Newsletter of the Conservation Paleobiology Network

Issue #14
July 2022

CPN Newsletter

Conservation Paleobiology Network

INSIDE THIS ISSUE:

Diversity, Equity, and Inclusion Statement:

The CPN upholds a commitment to diversity, equity, and inclusion as a core value. We seek to build on this commitment by striving to create an inclusive community whose members represent diverse cultures, backgrounds, career stages, and life experiences. This commitment is critical to strengthening our relevance, credibility, and effectiveness within the field of conservation paleobiology and broader STEM community. Through these efforts, we strive to transform the field in practice, while diversifying the face of conservation paleobiology for the future.

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Introducing Working Group: **Integrating Conservation Paleobiology into Caribou Management**

Principal Investigators: ***Joshua Miller, Jeff Rasic, Kyle Joly***

Caribou are ecologically, economically, and culturally important in boreal and arctic regions across the Northern Hemisphere. Some herds have recently gone extinct and many others are dramatically declining, though the drivers of these changes are poorly understood. Historical proxies are well-positioned to fill in our knowledge gaps in caribou conservation, in part because the sizes of caribou populations undergo dramatic fluctuations across multi-decadal timescales. While historical proxies show potential to inform caribou conservation, these insights are rarely integrated into management strategies and decision making, often due to mismatch between academic foci and management priorities.

The Caribou Working Group is exploring the relevance of historical proxies for informing caribou conservation and management. We are composed of academic and applied biologists, archeologists, and paleontologists, and our membership is currently expanding so we can incorporate knowledge of Indigenous peoples at multiple scales. Our overarching goals are to: (1) Identify and prioritize aspects of caribou management and conservation that may be informed by extended temporal perspectives, (2) Synthesize research on historical proxies relevant to caribou, (3) Produce case studies for how to effectively integrate historical proxies with biomonitoring data, and (4) Build collaborative project teams for future research on caribou and other ungulates.

More info and updates: https://conservationpaleorcn.org/caribou-management-working-group/

Image caption: *Caribou during fall migration in Kobuk Valley National Park (Kyle Joly, National Park Service)*

What are CPN Working Groups?
The network sponsors Working Groups focused on research questions that integrate conservation paleobiologists, academic partners, wildlife managers, and stakeholders to develop effective strategies for translating products of historical research into conservation and management actions. The Working Group panel oversees solicitation, selection, development, and assessment of Working Groups.

Conservation Paleobiology Research Highlight

By Dr. Kristina Barclay, University of Victoria, Canada

Fossil crab predation scars reveal declining crab populations

"*Fossil, archaeological, and historical data are underutilized tools that can provide missing data and baselines to understand species responses to climate change and overexploitation.*"

Worldwide, crustacean fisheries are becoming increasingly important socioeconomic resources. But as with many other commercially exploited marine species, the health of these fisheries is poorly understood, making it difficult to effectively manage and sustain these resources in a changing ocean. Fossil, archaeological, and historical data are underutilized tools that can provide missing data and baselines to understand species responses to climate change and overexploitation. On the west coast of North America, crabs have become one of the most valuable commercially exploited species, but have received little attention and have few historical records. However, reconstructing past crab populations is challenging as they do not usually preserve well. Instead, their presence is recorded in the form of predation scars (repair scars) they leave on their shelled prey. We used these repair scars from their common gastropod prey, *Tegula funebralis* (the black turban snail), to compare crab abundances from the Pleistocene of southern California to today. There were significantly fewer scars on *T. funebralis* today compared to the Pleistocene. By comparing the relative body size and size at which the repair scars occur, we also demonstrate that this reduction in crab scars is due to decreased crab abundance, rather than a change in crab success rate. Regardless of the cause, these results indicate that crab populations in southern California have declined since the Pleistocene and require urgent further attention to ensure sustainable management of these fisheries. The study demonstrates the importance of fossil and alternative data sources in providing missing baselines that can be used to aid modern conservation and fisheries management.

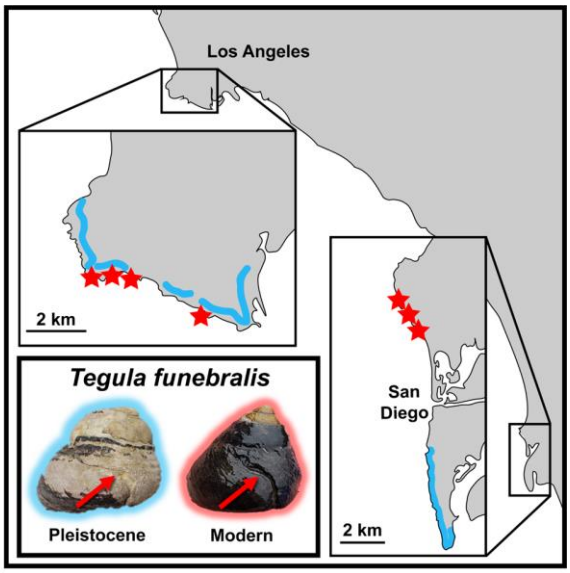


Image caption: *(top) Kristina Barclay holding a crab, and (bottom) Figure 1 from Barclay and Leighton, 2022. Map of southern California (Los Angeles to San Diego) showing general localities of fossil material in blue and modern sites as red stars. Red arrows on T. funebralis indicate crab predation traces (repair scars).*

This study was published in Front. Ecol. Evol. in February 2022. For more details see https://doi.org/10.3389/fevo.2022.810069

Practitioner Perspective *Interview by Alexis Mychajliw*

Featured Practitioner: David Needle

David Needle is a veterinary pathologist who uses microbial, genomic, and molecular techniques to explore zoonotic diseases of relevance to wildlife conservation and public health within a One Health framework. He received his Doctor of Veterinary Medicine (DVM) from Tufts University and serves as a clinical associate professor and the pathology section chief at the New Hampshire Veterinary Diagnostic Laboratory, based at the University of New Hampshire (UNH). His clinical work and scientific research address a wide range of taxa, from hedgehogs to moose to cows, and as a result, he collaborates widely with state and federal wildlife agencies, primary care veterinarians, and livestock producers.

1. As a veterinary pathologist at a diagnostic lab, how did you end up working with wild mammal populations?

I did not have a direct path! I met a microscope in vet school and fell in love with histology, which led me to pathology and a postdoctoral position in intracellular pathogens. After vet school, I completed an anatomic pathology residency and one year fellowship at Michigan State University, and when a job opened at UNH and I took it to work as a diagnostic pathologist for local agricultural and companion animals. But, in December 2015, someone brought in a fisher that had been sitting at the bottom of a tree. It turns out this fisher had canine distemper, and so did another that was submitted at the same time and had been part of the annual harvest. We also knew, through analyzing annual harvest data of fishers, that the catch per unit effort was decreasing. This made me start to think about the broader context of fishers and furbearers in general – going from individual to population health status. Their bodies are biomarkers of population health and in turn environmental health, capturing toxicants and giving us insight into disease ecology. Now we know there is an alarmingly high rate of rodenticide in mesocarnivores in Vermont and New Hampshire.

2. What time scales do the diseases you study typically represent?

Canine distemper virus, which affects almost every mammalian carnivore in our region, has been around for a long time – at least to us, a long time. The virus was described in domestic dogs in 1809. Because RNA viruses, such as morbilliviruses, are more mutationally active than DNA, it may be difficult to track the movement of these strains in deeper time. However it is likely that the increased prevalence of the virus in North America has to do with people moving around and affecting landscapes in ways that make these carnivore populations less stable.

Practitioner Perspective continued

3. What other changes in disease ranges have you noticed on decadal timescales?

Many diseases we are now seeing in New England are southern range diseases that haven't been in this region until the past 30 years. For example, winter ticks are decimating moose populations (Alexis' note: prepare yourself to be a little grossed out if you Google "moose winter tick" images...) such that otherwise viable moose habitat will not be populated as temperatures warm. Climate change intersects with other pressures that we put on the landscape: timber harvested on large woodlots can mediate how the moose use the landscape by making them walk in small corridors where ticks can cluster while questing. This is a reminder that even if places look "green", human activities can still alter the general health of the environment in ways that lead to more disease, parasites, and viruses.

4. How can understanding historical processes help us better interpret present day disease dynamics?

The population of black bears in New England have a recessively inherited metabolic disease (GM1-gangliosidosis) that has yet to be identified in other areas like New York, West Virginia, or Pennsylvania. This geographic distribution of a genetic disease could be a symptom of lack of gene flow and/or a bottleneck. We are trying to understand whether this is a result of historical glacial refugia or more recent anthropogenic barriers. Black bears appear to lose genetic diversity quickly, but targeted management decisions have also been able to help populations recover genetic diversity quickly as well, such as by concentrating annual harvest in one area or relocating a population to facilitate gene flow.

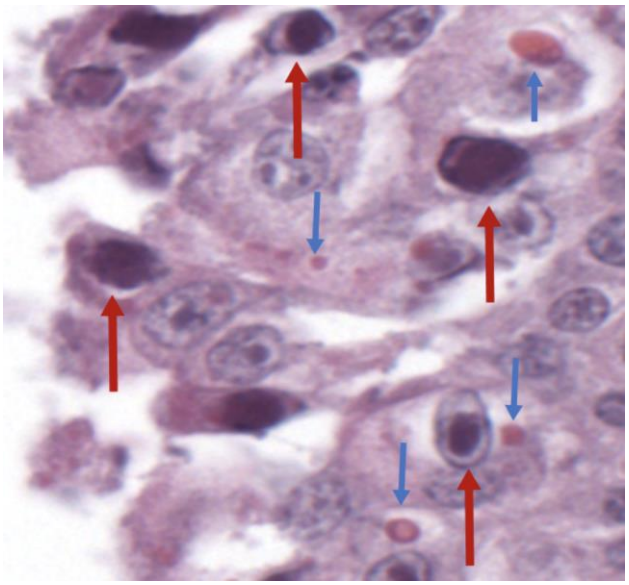


Image caption: *Photo 2- Hematoxylin and eosin histopathology (400x magnification) of a bronchus in a gray fox with respiratory epithelial cells simultaneously infected with canine distemper virus (inclusions in the cytoplasm, blue arrows) and skunk adenovirus-1 (intranuclear inclusion bodies, red arrows).*

5. Your research requires collaboration to obtain specimens, accurately diagnose diseases, and then share results. What advice do you have for developing and maintaining such collaborative relationships?

Forming relationships with collaborators starts by being excited about what you yourself are doing. If you find what you do to be exciting, then other people will get excited too, especially if you are asking them questions about species in their area of expertise.

I have also found that people enjoy a chance to work with unique samples. For example, I discovered a neoplasm (abnormal tissue mass) in a domestic hedgehog, then reached out to an expert and ended up getting a free consultation from one of the world's pre-eminent experts at the NIH!

Practitioner perspective continued

6. What is it like to simultaneously work in both academic and applied contexts?

I love it! A great example of this applied-academic potential is our BioBank program. Four years ago, we started formally "biobanking"– that is, we have been storing liver, lung, spleen, kidney, feces, and brain tissue from every animal, wild or domestic, that arrives at our lab. These tubes of tissue represent a library of potential research fodder and could be a baseline for the future. For example, it is very hard to find historical samples of little brown bats (the species now suffering from white nose syndrome) because they were once so abundant that no one thought to keep any. Now, we take tissues from everything regardless of whether it is a common or even domestic species. These specimens are also great for diagnostic comparisons, and we regularly have collaborators offsite who ask for reference samples.

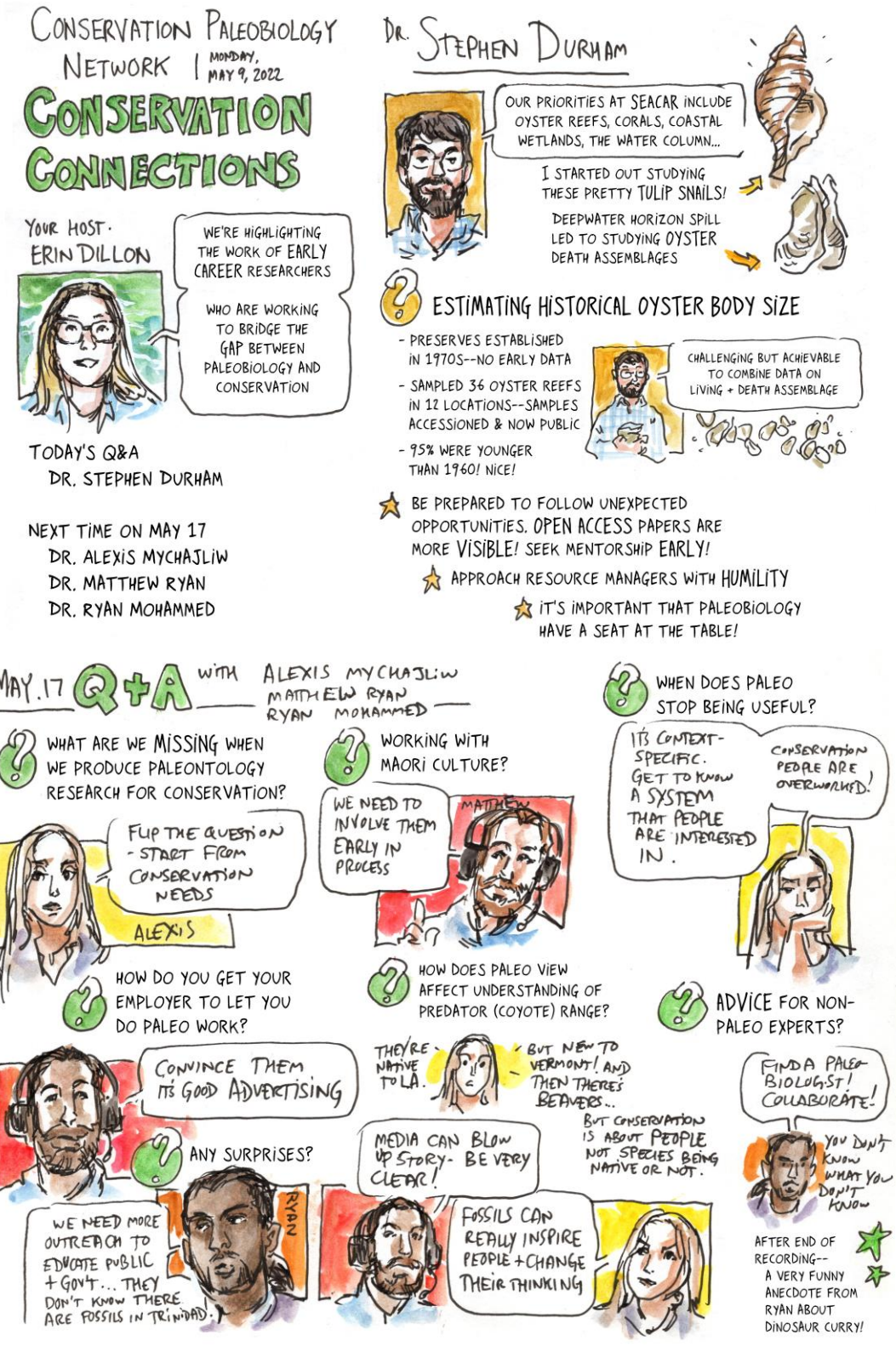
7. What advice do you have for students who are interested in applying their expertise to conservation?

I did not formally train to be a conservation biologist; I'm a pathologist but the questions I've asked have led me to be involved in conservation. You can engage in conservation practice from many different angles because conservation is a global challenge– we can all do the best we can to contribute to conservation and that will look different depending on your how your expertise aligns with different types of conservation targets (e.g., species health, population abundance, environmental protection).

Network Reminder

Student Section

The recordings and sketchnotes (by Mark Simmons) from the virtual panel "Bridging science and practice through conservation paleobiology research" are now available on the website, see some of the sketchnotes below!: https://conservationpaleorcn.org/early-career-virtual-panel/



First published online: July 2022

Paleo Proxy Spotlight – Beetles (Coleoptera) *by Mollie Mills*

What are Coleoptera?

Coleoptera is the insect order comprising beetles and weevils. It is the largest order of insects, with over 300,000 species described, and accounts for approximately 25% of all known organisms. Beetles inhabit a wide variety of environments, including terrestrial and freshwater niches. Many species are stenotopic, meaning they show a preference for specific environmental conditions. These strict habitat preferences mean that beetles can be important biological proxies for reconstructing past climates and environments.

Image caption: *A selection of modern beetle species found in the United Kingdom (photo credit: Geography Department, Royal Holloway University of London).*

Why are beetles good paleo proxies?

Our understanding of why beetles make good proxies for past environments comes largely from the work of British palaeoentomologist Russell Coope, whose entomological collection is now stored at Royal Holloway, University of London. He observed that many preserved beetle species were acutely sensitive to environmental change, showing marked climate and habitat preferences, especially to summer temperature thresholds. Coope also observed that beetles had undergone very little evolutionary change throughout the Quaternary Period (the last 2.6 million years) and attributed this to beetles moving with favourable habitat conditions in response to environmental change, rather than staying in place and adapting. Their acute environment sensitivity, evolutionary stasis, and mobility means that their presence or absence within deposits can be used as an indicator of past climate and environmental conditions. Beetles also preserve well and are found in a range of sedimentary deposits. They are easy to spot, sometimes in brilliant iridescent colours, and can be seen by the naked eye.

How can beetles be used to study past climate?

For use in paleoclimate research, the preserved beetles are removed from deposits either by hand, or more commonly through floatation techniques. This involves placing deposits into a solution, that when mixed with water causes the beetle remains to float to the top. The remains are collected and examined under a microscope to be identified. Entire beetles are rarely found; instead fragments of wing covers (elytron) and thoraxes are usually all that is present for identification, and so comparisons with modern beetles are needed to identify species. The data is usually presented as a species abundance list, with the number of species and individuals found within the sample. Once the beetles present have been identified, their known environmental tolerances can be used to reconstruct past climate and environmental conditions.

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Paleo Proxy Spotlight continued

What information can beetles provide for reconstructing palaeoenvironments?

Fossil beetles provide a wide variety of information on different aspects of the palaeoenvironment, including climate, vegetation, and fauna. Many beetle species are associated with specific temperature ranges and these thermal limits can be used to reconstruct local palaeoclimate conditions. There are some beetles that are substrate specific and can indicate a particular soil type, such as *Dyschirius globosus* which needs dry sandy soils. Other beetles occur exclusively in aquatic habitats, including *Platambus maculatus* which is found in running water and thus indicates actively flowing water. Certain beetles are indicative of specific plants or animals, which they depend on for food. For example, the pill beetle *Simplocaria semistriata* feeds only on moss. Some dung beetles are associated with particular mammals, including ice age species such as woolly mammoths. Fossil beetles can therefore provide insights into the wider biotic community, as well as past climate and environment conditions.

Interested in learning more? Check out Coope's 1977 paper https://doi.org/10.1098/rstb.1977.0112

Image caption: *A selection of modern beetle species found in the United Kingdom (photo credit: Geography Department, Royal Holloway University of London).*

Postcards from the Field

In this feature of our newsletter, we showcase members' research in the field, lab, or other settings. Please submit your "postcards" with approximately 100 words of text to us at conservationpaleo@floridamuseum.ufl.edu.

Conservation paleobiology fieldwork in Florida

Jaleigh Pier, PhD student at Cornell University, and advisor Dr. Greg Dietl were in Florida June 18-24th to conduct fieldwork on the Guana River in the Guana Tolomato Matanzas National Estuarine Research Reserve near St. Augustine, Florida. They successfully used a vibracoring method that allows ten-foot cores of oyster reefs to be collected, providing access to oysters buried deep within the reefs. The oysters within these cores will be analyzed to determine how they might have changed over the past several decades in response to human-induced changes in landscape use. Many oyster monitoring programs in Florida only began collecting data within the last couple of decades. This project, similar to the Historical Oyster Body Size Project, is an ongoing collaboration between the Paleontological Research Institution and the Florida Department of Environmental Protection since 2018, uses dead oyster shells buried beneath reefs to establish baselines to help fill an information gap in long-term data that can be used to make informed habitat management decisions.

Postcards from the Field continued

Edgar Mulder - bachelor student at Utrecht University (Netherlands) and Sociedade de História Natural (Portugal)

My name is Edgar Mulder (Fig.1). I am a 3rd year Earth Sciences student from Utrecht University (the Netherlands). Currently, I am working on my bachelor thesis at Sociedade de História Natural (Portugal). My thesis is on new fossil material from the famous Lagerstätte 'Mina de lignite Guimarota'; the Guimarota coal mine. During 1972-1982, the excavations at this locality were one of the largest enterprises in the history of paleontology. Constantly working against an ever rising water level within the mine, the conditions were harsh, but worth it. The mine yielded an incredibly well-preserved mammalian fauna and other vertebrates from the Kimmeridgian. Among other things, researchers found the almost complete skeleton of *Henkelotherium guimarotae*, one of our oldest ancestors.

The new fossil material from this Lagerstätte consists of small coal pieces. In my thesis, I am analysing this material with micro-CT scanning and 3D imaging analysis. And (luckily) there is a lot to feast on! I already found several osteoderms of small crocodylomorphs, tiny teeth of fishes, and much more. As an example, I attached a 3D model image of a scanned reptile vertebra, which still needs identification (Fig.2). Who knows what more could be found analysing these little treasures.

Kind regards from sunny Portugal!

Fig.1 Me! On a fieldwork in Portugal with Sociedade de História Natural.

Fig.2 3D model of scanned vertebra of reptile from Jurassic.

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Are you interested in:

…contributing to **Postcards from the Field**?
…sharing a recent publication as a **Research Highlight**?
…being featured in a **Practitioner's Perspective** piece?
…providing other content suggestions for this newsletter?

If yes, please email us at conservationpaleo@floridamuseum.ufl.edu

Invite Your Colleagues to Join our Network!

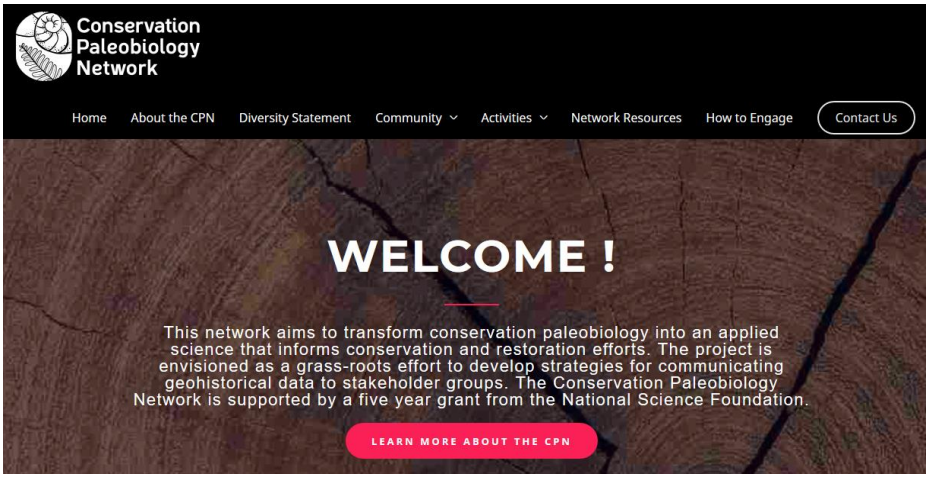
If you know people who might be interested in our network, please invite them to join. You can use the link below to extend your invitation on behalf of our network.

By joining the network, you become a member of our Community of Practice. The membership does not impose any obligations, but enables participants to engage fully in network activities. Members will be able to:

1. Participate in the CPN mailing list
2. Nominate and self-nominate for committees and panels
3. Submit announcements for publication in the CPN Newsletter
4. Apply to participate in the CPN activities such as Field Courses
5. View CPN webinars and submit proposals for webinar modules

To join please go to our website and select "Join the Network".

Visit the website! https://conservationpaleorcn.org/



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