Kertson

Grants –Melanie Culver, Anthony Giordano, Sandra Ortiz, Linda Sweanor

Representative Coordinators – Sarah Hegg, Sandra Ortiz

~ WFA Representative Focus ~

Fernanda Cavalcanti is one of our two Brazilian representatives, collaborating with the WFA since 2013. She lives in the state of Goiás in Central Brazil. Goiás is located in the "heart" of the country and also in the heart of the second largest Brazilian biome, the Cerrado. The Cerrado is the most structurally diverse savanna in the world, comprised of vegetation ranging from open grasslands to dense forests. It also supports a high number of endemic and threatened species, making it a worldwide biodiversity hot spot. However, less than 20% of the Cerrado is preserved despite its conservation value.

Fernanda and Dr. Frederico Lemos leads the Cerrado Mammals Conservation Program (Programa de Conservação Mamíferos do Cerrado – PCMC), a research group composed of biologists and veterinarians. The PCMC mission is to raise awareness of mammals' eco-epidemiology (the multi-level causation of disease) and promote Cerrado biodiversity conservation. The Puma Project and Ecology and Conservation of the Hoary Fox are the two main projects that have been conducted by PCMC with a focus on responses of carnivores to human-caused habitat disturbances.

As part of Fernanda's PhD, The Puma Project was the first study in Brazil to use GPS radio collar technology to monitor pumas and assess aspects of their spatial organization, movement patterns, habitat use, activity period, diet, genetics and health. To provide continuity on puma ecology studies, Fernanda is starting two new projects where the puma will play the role of an "ecological detective", to indicate patches of higher biological relevance and priority for conservation in the ecotone between the Cerrado and Atlantic Rain Forest. In addition, she will study the interaction between humans and carnivores, mostly pumas and Pampas foxes, in terms of conflicts that arise due to predation on livestock, to start an engagement program aimed at developing educational activities that promote coexistence between humans, livestock, and big felids.

Fernanda is volunteer professor in the Department of Biological Sciences at the Federal University of Catalão, where she teaches Conservation Biology and Population Ecology classes, and advises undergraduate and graduate students in the Integrated Biology and Conservation Laboratory. Fernanda co-coordinates ConserVamos Cerrado Project, which disseminates information on the Cerrado Biome to promote its conservation through social media and lectures in regional schools. Since 2011, Fernanda has been a member of the Brazilian National Plan for Big Felids Conservation, coordinated by Brazilian Environmental Agency (CENAP/ICMBio) with the objective of creating strategies, networks, and actions for puma and jaguar management and conservation.

Fernanda has more than 20 years of experience working with a wide range of species, including hoary foxes (*Lycalopex vetulus*), maned wolves (*Chrysocyon brachyurus*), crab-eating foxes (*Cerdocyon thous*), and pumas and their prey. During these years she specialized in collecting information using non-invasive methods such as camera trapping, scat analyses (to examine diet, genetics and hormones), and tracking surveys. She also has training in carnivore capture techniques using foot hold-snares and box traps, collar deployment, and VHF and GPS monitoring.

"Fernanda hopes her efforts and research positively impact felid conservation, especially in Brazil, helping build a better world for people and wildlife!"

~ Upcoming Conferences ~

Chapters of the Wildlife Society and American Fisheries Society Joint Annual Meeting

https://sites.google.com/view/jam2022

"The American Fisheries Society is the world's oldest and largest organization dedicated to strengthening the fisheries profession, advancing fisheries science, and conserving fisheries resources. "

~Save the Dates~

February 3 — February 5, 2022

Ecological Society of America

https://www.esa.org/events/meetings/future-esa-meetings/

"The Ecological Society of America (ESA) promotes ecological science by improving communication among ecologists; raises the public's level of awareness of the importance of ecological science; increases the resources available for the conduct of ecological science; and ensures the appropriate use of ecological science in environmental decision making by enhancing communication between the ecological community and policy-makers."

~Save the Dates~

August 14 — August 19, 2022 in Montréal, Québec, Canada

The Wildlife Society 29th Annual Conference

https://wildlife.org/network/conferences-network/

"The Wildlife Society's Annual Conference is one of the largest gatherings of wildlife professionals and supporters in North America. "

~Save the Dates~

November 6 – November 10, 2022 in Spokane, WA, USA

The 13th Mountain Lion Workshop

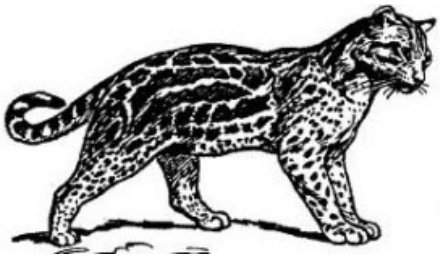
https://wafwa.org/workshops/mountain-lion-workshop/

The workshop provides a forum where leading mountain lion managers and researchers share research results, management strategies, and emerging issues in the realms of mountain lion management throughout North America.

~Save the Dates~

April 4 — 7, 2022 in Hood River, Oregon

WFA would like to extend a special thank you to our 2021 Wild Felid Legacy Scholarship supporters:



Hugh Robinson
Melanie Culver
Ken Logan
Valerie Bruington

Donations to our scholarship fund allow us to continue to provide support to students who are working to better understand wild felids and are investigating ways to manage and conserve them in a dramatically changing world.

If you'd like to help support the scholarship and the next generation of top-notch wildlife professionals, please go to https://www.wildfelid.org/donate.php

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Thank you, Melanie Anderson

WFA would like to extend our deepest gratitude to Melanie Anderson, Program Director for animals at The Summerlee Foundation. Melanie's belief in WFA and its mission has resulted in $64,000 of support by The Summerlee Foundation during the past 10 years. Programs that benefitted included the Wild Felid Legacy Scholarship — $14,000 of aid was provided to 13 graduate students. Another $40,000 in support allowed WFA to offer 2 separate grants to well-deserving, underfunded projects involving wild felids: The Latin American Wild Felid Research Grant and the Latin American Wild Felid Action Grant. Funded projects ranged from mitigating puma-livestock conflicts, to examining the role of emerging pathogens, to identifying habitat corridors, to developing agro-ecosystems that conserve felids. Other funds supported our newsletter and our website, and allowed WFA to investigate new forms of communication and networking. These include more Spanish content in our media and webinars that feature some of WFA's sponsored projects.

Melanie showed a keen interest and love for animals since early childhood and has been a force for wildlife conservation action throughout her 33-year career with The Summerlee Foundation. She has hinted at a special fondness for America's "powerful beast", the puma.

I speak for all of us at WFA wishing her a rich retirement, full of memorable experiences with wild neighbors, including maybe a few glimpses of a golden cat with a long, black-tipped tail.

-Linda Sweanor

~ Wild Felid Legacy Scholarship Announcement~

The Wild Felid Research and Management Association (WFA) began awarding the Wild Felid Legacy Scholarship in 2009 to encourage and support graduate level university students involved in wild felid research. To date, 35 scholarships totaling over $41,000 have been awarded. The scholarship honors distinguished and dedicated biologists who lost their lives while seeking to understand and contribute to the conservation of wildlife: Dave Maehr, Ian Ross, Rocky Spencer, Eric York, Deanna Dawn, and Donna Krucki. More on these inspiring biologists can be found on the WFA's web site: *www.wildfelid.org*. Scholarships are made possible through grants and donations to WFA. Past contributors have included The Summerlee Foundation, Deanna Dawn's family, Altria Group, WFA members, and private individuals.

PURPOSE OF THE FUND: The Wild Felid Legacy Scholarship provides financial aid to graduate-level university students conducting research on one of the Western Hemisphere's wild felids. Depending on funding, one to three scholarships of $1200 to $1500 each will be awarded during summer 2022 and recipients will be recognized in the WFA's newsletter, the *Wild Felid Monitor*. Applications are evaluated based on: demonstrated need for financial aid, participation in a research project that aims to improve our understanding of wild felid biology, management and/or conservation, and recommendations by professors and supervisors.

SCHOLARSHIP FUND ADMINISTRATION: The WFA's Scholarship Committee (SC) administers the Wild Felid Legacy Scholarship and selects recipients, who are subject to approval by a majority of the WFA Board of Directors. The SC reserves the right not to award a scholarship or to award more than one scholarship during a calendar year, depending on the SC's opinion of the applicants' qualifications and the availability of funds. All SC decisions are final.

APPLICATION CRITERIA: **Each Scholarship Applicant must be a student member of WFA**.
If you are not currently a member, simply go to our website at *www.wildfelid.org* and sign up. As of July 1, 2022, applicants also must have completed a Bachelor's Degree and be enrolled in a graduate program in Wildlife Biology, Wildlife Management, or a related natural resource field, with a research focus that includes wild felids. Recipients agree to provide at least one update on their graduate work for inclusion in the *Wild Felid Monitor*.

FOR DETAILS ON HOW TO APPLY, GO TO: ***http://www.wildfelid.org/legacy.php***
Note that your application requires a current résumé, proof of completion of a Bachelor's Degree, a copy of your acceptance into a graduate program, two letters of reference, and a short essay. To see how applications are scored, go to the page listed above and click on "Evaluation form used to score applicants."
Only emailed applications will be accepted. References can also send their letters electronically.

All application materials must be received by **MARCH 30, 2022**.
Incomplete applications will not be considered.

Completed applications should be emailed to:
Dr. Anthony Giordano, Scholarship Chair
Species1@hotmail.com
Please put "Wild Felid Legacy Scholarship Application" in the subject line.

~ Regional News ~

COLORADO

Colorado Parks and Wildlife (CPW) studied the effects of hunting on a mountain lion population on the Uncompahgre Plateau (UPSA) in southwestern Colorado. They found that a 15% average harvest rate of independent lions (i.e., adults and subadults) on the UPSA (the study area scale) and a 22% average harvest rate of independent lions at the population scale in 4 years resulted in a 35% decline in this population. This research revealed the importance of regulating hunting mortality to achieve puma population objectives. The researchers recommended implementing a source-sink management structure to conserve puma populations, provide sustainable hunting opportunities, and address puma-human conflicts. Colorado State University's Center for Human Carnivore Coexistence (CHCC) received a million-dollar donation from a Colorado rancher to minimize conflict between people and predators.

The Feline Ecology: Landscapes, Infectious Disease, and Epidemics research project, seeks to understand the ecology of infectious diseases in wild and domestic felids to inform policies that minimize disease outbreaks in wildlife, domestic animals, and humans. Specifically, an ongoing study on disease transmission between wild felids, domestic cats, and humans led by Dr. Kevin Crooks at Colorado State's CHCC works to understand how urbanization and wildlife management impacts disease risk among these species in Colorado. Additionally, a study on Colorado's pumas led by Dr. Nicholas Fountain-Jones showed that removing hunting pressure enhances the role of males in pathogen transmission, increasing the viral population growth rate and the role of evolutionary forces on the pathogen.

In March 2021, the CPW Commission decided to continue to allow the trapping of bobcats by commercial trappers and trophy hunting. The commission rejected a petition by the Humane Society of the United States, submitted on behalf of 20 organizations, asking the commission to ban "all traps, including box traps, for the purposes of recreation, sport or commerce."

-Erin Weingarten

IDAHO

In March 2021, the Idaho Department of Fish and Game Commission (IDFGC) voted in favor of removing statewide harvest quotas for cougars and permitting the use of electronic calls as cougar lures. Regarding the 2021-2022 big game season, IDFGC announced, "the changes were proposed as an effort to increase lion harvest and reduce predation on deer and elk, and reduce human conflicts and livestock depredations." However, research has shown that cougar harvest can fail to achieve the goal of reducing predation and may in fact result in the opposite outcome. Increased cougar harvest can exacerbate problems for mule deer by restructuring cougar populations to consist of primarily younger individuals who predominantly prey on deer rather than elk (Elbroch and Quigley, 2019). Similarly, removal of resident male cougars can drive increased predation pressure on mule deer, as female cougars with kittens prey-switch and specialize on rarer mule deer to avoid incoming infanticidal males (Keehner et al. 2015). Additionally, research published by IDFG Research Supervisor, Mark Hurley, and his colleagues concluded that cougar removal "likely will not appreciably change long-term dynamics of mule deer" (Hurley et al. 2011). While there is indeed a numerical relationship between predator abundance and predation risk, these studies demonstrate how demographic and behavioral changes resulting from predator harvest can negate some of the intended effects of this management strategy.

-Cameron Macias

MONTANA

United States wildlife officials have agreed to keep federal protections for the Canada lynx, under a court settlement approved November 1 by a judge in Montana. The settlement by the U.S. Department of Interior comes after wildlife advocates sued to retain protections for the lynx, which has been listed as a threatened species since 2000. Under the Trump administration, officials said lynx had recovered in some areas and protections were no longer needed. Independent scientists and wildlife advocates warned climate change could undo that progress by reducing lynx habitat and the availability of a key food source — snowshoe hares. There are no reliable estimates of lynx population sizes and officials rely on information about lynx habitat and hare populations to gauge the species' status. Their protected status has interrupted numerous logging and road-building projects on federal lands, frustrating industry groups and western lawmakers. The 2018 move to end protections came when U.S. Fish and Wildlife Service biologists shortened the government's time span for considering climate change threats, from 2100 to 2050, because of what officials said were uncertainties in long-term climate models. A government assessment based on that shortened time span concluded lynx populations remained resilient and even have increased versus historical levels in parts of Colorado and Maine. The animals also are found in Montana, Minnesota, Idaho, Washington state and occasionally Michigan. A new recovery plan for lynx is due by 2024 under the terms of the deal approved Monday by U.S. District Judge Molloy in Missoula, Montana.

Federal wildlife officials did not immediately respond to questions about the settlement. Under an earlier assessment of lynx, published in December 2016, U.S. government biologists predicted some populations would disappear by 2100. This was based on models predicting widespread and substantial changes to the animals' snowy habitat because of climate change.

-Matthew Brown AP 11/2/2021

NORTH DAKOTA

North Dakota Game and Fish Department (NDGF) will expand bobcat harvest to include northeastern North Dakota for the 2021/22 harvest season. This expansion will permit harvest statewide and will provide new opportunities for the first time since 1980. The state will have two management zones with different harvest regulations. Zone 1, west of U.S. Highway 83, will have no harvest limit. Zone 2, east of U.S. Highway 83, will have a one bobcat per person harvest limit and a total harvest limit of 8 bobcats. Once the total harvest limit is reached in Zone 2, the season will close immediately. The 2020/21 bobcat harvest report has yet to be completed.

NDGF reports that there have been no new changes to mountain lion management or research initiated this year. During the 2020/21 mountain lion season, 9 mountain lions (5 females, 3 males, and 1 unknown) were legally harvested. NDGF recorded an additional 3 mountain lion mortalities resulting from automobile collision, incidental snaring, and an illegal harvest. Examination of the nutritional condition, fat content, and parasite loads of mountain lion carcasses indicated that mountain lions in North Dakota were generally healthy. The average age of mountain lion carcasses examined was 3.2 ± 2.0 SD years.

-Marlin Dart

SOUTH DAKOTA

Marlin Dart and Stuart Fetherston from Dr. Robert Lonsinger's Lab, completed graduate research on bobcats in South Dakota (SD). Dart's research used camera trap data collected during the summers of 2019 and 2020 to investigate spatial and temporal patterns of bobcats and coyotes in an agricultural landscape in Charles Mix and Brule counties in southcentral SD. Bobcat space use was limited and associated with smaller, less-disturbed patches of woodland/shrubland, which were also associated with higher levels of coyote activity. Furthermore, bobcat and coyote activity showed high temporal overlap. Dart also examined the influence of a non-species-specific scent lure, sardines, on detection of bobcats and found that detection was negatively influenced by the presence of the scent lure.

Stuart Fetherston evaluated bobcat population genetic structure across SD. Harvest samples from 2014-2019 (n = 1215) were genotyped and programs STRUCTURE and BAPS were used to identify distinct genetic clusters. Fetherston found strong support for hierarchical structure at K = 2 and 4, and evidence of finer-scale structure (K = 10 and 12) that could not be fully evaluated due to resolution limitations. Genetic clusters at K = 4 aligned closely with the northwestern, southcentral, and Black Hills regions of western SD, and with eastern SD. Genetic clusters inferred at K = 2 aligned closely with current harvest management units (i.e., two units east and west of the Missouri River), but the eastern cluster included counties immediately west of the Missouri River in the southern half of the state.

The 2020/21 bobcat season concluded with 304 harvests, 10% from the Black Hills and 74% and 16% from the prairie units west and east of the Missouri River, respectively. Overall male:female ratio was 1.46 and juveniles made up 18% of the harvest. The 2020/21 mountain lion season concluded with 48 lions (23 males and 25 females) harvested within the Black Hills, falling short of the 60 total or 40 female harvest limit. Additionally, 10 lions (7 males and 3 females) were harvested in the prairie. SDGFP reports no apparent trends in sex and age compositions that would be suggestive of population changes.

-Marlin Dart

SINALOA

In 2010, Sinaloa participated in the first national jaguar census (CENJAGUAR) using camera trapping data. In addition to jaguars (*Panthera onca*) five other felines (*Puma concolor, Lynx rufus, Leopardus wiedii, Leopardus pardalis, Puma yagouarondi)* were "captured" on camera. Monitoring fauna and determining how distribution changes due to problems they face such as deforestation, cattle rearing and agricultureal expansion, and excessive hunting can aid ecosystem conservation measures within Sinaloa. We have also expanded wildlife education, conservation projects, and built a museum to support field work and environmental education for conservation, not only for felines, but for all flora and fauna while involving people of all ages and backgrounds within the community.

In 2012, the Museo del Jaguar (Jaguar Museum) opened its doors in Cabazan, a rural community in San Ignacio, in northwestern Mexico, with the support of the community, students, and researchers from the Universidad Autónoma de Sinaloa (Autonomous University of Sinaloa),Universidad Nacional Autónoma de México (UNAM), and Comisión Nacional de Áreas Naturales Protegidas (CONANP).The main objective of this project is to share knowledge and information about the six felids species in Mexico, especially the Jaguar (*Panthera onca*), and to promote their conservation. In addition, the cultural and social value that felines have as symbols of identity and power has been retaken and strengthened, considering that they have had an important role within the Mexican cosmogony.

-Yamel Rubio Rocha & Mariana Valeria Ayala Rubio

Using the Epiphyseal Cartilage to Index Bobcat Age Classes

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The ability to determine wildlife age classes is important for wildlife management and understanding the life history of a species. Fur trappers in Arizona are required to submit the lower jaw of each bobcat *(Lynx rufus)* taken to the Arizona Game and Fish Department to meet the provisions of the Convention on International Trade in Endangered Species (CITES). This requirement, while of management value (Roberts and Crimmins 2010) is inconvenient, as it requires the trapper to clean and provide a bobcat jaw and the Department to archive, section, and process the teeth for aging.

To test an easier bobcat aging technique, we used radiograph images of the epiphyseal cartilage at the distal end of the radius to separate bobcats into mature and immature age classes using a known bobcat age. This technique has proved satisfactory for aging cottontail rabbits *(Sylvilagus floridanus)* (Hale 1949), tree squirrels *(Sciurus spp.)* (Carson 1961) and jackrabbits *(Lepus spp.)* (Altemus 2017).

A wild born bobcat kitten, estimated to be only a few days old, was surrendered to the Southwest Wildlife Conservation Center (SWCC) in August 2018. The forepaws of this male bobcat were radiographed at approximately 12 months of age when the gap of the epiphyseal cartilage at the distal end of the radius was readily apparent (Figure 1). We continued to radiograph the bobcat's forepaws monthly until the epiphyseal cartridge was closed in August 2020 (Figure 2). We considered the bobcat an adult when the epiphyseal cartilage was replaced by bone at 101 weeks or nearly 2 years of age. We were surprised that the male bobcat was nearly 2 years old before the epiphyseal gap was closed and consider this an important biological consideration when managing bobcats.

Figure 1. Radiograph of front leg taken in August 2019 at 1 year of age. The epiphyseal cartilage gap is clearly discernable.

Figure 2. X-ray taken in April 2020 at 21 months. The epiphyseal gap remains clearly visible.

Although ossification can be delayed because of malnutrition or stress, this study can be considered as providing optimum conditions as the animal was in captivity, fed daily, and subjected to a minimum of stress.

To check on the practicality of this technique in the field we obtained eight bobcat legs from a site where trappers deposited their carcasses. Eight legs were extracted and x-rayed for examination. We considered these leg bones as belonging to 4 immature and 4 adult bobcats. We described the animal as immature (< 2 years of age) if the epiphyseal gap was not closed, and mature (>2 years of age) if the cartilage had been replaced by bone.

We believe this technique has management applications in that collecting bobcat legs provides an easier and less time-consuming method of indexing bobcat age ratios than tooth sectioning when the objective is to separate immature and mature bobcats. X-raying the epiphyseal cartilage is potentially quicker and less expensive – both valuable considerations for wildlife managers.

Although we only have a sample of one animal and the technique requires experience, this technique could prove superior to current bobcat aging methods and can be used on both live and dead animals. Using this method, biologists can index young and mature bobcats to estimate recruitment rates and predict population changes. Although several accounts report yearling females reproducing based on placental scars, and many states consider 1-year old animals as mature, we suspect successful reproduction is uncommon prior to dispersal and that bobcats < 2 years of age are not a reproductive cohort in most populations (Roberts and Crimmins 2010, Parker and Smith 1983). This technique also indicates the approximate age of an animal when it can expend more energy than required for osteological growth.

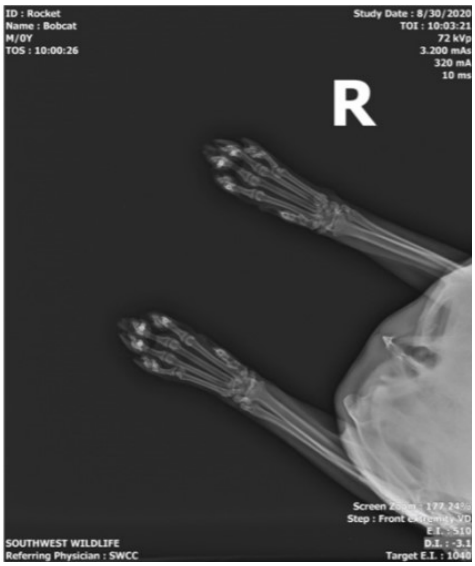

Figure 3. Radiograph of front leg taken in August 2020 at 24 months of age. The epiphyseal cartilage gap is closed., and the animal is considered an adult.

This article and many others, along with the numerous books Dave Brown wrote or contributed to in his remarkable career as a wildlife biologist and historian is just another example of how Dave's mind was constantly working on problems, always seeing things from a different and often unconventional and controversial perspective. It is an honor for me to have my name on a publication with Dave. He accomplished what many of us hope to —he truly left Arizona, the wildlife of the southwestern United States, and our profession, better for his having been here. *-Cheryl Mollohan*

Jaguar Space Use Via Novel Application of Spatially Explicit Capture-Recapture

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Over the last century, jaguars (*Panthera onca*) have been extirpated from over half of their former geographical range, and most subpopulations are classified as either endangered or critically endangered (De La Torre et al. 2018). Outside of the Amazonia subpopulation, this figure rises to 82%. Habitat loss is one of the main threats to jaguar populations and is an issue exacerbated by deforestation and resource exploitation (De La Torre and Medellín 2011).

Understanding space-use and movement patterns are key to conservation. However, telemetry is expensive and labor- and time-intensive. As camera traps are widely employed to study population dynamics, they may provide an alternative, minimally invasive method to assess space-use with population-level metrics. We evaluate space-use of a low-density carnivore using camera data with a novel use of spatially explicit capture-recapture (SECR) methods.

We used data from long-term camera trap surveys in northwestern Belize, Central America, over a 9-year period (2010-2018) (see Satter et al. 2019 for site details). Spatially explicit capture-recapture (SECR) models (Borchers and Efford 2008, Royle et al. 2013) are typically used to estimate density and study population dynamics, but since they explicitly incorporate animal movements, we adapted them to estimate jaguar space-use. SECR assumes that each individual has a fixed home range center, and that the probability of detection decreases with distance away from this activity center. As opposed to conventional SECR applications, we used the models to estimate the probability of an individual moving to any point, not just camera stations, and we built separate models for each individual, rather than for the population collectively. This resulted in unique estimates of each individual's activity center, and a circular area in which 95% of that individual's movements are expected to occur. We use the term "Area of Use" (AoU) instead of home range because these circular estimates are a simplification of home range shape. We mapped each jaguar's AoU to quantify overlap with other jaguars at the population level. For each individual, we calculated the percentage of their AoU overlapped by others (percent overlap) and the number of other individuals overlapping their AoU (counts overlap) (Figure 1). We estimated 167 individual AoUs, 73 females and 94 males.

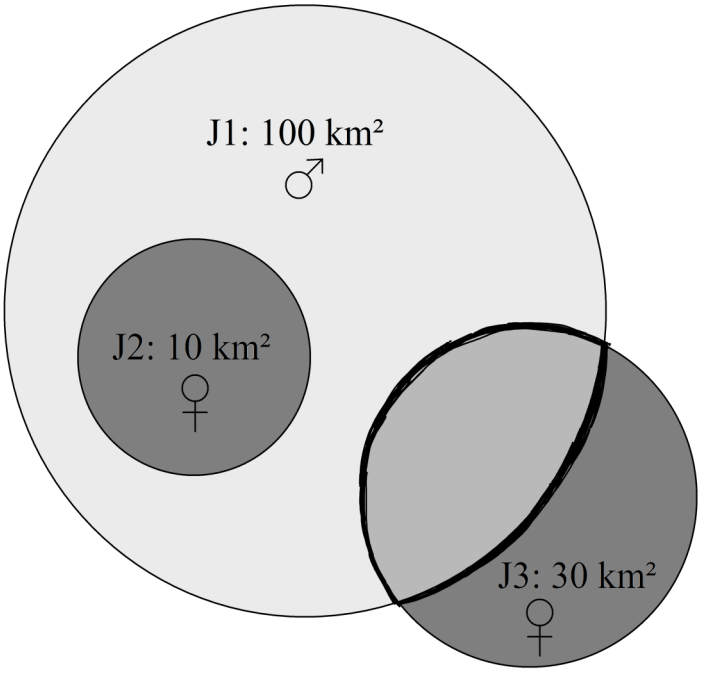

Figure 1. Example illustrating overlap metrics for areas of use (AoUs) estimated from camera trapping data of jaguars, collected in Belize, Central America from 2010 – 2018. Shown are hypothetical AoU estimates for 3 individual jaguars: J1 (male) with an area of 100 km^2, J2 (female) with an area of 10 km^2, and J3 (female) with and area of 30 km^2. Roughly half (15 km^2) of J3's AoU overlaps J1's AoU. J1 also completely overlaps J2's AoU. Thus, a total of 15 + 10 = 25 km^2 of J1's AoU is overlapped by females, or 25/100 = 25% overlap. Because there were 2 females overlapping J1's AoU, J1's female overlap count is two. No males are overlapping J1's AoU, so the male percent overlap is 0%, and count overlap is 0. J2 has 100% male overlap (count 1), and J3 has 50% male overlap (count 1).

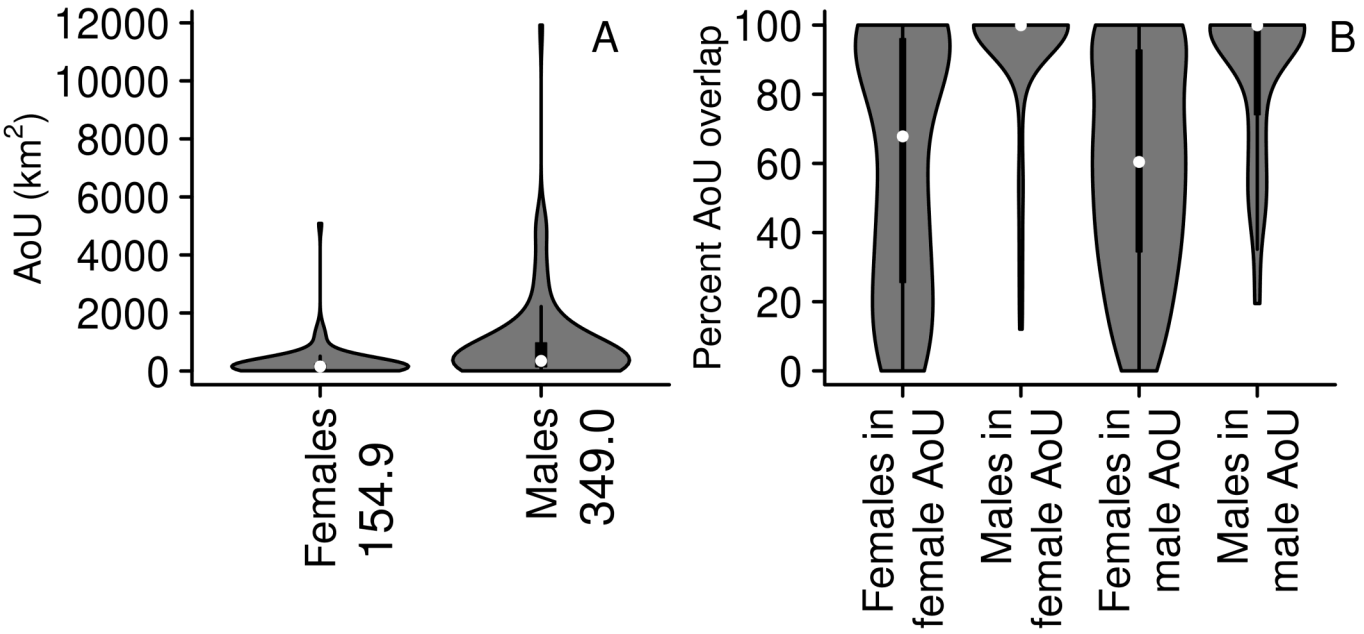

Figure 2. Estimated Areas of use (AoUs) for female (n=73) and male (n=94) jaguars with exact medians printed beneath each violin plot (A) and percent AoU overlap with comparisons of (left to right) % female AoUs overlapped by other females, % female AoUs overlapped by males, % male AoUs overlapped by females, and % males AoUs overlapped by other males (B). White dots indicate medians. Dark interiors are box and whisker plots with rectangles bounding first to third quartiles and whiskers extending to 1.5x the interquartile range. Outer curves are kernel density estimates of the distributions -- wider areas indicate more estimates at that value.

The median AoU for females was 155 km^2 and for males was 349 km^2 (Figure 2A). Females had 5 males overlapping their AoUs, taking up 99.9% of their AoUs, whereas percent overlap with other females was 67.8%, with 2 females overlapping their AoUs. Males had 5 males overlapping their AoUs, taking up 99.9% of their AoUs, whereas they had 4 females overlapping their AoUs, taking up 60.4% of their AoU (Fig. 2B). Additionally, we found that the AoUs of 22 individuals, 8 females and 14 males, were estimated to cross the borders of Mexico or Guatemala. All summary statistics we report are medians due to some extreme outliers.

Male AoU estimates were more than double females'. Male to male overlap was much higher than expected, challenging the idea that male jaguars hold exclusive territories and avoid overlap. We were unable to determine, however, whether individuals inhabited the space at the same time or how long temporal gaps between detections were, but this could be the subject of future research. Males also had a high overlap with females, presumably to maximize exposure to potential mates. Females had slightly lower overlap with each other, possibly because their smaller AoUs limit their tendency to overlap compared to the larger male AoUs. Overlap counts showed similar trends as percentages, with females showing lower overlap with other females and higher overlap with males.

One noteworthy individual, J64, had AoUs estimated to cross international borders 7 out of 8 years that he was detected. Another individual, J114, or "Short-tail", was notable for being the first cat visually confirmed on both sides of the Guatemala border (García-Anleu et al. 2020). Our model predicts his trans-border movement, which shows promise for the ability of this method to predict such movements, highlighting the need for international cooperation to protect jaguars.

Finally, this technique shows promise for quantifying range shifts and providing managers insight into space use and movement patterns, even in the absence of telemetry data. Such questions, especially for elusive species of concern like jaguars, are vital to international conservation, particularly informing corridor and reserve design. Since camera trapping data is often already collected and available for many projects, this approach has high potential for future applications.

Wild cat richness in Monteverde Cloud Forest Preserve, Costa Rica

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The Tropical Science Center (TSC) is a nonprofit organization, created in Costa Rica in 1962. TSC owns Monteverde Cloud Forest Preserve (MCFP), a territory of 4,125 hectares established in 1972. MCFP focuses on conservation, environmental education, and research within this area. This multifaceted approach has led to the protection of a variety of species, including wild cats, which require extensive and continuous forests. MCFP has an elevational range between 860 and 1,840 meters, an average annual temperature of 18.8 ºC, and an annual average precipitation of 2,579 mm. There are four life zones found in the MCFP: premontane rain forest, lower montane rain forest, lower montane wet forest and premontane wet forest. These life zones make for extraordinary beauty and biodiversity (Holdridge 1982).

We have been monitoring mammals in MCFP with camera traps for ten years: 2011-2016, 2017-2018, and 2019- 2021. The main objectives were to estimate richness of species within the cloud forest and to better understand impacts of ecotourism on mammalian species on trails.

We identified 25 species of mammals, including all six species of wild cats in Costa Rica: jaguar (*Panthera onca*), puma (*Puma concolor*), ocelot (*Leopardus pardalis*), margay (*Leopardus wiedii*), oncilla (*Leopardus tigrinus*), and jaguarundi *(Herpailurus yagouaroundi*). Other species included some key prey such as the paca (*Cuniculus paca*), agouti (*Dasyprocta punctata*), Gabb's cottontail (*Sylvilagus gabbi*), and peccari (*Pecari tajacu*).

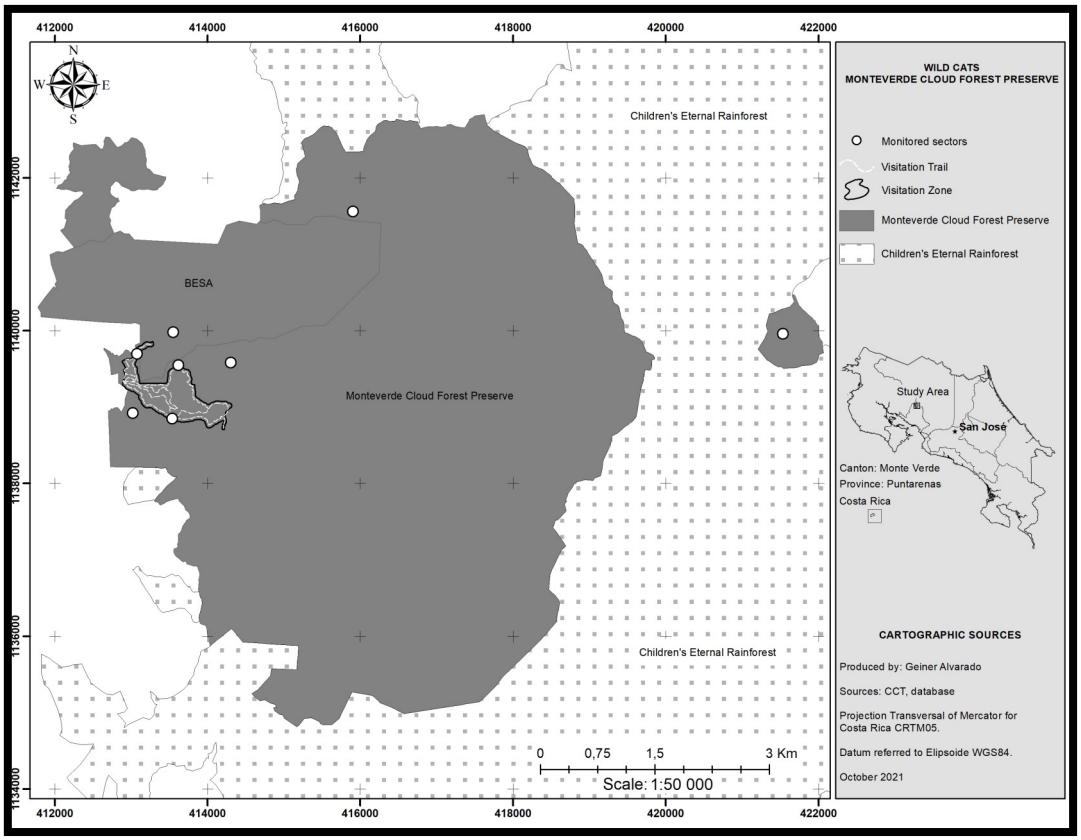

Figure 1. Sampling sites inside the Monteverde Preserve.

We confirmed that MCFP has all six species of wild cats found in Costa Rica. Of the 237 captures of wild cats during the study, 65 (27%) occurred during the period 2011-2018 and 172 (73%) occurred during 2019-2021. From the first period to the second, captures of pumas increased from 30% to 35% of the total while captures of ocelots increased from 19% to 23% and those of oncillas increased from 11% to 16%. In contrast to these increases, captures of margays decreased from 29% to 25% and those of jaguarundis decreased from 9% to 1% between the two periods. The single capture of a jaguar occurred during 2011-2018.

The largely minor variations between periods probably reflect random differences and changes in sampling, along with the rarity of jaguars. However, the decrease in captures of jaguarundis may represent a shift in their presence in the area.

Since the puma occupies a wide variety of niches it is perhaps not surprising that it has the highest percentage of captures in the MCFP ecosystem (Dirzo et al. 2014). This also potentially indicates healthy conditions in MCFP to support a puma population. Regarding jaguar records, only one capture was recorded in the first period (2015). This could be due to the location of the sampling stations, which were focused mainly on the visitor area and not in the protected area. Also, pumas and jaguars may be exhibiting spatial partitioning as evidenced in the Alberto Manuel Brenes Reserve (Cartín 2011), where the puma occurs in the area as long as the jaguar is not occupying the same site. We observed this in the visitor area where there have been records only of puma and not jaguar.

"All information gathered within the MCFP provides evidence of the success of the continuous efforts in research, environmental education and conservation for almost 50 years. These contributions generate fundamental information for the conservation of wild cats, other mammals, and the cloud forest ecosystem in the Arenal-Monteverde protected area, through alliances between the reserves of Monteverde."

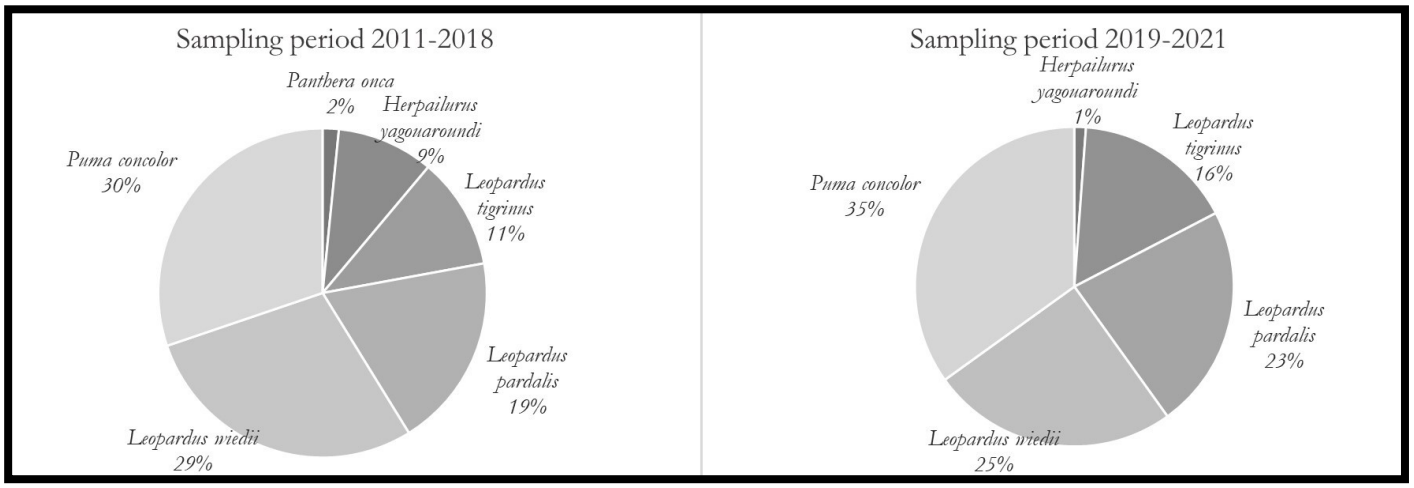

Figure 2. Comparison of the wild cats records by sampling period.

Records of melanistic oncilla (*Lepardus trigrinus*) in Monteverde Cloud Forest Preserve (MCFP), Costa Rica

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2- Las Pumas Rescue Center and Sanctuary

Figure 1. Capture of melanistic oncilla in the MCFP.

This research was also conducted in the Tropical Science Center (TSC) (see previous article for more information). In ten years, we recorded 37 videos of oncillas (*Leopardus tigrinus*) of which 7 belonged to individuals with melanistic coloration patterns. Of these videos, 72% were recorded in the visitor area.

> *"The first record of a melanistic oncilla for the MCFP was in 2013, however, the events were more frequent during 2020 and 2021 (Figure 1)."*

All records (melanistic and non-melanistic) were obtained in the lower montane rain forest in the daytime (n=4; 57%) and night time (n=3). Interestingly, spotted oncilla (non-melanistic) activity was mostly nocturnal with only 7% of records during daytime.

Melanism in wild cats has been observed in moist and cloud forests (Yacelga and Craighead 2019, Gonçalves da Silva 2017). In Costa Rica, melanistic jaguars, margays, and oncillas have been reported in moist forests with dense vegetation at elevations greater than 1.000 m (Mooring et al. 2020, González-Maya et al. 2018). Records of melanistic oncillas within the MCFP concur with these descriptions, indicating that their distribution may be restricted to these ecosystems whereas spotted oncillas could have better camouflage during bright nights or during daylight hours (Mooring et al. 2020, Graipel et al. 2014). The activity patterns of melanistic oncillas in Monteverde coincide with Mooring et al.'s (2020) predictions that these individuals would be more active during the day compared to spotted individuals, however, our sample size is not sufficient to confirm this forecast. The diurnal activity of melanistic oncillas could potentially reduce competition with other small nocturnal predators present in the MCFP such as margays, ocelots, and coyotes (Rocha Mendes et al. 2010, Botts et al. 2020).

Melanistic individuals could be more cryptic compared to spotted oncillas (Graipel et al. 2014). and thus they could use daylight hours to eat alternative prey like terrestrial birds (Marinho, et al. 2018), decreasing competition with nocturnal predators (Graipel et al. 2014, Botts et al. 2020). Given that melanistic oncillas occur in the visitor's area, proper management of ecotourism will likely allow wild cats and people to coexist.

Taking into consideration that the population trend of oncillas is decreasing, it is important to generate information for oncilla conservation and to continue monitoring in the Arenal-Monteverde protected area.

For more information visit *https://cloudforestmonteverde.com/make-an-impact/*

High spatial and temporal overlap of bobcats (*Lynx rufus*) and coyotes (*Canis latrans*) in an agricultural landscape

Marlin Dart, 2020 Wild Felid Legacy Scholarship recipient; *mdart90@gmail.com*

Understanding how landscape patterns and interspecific interactions influence spatial and temporal dynamics of carnivores is important for their management and conservation. Carnivores are sensitive to habitat loss and fragmentation due to their low densities and reproductive rates (Woodroffe and Ginsberg 1998, Crooks 2002). Conversion of native landcover to agricultural lands has contributed to habitat loss across the Northern Great Plains (Stephens et al. 2008). Bobcats are of management interest in South Dakota due to their value as a furbearer and susceptibility to habitat loss and fragmentation. Previous research on competition between bobcats and coyotes has yielded mixed results, but coyotes have been shown to negatively influence bobcats in some systems (Litvaitis and Harrison 1989, Wilson et al. 2010). Coexistence of sympatric species competing for similar resources can be facilitated through spatial, temporal, or dietary resource partitioning (Schoener 1974). My objective was to evaluate spatial and temporal patterns of bobcats and coyotes in an agriculturally-dominated landscape.

My study area encompassed ~4,275 km^2 of Charles Mix and Brule counties in southcentral South Dakota, which consisted primarily of privately-owned agricultural land used for cattle grazing and crop production. The western extent of the study area was bordered by the Missouri River and consisted of relatively rugged terrain that has experienced eastern red cedar (*Juniperus virginiana*) encroachment, and thus, had relatively more woodland and shrubland habitat. Away from the Missouri River, the majority of woodland and shrubland habitat was distributed as shelterbelts or riparian areas along creeks or springs.

I divided the study area into 25 km^2 sites, roughly the size of bobcat home ranges previously reported in South Dakota (Mosby 2011), and surveyed 60 randomly selected sites during the summers of 2019 and 2020. Each site was surveyed for ~28 days with 3 camera stations, which surveyed concurrently. To optimize probability of detection, I evaluated the influence of a non-species-specific olfactory lure (sardines) on detection in 2019. I randomly assigned 1 of 3 lure treatments—(i) lure applied, (ii) no lure, and (iii) lure applied during the latter half of the survey—to each camera station within a site without replacement. I evaluated the influence of the lure at 3 hierarchical scales including (i) number of triggers per sequence, (ii) number of sequences per daily detection, and (iii) daily probability of detection. Due to high coyote occupancy and high overlap between coyote and bobcat site occurrence, I used single-species, single-season occupancy modeling to evaluate patterns of occurrence (MacKenzie et al. 2002) for coyotes and bobcats separately and used the proportion of survey days with a coyote detection as a measure of relative coyote activity to evaluate the influence of coyotes on bobcat space use. I also investigated temporal activity overlap between coyotes and bobcats to evaluate evidence of temporal resource partitioning. I generated activity curves from camera detection data using a non-parametric kernel density approach and calculated a coefficient of overlap with 95% confidence intervals from 10,000 bootstrap samples (Ridout and Linkie 2009). I then conducted a Watson's two-sample test of homogeneity to test for homogeneity between activity curves (Lund and Agostinelli 2018).

The presence of the lure negatively influenced detection of bobcats such that daily probability of detection was significantly lower with a lure than without one, and the number of triggers per sequence was marginally lower when a lure was applied. The lure did not significantly influence coyote daily probability of detection but sequences per detection and triggers per sequence were both significantly higher when a lure was applied. The scent lure was not used in 2020 due to its negative influence on detection of bobcats in 2019.

I found that bobcat space use was positively associated with coyote activity, distance to paved roads, and percent woodland and shrubland landcover. Coyote space use was positively associated with slope, edge density, and percent agriculture landcover. Bobcats and coyotes had high temporal overlap both years with most detections occurring during crepuscular or nocturnal periods. Bobcat and coyote activity curves were not significantly different and showed no evidence of temporal resource partitioning.

The Jaguar Reintroduction Center: a tool to bring jaguars back to Argentina

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Rewilding Argentina Foundation is a nonprofit organization committed to restoring ecological processes (e.g., herbivory, seed dispersal, predation) through the creation of protected areas, the reintroduction of key species, and the elimination of factors that drove these species to extinction. This work is tightly connected to the development of local economies based on ecotourism, where wildlife observation and the possibility to reconnect with nature are the main attractions. Since 2007, Rewilding Argentina has been implementing a multi-species reintroduction program, which includes an apex predator, the jaguar (*Panthera onca*).

The Great Iberá Park (28°36´S, 57°49´O) is located in the province of Corrientes, northwestern Argentina, encompassing 700,000 hectares of federal and provincial lands, and is the site for jaguar reintroduction (Figure 1). The Great Iberá Park conserves the largest wetland of Argentina together with a diverse array of biomes including the Paraná forest, the Chaco dry forests and grasslands, and the thorny shrublands of the Espinal. In Iberá, the jaguar went extinct around 1950. In fact, country-wide extinctions resulted in the catastrophic decline of jaguar populations in Argentina. Researchers speculate that fewer than 300 animals currently exist in the country, and they are distributed in only 5% of the species' historical geographic range.

Rewilding Argentina is implementing the reintroduction of jaguars through the Jaguar Breeding Center (see above photo). This one-of-a-kind center was created to breed and prepare jaguars to survive in the wild with the goal to establish a self-sustaining population in an area where it has been extirpated. In the center, adults and cubs that are candidates for release are managed free from human contact and fed with live prey. Management also includes pairing males and females with no human intervention and evaluating jaguar behaviors to avoid potential conflict with livestock once jaguars are released.

To date, the center has acquired eight adult jaguars: five (2 males, 3 females) that were captive bred and obtained from zoos; and three (1 male and 2 females) that were born wild in Brazil but captured and then seized by the authorities. These last three animals were donated by the government of Brazil to the reintroduction project. In the last two years, one captive and two wild-born females gave birth to a total of six cubs. One Brazilian female and her two, 4-month-old cubs were released in early January 2021. Six additional animals, one male and one female (both from Brazil) with two cubs, and two, 2-year-old females born at the center will be released this year.

The female and two cubs already released represent the first reintroduced jaguars in an area where the species had been extirpated. They are the first free-ranging jaguars in the Iberá wetlands after 70 years of absence. This female arrived at the reintroduction center from Brazil in 2019 and became pregnant in 2020. She gave birth and raised her cubs in natural conditions, first inside a 1-ha pen and then in a 30-ha corral, where she and the cubs were exposed to all the habitats that are present in Iberá. After four months of evaluating her performance hunting and providing food for the cubs, the gate of the corral was opened, and the family was released. Intensive monitoring of the female through an Iridium collar shows that the female has established a home range nearby the 30-ha pen. Periodic investigation of putative kill sites shows that the female is successfully preying on native herbivores, particularly the abundant capybara. No conflict with humans has been reported to date.

"The Jaguar Reintroduction Center is showing promise as an efficient tool to repatriate jaguars to areas where they previously occurred. We envision a future where the center provides individuals for reintroductions and population reinforcements in other areas of Argentina and elsewhere in Latin America."

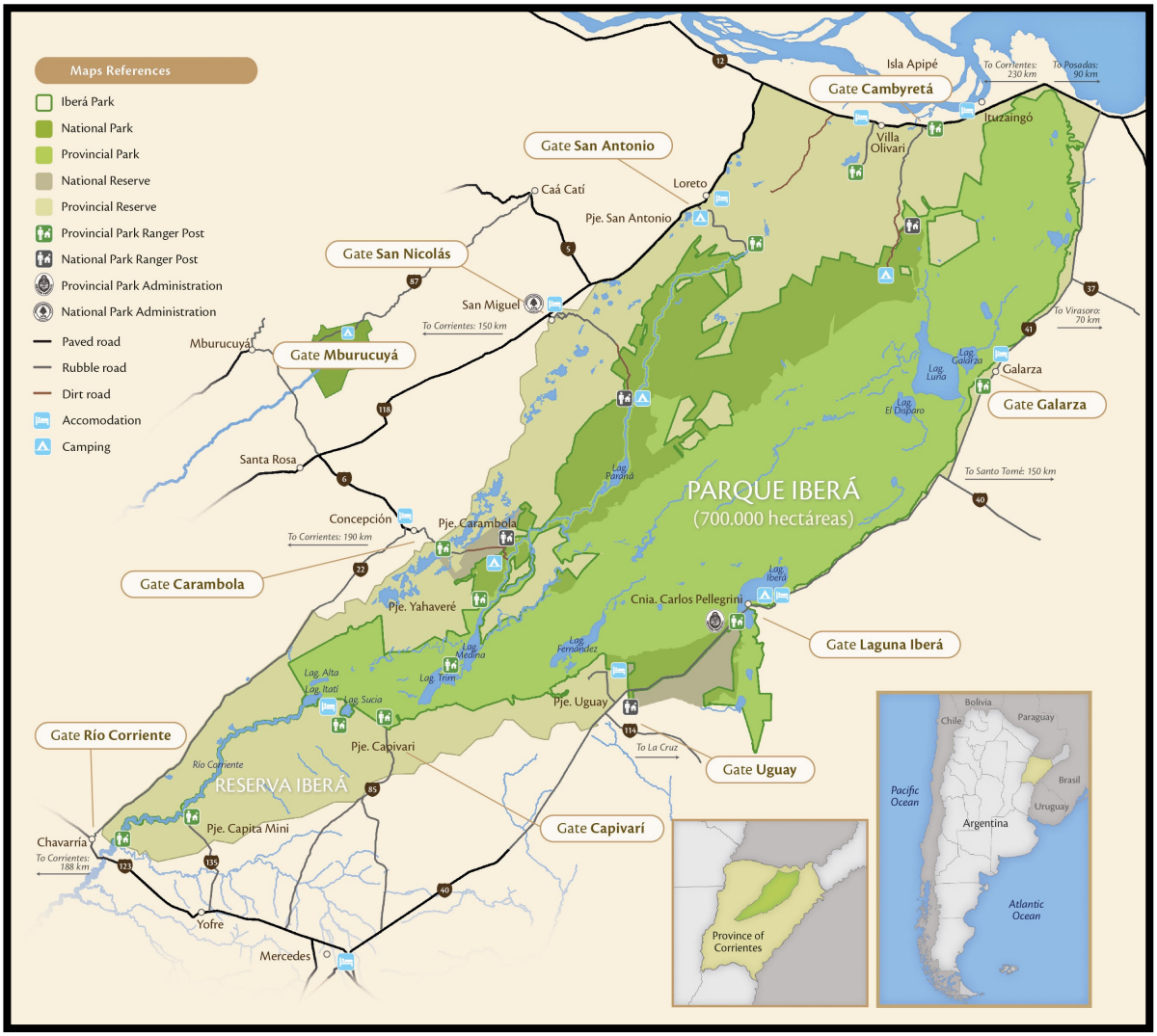

Figure 1. The Iberá Park (28°36´S, 57° 49´W) is in Corrientes province, northeastern Argentina. This protected area formed by federal and provincial lands and characterized by wetlands, grasslands, and patches of forests, encompasses 700,000 hectares of prime jaguar habitat.

El Centro de Reintroducción de Yaguareté: una herramienta para traer a los jaguares de vuelta a Argentina

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La Fundación **R**ewilding Argentina es una organización sin fines de lucro comprometida con la restauración de procesos ecológicos (p.e. herbivorismo, dispersión de semillas, depredación)

en vastas áreas, a través de la creación de áreas protegidas, la reintroducción de especies clave y la eliminación de los factores que llevaron a estas especies a la extinción. Este trabajo está estrechamente relacionado con el desarrollo de economías locales basadas en el ecoturismo, donde la observación de la vida silvestre y la posibilidad de reconectarse con la naturaleza son los principales atractivos. Desde 2007, Rewilding Argentina ha estado implementando programas de reintroducción de múltiples especies que incluyen al jaguar (*Panthera onca*), un depredador tope,

El Gran Parque Iberá (28°36´S, 57°49´O) está ubicado en la provincia de Corrientes al noroeste de Argentina, abarcando 700.000 hectáreas de tierras federales y provinciales, y es el sitio para este esfuerzo de reintroducción (Figura 1). El Gran Parque Iberá conserva el humedal más grande de Argentina y una diversa gama de biomas que incluyen la selva Paranaense, los bosques secos y pastizales del Chaco y los matorrales espinosos del Espinal. El jaguar se extinguió en Iberá alrededor de 1950. Los investigadores especulan que actualmente existen menos de 300 animales en el país y se distribuyen en solo el 5% del rango geográfico histórico de la especie. Rewilding Argentina está implementando la reintroducción de jaguares a través del Centro de Reintroducción de Yaguareté o Jaguar. Este centro único en su tipo fue creado para criar y preparar jaguares para prosperar en la naturaleza. El objetivo es establecer una población autosuficiente en un área donde ha sido extirpada. En el centro, los adultos y cachorros que son candidatos para la liberación son manejados sin contacto humano y alimentados con presas vivas. El manejo también incluye el emparejamiento de machos y hembras sin intervención humana y la evaluación de los comportamientos de los jaguares para evitar posibles conflictos con el ganado una vez que los jaguares sean liberados.

Hasta la fecha, el centro ha adquirido ocho jaguares adultos: cinco (2 machos, 3 hembras) que fueron criados en cautiverio y obtenidos de zoológicos; y tres (1 macho y 2 hembras) que nacieron silvestres en Brasil pero fueron capturados y luego decomisados por las autoridades. Estos últimos 3 animales fueron donados por el gobierno de Brasil al proyecto de reintroducción. En los últimos dos años, una hembra de cautiverio y dos hembras nacidas en la naturaleza dieron a luz a un total de seis cachorros. Una hembra brasileña y sus dos cachorros de 4 meses fueron liberados a principios de enero de 2021. Seis animales adicionales, un macho y una hembra (ambos de Brasil) con dos cachorros, y dos hembras de 2 años nacidas en el centro serán ser liberados este año.

La hembra y dos cachorros ya liberados son los primeros jaguares salvajes en los Esteros del Iberá luego de 70 años de ausencia. Esta hembra llegó al centro de reintroducción desde Brasil en 2019 y quedó preñada en 2020. Dio a luz y crió a sus cachorros en condiciones naturales, primero dentro de un corral de 1 ha y luego en un corral de 30 ha, donde ella y los cachorros estaban expuestos a todos los hábitats que están presentes en el Iberá. Después de cuatro meses de evaluar su desempeño cazando y proporcionando comida a los cachorros, se abrió la puerta del corral y la familia fue liberada. El seguimiento intensivo de la hembra a través de un collar Iridium muestra que la hembra se ha establecido cerca del corral de 30 ha. La investigación periódica de los sitios putativos de caza muestra que la hembra está depredando a los herbívoros nativos con éxito, particularmente al abundante capibara. Hasta la fecha no se ha reportado ningún conflicto con humanos.

> "El Centro de Reintroducción de Yaguareté se muestra prometedor como una herramienta eficiente para repatriar jaguares en las áreas donde habitaban anteriormente. Visualizamos un futuro en el que el centro provea de individuos para reintroducciones y refuerzos para la población en otras áreas de Argentina y en otros lugares de América Latina."

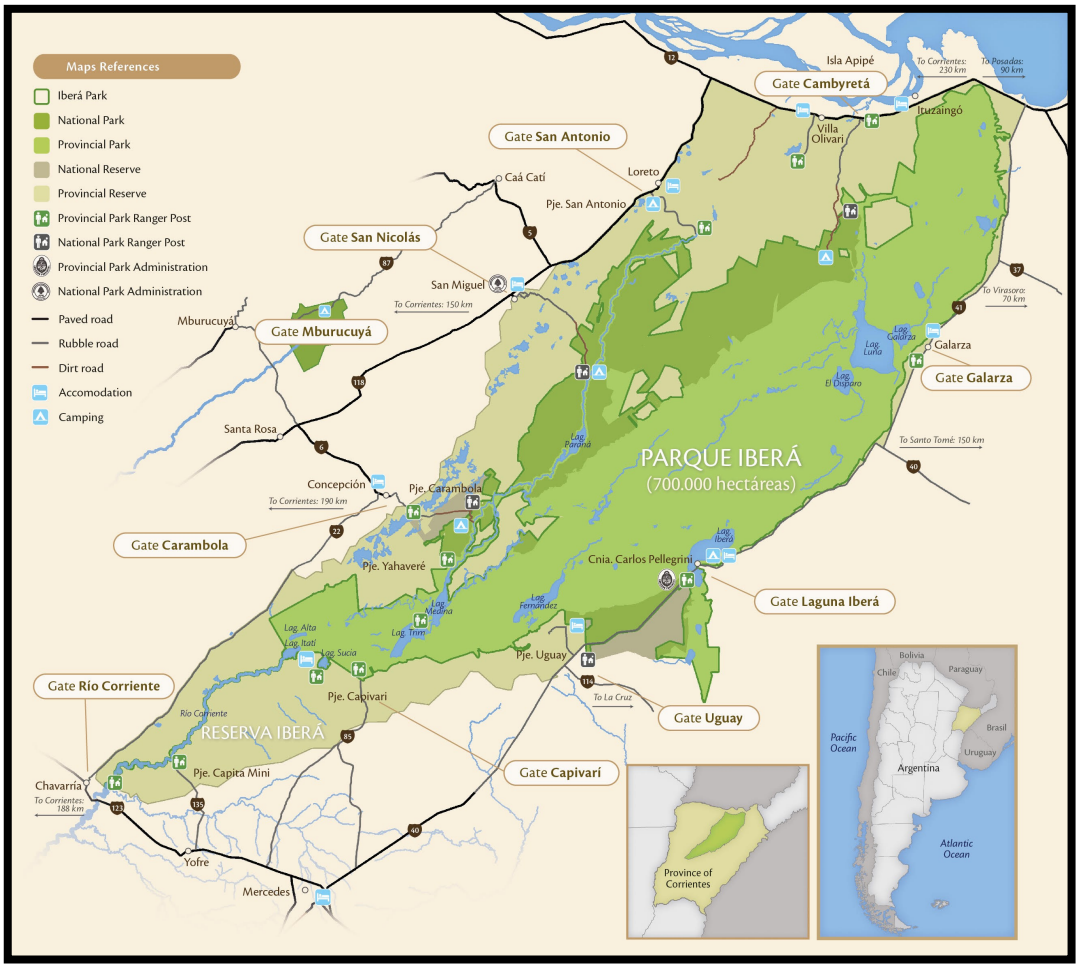

Figura 1. El Gran Parque Iberá (28°36´S, 57°49´O)

Reintroducing the America's apex predator: the jaguar (*Panthera onca*)

Lilian Rampim[1], Leonardo Sartorello[1], Mario Haberfeld[1,2,3], Ronaldo Gonçalves Morato[4], Rose Lilian Gasparini-Morato[4], Joares Adenilson May-Júnior[1,2], Carlos Eduardo Fragoso[1]

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Long-term conservation of apex predators is challenging (Chapron et al. 2014) due to habitat loss and fragmentation, prey depletion, and persecution and retaliatory killing, which are the main drivers of their population declines worldwide. Such pressures reduced jaguar (*Panthera onca*) historical distribution by about 54% (Paviolo et al. 2016). The jaguar is listed as Near Threatened by IUCN (Quigley et al. 2017) and Vulnerable in Brazil (MMA, 2018), a key country for jaguar conservation (Zimmermann, et al. 2005; Sollmann et al. 2017). Nonetheless, many jaguar subpopulations are under threat, such as in the Caatinga and Atlantic Rainforest, in Brazil, with effective population sizes estimated at only 120 (Morato et al. 2014) and 250 individuals, respectively (Lorenzana et al. 2020). An array of strategies are employed to reverse this pessimistic scenario, including reintroduction (Zamboni et al. 2017; Gasparini-Morato et al. 2021; Sanderson et al. 2021).

We briefly describe the experiences of the Onçafari and Cenap teams in rehabilitating and releasing jaguars back to the wild in three separate projects. The first project started in 2014 at Caiman Ecological Refuge (CER) and culminated with the release of two female jaguars, Isa and Fera (Gasparini-Morato et al. 2021). After the release, no interventions were implemented and the two females survived, had cubs, and their daughters from the first litters also reproduced in the wild. From these two jaguars, at least nine more jaguars in the local population were added (Figure 1).

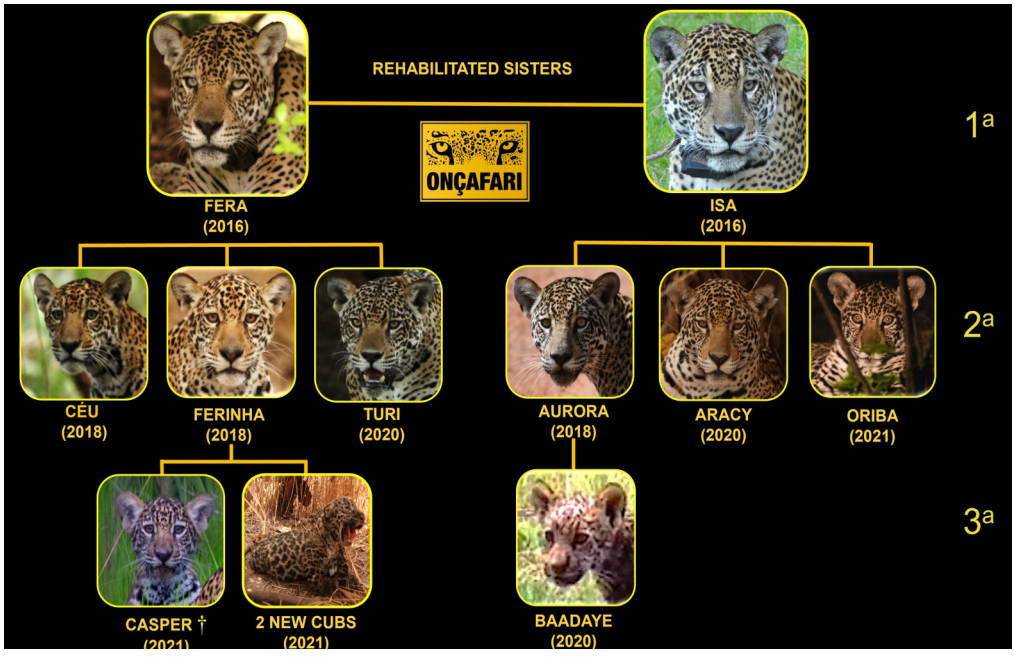

Figure 1. Female jaguars released in 2016, their litters and the third generation of jaguars born from the rehabilitation in the Pantanal, Miranda (MS), Brazil.

The same protocol was repeated in the Amazon Forest in 2018. Two newborn jaguars (~3 days-old) were received by the Brazilian Environmental Agency (IBAMA) in Itaituba (PA). They stayed at Instituto NEX, located in Corumbá de Goiás (GO), for 20 months. A similar but larger enclosure (1.5 ha) (Figure 2) was built in the forest in Jacareacanga (PA), Brazil. Live wild preys offered to the jaguars varied slightly from the Pantanal project, including agouti (*Cuniculus paca*) and collared peccaries (*Pecari tajacu*). Difficulty level was increased over time, from less harmful to aggressive prey. They stayed in the enclosure for 12 months and were released in Serra do Cachimbo, a protected area nearby. Both females (named Pandora and Vivara) were followed through satellite collars (Telonics Inc., Mesa, Arizona, USA), as ground monitoring was not possible due to difficult access within the dense forest. According to the collar data, they managed to hunt (GPS clusters) and survived for at least 2 and 10 months, respectively, when the collars stopped sending locations. Until the present date, there was no information on whether they successfully reproduced.

The third project started in 2019, when a weakened male jaguar with an estimated age of 13 months-old was captured at a school near Corumbá (MS), Brazil. Blood tests revealed protozoan infection *(Trypanosoma evansi)*. Under the care of veterinarians from Universidade Federal do Mato Grosso do Sul, Campo Grande (MS), he fully recovered and all subsequent tests have been negative. This male (named Jatobazinho) was transferred to the same enclosure at CER (Figure 3), in the Pantanal. The team followed the same rehabilitation methods. This male successfully hunted the same live wild prey described in Gasparini-Morato et al. (2021). Some successful hunts occurred in the rewilding project in Esteros del Iberá, Corrientes, Argentina, where the jaguars were completely extirpated (Zamboni et al. 2017). Jatobazinho sired the first litters reintroduced in Iberá, and he will also be reintroduced in the area.

The keys to succeed in this rehabilitation processes were: 1) minimum human contact with the target animals; 2) offering of live wild preys; 3) fasting to stimulate hunting skills; 4) visual and olfactive contact with free-ranging jaguars (may help in the acceptance of new individuals into the local population); 5) large enclosures; 6) soft release with open gates for 3 months without offering food/preys; 7) animals dictating the process' stages.

We consider that reintroduction/rehabilitation can be a feasible tool to restore previously extirpated species, reinforce declining populations of large carnivores or even to give a second chance to animals that would be fated to a life in captivity, usually in poor condition, under high stress, and poor care and diet. But this strategy will only be more effective if there are integrated efforts, such as environmental education, conflict mitigation, research, and creating a link between the local human population with the animals to be reintroduced/released.

Figure 2. Enclosure with 1.5 ha built in 2018 for the rehabilitation in the Amazon, Jacareacanga (PA), Brazil

Figure 3. Enclosure with 1.0 ha built in 2016 for the rehabilitation in the Pantanal, Miranda (MS), Brazil

Reintroduciendo al depredador tope de América: el jaguar (*Panthera onca*)

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La conservación a largo plazo de los depredadores tope enfrenta un futuro complejo (Chapron et al. 2014). La pérdida y fragmentación del hábitat, la disminución de sus presas, y la persecución y matanza en represalia son las principales causas de la disminución de sus poblaciones en todo el mundo, colocando a 16 de las 25 especies de grandes carnívoros en la Lista Roja de la UICN (Wolf y Ripple 2018). Tales presiones redujeron alrededor del 54% de la distribución histórica del jaguar (*Panthera onca*) (Paviolo et al. 2016). El felino silvestre neotropical más grande está catalogado como Casi Amenazado por la UICN (Quigley et al. 2017) y Vulnerable en Brasil (MMA, 2018), un país clave para la conservación del jaguar en toda su área de distribución (Zimmermann, et al. 2005; Sollmann et al. 2017). No obstante, muchas subpoblaciones están amenazadas, como las de Caatinga y la Selva Atlántica en Brasil, con un tamaño poblacional efectivo estimado de tan sólo 120 (Morato et al. 2014) y 250 individuos (Lorenzana et al. 2020), respectivamente. Han surgido una serie de estrategias para revertir este escenario pesimista, y la reintroducción aparece como una posible herramienta (Zamboni et al. 2017; Gasparini-Morato et al. 2021; Sanderson et al. 2021).

Describiremos brevemente a continuación las experiencias de los equipos de Onçafari y Cenap en la rehabilitación y liberación de jaguares de vuelta a su hábitat en tres proyectos separados. El primer proyecto comenzó en 2014 en el Refugio Ecológico Caimán (CER) en Pantanal, descrito a detalle en Gasparini-Morato et al. (2021), culminando con la liberación de dos jaguares hembras llamadas Isa y Fera. Después de la liberación no fue necesario hacer más intervenciones y las dos hembras sobrevivieron, tuvieron cachorros y sus hijas nacidas de la primera camada también se reprodujeron en libertad. A partir de estos dos jaguares, se agregaron al menos nueve jaguares más a la población local (Figura 1).

El mismo protocolo se repitió en la Selva Amazónica en 2018. Dos jaguares recién nacidos (~3 días de edad) fueron recibidos por la Agencia Brasileña de Medio Ambiente (IBAMA) en Itaituba, Estado de Pará (PA). Permanecieron en el Instituto NEX, ubicado en Corumbá de Goiás en el Estado de Goiás, durante 20 meses.

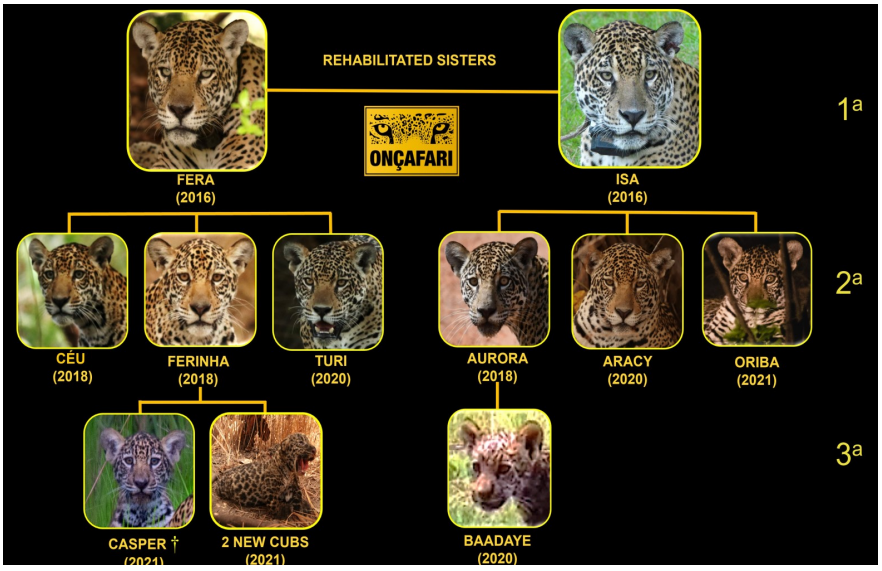

Figura 1. Jaguares hembras liberadas en 2016, sus camadas y la tercera generación de jaguares nacidos tras la rehabilitación en el Pantanal, Miranda, Estado de Mato Grosso do Sul (MS), Brasil.

Se construyó un recinto similar pero más grande de 1,5 ha (Figura 2) en el bosque en Jacareacanga (PA). Las presas silvestres vivas ofrecidas a los jaguares fueron ligeramente diferentes del proyecto en Pantanal, incluyendo agutíes (*Cuniculus paca*) y pecaríes de collar (*Pecari tajacu*). El nivel de dificultad se incrementó con el tiempo, presentando primero a las presas menos peligrosas y posteriormente a presas más agresivas. Permanecieron en el recinto durante 12 meses y fueron liberadas en Serra do Cachimbo, un área protegida cercana. Ambas hembras, llamadas Pandora y Vivara, fueron monitoreadas con collares satelitales (Telonics Inc., Mesa, Arizona, EE. UU.), ya que no fue posible monitorearlas en tierra debido al difícil acceso y densidad del bosque. Según los datos de los collares, lograron cazar y sobrevivieron durante al menos 1.5 y 12 meses, respectivamente, cuando los collares dejaron de enviar ubicaciones. Hasta la fecha no se tiene información si se habían reproducido con éxito o no.

El tercer proyecto comenzó en 2019 cuando un jaguar macho muy debilitado, con una edad estimada de 13 meses, fue capturado en una escuela cerca de Corumbá, en el estado de Mato Grosso do Sul (MS). Los análisis de sangre revelaron una infección por *Trypanosoma evansi*. El jaguar se recuperó completamente de esta enfermedad bajo el cuidado de veterinarios expertos de la Universidade Federal do Mato Grosso do Sul, en Campo Grande, y todas las pruebas posteriores dieron negativas. Este macho, nombrado Jatobazinho, fue trasladado al mismo recinto del CER (Figura 3), en el Pantanal. El equipo siguió los mismos protocolos de rehabilitación. Este macho logró cazar a las mismas presa silvestres vivas descritas en Gasparini-Morato et al. 2021. Cuando fue capaz de cazar presas con éxito, viajó al Proyecto Rewilding en Esteros del Iberá, en Corrientes, Argentina, donde los jaguares alguna vez fueron completamente extirpados, pero actualmente están siendo reintroducidos (Zamboni et al. 2017). Jatobazinho engendró a las primeras camadas reintroducidas en Iberá y él también será reintroducido en la zona.

Creemos que las claves del éxito en estos proyectos de rehabilitación fueron: 1) mínimo contacto humano con los jaguares; 2) ofrecer presas silvestres vivas; 3) ayuno para estimular las habilidades de caza; 4) contacto visual y olfativo con jaguares en libertad (puede ayudar a la aceptación de nuevos individuos en las poblaciones locales); 5) recintos grandes; 6) liberación suave con compuertas abiertas durante 3 meses sin ofrecer alimento/presas; 7) dejar que el animal dicte el proceso en cada etapa.

Consideramos que la rehabilitación y reintroducción pueden ser herramientas viables para restaurar especies previamente extirpadas, reforzar las poblaciones de grandes carnívoros que están disminuyendo y dar una segunda oportunidad a los animales que de otro modo estarían destinados a una vida en cautiverio, generalmente en malas condiciones, sometidos a mucho estrés y con cuidados y dieta inadecuados. Pero esta estrategia solo será más efectiva si se integran diversos esfuerzos como la educación ambiental, mitigación de conflictos, investigación y la creación de un vínculo entre las poblaciones humanas locales y los animales que se reintroducirán o liberarán.

Figura 2. Recinto de 1.5 ha construido en 2018 para la rehabilitación en el Amazonas, Jacareacanga, Estado de Pará (PA) Brasil.

Figura 3. Recinto de 1.0 ha contruido en 2016 para la rehabilitación en el Pantanal, Miranda, Estado de Mato Grosso do Sul (MS) Brasil.

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~ Recent Publications ~

Message to readers about the 'Recent Publications' Hello everyone! My name is Robert (Bob) Fitak, and I have been putting together the list of recent publications for the *Wild Felid Monitor* since the Winter 2014 issue. I normally make an extensive search using the Web of Science database with the various scientific and common names of felids native to the Western Hemisphere. I then trim the list of publications down to those most relevant and partition them into four categories: i) Conservation and Management, ii) Genetics and Disease, iii) Ecology iv) Research and Methodologies. I encourage readers who want to ensure that a publication is included (e.g., from journals not indexed in Web of Science) contact me at my email address to submit relevant literature. I will continue to do my best to provide a comprehensive list, and your help can make it better. Keep up the great research! *-Bob Fitak* (*rfitak9@gmail.com*)

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Andreasen, A. M. et al. 2021. Prey specialization by cougars on feral horses in a desert environment. Journal of Wildlife Management 85:1104-1120.

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~ Research Highlights ~

Cats, cars, and crossings: The consequences of road networks for the conservation of an endangered felid.

Blackburn, A. et al. 2021; Global Ecology and Conservation 27:e01582.

Encroaching urban development is a leading cause of habitat loss, replacing natural areas with anthropogenic infrastructure and road networks. Roadways can influence the spatial ecology and survival of mammalian carnivores, particularly felids, thereby threatening long-term persistence and conservation of sensitive populations. Ocelots (*Leopardus pardalis*) are a federally endangered felid in the United States with breeding populations restricted to the Lower Rio Grande Valley of South Texas, an area of extensive anthropogenic expansion. We evaluated the influence of road networks on ocelot survival using a long-term telemetry dataset (1982–2001, *n* = 59) and draw comparisons with a spatially referenced historical dataset of ocelot-vehicle collisions in the same area (1982–2020, *n* = 54). Vehicle collisions accounted for 40% of radio-collared ocelot fatalities. Annual survival rates were 0.90 (95% CI = 0.84–0.95) for resident ocelots and 0.66 (95% CI = 0.45–0.97) for transient ocelots. We evaluated biological and road-related factors that may influence ocelot survival using Cox proportional hazards regression. Mortality risk increased 16% with every 0.07 km/km^2 increase of high-volume roads within annual home range, decreased 45% with every 1.12 km/km^2 increase of unpaved roads, and decreased 276% for residents compared to transients. Further, probability of mortality specifically from vehicle collision increased with greater density of low-volume roads within ocelot home ranges. Within the historical dataset of ocelot-vehicle collisions, 46% occurred on low-volume roads while 39% occurred on high-volume roads. Our results highlight the necessity for mitigation strategies on low-volume roads which cause the most ocelot-vehicle collisions. In addition, continued attention towards high-volume roads is necessary to ocelot conservation. Understanding how road attributes affect the survival of species sensitive to urbanization and habitat fragmentation can aid in their conservation.

Connecting worlds: indigenous territories, habitat suitability and conservation of three large carnivores (Mammalia: Carnivora) in southern Mexico.

de Oca, E. et al. 2021; Ethnobiology and Conservation 10:26.

Human and wildlife conflicts pose conservation challenges for several charismatic species worldwide. Given their close long-standing interactions with wildlife, indigenous communities set an interesting framework to identify factors establishing these relationships. The first step is to account the perceptions and symbolisms of indigenous communities to define and complement conservation efforts. We used multi-temporal and multi-criteria analyses to assess species habitat suitability of three large carnivores (jaguar, puma, and coyote), and quantified the overlap with the Mixtec and Zapotec indigenous territories in southern Mexico. We observed a positive and proactive relationship between indigenous communities' self-identification and a high species habitat suitability for the conservation of these large carnivores in the Sierra Norte, Sierra Sur, Coastal, and Mixtec regions. Since most of these areas occur outside natural protected areas, the inclusion of indigenous communities in the management and planning of their territory is crucial for preserving their ethnocentric vision and ensuring long-term conservation of these charismatic large carnivores and their habitat.

Every case is different: Cautionary insights about generalisations in human-wildlife conflict from a range-wide study of people and jaguars.

Zimmermann, A. et al. 2021; Biological Conservation 260:109185.

Human-jaguar conflict occurs across a very large variety of geographic, agronomic and socio-economic contexts and across heterogeneous communities. We conducted seventeen case studies across seven countries in central and south America to search for patterns in socio-economic predictors of human-jaguar conflict that could help up-scale management of this range-wide jaguar conservation challenge. Our study revealed that within and across case studies there were considerable differences in farmers' education levels, economic dependence on livestock, personal experience with livestock losses, as well as tolerance of and attitudes and social norms towards jaguars. Among this diversity, we sought common predictors of tolerance of jaguars, but found that no quantifiable single contextual factor could be used to predict how farmers perceive jaguars and deal with depredation. We conclude that observations of patterns in human-wildlife conflict are valid only for informing action at a local scale, and even if a small number of case studies appear to show similar patterns this does not make the observation universally true. Nevertheless, although each case is likely to require individual solutions, insights from aggregate or wide-range studies can provide insights into the range of possible scenarios, adding breadth of information to depth of local knowledge.

Environmental and anthropogenic factors synergistically affect space use of jaguars.

Thompson, J. J. et al. 2021; Current Biology 31:3457-3466.E4.

Large terrestrial carnivores have undergone some of the largest population declines and range reductions of any species, which is of concern as they can have large effects on ecosystem dynamics and function. The jaguar (*Panthera onca*) is the apex predator throughout the majority of the Neotropics; however, its distribution has been reduced by >50% and it survives in increasingly isolated populations. Consequently, the range-wide management of the jaguar depends upon maintaining core populations connected through multi-national, transboundary cooperation, which requires understanding the movement ecology and space use of jaguars throughout their range. Using GPS telemetry data for 111 jaguars from 13 ecoregions within the four biomes that constitute the majority of jaguar habitat, we examined the landscape-level environmental and anthropogenic factors related to jaguar home range size and movement parameters. Home range size decreased with increasing net productivity and forest cover and increased with increasing road density. Speed decreased with increasing forest cover with no sexual differences, while males had more directional movements, but tortuosity in movements was not related to any landscape factors. We demonstrated a synergistic relationship between landscape-scale environmental and anthropogenic factors and jaguars' spatial needs, which has applications to the conservation strategy for the species throughout the Neotropics. Using large-scale collaboration, we overcame limitations from small sample sizes typical in large carnivore research to provide a mechanism to evaluate habitat quality for jaguars and an inferential modeling framework adaptable to the conservation of other large terrestrial carnivores.

COVID-19 suppression of human mobility releases mountain lions from a landscape of fear.

Wilmers, C. C. et al. 2021; Current Biology 31:3952-3955.e3.

Humans have outsized effects on ecosystems, in part by initiating trophic cascades that impact all levels of the food chain. Theory suggests that disease outbreaks can reverse these impacts by modifying human behavior, but this has not yet been tested. The COVID-19 pandemic provided a natural experiment to test whether a virus could subordinate humans to an intermediate link in the trophic chain, releasing a top carnivore from a landscape of fear. Shelter-in-place orders in the Bay Area of California led to a 50% decline in human mobility, which resulted in a relaxation of mountain lion aversion to urban areas. Rapid changes in human mobility thus appear to act quickly on food web functions, suggesting an important pathway by which emerging infectious diseases will impact not only human health but ecosystems as well.

On the need for rigorous welfare and methodological reporting for the live capture of large carnivores: A response to de Araujo et al.

Caravaggi, A. et al. 2021; Methods in Ecology and Evolution 12:1793-1799.

De Araujo et al. (*Methods in Ecology and Evolution*, 2021, *https://doi.org/10.1111/2041-210X.13516*) described the development and application of a wire foot snare trap for the capture of jaguars *Panthera onca* and cougars *Puma concolor*. Snares are a commonly used and effective means of studying large carnivores. However, the article presented insufficient information to replicate the work and inadequate consideration and description of animal welfare considerations, thereby risking the perpetuation of poor standards of reporting. Appropriate animal welfare assessments are essential in studies that collect data from animals, especially those that use invasive techniques, and are key in assisting researchers to choose the most appropriate capture method. It is critical that authors detail all possible associated harms and benefits to support thorough review, including equipment composition, intervention processes, general body assessments, injuries (i.e. cause, type, severity) and post-release behaviour. We offer a detailed discussion of these shortcomings. We also discuss broader but highly relevant issues, including the capture of non-target animals and the omission of key methodological details. The level of detail provided by authors should allow the method to be properly assessed and replicated, including those that improve trap selectivity and minimize or eliminate the capture of non-target animals. Finally, we discuss the central role that journals must play in ensuring that published research conforms to ethical, animal welfare and reporting standards. Scientific studies are subject to ever-increasing scrutiny by peers and the public, making it more important than ever that standards are upheld and reviewed. We conclude that the proposal of a new or refined method must be supported by substantial contextual discussion, a robust rationale and analyses and comprehensive documentation.

~ Obituary: David E. Brown~

Born in 1938 to parents Harold and Glady (Katherine) Brown, Dave spent his early childhood years in Wisconsin with his younger brothers Jim and Rick, where they engaged in fishing, chasing local birds, and playing in the snow. In 1950, the family moved to Santa Clara, California where the wood, marsh, and agricultural lands of rural 1950's California agreed with the boys. Dave's interest in the outdoors and hunting deepened. Even at this young age, Dave had the hallmarks of an exceptional naturalist. He kept meticulous notes on the small game he bagged, neatly organized in rows by species, number taken, and locality. Duck hunting became a passion for the young sportsman. With a friend, he made a dozen wooden pintail decoys, expertly carved and painted. He turned his boyhood room into a museum adorned with the skins of small mammals and his own taxidermied birds.

Dave attended San Jose State University where he worked on waterfowl banding projects. After graduating in 1961 in Natural Resources, Dave worked summers as a creel clerk on the Colorado River. Dave was soon offered to join the first class of Arizona Game and Fish Department wildlife officers. Dave devoured the natural history information he received in training. His first assignment was Gila Bend where he learned the remote lands, new plants and animals, and hidden places of his district. He moved to the Tucson Office where he served as a wildlife manager and met and married Louella, his spouse of 56 years. He also met naturalist, Dr. Charles H. Lowe who taught at University of Arizona. Dave sought out Dr. Lowe with questions about plant distribution. Lowe gave Dave a copy of the book *Arizona's Natural Environments* which Dave read in a single night and returned the next day with a list of questions for Dr. Lowe, marking the beginning of this mentoring relationship. . Their shared broad interests in Southwestern natural history sparked mutual respect and collaborative efforts that produced *Biotic Communities of Southwestern United States and Northwestern Mexico,* which remains one of the most referenced works in southwestern research.

By 1968, Dave moved to Game and Fish Headquarter in Phoenix supervising the Small Game Branch. Of all species he studied, squirrel research was what he enjoyed most. He also oversaw the reintroduction of river otters, a species that had disappeared decades earlier from the state. This research found its way into numerous reports, scientific papers, regulations. He described the 11 years he spent working with small game as the "happiest of my life". No doubt part of this joy was due to the birth of his only child, a daughter, Elaine who much later gave him a granddaughter, Brieanna, who he lovingly referred to as "The Varmint". In 1981, Dave moved to supervise the Big Game program where he oversaw bighorn sheep reintroductions, pronghorn and deer research, and a variety of other projects. In 1984 he was promoted to Chief of Game Management, a position he held until he retired in 1988, after 26 years of working for the Arizona Game and Fish Department.

Dave's involvement with wildlife transcended his employment with the Game and Fish Department. He played key roles in a variety of wildlife organizations including Arizona Desert Bighorn Sheep Society, The Wildlife Society, Arizona Wildlife Federation, and was founder of the Arizona Antelope Society. In 1981, while still employed with the Game and Fish Department Dave became an adjunct professor at Arizona State University, a position he continued in until 2021. He primarily taught wildlife classes but also science writing courses. Dave's classes were designed to prepare students for real jobs in wildlife sciences. He took students on numerous, rigorous, lengthy field trips where students camped out and participated in hands on learning. Many of the students he taught moved on to positions with the Arizona Game and Fish Department, U.S. Fish and Wildlife Service, Forest Service, and so on. Dave taught classes for 16 years but continued his mentoring of students until his death.

Dave was a curious man. He would tell his students "Ask the questions…why is that plant over there and not here? Why does this animal look like that? Why, ask why." This curiosity is what drove Dave. He was not content to merely read about a place/thing, he had to go see the "elephant" for himself. These visits informed his ideas and theories, which later found their way into hundreds of publications and ears of students and other biologists.

Dave also was smart enough to know what he didn't know. When he didn't know, he read, researched, and sought out those who did know. Their ideas and knowledge shaped his thoughts giving rise to new lines of query or expansion of existing ones. Often, he was the one who initiated research projects when during a casual conversation he would interject "what do you know about…. or we ought to do a project on…", the subject could be most anything from vampire bats to crocodiles to imperial woodpeckers. These collaborations spanned decades and continents, and it was rare that they did not find their way into print. He felt that researchers had an obligation to publish and share what they learned. He recognized that we all stand on the shoulders of the great naturalists that came before us and this only happens because they shared what they learned. This desire to learn and share is evidenced by his publications: over 300 popular articles, over 120 scientific and technical papers and more than 20 authored or edited books. During his career, he never stopped working or asking questions, culminating innumerous awards including being inducted into Arizona Wildlife Hall of Fame and Arizona The Wildlife Society David E. Brown Lifetime Achievement Award.

Dave gave so much to so many through his teaching, writing, and personal discussions. He made us all better biologists. No doubt, Dave will rank among the greatest biologists to have come out of the southwest. We are poorer for his loss; he is sorely missed. But we are so much richer for his curiosity.

-Randall Babb

~Quotes about David E. Brown~

We, Cheryl Mollohan and Lisa Haynes, retired Arizona Game and Fish Biologists, have seen first-hand the impact Dave Brown made in our profession in working for wildlife. We are grateful to have known Dave both personally and professionally, therefore, we contacted some of Dave's colleagues who worked with him during his tenure at Arizona Game and Fish and on various projects to gather their memories of Dave.

"We were proposing to restore brown bears in northern Mexico. We met with Dave to discuss a source population. Because of the Endangered Species Act and permitting issues, I suggested we look to Canada as a population source and "fly them over the U.S." Dave stated that would be a good "Alternative B". I looked at him quizzically and waited for his suggested "Alternative A". He then stated:

"We will bring them from Slovenia. Place them in the same canyon where the last one was killed by American hunters in 1963. The habitat has not changed since the last brown bear was killed in the Sierra del Nido (Dave had recently been to the location, as he was going to all last known brown bear kill sites). Slovenia is giving bears to France for re-wilding restoration. The bears are doing well. Slovenia's bear population is at a human-bear conflict carrying capacity. A brown bear is a brown bear, except in their behavior adaptations to humans and some specific readily available food resources (salmon). Slovenia is approximately the same latitude as northern Mexico and many of the food plants are related, and behaviorally the bears are not as aggressive as those in the U.S. and Canada. We do not have enough time remaining to biologically debate genetics or be boxed in by narrow-minded politically restricted recovery plans."

Dave's wildlife mind and vision were different from any other humans.

-Ron Thompson

"Of the many things I enjoyed about Dave, it was our biological discussions that I often found most compelling. Long drives flew by while we discussed biogeography, evolutionary relationships, or adaptations of plants and animals. His insights during these discussions were often staggering and usually left me thinking "why did that never occur to me".

-Randall D. Babb

"We all knew Dave as a great biologist, but I think his biggest contribution to Wildlife in Arizona was as a bio historian. His many hours spent in libraries and various archives researching the history of Arizona's animals and plant communities will be of value to many generations to come." -Al LeCount

In Grad School and my young career, few if any had more impact on me than Dave Brown. I was his TA when he first started teaching at ASU, and I quickly learned he knew more about what I wanted to do for my life than anyone. I attended all lectures and spent as much time as possible in his office. For a short time, I wanted to be just like him. But after 3 years in the profession, I knew I was too limited to accomplish what Dave had and has done until his recent passing. He was kind to me and mentored me during a tough time in my life and I always appreciated that.

One reason I admired Dave was his ability to deal with arrogant professionals, and how it never seemed to bother him. Most of us know that Dave had a quick wit and was a straight shooter, sometimes with little regard for consequences, but he maintained professionalism and was confident in his knowledge. This was rightfully so as he authored 23 books, 120+ scientific papers, and over 250 magazine articles.

It's hard for me to come to the realization that the most prolific Southwestern US naturalist will no longer be publishing papers or books. But I have so many to reread, and he will always be in my memories as a good mentor and a great biologist. It was my pleasure to know him!" -Stan Cunningham

Dave was a close personal friend. Some of my best memories involve a trip he and I made along the Canadian River in Texas and Oklahoma, wherein he and I wandered through multiple small cemeteries in northeast New Mexico, wondering how the historic prairies appeared. Dave, of course, played a big role in my life by introducing me to Patty. I chuckle every time I remember him saying, in his loose-lipped gutteral, "It'll never work out." The one time I'm happy you were wrong. Dave's list of publications is legend. Perhaps less well documented are the legions of young people he mentored and, often, found funds to support. Almost daily I still come up with an idea or think of some event that needs corroboration. I start to reach for the phone, but then remember. Some people, you truly miss.

-Harley Shaw

Jaguar (*Panthera onca*) caught on a DSLR camera trap in Belize, Central America. (Credit: David Lugo)

About the Wild Felid Research and Management Association

The Wild Felid Research and Management Association is open to professional biologists, wildlife managers, and others dedicated to the conservation of wild felid species, with emphasis on those species in the Western Hemisphere. The WFA acts in an advisory capacity to facilitate wild felid conservation, management, and research, public education about wild felids, and functions among various governments, agencies, councils , universities, and organizations responsible or interested in wild felids and their habitats.

Our intention is to:

1. Provide for and encourage the coordination and exchange of information on the ecology, management, and conservation of wild felids;
2. Provide liaison with other groups; and,
3. Provide a format for conducting workshops, panels, and conferences on research, management and conservation topics related to wild felids.

Our goal:

The goal of the Wild Felid Association is to promote the management, conservation, and restoration of wild felids through science-based research, management, and education.

Our objectives:

1. Promote and foster well-designed research of the highest scientific and professional standards.
2. Support and promote sound stewardship of wild felids through scientifically based population and habitat management.
3. Promote opportunities for communication and collaboration across scientific disciplines and among wild felid research scientists and managers through conferences, workshops, and newsletters.
4. Increase public awareness and understanding of the ecology, conservation, and management of wild felids by encouraging the translation of technical information into popular literature and other media, and other education forums.
5. Encourage the professional growth and development of our members.
6. Provide professional counsel and advice on issues of natural resource policy related to wild felid management, research, and conservation.
7. Maintain the highest standards of professional ethics and scientific integrity.