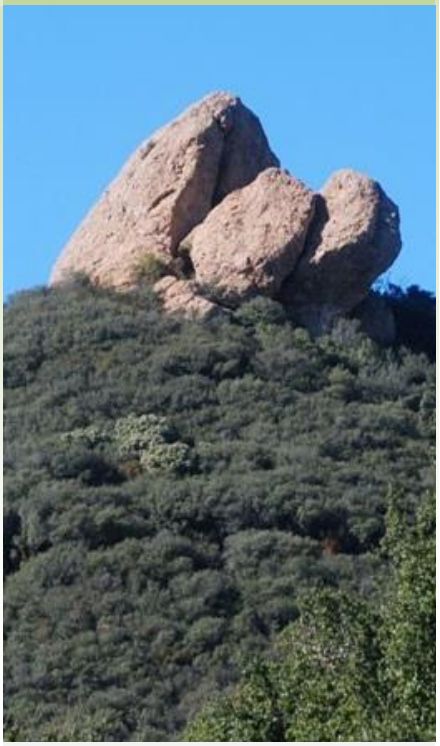
2021 Annual Report

UCLA La Kretz Center for California Conservation Science



The year in review

2021 is behind us, and for most of our community, there's a general feeling of "Thank goodness". Classes are back in session at UCLA, and we're looking forward with cautious optimism to the coming year.

Even with Delta and Omicron, the La Kretz Center moved forward on a number of important initiatives. 2020 was the year we launched the California Conservation Genomics Project; 2021 was the year we put it into high gear. We're turning out genomes at a rate that was inconceivable three years ago, and our team is running as a well-oiled machine, with key nodes at UC Davis, UC Santa Cruz, and UC Berkeley in addition to our central group at UCLA. We hosted a virtual La Kretz public lecture featuring all of our past and current postdocs—every one of them participated, and you can see their lightening talks here. It's an inspiring group of scholar-practitioners at the interface of academic and applied conservation science, and we're immensely proud of their dedicated work. We funded seven graduate student projects ranging from the effects of roads on California quail movement, to biodiversity monitoring in Santa Monica Bay using environmental DNA, to increasing our basic understanding of the ringtail--the most elusive mammalian carnivore in Southern California. Plus many others. And we've entered into new discussions with the National Park Service to rebuild our beloved La Kretz Field Station, but at a new locale and with a new, broader vision to support field research in the Santa Monica Mountains.

As we enter 2022, I hope to see many of you at LK events in the coming year. Or shoot me an email and let's get caught up. I love to talk!

Take care,

Brad Shaffer, Director

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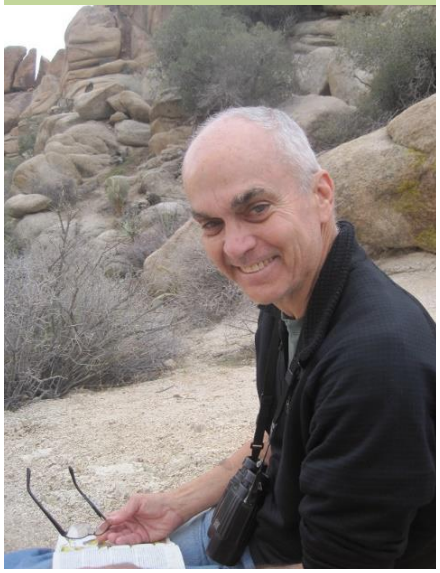
The La Kretz Center is made possible by a generous endowment by UCLA alumnus and philanthropist Morton La Kretz

Director's Initiative



California Conservation Genomics Project

One million species are at risk of extinction worldwide, many of which are found in—or restricted to—California. Climate change is stretching species and habitats to their breaking points.

To address this crisis, the La Kretz Center launched, and has continued to lead, the California Conservation Genomics Project (CCGP), a $12 million dollar project funded by the state of California. We're engaging leading experts in genomics and conservation science across the UC system to rapidly sample and study genomic variation of 250 species that span the breadth of California's species and ecosystems. It's a huge project, with equally large impacts to CA biodiversity management.

During 2021, we hit high gear. We assembled fresh tissues for all 150 reference genome species, started sequencing most of them, and moved thousands of samples for resequencing through our newly- developed UCLA Mini-Core. Our goal is to deliver this amazing project to the state in late 2022. Stay tuned!

CCGP will provide genomic resources for conservation and resource managers, as well as the broader scientific community, that transform conservation in the state.

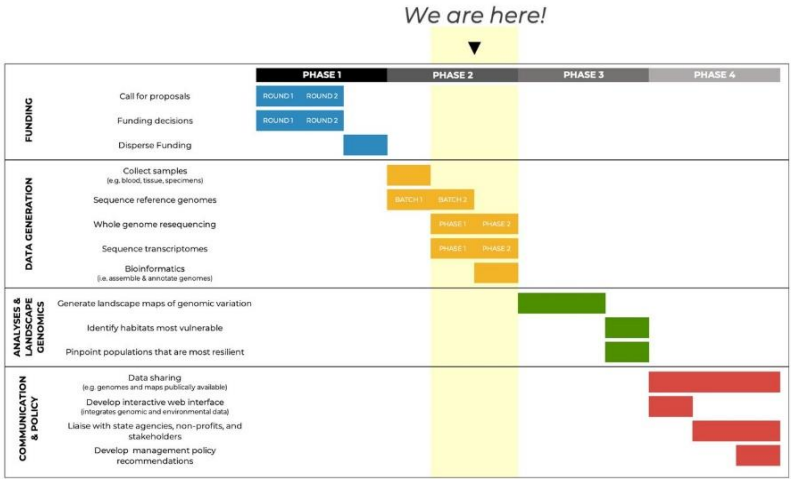
First plant and animal Genome Resource articles in the Journal of Heredity

For science to matter, it needs to be published in the peer reviewed literature. During 2021 we negotiated an agreement with the Journal of Heredity (JOH), one of the top journals focused on conservation genetics. Subject to successful peer review, all 150 species for which the CCGP is generating new genomes will be published in the JOH. What's more, they will be fully Open Access and freely available. Our first two Genome Resource articles are now completed. The Big Berry Manzanita (*Arctostaphylos glauca*) reference genome was published early online in 2021, and the Northwestern Pond Turtle (*Actinemys marmorata*) is under peer review. Both focus on species complexes under extreme conservation threat, and these genomes are a key element in using genetics for their recovery.

Visit the CCGP website to discover our study species …




… and learn more about our progress:



Optimizing landscape connectivity to conserve endangered species threatened by disease

Now starting his second year, Dave Daversa's La Kretz postdoctoral research aims to determine optimal strategies for conserving endangered Yosemite Toads (*Anaxyrus canorus*), a species restricted to alpine meadows in Yosemite, Sequoia, and Kings Canyon National Parks. Populations of this high elevation specialist plummeted in the late 1970s for largely unknown reasons, and the viability of their populations remains uncertain. Meanwhile, the amphibian-killer fungal pathogen, *Batrachochytrium dendrobatidis* (*Bd*) is circulating in the parks, but its impact on the toads has never been investigated.

In partnership with, and co-funded by Yosemite National Park, Dave is executing systematic *Bd* surveillance in toad populations. He combines intensive field surveys and PCR-based disease detection protocols to characterize fungus transmission between tadpoles, juveniles, and mature adults, especially as they migrate from breeding meadows to hibernation sites. These data inform spatial disease models to determine how *Bd* is maintained in these endangered amphibians, and how it might be eliminated. The results will provide the park with additional guidance on minimizing disease prevalence as staff scientists implement re-introductions across the park. Dave was assisted by UCLA undergraduate Molly Posta in 2021.

Disentangling California (bio)diversity

La Kretz postdoc Joshca Beninde, in collaboration with La Kretz affiliate Erin Toffelmier and nine UCLA undergraduates, has brought the CaliPopGen database of all published population genetic data for native and naturalized species in California across the finish line. It summarizes our accumulated state of knowledge, based on all published literature, of 448 species, 5,453 populations, and 187,394 individuals, to summarize what we know about genetic variation across our state. Joscha is also collaborating with two undergrads to compile and analyze citizen-science based observational records (in the iNaturalist database) of 1,000 species across the LA basin to help managers understand the distribution of hotspots, and coldspots, of animal and plant diversity in our city.

Wildlife and recovery

Chloe Nouzille was awarded a La Kretz Center + Stunt Ranch Research Award in 2021 for her study using remote camera technology to study how wildlife in the Santa Monica Mountains (SMMs) recovered after the Woolsey Fire. Her work was featured in local media; what follows is from her KPCC interview last November.

What is most important about this work?

Chloe: As fires become more intense and frequent due to climate-mediated disturbance and natural areas become rapidly urbanized and fragmented, this research will be critical to help inform management and conservation practices in similar landscapes facing these potentially synergistic effects.

And, how will your research give us a better understanding of what's happening locally?

Chloe: This study is unique in terms of its long-term and widespread monitoring of mammals in the SMMs. It will give a better understanding of what kinds of habitats these animals currently occupy, mammal species richness, and interspecific interactions. Local managers will be able to use this research to gain insight into how animals will respond to future disturbances and ways to help their recovery, if necessary.

Any surprising results you care to share?

Chloe: Unexpectedly, I have caught some of the more elusive species on my cameras like the Spotted Skunk (*Spilogale putorius*) and the Badger (*Taxidea taxus*) and expect to have enough data to create a distribution map for them, the first of which for the SMMs area.

Two postdoc fellowships awarded in 2021

La Kretz Postdoc Samantha Catella is fascinated by the causes and consequences of spatial variation in plant communities, especially in urban ecosystems. Samantha's research investigates how spatial heterogeneity across different anthropogenic disturbances has affected the population structure and local adaptation of California buckwheat at the urban-wildland interface.

Zac MacDonald, our second postdoc awardee, is broadly interested in ecological and evolutionary mechanisms that structure biodiversity in space and time. He also loves butterflies. His research is aimed at advancing landscape genomics by providing a toolkit for identifying threats to species of conservation concern. His study system is alpine butterfly species suffering from climate change.

Our postdocs collaborate with government and non-government partners to produce cutting edge research that facilitates conservation policy outcomes

Where are they now?

Eric Abelson (2013-2015) is a research scientist at University of Texas, Austin

Elizabeth Long (2014-2015) is the past Director of Conservation Science at Mohonk Preserve, New York

John Benson (2014-2016) is an assistant professor at the University of Nebraska School of Natural Resources

Alexandria Pivovaroff (2015-2017) is a postdoc at Pacific Northwest National Lab

Gary Bucciarelli (2015-2017) is an Adjunct Assistant Professor at UCLA

Jesse Grismer (2016-2018) is an Assistant Professor at La Sierra University

Justin Valliere (2016-2018) is an Assistant Professor at CSU Dominguez Hills

Luke Browne (2017-2019) is a postdoctoral associate at Yale University

Postdoc update: Congrats to Justin Valliere, Assistant Professor, CSU Dominguez Hills

Justin is a plant ecologist whose research is motivated by "a lifelong fascination of plants and a passion for conservation". The goal of his research is to explore the impacts of human-caused global change on native plant communities, identify mechanisms of change, and inform land management and ecological restoration. As a La Kretz postdoc from 2016-2018, Justin worked on botanical restoration projects, including at the UCLA Stunt Ranch Reserve.

In 2020, Justin joined the faculty at CSU Dominguez Hills, and in 2021 he was awarded a grant by the state of California to study the environmental and ecological impacts of automobile emissions and other anthropogenic pollution on Southern California ecosystems.

The project will use dendrochronology – the study of tree rings – and stable isotope analysis to explore relationships between climate change, tree growth, and air pollution at high and low pollution sites in the Santa Monica Mountains. In addition to supporting this novel research approach, the program will also directly engage and train his CSUDH students in inquiry-based environmental research.

"This award will provide a really exciting opportunity for understanding the environmental impacts of air pollution and climate change on Southern California's ecosystems, and it will also be a wonderful experience for the graduate and undergraduate students engaged in the research project," said Valliere.

Read about Justin's project at the CSUDH Campus News Center

La Kretz Center and Stunt Ranch award conservation grants to UCLA grad students

Awards totaling $30,000 will help students conduct research in the Santa Monica Mountains and throughout Southern California

Congratulations to:

Wilmer Amaya-Mejia: Urbanization effects on the disease ecology of dark-eyed juncos (*Junco hyemalis*)

Candice Cross: Characterizing community biodiversity of eelgrass (*Zostera marina*) in the Port of LA surrounding a localized dredging event

Janine Fischer: Effects of interspecific competition on habitat use by Stephens' kangaroo rat

Sara Freimuth: Effects of Urbanization on Gut Microbial Communities in Dark-Eyed Juncos (*Junco hyemalis*)

Chloe Nouzille: Wildlife post-Woolsey Fire Recovery and Recolonization

Carolyn Xue: Comparisons in Patterns of Antibiotic Resistance Bacteria Between Urban and Non-urban Populations of Dark-Eyed Juncos (*Junco hyemalis*)

Stella Yuan: DNA methylation variation as a mechanism to alleviate inbreeding depression in the island fox (*Urocyon littoralis*)

To learn more about these great student projects, just click on their name.

Our student research projects draw on local resources to answer basic and applied conservation questions

Each academic year, the La Kretz Center partners with the UCLA Stunt Ranch Reserve to fund outstanding graduate student projects, and to help our students complete their conservation science research. The research projects that we support address important issues in basic environmental science and simultaneously fulfill our mission of working to preserve California's biological and ecological diversity.

Highlighted student project

Elijah Catalan received a La Kretz award in 2021 to study the restoration of reef communities off of Palos Verdes using environmental DNA (eDNA) methods. His work was featured during the 2021 IoES Gala. See the video below that highlights the research that Elijah is doing to understand kelp forests and marine ecosystems along our Southern California coast. He also gives a great explanation of eDNA and why it is changing how we monitor marine biodiversity.

Pyrodiversity begets biodiversity in the Santa Monica Mountains National Recreation Area

Rachel Blakey is a La Kretz Center postdoc who has been in residence at the Field Station since August 2021. Rachel seems to be everywhere at once—in the field, leading discussion groups, and studying how fire changes the biology of our mountains. In collaboration with NPS wildlife ecologists Seth Riley and Jeff Sikech plus four other California mountain lion biologists, Rachel is leading a team that studies how different fire regimes (pyrodiversity) influences mountain lion movement. They have found that lions actually select pyrodiverse areas when moving and hunting, adding to the growing literature indicating that pyrodiversity begets biodiversity.

Rachel is also collaborating with UCLA professor Morgan Tingley and seven other scientists to produce a "roadmap for pyrodiversity research", and with former La Kretz postdoc Eric Abelson on urban wildlife space.

The Field Station is a base of operations for grad students and postdocs who collaborate with the National Park Service on wildlife research in the Santa Monica Mountains

La Kretz Center in discussion with National Park Service about expanding Field Station operations to Arroyo Sequit

Tucked away in a remote area of the western Santa Monica Mountains, Arroyo Sequit is one of the true gems in the SMM National Recreation Area. After we lost our main La Kretz field station building in the Woolsey Fire, we have been seeking the ideal place to rebuild, providing facilities for classes and researchers seeking a study site within an hour (traffic permitting) of UCLA. We recently entered into initial discussions with the park for a joint facility at Arroyo Sequit. It's gorgeous, remote, and only 37 miles from campus. We're working with our park service partners, and hope to have more to share soon!

The influence of anthropogenic disturbances on wildlife behavior and predator-prey interactions

Ellie Bolas, Ph.D. student at UC Davis and co-advisee of former La Kretz postdoc John Benson at the University of Nebraska, also stayed at the La Kretz Center Field Station for 2 1/2 months in 2021 while conducting field work for her dissertation. Ellie is investigating the synergistic effects of multiple anthropogenic disturbances on wildlife behavior and predator-prey interactions in the Santa Monica Mountains National Recreation Area (SMMNRA), a system that is influenced by multiple human-caused disturbances including a gradient of development, fragmentation by freeways, heavy recreational use, and multiple recent fires. While many large vertebrate systems have multiple interacting predator and prey species, the SMMs is occupied by a single top predator, mountain lion (*Puma concolor*), and one large prey species, mule deer (*Odocoileus hemionus*). This simplified system facilitates understanding the choices each species makes about foraging and space use in response to disturbances, as well as each other.

Ellie's work addresses questions of how fire and human development influence perceived safety and food quality for both mule deer and mountain lions by using GPS collars and camera traps to collect data on the habitats they utilize, their diet, and movement parameters through time. As both human development and fire frequency increase across California, Ellie's work will add to our understanding of how these iconic large mammals respond to human disturbances, informing conservation and human-wildlife coexistence in shared landscapes.

All of Ellie's research is undertaken in partnership with La Kretz affiliate Dr. Seth Riley of the National Park Service and occurs throughout the Santa Monica Mountains National Recreation Area.

Stunt Ranch year in review

Monitoring and managing biodiversity is a big part of the Stunt mission. Much like La Kretz, Stunt supports efforts that maximize local conservation impacts. During the last year, we had 77 users visit Stunt for a total of 274 user days, and a majority of those users were visiting researchers working in field sites to collect data that will help protect and promote biodiversity in Southern California. One of those visitors was UCLA undergraduate Bianca Ryans (pictured at right), who worked all summer on a very special project. Bianca was one of only four recipients of the UC Natural Reserve System Field Science Fellowship, which provides awards to the best and brightest students across the UC system to conduct research at a UC Reserve. Bianca focused on biodiversity in local streams, especially in the Cold Creek watershed that runs through Stunt. She collected species data from streams across the Santa Monica Mountains to determine how wildfire and invasive species affect biodiversity. Her results indicate that invasive species like introduced crayfish severely depress biodiversity in local streams and that their effect far exceed that of wildfire.

Stunt is not all biology—we also hosted some fantastic UCLA Master of Fine Arts students. Two filmmakers, Sam Goodner and Giovanna Molina both shot the majority of their recent films at Stunt and describe the 310-acre field station as a beautiful location. As Goodner put it, “Stunt Ranch gave us the environment we needed to be able to dream our way into the story as a cast and crew.” In considering the benefits of working at Stunt, Goodner noted, “I felt that our project was treated by Prof. Gary Bucciarelli as something of value, like we had a place in the space at Stunt Ranch where our perspectives as filmmakers and performers were relevant, alongside that of students and faculty whose work is in the natural sciences.” Giovanna highlighted, “As a UCLA student, I feel grateful to have it as a resource” and added, “After working at Stunt, it made me excited to think of a reserve as an interdisciplinary space for both arts and science.”

As Stunt and La Kretz increase the broader impacts of our work, it will be critical to support researchers from the biological, physical, and social sciences, as well as the arts. Field stations are dynamic places that should encourage researchers and artists to collaborate and exchange ideas, helping us all to understand and appreciate biodiversity in novel ways.

Gary Bucciarelli

Gary Bucciarelli is the director of research at the Stunt Ranch Reserve, and an assistant adjunct professor in EEB at UCLA. His research program is based in the Santa Monica Mountains and the Cold Creek watershed that runs through the Reserve. Gary is also collaborating with the National Park Service to optimize a long-term management plan for amphibians in the Santa Monicas.

Established as a reserve site of the UC Natural Reserve System in 1995, Stunt Ranch Reserve has been partnering with the La Kretz Center since 2015. The Reserve is a 310-acre biological field station located in the Santa Monica Mountains and is composed of chaparral, coast live oak woodland, riparian, and annual grassland habitats. Less than an hour drive from UCLA, the Reserve offers a unique research opportunity for university-level teaching, research, and public outeach. For more information about Stunt, please contact Gary Bucciarelli (research director) or Brad Shaffer (director).

La Kretz Annual Lecture

In 2021 we celebrated our tenth year using the platform of a broad public lecture to promote and enhance our understanding and appreciation of conservation research. Because of Covid-19 restrictions, it was a remote event, featuring three-minute lightening talks by each of our 13 past, current, and (at the time of the lecture) future La Kretz postdoctoral fellows. The zoom presentations were followed by a Q & A session with the audience and breakout rooms where folks with different interests could virtually chat with the speakers and among themselves. What was striking was how well our postdocs have done—to a person, all have jobs in the conservation sphere, and several have secured positions in SoCal, where they can keep working with our La Kretz crew. And it really was fun!

If you weren't able to attend the event, catch it here on youtube.

We aim to raise the visibility and impact of California conservation science through our public outreach programs

Genomics for conservation

At the April zoom meeting of the Northern California Science Writers Association, Brad Shaffer presented on the California Conservation Genomics Project.

Here's what the California Institute for Biodiversity says about the presentation: "Great overview of a fantastic project. In this talk, Brad shares his understanding and vision, from the intimate distribution details [of a] single species, to the potential for this approach to transform how we save California's biodiversity." If you're not a science writer and somehow missed the talk, check out the video, below.

La Kretz Center and IoES students lead Piru Creek effort to help endangered Arroyo Toad

A team of 16 biologists and 9 UCLA Environmental Sciences undergraduates worked with United Water, a local water agency, to study a timed water release from Pyramid Lake (you've seen it along I-5 heading north out of LA) that could improve breeding outcomes for our endangered Arroyo Toad. The project, part of Brad's Senior Practicum course, brings IoES undergrads and agency clients (US Fish and Wildlife Service, and US Geological Survey) together to further conservation outcomes for the federally endangered Arroyo Toad. Our data collection effort at Piru was one part of this year-long project. And it looks like it worked!

Selected Publications

Below are a few of the 2021 papers published by La Kretz postdocs, students and faculty. Sorry for the many we had to pass over—this is a representative sample from some of our team.

Beilke, E.A., Blakey, R. V., O'Keefe, J.M., 2021. Bats partition activity in space and time in a large, heterogeneous landscape. Ecol. Evol. 11, 6513–6526. https://doi.org/10.1002/ece3.7504

Bucciarelli, G. M., M. Lechner, A. Fontes, L. B. Kats, H. L. Eisthen, and H. B. Shaffer. 2021. From poison to promise: the evolution of tetrodotoxin and its potential as a therapeutic. Toxins 2021, 13, 517.

Catella, Samantha A., Castilleja Fallon Olmsted, Shaniya H. Markalanda, Connor J. McFadden, Corlett W. Wood, and Sara E. Kuebbing. "A generalist nematode destabilizes plant competition: no evidence for direct effects, but strong evidence for indirect effects on rhizobia abundance." New Phytologist(2021).

Cooper, R. D. and H. B. Shaffer. 2021. Allele specific expression and gene regulation explain transgressive thermal tolerance in non-native hybrids of the endangered California tiger salamander (*Ambystoma californiense*). Molecular Ecology 30:987–1004.

Loeb, S.C., Blakey, R. V., 2021. Bats and Fire: a global review. Fire Ecol. 17.

MacDonald, Z.G., Shaffer, H. B., Sperling, F.A.H. (In Press) Impacts of land use and climate change on natural populations: the butterfly perspective. Chapter 8 In: Cork, S., Whiteside, D. (eds.) Case Studies in Eco Health. 5m Publishing, Sheffield, U.K.

MacDonald, Z.G., Deane, D.C., Lamb, C.T., He, F., Acorn, J.H., Nielsen, S.E. (2021) Distinguishing effects of area per se and isolation from the sample-area effect for true islands and habitat fragments. Ecography. 44(7), 1051-1066.

Manzo, S., E. G. Nicholson, Z. Devereux, R. N. Fisher, C. W. Brown, P. A. Scott, and H. B. Shaffer. 2021. Conservation of northwestern and southwestern pond turtles: Threats, population size estimates, and population viability analysis. Journal of Fish and Wildlife Management, 12(2):485–501; e1944-687X.

Niesner, C.A., Blakey, R.V., Blumstein, D.T., Abelson, E.S., 2021. Wildlife Affordances of Urban Infrastructure: A Framework to Understand Human-Wildlife Space Use. Front. Conserv. Sci.

Piccioli Cappelli, M., Blakey, R. V., Taylor, D., Flanders, J., Badeen, T., Butts, S., Frick, W.F., Rebelo, H., 2021. Limited refugia and high velocity range-shifts predicted for bat communities in drought-risk areas of the Northern Hemisphere. Glob. Ecol. Conserv. 28, e01608.

Snedden, C.E., Makanani, S.K., Schwartz, S.T., Gamble, A., Blakey, R. V., Borremans, B., Helman, S.K., Espericueta, L., Valencia, A., Endo, A., Alfaro, M.E., Lloyd-Smith, J.O., 2021. SARS-CoV-2: Cross-scale Insights from Ecology and Evolution. Trends Microbiol. 29, 593–605.

Uchida, K., Blakey, R. V., Burger, J.R., Cooper, D.S., Niesner, C.A., Blumstein, D.T. 2021. Urban biodiversity and the importance of scale. TREE 36, 123–131.

Highlighted paper

About 60% of the world's turtle species are considered threatened or endangered, making them arguably the most vulnerable group of animals on the planet.

A new study in the Proceedings of the National Academy of Sciences reveals new findings about turtles' evolution so far and the tough prospects they face for survival.

"Turtles are in horrible shape," said UCLA conservation geneticist Brad Shaffer, senior author of the paper. "There aren't very many species of turtles and tortoises to begin with, so we don't have many to lose."

The number of turtle species — around 360 — is tiny compared with the numbers of species of amphibians (over 8,200), mammals (6,400) and birds (10,000).

Human hunting of turtles for food and traditional medicine is by far the biggest current factor in their threatened status. But according to the paper, rising sea levels driven by climate change will become a devasting problem in coming years and decades.

The crux of the paper is one of the most complete phylogenetic trees ever created for any major animal group, and the most complete ever for turtles. Phylogenetic trees — branching diagrams that show evolutionary relationships among organisms — include information on how species are interrelated and when they evolved into separate species.

Read more in UCLA News

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The La Kretz Center, a research unit of the UCLA Institute of Environment and Sustainability, is jointly administered by UCLA College, Division of Life Sciences and the IoES.

The La Kretz Center is made possible by a generous endowment by UCLA alumnus and philanthropist Morton La Kretz

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Our partners

We are affiliated with a diverse network of UCLA faculty, postdocs and students, and we work closely with our partners, including the U.S. National Park Service, the Museum of Natural History of Los Angeles County, The Nature Conservancy, the U.S. Geological Survey, the U.S. Fish and Wildlife Service, the California Department of Fish and Wildlife, the U.S. Bureau of Land Management, California State Parks, and the Natural Communities Coalition. Our collective goal is to protect and restore California's biodiversity, across ecosystems ranging from urban LA landscapes to pristine national parks.