



PALEOCLIMATE AND HUMAN EVOLUTION

Spring 2022 ANTH 573-001 (3 credits)

MEETING TIME AND PLACE: THURSDAY, 3:00-5:50PM ANIMAL SCIENCE 135

INSTRUCTOR INFORMATION

Instructor: Andrew Du, Ph.D.

Email: Andrew.Du2@colostate.edu

Pronouns: he, him, his

Office Location: Clark B-225

Office Hours: Tuesday 1:00-4:00 pm

Attend virtually: <https://tinyurl.com/ANTH573>

COURSE GOALS AND CONTENT

Despite the course name, the purpose of this course is to introduce you to the principles, theories, and methods of paleoecology, and to examine and understand the way(s) in which paleoecologists use these theories and methods to understand the ecology and evolution of fossil taxa (with an emphasis on paleoanthropology and human evolution where applicable). The course begins with defining what paleoecology is and a discussion of perhaps the two most pervasive concepts in paleoecology: scale and taphonomy. Because paleoenvironmental reconstruction plays such a prominent role in paleoanthropology, we spend two weeks on this topic. We then discuss one of the most foundational topics in ecology, the niche, and how it influences biotic interactions and taxonomic diversity at a given time and place. We lastly finish with micro- and macroevolutionary theories and how ecology and evolution are unified within certain hypotheses of human evolution.

By the end of the course, you should have a foundational knowledge of the different subfields within paleoecology and how these subfields are related and integrated. You should also be able to understand the paleoecological peer-reviewed literature, as well as possess the background knowledge for conducting your own paleoecological research.

READINGS

There is no required book for this course, but multiple reference books will be posted to Canvas if you are unfamiliar with certain anthropological or (paleo)ecological topics. About two to three articles will be assigned each week, with one additional paper selected by two students (see *Weekly Assignments* below). All readings will be posted to Canvas.

COURSE FORMAT

This class will be conducted in a **seminar format**, where two students lead discussion each week (see *Weekly Assignments* below). This means that everyone's **attendance and participation is required**. That participation is dependent, in part, on **completing all the assigned readings** each week and being prepared to discuss them in class. "Doing the readings" means that you acquire a deep understanding of the concepts and arguments, requiring more than just skimming. You are expected to be prepared to discuss the readings in detail each week.

WEEKLY ASSIGNMENTS

Two students will be required to lead discussion for a week/topic of their choosing. This involves:

1. **Picking one additional paper related to that week's topic (due 10pm on Sunday before class).** This will give you experience combing through the literature, in addition to providing you with the opportunity to pick a paper more aligned with your research interests. The two student leaders need to pick only one paper between them, and only one student uploads the paper to Canvas. Both students will receive credit (I assume the two will have discussed the paper choice beforehand).
2. **Teaching the class about the week's topic using at least one active learning strategy (done in the beginning of class).** This will familiarize you with the latest teaching strategies, as well as diversify how these topics are taught each week. Each active learning session should be about 15 minutes long. Feel free to use handouts, PowerPoint slides, or whatever materials you'd like. A PDF with different active learning strategies is posted to Canvas. The two student leaders will team teach the topic, so there is only one ~15 minute presentation between them.
3. **Leading discussion.** The two student leaders are expected to keep discussion going for the duration of the class period. This includes coming up with a list of "discussion-starter" questions in case there is a lull in the discussion.

GRADING

ASSIGNMENT	GRADE PERCENTAGE
In-class participation	15%
Weekly assignments	30%
Term paper assignments	40%
Term paper presentation	15%

TERM PAPER AND PRESENTATION

You will need to write an original research paper on a topic of your choice (can be related to your own research), as long as it is related to at least one of the topics we covered in this course. The paper will be completed in five stages:

1. **Topic description (5pts; due 3/3).** Describe your proposed paper topic in about five sentences and provide at least five references in APA format.
2. **Thesis statement or research question, abstract, and annotated bibliography (10 pts; due 3/31).**
 - a. **Thesis statement.** One to two sentences.
 - b. **Abstract.** Maximum of 300 words.
 - c. **Annotated bibliography.** At least 10 references in APA format. Four to five sentences per annotation.
3. **Rough draft (30 pts; due 4/28).** If you are happy with the grade you receive for this, you do not need to do the final draft. Paper requirements are as follows:
 - a. **12–15 pages.** This does not include the abstract, images that you choose to use, or the bibliography.
 - b. **Minimum of 20 peer-reviewed references.** You can use more if necessary. Peer-reviewed references include journal articles or chapters from edited volumes.
 - c. **Citations and bibliography should follow APA format.**
 - d. **Double-spaced, 12-point, Times New Roman font with 1-inch margins and page numbers.**

e. **For the abstract and bibliography, use single-spaced sentences.**

4. **12–15-minute presentation of your term paper (presented in class on 5/5).** This includes:
 - a. The purpose/significance of your paper
 - b. Background and/or controversy if there is one
 - c. Your findings
 - d. Conclusions and directions for future research

5. **Final draft (30 pts; due 5/12).** Same format as the rough draft

COVID POLICIES

Important information for students: Masks are required inside university buildings. You must also meet university vaccine or exemption requirements.

All students are expected and required to report to the COVID reporter (<https://covid.colostate.edu/reporter/>) when:

- You suspect you have symptoms of COVID, regardless of whether or not you are vaccinated and even if your symptoms are mild
- You have tested positive for COVID through a non-CSU testing site, such as home test or test at a pharmacy
- You believe you may have been exposed to COVID go to the COVID Reporter and follow the guidance under “I believe I have been in close contact with someone who has COVID-19.” This guidance will depend upon your individual circumstances

You will not be penalized in any way for reporting symptoms or concerns.

Do not ask me as your instructor to report for you. It is your responsibility to report through the COVID Reporter promptly.

As your instructor I may not ask you about vaccination status or if you have COVID, but you may freely volunteer to send me information from a public health official - if you have been asked to isolate or quarantine.

When you complete the COVID Reporter, the CSU Public Health office is notified. Once notified, that office will contact you and, depending upon each situation, will conduct contact tracing, initiate any necessary public health requirements and notify you if you need to take any steps.

If you do not have internet access to fill out the online COVID-19 Reporter, please call (970) 491-4600.

For the latest information about the University’s COVID resources and information, including FAQs about the spring semester, please visit the **CSU COVID-19 site** <https://covid.colostate.edu/>.

ACADEMIC INTEGRITY POLICY

This course adheres to the Academic Integrity Policy of the Colorado State University General Catalog and the Student Conduct Code. Any breach of these policies and codes will be taken very seriously. For more details visit <https://tilt.colostate.edu/Integrity/Pledge>.

UNIVERSAL DESIGN FOR LEARNING

I am committed to the principle of universal learning. This means that our classroom, our virtual spaces, our practices, and our interactions be as inclusive as possible. Mutual respect, civility, and the ability to listen and observe others carefully are crucial to universal learning. See also CSU's Principles of Community (<https://inclusiveexcellence.colostate.edu/principles-of-community/>).

If you need accommodations in this class, please contact me to discuss your individual needs. Any accommodation must be discussed in a timely manner prior to implementation. A verifying memo from the Student Disability Center (<https://disabilitycenter.colostate.edu>) may be required before any accommodation is provided.

COURSE SCHEDULE

Changes may be made to this schedule as necessary and will be announced in class or through email. Asterisks indicate no readings for that week.

Week	Topic	Assignments (due 10pm)
Week 1: 1/20	Course introduction & logistics*	
Week 2: 1/27	What is paleoecology?	
Week 3: 2/3	The importance of scale	
Week 4: 2/10	Taphonomy	
Week 5: 2/17	Reconstructing paleoenvironments I	
Week 6: 2/24	Reconstructing paleoenvironments II	
Week 7: 3/3	The ecological niche	Paper topic description
Week 8: 3/10	Reconstructing ancient diets	
Week 9: 3/17	No class (Spring Break)*	
Week 10: 3/24	No class (Paleoanthropology meetings & AABA)*	
Week 11: 3/31	Biotic interactions	Abstract and bibliography
Week 12: 4/7	Taxonomic diversity	
Week 13: 4/14	Microevolution & adaptation	
Week 14: 4/21	Macroevolution	
Week 15: 4/28	Environmental hypotheses in human evolution & course wrap-up	Rough draft
Week 16: 5/5	Student presentations*	

Final paper draft due May 12th at 10 pm.

INSTRUCTOR-ASSIGNED READING LIST (I.E., STUDENT-SELECTED PAPERS NOT INCLUDED)

Week 1: Course introduction & logistics

- No readings

Week 2: What is paleoecology?

- Behrensmeyer, A.K., Bobe, R., Alemseged, Z., 2007. Approaches to the analysis of faunal change during the East African Pliocene. In: *Hominin Environments in the East African Pliocene: An Assessment of the Faunal Evidence*. Springer, pp. 1–24.
- Faith, J.T., Du, A., Behrensmeyer, A.K., Davies, B., Patterson, D.B., Rowan, J., Wood, B., 2021. Rethinking the ecological drivers of hominin evolution. *Trends in Ecology & Evolution*. 36, 797–807.

Week 3: The importance of scale

- Wiens, J.A., 1989. Spatial Scaling in Ecology. *Functional Ecology*. 3, 385–397.
- Levin, S.A., 1992. The Problem of Pattern and Scale in Ecology: The Robert H. MacArthur Award Lecture. *Ecology*. 73, 1943–1967.
- Du, A., Behrensmeyer, A.K., 2018. Spatial, temporal and taxonomic scaling of richness in an eastern African large mammal community. *Global Ecology and Biogeography*. 27, 1031–1042.

Week 4: Taphonomy

- Behrensmeyer, A.K., Kidwell, S.M., Gastaldo, R.A., 2000. Taphonomy and Paleobiology. *Paleobiology*. 26, 103–147.

Week 5: Reconstructing paleoenvironments I

- Bobe, R., Behrensmeyer, A.K., Eck, G.G., Harris, J.M., 2007. Patterns of abundance and diversity in late Cenozoic bovids from the Turkana and Hadar Basins, Kenya and Ethiopia. In: Bobe, R., Alemseged, Z., Behrensmeyer, A.K. (Eds.), *Hominin Environments in the East African Pliocene: An Assessment of the Faunal Evidence, Vertebrate Paleobiology and Paleoanthropology Series*. Springer Netherlands, pp. 129–157.
- Kovarovic, K., Su, D.F., Lintulaakso, K., 2018. Mammal Community Structure Analysis. In: Croft, D.A., Su, D.F., Simpson, S.W. (Eds.), *Methods in Paleoecology, Vertebrate Paleobiology and Paleoanthropology*. Springer International Publishing, Cham, pp. 351–372.

Week 6: Reconstructing paleoenvironments II

- Barr, W.A., 2018. Ecomorphology. In: Croft, D.A., Su, D.F., Simpson, S.W. (Eds.), *Methods in Paleoecology, Vertebrate Paleobiology and Paleoanthropology*. Springer International Publishing, Cham, pp. 339–349.
- Du, A., Robinson, J.R., Rowan, J., Lazagabaster, I.A., Behrensmeyer, A.K., 2019. Stable carbon isotopes from paleosol carbonate and herbivore enamel document differing paleovegetation signals in the eastern African Plio-Pleistocene. *Review of Palaeobotany and Palynology*. 261, 41–52.

Week 7: The ecological niche

- Hutchinson, G.E., 1957. Concluding Remarks. *Cold Spring Harbor Symposia on Quantitative Biology*. 22, 415–427.
- Leibold, M.A., 1995. The Niche Concept Revisited: Mechanistic Models and Community Context. *Ecology*. 76, 1371–1382.
- Jackson, S.T., Overpeck, J.T., 2000. Responses of plant populations and communities to environmental changes of the late Quaternary. *Paleobiology*. 26, 194–220.

Week 8: Reconstructing ancient diets

- Davis, M., Pineda-Munoz, S., 2016. The temporal scale of diet and dietary proxies. *Ecology and Evolution*. 6, 1883–1897.
- Green, J.L., Croft, D.A., 2018. Using Dental Mesowear and Microwear for Dietary Inference: A Review of Current Techniques and Applications. In: Croft, D.A., Su, D.F., Simpson, S.W. (Eds.), *Methods in Paleoecology, Vertebrate Paleobiology and Paleoanthropology*. Springer International Publishing, Cham, pp. 53–73.

Week 9: Spring break

- No readings

Week 10: No class (Paleoanthropology meetings & AABA)

- No readings

Week 11: Biotic interactions

- Winterhalder, B., 1980. Hominid paleoecology: The competitive exclusion principle and determinants of niche relationships. *American Journal of Physical Anthropology*. 23, 43–63.
- Wisheu, I.C., 1998. How organisms partition habitats: different types of community organization can produce identical patterns. *Oikos*. 83, 246–258.
- Lang, J.M., Benbow, M.E., 2013. Species interactions and competition. *Nature Education Knowledge*. 4, 8.

Week 12: Taxonomic diversity

- Raup, D.M., 1972. Taxonomic Diversity during the Phanerozoic. *Science*. 177, 1065–1071.
- Du, A., Alemseged, Z., 2018. Diversity analysis of Plio-Pleistocene large mammal communities in the Omo-Turkana Basin, eastern Africa. *Journal of Human Evolution*. 124, 25–39.

Week 13: Microevolution & adaptation

- Arnold, S.J., Pfrender, M.E., Jones, A.G., 2001. The adaptive landscape as a conceptual bridge between micro- and macroevolution. *Genetica*. 112–113, 9–32.
- Hunt, G., Bell, M.A., Travis, M.P., 2008. Evolution toward a new adaptive optimum: phenotypic evolution in a fossil stickleback lineage. *Evolution*. 62, 700–710.
- Love, A.C., Grabowski, M., Houle, D., Liow, L.H., Porto, A., Tsuboi, M., Voje, K.L., Hunt, G., 2021. Evolvability in the fossil record. *Paleobiology*. 1–24.

Week 14: Macroevolution

- Van Valen, L., 1973. A new evolutionary law. *Evolutionary Theory*. 1, 1–30.
- Jablonski, D., 2017. Approaches to Macroevolution: 2. Sorting of Variation, Some Overarching Issues, and General Conclusions. *Evolutionary Biology*. 44, 451–475.

Week 15: Environmental hypotheses in human evolution & course wrap-up

- Vrba, E., 1995. The fossil record of African Antelopes (Mammalia, Bovidae) in relation to human evolution and paleoclimate. In: Vrba, E., Denton, G., Partridge, T., Burckle, L. (Eds.), *Paleoclimate and Evolution, with Emphasis on Human Origins*. Yale University Press, New Haven, pp. 385–424.
- Potts, R., 1998. Variability selection in hominid evolution. *Evolutionary Anthropology: Issues, News, and Reviews: Issues, News, and Reviews*. 7, 81–96.

Week 16: Student presentations

- No readings