Newsletter of the Conservation Paleobiology Network

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CPN Newsletter

Conservation Paleobiology Network

INSIDE THIS ISSUE:

Pathways Working Group: Fostering Core Competencies for Conservation Paleobiologists (Principal Investigators: Patricia Kelley and Gregory Dietl)

***Image caption**: Pathways Working Group participants at the Museum of the Earth at PRI (Ithaca, NY, USA).*

How do we train the next generation of conservation paleobiologists? A new Working Group convened at the Paleontological Research Institution (PRI) in Ithaca, New York, to address this question. A demographically diverse group, spanning a range of disciplinary specialties, institutional types, and career stages (from graduate student to retiree) shared perspectives at this July 2024 working group meeting.

Despite having to wrap up the meeting while sheltering from a tornado (!), we made excellent progress in identifying core competencies needed by conservation paleobiologists to tackle conservation challenges. Competencies represent a combination of knowledge, skills, attitudes, and behaviors that are needed to perform specific tasks. The six competencies we identified go beyond general academic competencies, and those needed in traditional paleontology, to include, e.g., "strategic competency - the ability to collaboratively develop and implement solutions to conservation problems." We also began to identify specific skills associated with each competency, with different levels of skills appropriate for novice, intermediate, and advanced levels of training.

We plan to chart a variety of pathways (hence the name of our group) to careers in conservation paleobiology (CPB); reflect on mentoring in CPB; map skills onto the six core competencies we have identified; and evaluate pedagogical approaches to fostering these competencies. We also plan to compile a variety of pedagogical resources (curricula, syllabi, reading lists, projects, etc.) for use by the CPB community. The Pathways Working Group is energetic, ambitious, collegial, and abounding in innovative ideas that we look forward to sharing with the CPB community!

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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Conservation Paleobiology Research Highlight *By Damien Fordham*

Extinction of Woolly Rhinoceros Provides Lessons to Safeguard Earth's Remaining Megafauna

Extinction of the woolly rhinoceros has long been a mystery with contrasting evidence regarding its cause and spatiotemporal dynamics. Fordham et al., (2024) used an abundant fossil record, ancient DNA samples, and simulation models to reconstruct the final 52,000 years of metapopulation dynamics for the woolly rhinoceroses, uncovering the most likely reasons for the woolly rhinoceros extinction following the last ice age.

Tens of thousands of plausible scenarios of process-driven interactions among woolly rhinoceroses, climate, and humans were simulated and validated against ecological inferences from radiocarbon dated fossils and ancient DNA retrieved from sediments. This approach found that a combination of weakened population dynamics, climate-driven habitat fragmentation, and low but persistent levels of hunting by humans are likely to have caused the extinction of the woolly rhinoceros.

"Insights from ghosts of species past can be invaluable for current-day wildlife management."

The study identified that the pathway to extinction began long before the height of the last ice age, when cooling temperatures and hunting by humans trapped the species in suboptimal habitats. Reconstructing inferences of demographic change from the fossil record and ancient DNA using simulation models showed the possible intensification of this scenario at the end of the Pleistocene, which prevented woolly rhinoceroses from colonizing newly forming habitats in the north of their historical range, restricting their distribution to small fragments of rapidly declining habitat.

Weakened metapopulation processes due to increased fragmentation and loss of connectivity are likely to have eventually caused the extinction of the woolly rhinoceros at the beginning of the Holocene.

Today, rhinoceroses persist in highly fragmented ranges across Africa and Asia. Poaching, climate change, low dispersal abilities and anthropogenic dispersal barriers further threaten these irreplaceable megafaunas. This new understanding tells us that efforts that maintain metapopulation processes through increased connectivity are needed to avert further rhinoceros extinctions, and confirms that insights from ghosts of species past can be invaluable for current-day wildlife management.

While habitat fragmentation is a well-established threat to today's megafauna, until now it has not been shown to cause ancient megafauna extinction. These results suggests that metapopulation dynamics should be considered more regularly in explanations of late Quaternary megafauna extinctions.

***Image caption**: The woolly rhinoceros was an iconic species of megafauna from northern and central Eurasia that went extinct at the beginning of the Holocene. Image Credit: Mauricio Anton*

For more information see the article by Fordham et al., 2024 in PNAS: https://doi.org/10.1073/pnas.2316419121

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Practitioner Perspective

By Lucia Snyderman

Dr. Rosalind Kennerley – *Dr. Kennerley is an independent biodiversity consultant in the UK who identifies as a conservation biologist and incorporates paleontological and historical information to guide conservation projects.*

***Image caption**: Dr. Rosalind Kennerley*

1. How would you introduce yourself to our readers?

I am a conservation biologist who has worked extensively within Non-Government Organizations and academia. I have experience conducting fieldwork and managing conservation projects both in the UK and internationally on a range of threatened species and in a variety of habitats. During my career so far, I have been lucky enough to have contributed to some high-profile conservation success stories, such as working within the Pink Pigeon and Echo Parakeet programmes in Mauritius. I made the switch from mostly working on birds to studying mammals when I had the opportunity to do my PhD research on two endemic and unusual mammals on Hispaniola – one of which was the Hispaniolan Solenodon. This species is a 'living fossil', one of the few venomous mammals in the world that has gone pretty much unchanged since it diverged from other living mammals around 76M years ago. Since completing my doctorate, I have focused on championing research and conservation of the small mammals, which are often overlooked and under-represented, compared to charismatic megafauna. I have been involved in the IUCN SSC Small Mammal Specialist Group (SMSG) https://small-mammals.org/ for nearly ten years now, and am currently the Co-Chair for the group. It's a real privilege to represent over half of the world's mammals – rodents, hedgehogs, moles, shrews, solenodons, and treeshrews. One of the best things about my current job is that we work with our 200 or so members based across the globe, providing them with the training and support they need to undertake their vital work.

2. How does your work intersect with conservation paleobiology?

Historically, not at all! I first became more familiar with the discipline when I started my PhD research on two endemic mammals on Hispaniola. Thanks to my supervisor, Prof. Sam Turvey at the Institute of Zoology, London, I was introduced to the world of paleoecology and I now have a good appreciation for how we as wildlife biologists can use past knowledge of species and ecosystems to inform modern-day conservation efforts.

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Practitioner Perspective continued

In my current role with the SMSG, I regularly need to consider the information gathered by paleobiologists. Many small mammal species that are globally threatened have experienced huge range contractions. Thinking about the conservation actions and future ideal outcomes for those species needs to include a good understanding of historical ranges, past events, and the causes of those. Most people are probably aware of the IUCN Red List of Threatened Species, but we are now working on new additional assessments called the Green Status of Species.

These have the purpose of assessing species recovery and the framework allows practitioners to assess the current status of the species (Species Recovery Score), as well as recognise conservation successes and drive conservation ambition, through metrics reporting the impact of past conservation actions, and potential impact of future conservation actions. Historical knowledge of species and habitats are essential to these assessments, because we need to answer questions such as: In what year did human impacts become a major factor influencing the species' abundance and distribution? What were the areas of the indigenous range? What ecological functions does the species have and were these different historically?

I am fortunate to be directly involved in several on the ground conservation projects, particularly in the Caribbean. I recently became a member of RELIC: Bahamas (Restoring Ecosystems Lost in Conservation: Bahamas) https://conservationpaleorcn.org/bahamas-lost-ecosystems-working-group/. Being part of this group has opened my eyes further to the huge benefits of forming collaborations with paleobiologists. As part of this group, one of the focal species is a small mammal - the Bahamian Hutia. This is a particularly interesting species, where an additional factor to be considered as well as the threats that have shaped past and current distributions (such as habitat loss and invasive species) is that humans moved the species around from island to island as a food source. Paleoecology research has helped to unravel the complex stories, and we use this new understanding to help plan future conservation efforts.

3. What has your international experience managing conservation projects taught you?

As a wildlife biologist, the usefulness of being as multidisciplinary as possible, so you can arm yourself with as many of the skills and tools as possible to be able to manage successful projects. I think it is also really important to realise the areas where we lack the necessary experience and understanding, and when this is the case we shouldn't be afraid to admit it and to seek and request collaborators with the expertise from other sectors. To conserve species and habitats, we need all the help and knowledge that we can get and I think the conservation world is now far more appreciative that we need to think beyond traditional conservation and look to other scientific disciplines such as social-science and palaeontology.

Practitioner Perspective continued

4. Do you have advice for students who seek to directly apply paleontology to conservation practice? In ways outside academia?

There are many ways in which to get involved in conservation. For example, there are now a huge number of rewilding projects going on all over the world, where we need scientists who can help us in our work. Within conservation, shifting-baselines is often an issue when we are considering rewilding, because of the way conservationists perceive the environment changes over time, it results in a gradual lowering of expectations for the natural world. Paleontologists have a clear role to play here, demonstrating the species and habitats that were once present, assisting us to understand what's changed and why. Rewilding work needs to be evidence driven, so that we can make good decisions about what we should be aiming to restore and why. They can force us to be aspirational and help us by answering questions like What species are missing? And what ecosystem functions might need to be restored or replaced?

As well as wider ecosystem restoration projects, such as rewilding, NGOs are increasingly in need of expertise about historical baselines for species-specific projects to help decide what species to reintroduce where and how these may be affected by climate change. A particularly nice example of where our understanding of the past species composition of flora and fauna has provided direction for a conservation project is on Round Island, Mauritius, where Aldabra Giant Tortoises have been introduced as an 'analogue species' to replace the lost ecosystem functions of browsing and seed dispersal that was once provided by the extinct Saddle-backed Mauritius Giant Tortoise. Thanks to this work, many near-extinct plant species are now flourishing and the technique of replacing lost functions is being used elsewhere.

Relevant links:

https://appliedecologistsblog.com/2022/02/03/seven-years-of-rewilding-with-giant-tortoises/

https://www.jstor.org/stable/1566002

https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2664.14096

https://www.iucnredlist.org/about/green-status-species

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Paleo Proxy Spotlight – Foraminifera *By Amanda Manoogian*

What is a proxy? A proxy is, broadly, something that can substitute for something else. For example, you might vote "by proxy" in a meeting you're unable to attend. In paleoclimatology, we use proxies to infer details about the climate system that we cannot observe directly, such as past sea surface temperatures or CO_2 levels. As discussed in past CPN issues, researchers derive proxies from archives that record climate data, such as sediment cores, speleothems, and packrat middens. Gathering data about past climates is important for informing present conservation efforts, especially in determining "baseline" conditions. Furthermore, climate model simulations used to predict future climate conditions rely on paleoclimate data to produce more sensitive projections (Tierney et al., 2020).

What are foraminifera? Foraminifera (colloquially known as "forams") are unicellular protists with an impressive fossil record that extends from the latest Ediacharan to modern. The majority of foraminifera live in the ocean and form chambered calcareous tests during their approximately month-long lifetimes. There are two main types of foraminifera: benthic, which live on or in seafloor sediments, and planktic, which likely evolved from benthic foraminifera during the Jurassic period and float at known depths in the water column. Benthics are more diverse than planktics, with thousands of species living currently; benthic foraminifera are especially useful in inferring bottom water conditions and broader climatic trends. While there are fewer planktic species (~40 in the modern), their differing depth habitats in the water column make them particularly useful for studying ocean-atmosphere interactions and localized ocean conditions.

What kind of proxies can we derive from foraminifera? Early studies of foraminifera focused predominantly on biostratigraphy, constraining the relative age of an interval based on the distinctive "marker" species present. Because we cannot extract DNA from foraminifera in deep time, researchers use morphotypes to determine taxonomy.

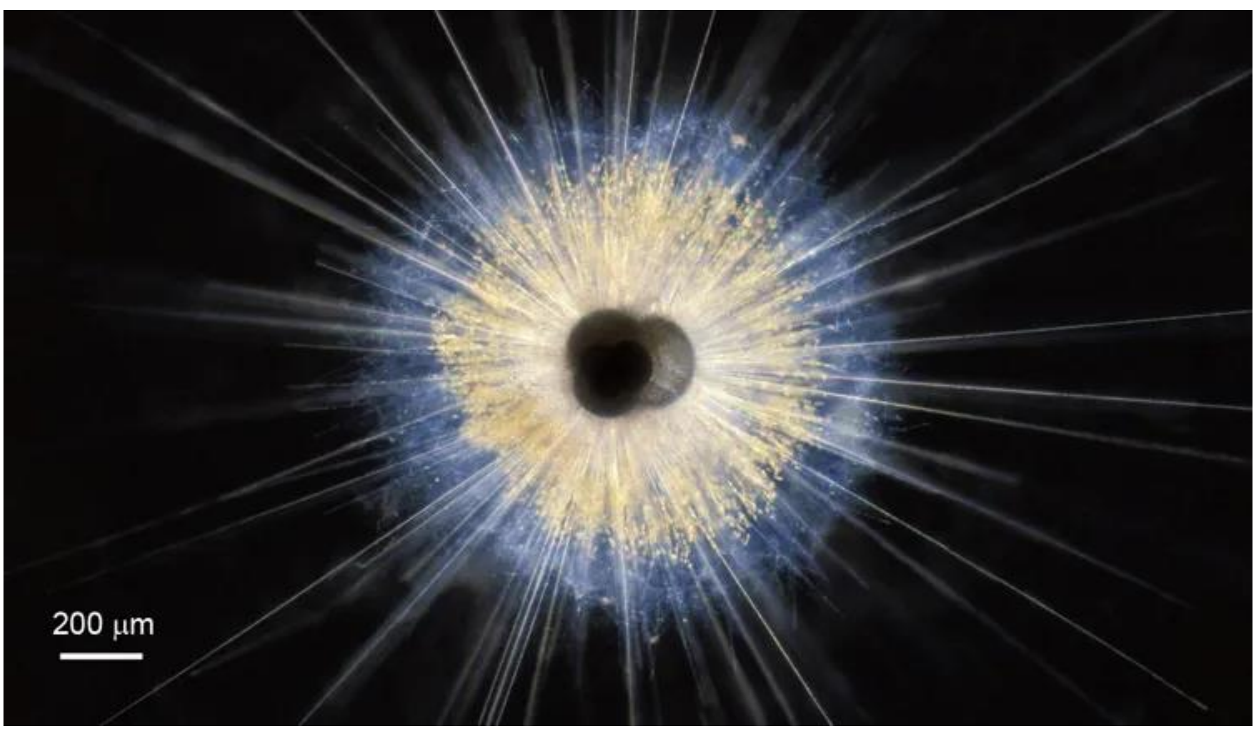

***Image caption**: A living foraminifer (Globigerinoides ruber) with its protoplasm extended. Credit: Howard J. Spero/University of California, Davis*

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Paleo Proxy Spotlight continued – Foraminifera

Many studies of foraminifera analyze ocean conditions by counting the number of morphospecies present in a representative sample ("species assemblages"). Because we know the general habitat preferences of species, the relative abundance of certain species with respect to others can help us infer details about the climate system. For example, the sudden appearance of a thermophilic species (one that "prefers" higher sea surface temperatures) may indicate an overall warming trend or changes in surface currents. Alternatively, a low relative abundance of specialized or highly ornamented species may indicate a period of biotic stress.

Researchers typically use assemblages in conjunction with geochemistry; the $CaCO_3$ composition of foraminiferal tests lends itself to the use of numerous geochemical proxies, including stable isotopic ratios (e.g. $\delta^{18}O$, $\delta^{13}C$, $\delta^{11}B$) and trace metal ratios (e.g. Mg/Ca, Sr/Ca). Because temperature controls oxygen fractionation in calcite, $\delta^{18}O$ from foraminifera is a commonly-used proxy for ocean temperatures (Urey, 1947). Foraminifera that have higher $\delta^{18}O$ typically indicate colder temperatures, while those with lower $\delta^{18}O$ indicate warmer temperatures. Salinity also impacts $\delta^{18}O$, though this impact is more pronounced locally than in the open ocean.

How do I apply foraminiferal proxies in my research? My research utilizes a combination of the above methods to study planktic foraminifera from the Cretaceous-Paleogene (K-Pg) mass extinction, during which over 90% of planktic foraminifera disappeared from the fossil record (Smit, 1982). Comparing planktic foraminiferal species assemblages from high- and low-latitude sediment cores, I am assessing the impact of an eruption of the Deccan Traps, a large igneous province, that occurred ~250 ky prior to the K-Pg extinction. In addition to analyzing relative abundances, I am looking at $\delta^{18}O$ and $\delta^{13}C$ stable isotopes from the late Maastrichtian to constrain the timing of the Deccan eruption in my samples and to observe the incurred changes in temperature and productivity. Furthermore, in collaboration with nannofossil workers studying the same sediment core, I am using biostratigraphy to aid in developing an age model for the high-latitude core.

While today's climate is hardly comparable to the Cretaceous hothouse, understanding how groups like foraminifera responded to past environmental perturbations is important for projecting how they may respond in the future, especially in the context of the ongoing anthropogenically-driven biodiversity loss that some consider Earth's next mass extinction. Using geochemical proxies from foraminifera can aid in our understanding the ocean (and by extension the atmosphere) over time, allowing researchers to comprehend baseline conditions and sharpen climate model simulations.

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Urey, H. C. (1947). The thermodynamic properties of isotopic substances. Journal of the Chemical Society (Resumed), 562.

Smit, J. (1982). Extinction and evolution of planktonic foraminifera after a major impact at the Cretaceous/Tertiary boundary. Geological Society of America Special Papers, 329–352.

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Postcard 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.

Max Zeltsar- undergraduate researcher, Middlebury College (Vermont, USA)

My name is Max Zeltsar. Over this past summer, I have been studying a unique population of introduced muskrats on Appledore Island and the other Isles of Shoals in Maine and New Hampshire. Genetic evidence shows that these muskrats were introduced to the Isles of Shoals in the late 1800's or early 1900's. Based on the timing of this introduction, it is likely that the muskrats' presence on the Isles of Shoals is a result of their popularity in the fur-trapping industry. While fur trapping no longer occurs on the Isles of Shoals, the population of muskrats still exists on the islands as a byproduct of the North American fur trade era. While we know when the muskrats were introduced to the archipelago, very little is known about how they have changed since arriving on the Isles of Shoals. The goal of my research is to gain a better understanding of their habitat selection, behavior, and diet and what changes the population has undergone since being introduced.

***Image caption**: Setting up camera traps to study the Appledore muskrats.*

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Conservation Paleobiology Network

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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!

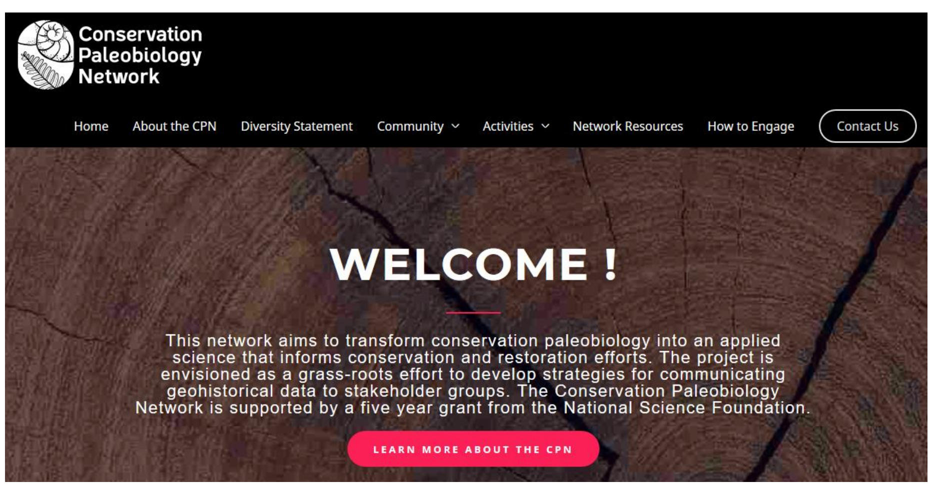
If you know people who might be interested in our network, please invite them to join. You can use the link below to extend your invitation on behalf of our network.

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
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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