

Syllabus
Integrative Biology 155
(Cross-listed as Anthropology C129D)
Holocene Paleoecology: How Humans Changed the Earth

Instructor: Professor Patrick V. Kirch, Class of 1954 Professor of Anthropology and Integrative Biology

Class Times: Tu/Th 3:30-5 pm, 118 Barrows Hall

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Office Hours: Tu, 1:30-3:20 pm; Th, 1:30-3:20 pm

Overview of the Course

"Global change" has become one of the most urgently debated topics of our time. Climate warming, the greenhouse effect, the rapid destruction of tropical and temperate rainforests, aquatic and marine pollution, the biodiversity crisis and species extinctions: all of these are tied at least in part to the actions and behavior of *Homo sapiens*, even though many aspects of global change have natural (i.e. non-human) causes. But is global change primarily a new phenomenon, a consequence of the industrial revolution and of modern capitalist and totalitarian states? Or have humans been active agents of environmental and landscape change over longer periods of time? Is our propensity to modify natural environments a distinctive or even defining aspect of our species? These are fundamental questions which this course will address.

Although human-induced changes to the global environment and natural biotic resources have accelerated with industrialization over the past 300 years, such changes have a much longer history. Particularly since the rise of agriculturally-based societies and associated population expansion during the early Holocene, humans have had cumulative and often irreversible impacts to natural landscapes and biotic resources worldwide. Archaeologists, working closely with natural scientists in interdisciplinary projects, have accumulated a large body of empirical evidence documenting such changes as deforestation, spread of savannahs, increased rates of erosion, permanent rearrangements of landscapes for agriculture, resource depression and depletion (and in many cases, extinction) in prehistory. Drawing upon case studies from North America, Mesoamerica, the Mediterranean, Near East, and the Pacific Islands, the diversity of prehistoric human-induced environmental change will be assessed, along with the empirical evidence which support these interpretations. These findings have important implications both for the understanding of long-term human socio-economic and political change, and for ecologists who need to assess current environmental dynamics in the context of longer-term environmental history.

This course thus explores a rapidly developing area of knowledge, one that is explicitly inter-disciplinary, at the interface between archaeology, ecology, geography, environmental studies, geomorphology, and many other traditional disciplines. The geographic scope is global, and over time the course will range from the Pleistocene-Holocene transition up to the contemporary era. The fundamental objective is to use the

power of such a multi-disciplinary perspective to ask how and to what extent humans and human cultural activity have played a key role in transforming the Earth.

Prerequisites

Either Bio 1B, General Biology, or Anthro 2, Introduction to Archaeology, are strongly recommended as prerequisites, or evidence that the student has mastered an equivalent set of basic concepts in evolution and ecology, and in fundamental archaeological methods.

Course Format

The course consists of a combination of lectures and in-class debates regarding current controversies over anthropogenic environmental change and "collapse" of ancient societies. Each student will be assigned to a specific "pro" or "con" debate team for particular topic. The in-class debates will be held during the final weeks of the semester.

Requirements and Grading

Attendance at lectures and participation in the classroom debates is expected of all students enrolled. There will be two mid-term exams scheduled approximately 1/3 and 2/3rds of the way through the semester, each of which will account for 25% of your grade. Another 25% of your grade will be based on participation in the in-class debates, and the final 25% will be based on a short research essay. The research essay should be based on the topic you will have debated in class, but in the essay you may take any position you like. The essay should be no less than 5 and no more than 10 pages in length, with appropriate bibliographic references to the literature you have consulted. **The research essays should be posted to your bSpace drop box by 5 pm on Friday, May 6.** Late papers will be marked down appropriately. The debate and research essay are in lieu of a final exam.

Required Readings

The following two books are required core reading for the course, and will provide the basis for the in-class debates. Additional readings, as noted in the syllabus, will be posed on b-Space. The content of these readings will be included in the two mid-term exams.

Diamond, J. 2005. *Collapse: How Societies Choose to Fail or Succeed*. New York: Viking Press.

McAnany, P. A. and N. Yoffee, editors, 2010. *Questioning Collapse: Human Resilience, Ecological Vulnerability, and the Aftermath of Empire*. Cambridge: Cambridge University Press.

Schedule of Lectures, Debates, and Mid-Terms

Jan 18 (Tu). Introduction to the Course

Review of the main themes of the course; course requirements and grading; setting up of the debating groups.

Readings: Kirch, P. V. 2005. Archaeology and global change: The Holocene record. *Annual Review of Environment and Resources* 30:409-440.

Van der Leeuw S, Redman CL. 2002. Placing archaeology at the center of socio-natural studies. *American Antiquity* 67:597-606.

Jan. 20 (Th). Lecture: Background to the Study of Human Paleoecology

Review of previous views about humans and nature; the rise of environmental archaeology, cultural ecology, historical ecology.

Reading: Barton CM, Bernabeu J, Aura JE, Garcia O, Schmich S, Molina L. 2004. Long-term socioecology and contingent landscapes. *J. Archaeological Method and Theory* 11:253-295.

Jan. 25 (Tu). The Contribution of Geoarchaeology to Human Paleoecology

Geological time scales; methods of geochronology; anthropogenic impacts on large-scale geomorphological processes.

Reading: Van Andel TH, Runnels CN, Pope KO. 1986. Five thousand years of land use and abuse in the Southern Argolid, Greece. *Hesperia* 55:103-128.

Jan. 27 (Th). Geoarchaeology and Geomorphic Change

Sedimentary and pedological approaches to anthropogenic landscape change.

Reading: Dickinson WR, Burley DV, Nunn PD, Anderson A, Hope G, de Biran A, Burke C, Matararaba S. 1998. Geomorphic and archaeological landscapes of the Sigatoka Dunes Site, Viti Levu, Fiji: Interdisciplinary investigations. *Asian Perspectives* 37:1-32.

Feb. 1 (Tu). Human Influence on the Plant World.

Methods for reconstructing vegetation change and anthropogenic impacts (palynology, anthracology, etc.); domestication of plants, the increasing dominance of agrarian systems.

Reading: Metcalfe SE, Street-Perrott FA, Brown RB, Hales PE, Perrott RA, Steininger FM. 1989. Late Holocene human impact on lake basins in Central Mexico. *Geoarchaeology* 4:119-142.

Feb. 3 (Th). The Contribution of Archaeobotany of Human Paleoecology: Prof. Christine Hastorf guest lecture

How do archaeobotanists approach the study of human paleoecology? Prof. Hastorf, a leading archaeobotanist will review key methods and give case examples.

Reading: Miller, N. 1985. Paleoethnobotanical evidence for deforestation in ancient Iran: A case study of urban Malyan. *Journal of Ethnobiology* 5:1-19.

Feb. 8 (Tu). Human Impacts on Animals: Exploitation and Impact on Invertebrates

The contribution of zooarchaeology. How did early humans exploit the invertebrate world (crustaceans, mollusks, etc.), and what impacts did they have on these animals?

Reading: Erlandson, J., T. Rick, and R. Vellanoweth, 2004. Human impacts on ancient environments: A case study from California's Northern Channel Islands. In S. M. Fitzpatrick, ed., *Voyages of Discovery: The Archaeology of Islands*, pp. 51-00. Westport: Praeger.

Feb. 10 (Th). Human Impacts on Vertebrates

The effects of hunting and fishing on vertebrate populations. Resource depression, extirpations, and extinctions.

Reading: Broughton JM. 1994. Late Holocene resource intensification in the Sacramento Valley, California. *Journal of Archaeological Science* 21:501-514.

Feb. 15 (Tu). The Debate over Megafaunal Extinctions: Prof. Tony Barnosky guest lecture

Prof. Barnosky is a leading researcher on the topic of megafaunal extinctions and will share his perspective with the class.

Reading: Martin PS, Steadman DW. 1999. Prehistoric extinctions on islands and continents. In *Extinctions in Near Time: Causes, Contexts, and Consequences*, MacPhee RDE, ed., pp. 17-55. New York: Kluwer Academic.

Koch, P. L. and A. Barnosky, 2006. Late Quaternary extinctions: State of the debate. *Annual Review of Ecology and Systematics* 37:215-250.

Feb. 17 (Th). In-Class Mid-Term Exam

Feb. 22 (Tu). How Humans Modify the Natural World Through Domestication of Plants and Animals

The domestication of plants and animals resulted not only in numerous genetic modifications to species ranging from corn to cattle, but also set the stage for agriculture and pastoralism.

Reading: Rollefson GO, Köhler-Rollefson I. 1992. Early Neolithic exploitation patterns in the Levant: Cultural impact on the environment. *Population and Environment: A Journal of Interdisciplinary Studies* 13:243-254.

Feb. 24 (Th). The Use of Fire in Ecosystem Management: A California Case Study: Prof. Kent Lightfoot guest lecture

Fire was one of the most important tools used by humans to modify and manipulate ecosystems. Prof. Lightfoot will describe his current research project investigating the use of fire by Native Californians.

Readings: Pyne SJ. 1998. Forged in fire: History, land, and anthropogenic fire. In *Advances in Historical Ecology*, Balée W, ed., pp. 64-103. New York: Columbia University Press.

Lentfer, C., C. Pavlides, and J. Specht, 2010. Natural and human impacts in a 35,000 year vegetation history in Central New Britain, Papua New Guinea. *Quaternary Science Reviews* 29:3750-3767.

Mar. 1 (Tu) The Role of Human Population: Paleodemography

How did human population grow and expand over the course of the Holocene? How do we reconstruct human population numbers? Theories of Malthus, Boserup, and others regarding controls on human population growth.

Reading: Hassan, F. A. *Demographic Archaeology*. Chapter 6. New York: Academic Press.

Mar. 3 (Th). Human Influence in the Ancient Amazon: The Black Earth Soils: guest lecture by Anna Browne

The vast Amazon basin is sometimes thought of as a “pristine” landscape unaltered by humans, yet there is considerable evidence that dense indigenous populations once inhabited the region. Anna Browne will share the results of her recent and on-going research in the Amazon.

Reading: Sandor JA. 1992. Long-term effects of prehistoric agriculture on soils: Examples from New Mexico and Peru. In *Soils in Archaeology: Landscape Evolution and Human Occupation*, Holliday VT, ed., pp. 217-245.

Mar. 8 (Tu). Agriculture and Intensification

The domestication of plants and invention of agriculture spurred population growth and led to the transformation of vast areas into agrarian, managed landscapes.

Reading: Butzer KW. 1996. Ecology in the long view: Settlement histories, agrosystemic strategies, and ecological performance. *J. Field Archaeology* 23:141-150.

Mar. 10 (Th). Island Models I: Mangaia and Mangareva

This is the first of three island case studies, looking at islands as “model systems.” Here I will compare human impacts on two mid-sized islands in Polynesia

Reading: Kirch PV. 1996. Late Holocene human-induced modifications to a central Polynesian island ecosystem. *Proceedings of the National Academy of Sciences, USA*, 93:5296-5300.

Mar. 15 (Tu). Island Models II: Tikopia

The second island case study examines Tikopia, a small island where a “sustainable” socio-natural system was developed over 3,000 years.

Reading: Kirch, P. V. 1986. Tikopia: Tracing the prehistory of a Polynesian culture. *Archaeology* (March-April), pp. 53-59.

Mar. 17 (Th). Island Models III: Hawai'i

The final island case study looks at Hawai'i, and the development of large-scale agro-ecosystems linked to the emergence of archaic states.

Reading: Vitousek PM, Ladefoged T, Hartshorn A, Kirch PV, Graves M, Hotchkiss S, Tuljapurkar S, Chadwick O. 2004. Soils, agriculture, and society in precontact Hawai'i. *Science* 304:1665-1669.

Mar. 21-Mar. 25 SPRING BREAK

Mar. 29 (Tu). In-Class Mid-Term Exam

Mar. 31 (Th). No class--Society for American Archaeology Meetings. Use free time to prepare for debate assignment.

Apr. 5 (Tu). DEBATE 1: Mesopotamia

Apr. 7 (Th). DEBATE 2: The Maya

Apr. 12 (Tu). DEBATE 3: The Southwest and the Anasazi

Apr. 14 (Th). DEBATE 4: Easter Island

Apr. 19 (Tu). DEBATE 5: Greenland

Apr. 21 (Th). DEBATE 6: The Inca

Apr. 26 (Tu). Final wrap up: In class discussion and synthesis of the debates.

Apr. 28 (Th). No class--American Philosophical Society meetings. Work on your research papers due Friday May 6.