

Sarah Ivory

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<https://sarahivorypollen.wordpress.com/>

Research Interests

I am a dually trained biologist and geologist. I use paleoecological records from fossil pollen along with models and data analysis to better understand changes in vegetation related to climate and ecological dynamics.

Professional Appointments

2018-present Assistant Professor, Department of Geosciences, Penn State University

2016-2018 Postdoctoral Scholar, Department of Anthropology, Ohio State University

2014-2016 Voss Postdoctoral Fellow, Institute at Brown for the Study of Environment and Society, Brown University

Education

2013 PhD, Geosciences, University of Arizona
Dissertation Title: *Vegetation and Climate of the African Tropics for the last 500,000 years*

2006 BS, Biology, French, University of Wisconsin – Eau Claire

Peer-reviewed Publications

(in review or revision)

1. McGlue, M., ... Ivory, S., Deepwater carbonaceous slope sedimentation in southern Lake Tanganyika (East African Rift Valley), submitted to *Sedimentology*.
2. Domic, A., Hixon, S., ... **Ivory, S.**, ... Kennett, D., Influence of Late Holocene climate change and human occupation on terrestrial and aquatic ecosystems in southwest Madagascar, in review in *Frontiers in Ecology and Evolution*.
3. **Ivory, S.**, Cole, K., Anderson, R.S., Anderson, A., McCorriston, J., Human landscape modification and expansion of tropical woodland in southern Arabia during the mid-Holocene from rock hyrax (*Procavia capensis*) middens, in revision at *Journal of Biogeography*.

(accepted or published)

* equal contributors

4. Mottl, O., Flantua, S., ..., **Ivory, S.**, ..., Williams, J., Global acceleration in rates of vegetation change is unprecedented over the last 18,000 years, *Science*, accepted.
5. Thompson, J.*, **Ivory, S.***, ... , Wright, D.* Earliest evidence for large-scale ecosystem

- modification by Homo sapiens, *Science Advances*, 2021.
6. **Ivory, S.**, Dinies, M., Lézine, A.M., Ecosystem change and human-environment interactions of Arabia, *Palaeoecology of Africa*, accepted.
 7. Lézine, A., **Ivory, S.**, Gosling, W., Scott, L., The African Pollen Database, State of the Art, *Palaeoecology of Africa*, accepted.
 8. **Ivory, S.**, McGlue, M., ... Soreghan, M. Climate, vegetation, and weathering across space and time in a tropical watershed, *Global and Planetary Change*, 2021.
 9. Wright, D., **Ivory, S.**, Thompson, J. The emergence and intensification of early hunter-gatherer niche construction, *Evolutionary Anthropology*, 2021.
 10. McGlue, M., **Ivory, S.**, Stone, J., Cohen, A., Kamulali, I., Latimer, Brannon, Kimirei, I., Soreghan, M. Solar forcing of primary production in Lake Tanganyika during the Common Era, *Science Advances*, 2020.
 11. Yost, C, Deino, A., Cohen, A., Kingston, J., Rabideaux, N., **Ivory, S.**, Phytoliths, pollen, and microcharcoal from the Baringo Basin, Kenya reveal savanna dynamics during the Plio-Pleistocene transition, *Palaeogeography, Palaeoclimatology, Palaeoecology*, 2020.
 12. Russell, J., Barker, P., Cohen, A., **Ivory, S.**, ... and the Lake Tanganyika Scientific Drilling Team, Scientific Drilling in Lake Tanganyika, Africa: A late Neogene-Quaternary record of climate, rifting, and ecosystem evolution from the world's oldest tropical lake *Scientific Drilling*, 2020.
 13. **Ivory, S.**, McGlue, M., Spera, S., Silva, A., Bergier, I. Vegetation, rainfall, and pulsing hydrology in the Pantanal, the world's largest tropical wetland, *Environmental Research Letters*, 2019.
 14. **Ivory, S.**, Early, R., Russell, J.M., Sax, D., Broader niches revealed by fossil data do not reduce estimates of range loss and fragmentation of African montane trees, *Global Ecology and Biogeography*, 2019.
 15. Nolan, C., Jackson, S., Overpeck, J., Allen, J., Anderson, P... **Ivory, S.**, et al. Past and future global transformation of terrestrial ecosystems under climate change, *Science*, 2018.
 16. McCorrison, J., Moritz, M., Buffington, A., Pustovoytov, K., **Ivory, S.**, Abuazizeh, W. Constructing the South Arabian Pastoral Landscape, in From refugia to oases : living in arid environments from prehistoric times to the present day, XXXVIIIe rencontres internationales d'archéologie et d'histoire d'Antibes, 2018.
 17. **Ivory, S.**, Lézine, A., Vincens, A., Cohen, A., Waxing and Waning of Forests: Late Quaternary Biogeography at Lake Malawi, *Global Change Biology*, 2018.
 18. **Ivory, S.**, Russell, J. Lowland forest collapse at the end of the African Humid Period at Lake Edward, Equatorial East Africa, *Quaternary Research*, 2017.
 19. **Ivory, S.**, McGlue, M.M., Ellis, G.S., Boehlke, A., Cohen, A.S., Scholz, C.A., East African weathering dynamics controlled by vegetation-climate feedbacks, *Geology*, 2017.
 20. Lézine, A.-M., **Ivory, S.**, Braconnot, P., Marti, O., Timing of the southward retreat of the ITCZ at the end of the Holocene Humid Period in Southern Arabia: data- model comparison, *Quaternary Science Reviews*, 2017.
 21. McGlue, M., Palacios-Fest, M., Cusminksy, G., Camacho, M., **Ivory, S.**, Kowler, A., Chakraborty, S., Ostracode biofacies and shell chemistry reveal Quaternary aquatic transitions in the Pozuelos Basin (Argentina), *PALAIOS*, 2017.

22. **Ivory, S.**, Blome, M., King, J., McGlue, M., Cole, J., Cohen, A. Environmental change explains cichlid adaptive radiation at Lake Malawi over the past 1.2 million years,
23. **Ivory, S.**, and Russell, J.M. Climate, herbivory, and fire controls on tropical African forest for the last 60ka, *Quaternary Science Reviews*, 2016.
24. Russell, J., Bijaksana, S., Vogel, H., Melles, M., ... , **Ivory, S.**, et al. The Towuti Drilling Project: Paleoenvironments, Biological Evolution, and Geomicrobiology of a Tropical Pacific Lake, *Scientific Drilling*, 2016.
25. **Ivory, S.**, Early, R., Sax, D., Russell, J.M., Niche expansion and temperature sensitivity of tropical African montane forests, *Global Ecology and Biogeography*, 2016.
26. Cohen, A., Campisano, C., Arrowsmith, R., ..., **Ivory, S. et al.**, The Hominin Sites and Paleolakes Drilling Project: Inferring the Environmental Context of Human Evolution from Eastern African Rift Lake Deposits, *Scientific Drilling*, 2016.
27. Lyons, R., Scholz, C., Cohen, A., King, J., Brown, E., **Ivory, S., et al.**, A continuous 1.3 million year record of East African hydroclimate, and its implications for patterns of evolution and biodiversity, *Proceedings of the National Academy of Science*, 2015.
28. **Ivory, S.**, McGlue, M.M., Ellis, G.S., Lézine, A.-M., Vincens, A., Cohen, A., Vegetation controls on weathering intensity during the last deglacial transition in southeast Africa, *PLOS ONE*, 2014.
29. **Ivory, S.**, Russell, J., Cohen, A. – In the hot seat: Insolation, ENSO, and vegetation in the African tropics, *Journal of Geophysical Research –Biogeosciences*, 118, 1347–1358. 2013.
30. **Ivory, S.**, Lézine, A.-M., Vincens, A., Cohen, A. - Effect of aridity and rainfall seasonality on vegetation in the southern tropics of East Africa during the Pleistocene/Holocene Transition, *Quaternary Research*, 77, 77-76, 2012.
31. Beuning, K., Zimmerman, K., **Ivory, S.**, Cohen, A. Vegetation response to glacial-interglacial climate variability near Lake Malawi in the southern African tropics, *Palaeogeography, Palaeoclimatology, Palaeoecology*, 303, 81-92, 2011.
32. **Ivory, S.**, Lézine A.-M. - Climate and Environmental change at the end of the Holocene Humid Period: a pollen record off Pakistan, *CR-Geosciences*, 340, 760-769, 2009.
33. Cohen, A., Stone, J., Beuning, K., Park, L., Reinthal, P., Dettman, D., Scholz, C., Johnson, T., King, J., Talbot, M., Brown, E., and **Ivory, S.** Ecological consequences of Late Pleistocene Megadrought in Equatorial Africa. *Proceedings of the National Academy of Science* 104:16422-16427, 2007.

Other publications/reports

1. **Ivory, S.**, Lézine, A., Grimm, E., Williams, J. Relaunching the African Pollen Database: Abrupt change in climate and ecosystems, *PAGES Magazine*, 2020.

Grants

Successful

- 2021 – National Science Foundation – Division of Environmental Biology, Title: Fire, ecosystem, and landscape dynamics in Afroalpine environments in a warmer world,

PI, \$302,474
2021 – Penn State Earth and Environmental Systems Institute Diversifying STEM grant, PI, \$30,000
2020 - International Continental Scientific Drilling Program, Title: Scientific Drilling at Lake Tanganyika, co-PI, \$1,500,000
2019 - Belmont Forum, Title: Abrupt Change in Climate and Ecosystems: Where are the Tipping Points?, PI, \$97,540
2019 - Penn State Dept of Geosciences Blue Sky Award, PI, \$15,000
2018 - Penn State Institutes of Energy and the Environment Seed Grant, Title: Weathering and vegetation in central Appalachia from Bear Meadows Bog, co-PI, \$10,000
2017 – National Science Foundation - Integrated Earth Systems, Title: Collaborative Research: Interactions Between Incipient Continental Rifting, Fluvial Systems, and Regional Climate in Southern Africa: The Okavango-Makgadikgadi Complex, Botswana, PI, \$127,122
2016 - National Science Foundation - Coupled Human and Natural Systems, Title: CNH-L: Pastoral Territoriality as a Dynamic Coupled System, co-PI, \$211,865
2014 – Brown University Voss Postdoctoral Fellowship Grant, PI, \$10,000
2009-2012 – National Science Foundation Graduate Research Fellowship Grant, \$100,000

Pending

NSF – DEB, Title: Evaluating the resilience of semi-arid vegetation to climatic change and human-ecosystem interactions during the late Holocene in the south-central Andes (PI - \$500,000)

NSF – SGP, Title: Tropical Rainforest Resilience to Quaternary Climate Changes in a Biodiversity Hotspot on Sulawesi, Indonesia (PI - \$350,000)

Recognition in Media

Climate impacts could put major fishery, food security at risk in East Africa,
<https://news.psu.edu/story/634914/2020/10/09/research/climate-impacts-could-put-major-fishery-food-security-risk-east>

Study: Earth's ecosystems face 'major transformation' from climate change, Penn State News,
[psuhttps://news.psu.edu/story/534862/2018/09/05/research/study-earths-ecosystems-face-major-transformation-climate-change](https://news.psu.edu/story/534862/2018/09/05/research/study-earths-ecosystems-face-major-transformation-climate-change)

New study finds climate change will dramatically alter Earth's ecosystems, State Impact Pennsylvania NPR,
<https://stateimpact.npr.org/pennsylvania/2018/08/31/new-study->

finds-climate-change-will-dramatically-alter-earths-ecosystems/

Environmental change drove diversity in Lake Malawi cichlids, Brown University
Press Release, <https://news.brown.edu/articles/2016/09/malawi>
-Also covered in the Environmental Monitor:
<http://www.fondriest.com/news/sediment-cores-reveal-secrets-lake-malawi-cichlid-diversity.htm>

Science, Highlight of recent paper on the future of Afromontane forests
<http://science.sciencemag.org/content/352/6292/1422.3>

A Human Climate, Earth Images Foundation, short video of environmental research to better understand the context of human evolution to be shown at international museums. <http://www.earthimage.org/Africa.html>

Drilling from Above, Ray Globe Productions, short video of scientific drilling operations on Lake Towuti, Indonesia,
<https://www.facebook.com/towutidrilling>

Professional and Field Experience

- 2018-2020 Ancient Socio-ecological systems of OMan (ASOM)
-Fieldwork leading graduate students, including the location and sampling of fossil hyrax middens for paleoecological analysis
- 2015 Lake Towuti Drilling Project (Indonesia)
-Science principal investigator and data curation during core drilling field work in Sulawesi, Indonesia
- 2014 Hominin Sites and Paleolakes Drilling Project (Kenya)
-Postdoctoral researcher doing field logistics coordination, drilling data curation, and site supervision
- 2012 Laboratoire de l'Océanographie et du Climat (LOCEAN) –
CNRS/Université de Paris VI, Paris, France
-Research Assistantship in palynology on Lake Malawi drill cores
- 2008-2011 Laboratoire des Sciences du Climat et de l'Environnement (LSCE) –
CNRS, Paris, France
-Research Assistantship in palynology on Lake Malawi drill cores
- 2007-2008 Laboratoire des Sciences du Climat et de l'Environnement (LSCE) –
CNRS, Paris, France
-Research Technician in palynology of Arabia and Pakistan

Invited Lectures (Selected)

- 2020 Invited convener at Neotoma Paleocological Database Data Steward Training, Amsterdam, Netherlands
- 2019 Invited participant and speaker at African Pollen Database Workshop, Paris, France

- 2019 Invited participant and speaker at Lake Tanganyika Drilling Workshop, Dar es Salaam, Tanzania
- 2018 Invited lightening talk at ICDP/CSDCO science planning workshop, *Lake Tanganyika Drilling Project: Scientific Aims*
- 2017 Invited seminar speaker at University of Oklahoma, *The past and future of African forests: inferences from muds and models.*
- 2017 Invited seminar speaker at University of Kentucky, *Human and climatic dimensions of African forests.*
- 2017 Invited seminar speaker at Northern Arizona University, *Learning from the past: inferences from muds and models.*
- 2017 Invited seminar speaker at Pennsylvania State University, *The past and future of African forests: inferences from muds and models.*
- 2017 Invited lecture at the Oman Botanic Garden, *Initial Location and Investigations for Hyrax middens for ancient vegetation reconstruction*
- 2016 Invited Lake Tanganyika paleoecology workshop speaker at University of Basel, *Paleoecology and source to sink dynamics in East Africa, application and planning for Lake Tanganyika drilling*
- 2016 Invited seminar speaker at Michigan Technological University, *Learning from the past: inferences from muds and models.*
- 2015 Invited STEPPE workshop speaker at AGU 2015, *Paleoecology and source to sink dynamics in East Africa, application and planning for Lake Tanganyika drilling*
- 2015 Invited Paleoclimate seminar speaker at Lamont Doherty Earth Observatory, *Paleoecology and continental drilling in the tropics*
- 2015 Invited speaker for fall meeting of Geological Society of America, session title: *Paleoecological Patterns, Ecological Processes, Modeled Scenarios: Crossing Temporal Scales to Understand an Uncertain Future*, talk title: *The past and future of Africa forests: inferences from muds and models.*
- 2015 Invited Paleoecology seminar speaker at Woods Hole Oceanographic Institute, *The past and future of Africa forests: inferences from muds and models.*
- 2014 Invited master's convocation speaker at King's College London, *Vegetation controls on weathering intensity in Southeast Africa.*
- 2014 Invited speaker at the Wisconsin Geological Survey and University of Wisconsin – Department of Geography seminar, *Vegetation controls on weathering intensity in Southeast Africa.*
- 2014 Guest lecturer at University of Kentucky for Paleolimnology course, lecture *African Great Lakes and their hinterlands.*
- 2013 Invited speaker for workshop on "Forests from central Africa: present and past biodiversity: What is at stake for the future?" Yaoundé, Cameroun
- 2012 Invited speaker for workshop on African climate-vegetation interactions, MARUM Center for Marine Environmental Sciences, University of Bremen, Germany
- 2011 Invited speaker for NSF African Great Lakes Drilling Workshop, Brown University, Providence, Rhode Island, *Tertiary/Quaternary vegetation dynamics in East Africa: Questions for a long core*
- 2008 Invited speaker at l'Académie des Sciences, Paris (French National Academy of

Sciences), *Climate and Environmental change at the end of the Holocene Humid Period: a pollen record off Pakistan*

Conference Abstracts (selected, * denotes student presenter)

- *2020 Vegetation-climate interactions in Dhofar, Oman from the mid-Holocene to present, American Geophysical Union (AGU)
- *2020 Erosional and ecological response to climate change in a periglacial landscape 14-8ka, Central Appalachia, Geological Society of America (GSA)
- *2020 Terrestrial ecosystem response to abrupt climate change at Mono Lake, California, Geological Society of America (GSA)
- *2020 Reconstructing Past Fire Intensity from a Sediment Core Collected at the Namonte Site in Southwestern Madagascar, Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS)
- 2019 Woodlands, oases, and fire in southern Yemen during the Holocene Humid Period, Geological Society of America (GSA)
- *2019 Pleistocene climate-modulated erosion, Geological Society of America (GSA) meeting.
- *2018 A Late Quaternary Hydroclimatic and Vegetation Reconstruction in the Eastern Sierra Nevada: Preliminary Results, Geological Society of America (GSA) meeting.
- 2018 *Vegetation, rainfall, and pulsing hydrology in the Pantanal, the world's largest tropical wetland*, American Geophysical Union (AGU) meeting.
- 2018 *Archaeological proxies of early modern human niche construction in northern Malawi*, Society for American Archeology (SAA) meeting, lead author :Jessica Thompson
- 2018 Collaborator on oral presentation for the Society of Africanist Archaeologists meeting, *Scales of Impact: The Human Dimensions of Landscape Change from the Paleolithic to Iron Age, Malawi* (presented by David Wright)
- 2017 Poster Presentation for Geological Society of America Fall Meeting, *Climate, herbivory, and fire controls on tropical African forests for the last 60ka*.
- 2016 Poster presentation for American Geophysical Union (AGU) Fall Meeting, *Climate and disturbance controls on tropical African forests*.
- 2015 Poster presentation for American Geophysical Union (AGU) Fall Meeting, *Climate change and early human land-use in a biodiversity hotspot, the Afromontane region*
- *2015 Poster presentation for Geological Society of America (GSA) Fall Meeting (with student co-author Josephine Benson as primary presenter), *Vegetation and climate change in equatorial East Africa from a 6000 yr pollen record, Lake Edward, Uganda*
- 2014 Oral presentation for American Geophysical Union (AGU) Fall Meeting, *Waxing and Waning of Forests: Late Quaternary biogeography of Lake Malawi, southeast Africa*.
- 2013 Poster presentation for American Geophysical Union (AGU) Fall Meeting, *Vegetation controls on weathering intensity in Southeast Africa*.
- 2011 Oral presentation for the International Union for Quaternary Research (INQUA), *Tropical vegetation and high-amplitude climate variability: the Last Interglacial at Lake Malawi, southeast Africa*

- 2010 Oral presentation for American Geophysical Union (AGU) Fall Meeting, *In the hot seat : Insolation and ENSO controls on vegetation productivity in tropical Africa inferred from NDVI*
- 2009 Oral presentation for Geological Society of America (GSA) Fall Meeting, *Vegetation and climate of Lake Malawi, Southeast Africa during the Last Deglaciation*
- 2008 Poster for International Palynology Congress, Bonn, Germany, *Climate and Environmental change at the end of the Holocene Humid Period: a pollen record off Pakistan*

Courses taught (*indicates experience with remote synchronous delivery)

- Penn State – GEOSC 497 Paleoclimate (SP19, SP21)*
Penn State – GEOSC 204 Geobiology (FA19, FA20)*
Penn State – EARTH002 The Earth System (SP20)*
Penn State – GEOSC597 Paleobiology (FA20)

Student Mentorship (* indicates completed)

Penn State:

PhD students (role as primary advisor)

Adam Benfield
Katie Horisk
Karen Pham

Committee Member

Morgan Black (Masters – University of Kentucky)*
Allison Karp (PhD – Penn State)*
Joanmarie Delvecchio (PhD – Penn State)
Claire Cleveland (PhD – Penn State)
Shelby Kirkpatrick (PhD – Penn State)
Tyler Jones (PhD – Penn State)

Undergraduate research or senior thesis advisor

Matt Wileyto (Penn State)
Joe Barbusca (Penn State)
David Early (Penn State)
Matt Leddy (Penn State)*
Yurik McCray (Penn State)
Annalee Sekulic (Ohio State)*
Molly McHale (Penn State)

Postdoctoral scholar

Alejandra Domic (Penn State)

Prior to Penn State mentorship (all completed)

Undergraduate research supervisor

Preston Smith (lacustrine sedimentology)
Elizabeth MacDougall (African palynology)
Maria Orbay-Cerrato (African palynology)
Josie Benson (African palynology)
Blake DeVaney (African palynology)
Annalee Sekulic (hyrax midden macrofossil identification)

Undergraduate Thesis Reader/Supervision

Aaron Rachels (Indonesia paleoclimate)
Birch Malotky (ecological modeling of species distributions)
Gene Robinson (remote sensing of tropical vegetation)

Postdoctoral mentorship

Marie Mathis (African palynology)

Outreach and Service Activities

Chair, African Pollen Database council
Lead Data Steward, Neotoma Paleoecology Database
Leadership Council Member, Neotoma Paleoecology Database
AGU Fall Meeting Outstanding Student Poster Award (OSPA) judge and liaison
Siemens Competition in Math, Science & Technology – Science project judge
Professional Associations – Geological Society of America, American Geophysical Union
Participant, writer, and speaker at numerous International Continental Scientific Drilling Program (ICDP) community and science planning workshops

Manuscript Reviewer – *PNAS; PloS One; Journal of Biogeography; Journal of Geophysical Research – Biogeosciences; Quaternary International; Climates of the Past; Ecology Letters; Environment, Development, and Sustainability, Paleoceanography, Review of Paleobotany and Palynology, Earth and Planetary Science Letters*

Languages

English (Native Speaker)
French (Fluent)
Arabic (Notions)