

# Profit

*Environmental History*

Adrian Howkins, *The Polar Regions*

Paul R. Josephson, *Chicken*

Jon Mathieu, *The Alps*

# PROFIT

An Environmental History

Mark Stoll

polity

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## *How It Started*

### *An ecological odyssey*

As the 1968 movie *2001: A Space Odyssey* opens, humanity's ape-like ancestors three or four million years ago are struggling to survive. One day, unseen aliens place a large black monolith in their midst. Inspired by its mysterious powers, the hominins learn to use tools. They first wield weapons against prey and predators, ensuring their survival. Soon, however, they murderously turn them on their neighbors, driving them away from territory and resources. The monolith vanishes, but a second one lies buried on the moon, whose purpose is to send a beacon when humans have advanced enough to find it and expose it to the light of the sun. The surviving crewmember of a spaceship sent to follow the direction of the beacon discovers a huge third monolith orbiting Jupiter. This one is a Star Gate, which takes him across the galaxy to a distant planet. There, a fourth monolith transforms him to the Star Child. His evolution complete, he returns to earth to bring peace to warring nations.<sup>1</sup>

However much humanity could use a little benevolent extraterrestrial guidance these days, we unfortunately have found no alien monolith buried on the moon for uncounted eons to guide us out of a troubled present into a utopian future. On the other hand, in the decades since author Arthur C. Clarke and director Stanley Kubrick wrote the novel and screenplay, we have come to realize there was no need for aliens to have intervened in human history to set humanity on its present track. Observers have watched many ape, monkey, and bird species use tools. Archeologists discovered evidence that pre-*Homo* hominids also used stone tools and seem to have figured out tool-making on their own. (On the other hand, a utopian future still seems likely to require outside assistance.) Our ancient ancestors also, stone by stone, laid the foundation for the rise of early capitalism, changing the environment as they did so.

*In the beginning: economy and ecology*

When the earliest species of the genus *Homo* evolved about 2.6 million years ago, something happened almost as dramatic as a timely hint from benevolent aliens. Developments having no equal in earthly evolution set our ancestors on the long, meandering course that has led us to today's global consumer capitalism and global environmental crisis. The first steps were small but fateful. Superior powers of communication made possible greater cooperation. Our omnivorous ancestors now gathered and used resources for their survival more effectively. They passed accumulated cultural and technical knowledge to others and to future generations. Greater manual dexterity allowed them to improve the basic spears and stone tools of chimpanzees and *Australopithecus*. Talking and working together, hominins could now bring to the table animals as large or larger than they. Defending their kills against scavengers and thieves, they took their place among top predators. A meatier diet with considerably more protein made them larger and perhaps more intelligent.

Early humans also fatefully made the first energy transition and learned to get more out of available natural resources. They tamed a vital source of energy to supplement muscle power when they learned to liberate the heat energy stored in plants. Humans mastered fire possibly 1.9 million years ago, probably by 790,000 years ago, and certainly by 300,000–200,000 years ago. Fires burned undergrowth and made forests more open. Game species thrived, and with them, humans. For the first time in the history of life, a species deliberately refashioned whole ecological systems to support more of its kind from the same physical resources. Cooking food gave hominins access to a wider selection of food sources and, it has been suggested, allowed energy saved in digesting raw foods to feed the voracious energy appetite of larger brains.<sup>2</sup> Fire kept humans warm as climates cooled after they spread into temperate latitudes during warm interglacial periods.<sup>3</sup> Humans gave vent to creative impulses with fired clay figures at some early date, followed by pottery and, about 10,000 years ago in the early Holocene, by copper, all gifts of the stored energy of burning wood.

While the durability of stone implements lent the name “Stone Age” to the era, early humans developed all sorts of technology and simple machines. Bones made excellent material for such tools as awls and

needles. No doubt early humans used perishable body parts like sinews as well. About 70,000 years ago, cooling climates in once-warm latitudes into which hominins wandered inspired leather-working technology for clothes, bags, and other objects.<sup>4</sup> At some time before the onset of the Holocene about 11,700 years ago, humans developed bows and arrows, fishhooks, and throwing-sticks for hurling darts, spears, and harpoons. Seaworthy boats, probably built for fishing the ocean, carried people across fifty miles of open water to Australia 65,000 years ago.<sup>5</sup> People wove dyed fibers into textiles for stylish colorful clothes no later than 30,000 years ago.<sup>6</sup> Basket-weaving provided storage until fired clay pots offered all-purpose waterproof and vermin-proof containers as early as 20,000 years ago.<sup>7</sup>

So it was that the earliest human species developed technology and simple machines and harnessed stored energy—the tiny mustard seeds of the Industrial Revolution. Technology and energy are, however, not sufficient in themselves. The extraordinarily long infancy and childhood of humans gives time for teaching and training at a unique scale. Humans organized themselves to kill large prey, cook, and share food, perform ceremonies, and much more. They developed techniques to produce dangerous weapons, hunt, form pots, and kindle fires. Far beyond that, they also had techniques for binding wounds, treating illness, and using magic and ritual to attempt to control for human benefit the mysterious forces that rule the world.<sup>8</sup>

The environmentally destructive mining that brings us the components of our cell phones is an ancient practice writ large. Humans are a mining species. The nearest rock was likely not the best rock for human purposes. Early humans dug shallow open-pit mines to get to unweathered flint, which flaked better. Mining always leaves scars upon the land, a boon for archeologists. Evidence survives of a 1.3-million-year-old flint quarry in Morocco.<sup>9</sup> In Swaziland at least 43,000 and perhaps 80,000 years ago, miners extracted tons of specularite (a source of red ocher). By 35,000 years ago, people in Poland and Hungary had dug pits and sometimes subterranean mines for colored ores, while in Paleolithic Egypt, Australia, France, Spain, Belgium, Poland, and (later) in Texas, they dug up flint.<sup>10</sup>

Groups that controlled mines found themselves in economically valuable positions, direct ancestor of today's mining, manufacturing, and

trading enterprises. Archeologists have found obsidian and red ocher far from the nearest outcrop and inferred development of kinship, social, and trade networks.<sup>11</sup> Groups mined and manufactured tools and exchanged them for articles they did not have to hunt or make themselves, presumably at an advantage to themselves (the first profits). The market for red ocher represents the earliest known demand for consumer goods, which had no practical use. Scattered surviving evidence of beadwork, pigment from red ocher, and other artifacts suggests the development by 300,000 years ago of status markers, symbolic thought, and perhaps religion. By late prehistoric times, desirably distinctive stone spread along trade routes hundreds of miles from the mines it came from.<sup>12</sup>

When *Homo sapiens* first appeared, between 200,000 and 300,000 years ago, they prospered, went forth, and multiplied. Population grew very rapidly—it leaped tenfold in just the transition from *H. neanderthalensis* to *H. sapiens* in Europe around 40,000 years ago. In multiplying so rapidly, they repeatedly overdrew the fund of resources landscapes offered to foragers. Some of them would have to move elsewhere, pulled by greener pastures and pushed by stronger competitors. Between 120,000 and 90,000 years ago, wet and cool conditions enticed *sapiens* into the Levant and Arabia. When the climate dried 65,000 years ago, *Homo sapiens* rolled across the world in a global blitzkrieg.<sup>13</sup> They soon reached Australia. No later than 15,000 to 12,000 years ago humans stepped on American soil. No other vertebrate has managed to thrive in virtually every ecosystem from tropics to tundra (and now ventures up into space and down to the bottom of the sea).<sup>14</sup>

Whenever we might date the onset of the Anthropocene, *anthropos* changed environments and left a mark on the fossil record wherever they went. Escaped cooking fires and deliberately set fires announced the ability of this new-and-improved ape to alter ecosystems, sometimes radically.<sup>15</sup> No later than two million years ago, competition from these new top predators caused the rich diversity of large African predator species to decline for the first time.<sup>16</sup> Hominins also suppressed the diversity of African species of large mammals.<sup>17</sup> When *Homo sapiens* charged across the world's continents, they simplified (or, really, impoverished) ecosystems as they went. The Pleistocene had fostered an unusually abundant and diverse array of extremely large mammals on every ice-free continent: mammoths, giant ground sloths, saber-toothed cats, hippopotamus-sized

wombats (*Diprotodon*), and many more. Climate change exacerbated the stress animals were under, of course, but never had climate pressure alone selectively eliminated only large animals. But now, as humans arrived conversing, cooperating, making weapons, setting fires, and reproducing abundantly, megafauna went extinct everywhere.<sup>18</sup>

Hominins simplified ecosystems by removing species but also rearranged ecosystems by introducing alien species, a propensity that today has altered nearly every ecosystem on earth. Evidence in southeast Asia shows that prehistoric foragers translocated plants and animals far from their ordinary habitats. No later than 45,000 years ago, yams appeared on both sides of Wallace's Line dividing the flora and fauna of Asia and Australia. Humans translocated animals and plants as they migrated and surely also traded species as they exchanged information and goods with others. They seem also to have encouraged the growth of food trees near their settlements, possibly by planting nuts and seeds. Transplantation and cultivation long pre-dated the Agricultural Revolution in the Near East.<sup>19</sup>

At the same time, like the primitive hominins in 2001, humans also turned their aggressive capacity for communication and cooperation against competitors of their own genus. Practices that evolved into war and slavery began at a very early date. Several species of hominins had always coexisted at any time. Now, however, when *Homo sapiens* moved into the neighborhood, neither man nor beast was safe. Neanderthals, Denisovans, Floresians, and all other species of *Homo* died out when cousin *H. sapiens* arrived. The inclination for violence strengthened through time as numbers increased and weapons grew deadlier.<sup>20</sup> The slaughter of people on a huge variety of pretexts suggests the power of human tribalism and hostility to difference. Evidence from more recent times repeatedly shows that groups that controlled important resources attracted conflict with envious others, particularly during climate stress and other crises.

People very early in human history must have faced the question of what to do with captives. If the practices of pre-Columbian Americans are any guide, societies treated captives variously: adoption into the tribe, servitude including slavery, or death by torture or sacrifice. The recent discovery that small amounts of DNA from other species of *Homo* survive in our bodies suggests that bands of *Homo sapiens* likewise captured

vanquished foes and incorporated some of them into their groups, by either adoption or enslavement.<sup>21</sup>

By the end of the Ice Ages, a once meek denizen of field and forest had inherited the earth. *Homo* altered ecosystems and reduced diversity and body size of other species. By the time humans had crossed the oceans to Madagascar and the islands of the Pacific, transforming ecosystems and extinguishing species as they went, humanity, who were once merely bad neighbors, had become bad landlords. Just as importantly, humans had carried fundamental elements of modern capitalism—technology, machines, use of concentrated energy, efficient exploitation of resources, mining and manufacturing for use and consumption, trade, competition, conflict, domination, ecological disruption—to the ends of the inhabitable earth.

*Planting and herding: inventing capital and property*

Humans began to practice true pastoralism and agriculture with the onset of the Holocene. They now passed irrevocably through a gate that opened onto momentous changes in society, economics, and the planet. Agriculture created surpluses that led to towns and cities. Literacy and literature developed. Power and wealth accumulated. Trade increased. Towns and then empires warred with each other. Inequality and slavery grew dramatically. Both herding and farming radically simplified ecosystems for human benefit. Moreover, they altered the climate.

Why did *Homo sapiens* around the world wait until the Holocene to develop agriculture independently in many places? The earliest agriculture known to us were the yam fields of the tropical Borneo highlands 30,000 years ago. Grinding stones and hearths from Kebaran settlements 19,000 years ago on the shores of Lake Galilee, and from the bread-baking Natufian culture throughout the Levant between 14,000 and 11,000 years ago, attest to preparation of nuts and wild cereals that could not be consumed unprocessed.<sup>22</sup> These were notable exceptions. Perhaps climate instability during the late Pleistocene discouraged successful agriculture elsewhere. Conditions swung back and forth from warm to cold and wet to dry, often very suddenly. The onset of the Holocene inaugurated an unusually stable climate that apparently encouraged agriculture.

- the vital roles of communication and transportation in the history of capitalism.
- 8 Fernand Braudel proposed the idea of layers in *Civilization and Capitalism, 15th–18th Century*, vol. 1, *The Structures of Everyday Life: The Limits of the Possible*, trans. by Siân Reynolds (New York: Harper & Row, 1982), 23–26.
  - 9 Why industrial capitalism developed in the West and not elsewhere is a question famously raised by Kenneth Pomeranz in *The Great Divergence: China, Europe, and the Making of the Modern World Economy* (Princeton: Princeton University Press, 2000). Perhaps the most important factors were environmental. In England and nowhere else, waterpower sites, coal and iron deposits, water transportation, and harbors lay very near to each other and to suitable workers.
  - 10 Damian Carrington, “‘Extraordinary’ levels of pollutants found in 10km deep Mariana trench,” *Guardian* (London), February 13, 2017.

### 1 How It Started

- 1 Stanley Kubrick and Arthur C. Clarke, *2001: A Space Odyssey*, film (MGM, 1988); Arthur C. Clarke, *2001: A Space Odyssey* (New York: New American Library, 1968); Michael Benson, *Space Odyssey: Stanley Kubrick, Arthur C. Clarke, and the Making of a Masterpiece* (New York: Simon & Schuster, 2018). The opening scene is dated differently in the movie and the book.
- 2 Sabine Gaudzinski-Windheuser, et al., “Evidence for Close-Range Hunting by Last Interglacial Neanderthals,” *Nature Ecology and Evolution* 2 (July 2018): 1087–1092; Kwang Hyun Ko, “Origins of Human Intelligence: The Chain of Tool-Making and Brain Evolution,” *Anthropological Notebooks* 22(1) (2016): 5–22; Vaclav Smil, *Harvesting the Biosphere: What We Have Taken from Nature* (Cambridge, Mass.: MIT Press, 2013), 74.
- 3 Ian Gilligan, “The Prehistoric Development of Clothing: Archaeological Implications of a Thermal Model,” *Journal of Archaeological Method and Theory* 17(1) (2010): 38–39.
- 4 Ibid., 15–80; Ralf Kittler, Manfred Kayser, and Mark Stoneking, “Molecular Evolution of *Pediculus humanus* and the Origin of Clothing,” *Current Biology* 13 (August 19, 2003): 1414–1417.
- 5 Chris Clarkson, et al., “Human Occupation of Northern Australia by 65,000 Years Ago,” *Nature* 547 (7663) (2017): 306–310; Curtis W. Marean, “Archaeology: Early Signs of Human Presence in Australia,” *Nature* 547 (7663) (2017): 285–287.
- 6 Eliso Kvavadze, et al., “30,000-Year-Old Wild Flax Fibers,” *Science* 325 (5946) (September 11, 2009): 1359.
- 7 Xiaohong Wu, et al., “Early Pottery at 20,000 Years Ago in Xianrendong Cave, China,” *Science* 336(6089) (June 29, 2012): 1696–1700.



- 8 See Jacques Ellul, *The Technological Society* (New York: Vintage Books, 1964), 24–27.
- 9 Rosalia Gallotti, et al., “First High Resolution Chronostratigraphy for the Early North African Acheulean at Casablanca (Morocco).” *Scientific Reports* 11(1) (2021), <https://www.proquest.com/scholarly-journals/first-high-resolution-chronostratigraphy-early/docview/2555779192/se-2>.
- 10 Robert G. Bednarik, “Early Subterranean Chert Mining,” *The Artefact* 15 (1992): 11–24. Observers in 1834 saw native Tasmanians mine for ocher using hammer stones and pointed sticks; the miners were women (15).
- 11 Alison S. Brooks, John E. Yellen, Richard Potts, et al., “Long-Distance Stone Transport and Pigment Use in the Earliest Middle Stone Age,” *Science* 360 (April 2018): 90–94. The inference is based on knowledge that in agricultural societies, and by implication long before, trade formed part of complex intergroup interactions which involved status, power, and politics.
- 12 Jack Goody, *Metals, Culture and Capitalism: An Essay on the Origins of the Modern World* (Cambridge: Cambridge University Press, 2012), 5; Tammy Hodgskiss, “Identifying Grinding, Scoring and Rubbing Use-Wear on Experimental Ochre Pieces,” *Journal of Archaeological Science* 37(12) (December 2010): 3344–3358. See also Susan C. Vehik, “Conflict, Trade, and Political Development on the Southern Plains,” *American Antiquity* 67(1) (2002): 37–64.
- 13 Jessica E. Tierney, Peter B. deMenocal, and Paul D. Zander, “A Climatic Context for the Out-of-Africa Migration,” *Geology* 45(11) (2017): 1023–1026. The authors note that the supposed Toba bottleneck around 75,000 years ago remains in dispute (p. 1023; cp. Smil, *Harvesting the Biosphere*, 67).
- 14 For a detailed history of the influence of climate change on prehistoric peoples, see William James Burroughs, *Climate Change in Prehistory: The End of the Reign of Chaos* (Cambridge: Cambridge University Press, 2005).
- 15 Smil, *Harvesting the Biosphere*, 74.
- 16 Lars Werdelin and Margaret E. Lewis, “Temporal Change in Functional Richness and Evenness in the Eastern African Plio-Pleistocene Carnivoran Guild,” *PLoS ONE* 8(3) (2013): e57944.
- 17 Felisa A. Smith, Rosemary E. Elliott Smith, S. Kathleen Lyons, and Jonathan L. Payne, “Body Size Downgrading of Mammals Over the Late Quaternary,” *Science* 20 (April 2018): 311.
- 18 Smith, et al., “Body Size Downgrading,” 310.
- 19 Patrick Roberts, Chris Hunt, Manuel Arroyo-Kalin, Damian Evans, and Nicole Boivin, “The Deep Human Prehistory of Global Tropical Forests and Its Relevance for Modern Conservation,” *Nature Plants* 3 (2017): 17093.
- 20 See Richard B. Lee, “Hunter-Gatherers and Human Evolution: New Light on

- Old Debates,” *Annual Review of Anthropology* 47(1) (2018): 513–531, on reasons for increasing incidence of deadly conflict over time.
- 21 See Raymond C. Kelly, “The Evolution of Lethal Intergroup Violence,” *Proceedings of the National Academy of Sciences of the United States of America* 102(43) (2005): 15294–15298; Richard W. Wrangham, “Two Types of Aggression in Human Evolution,” *Proceedings of the National Academy of Sciences* 115(2) (January 2018): 245–253; and Leland Donald, “Slavery in Indigenous North America,” and Neil L. Whitehead, “Indigenous Slavery in South America, 1492–1820,” in David Eltis and Stanley L. Engerman, *The Cambridge World History of Slavery*, vol. 3, *AD 1420–AD 1804* (Cambridge: Cambridge University Press, 2011), 217–271.
- 22 Graeme Barker, *The Agricultural Revolution in Prehistory: Why Did Foragers Become Farmers?* (Oxford: Oxford University Press, 2006), 109–128. Barker thoroughly examines and judiciously evaluates all available evidence. Amaia Arranz-Otaegui, Lara Gonzalez Carretero, Monica N. Ramsey, Dorian Q. Fuller, and Tobias Richter, “Archaeobotanical Evidence Reveals the Origins of Bread 14,400 Years Ago in Northeastern Jordan,” *Proceedings of the National Academy of Sciences* 115(31) (2018): 7925–7930.
- 23 In Central Europe, for example, Mesolithic hunter-gatherers apparently contentedly lived alongside Neolithic farmers for 2000 years. Ruth Bollongino, et al., “2000 Years of Parallel Societies in Stone Age Central Europe,” *Science* 342(6157) (2013): 479–481.
- 24 Alfred W. Crosby, *Ecological Imperialism: The Biological Expansion of Europe* (New York: Cambridge University Press, 1986), 177.
- 25 Ruth Bollongino, et al., “Modern Taurine Cattle Descended from Small Number of Near-Eastern Founders,” *Molecular Biology and Evolution* 29(9) (September 1, 2012): 2101–2104; Jared E. Decker, et al., “Worldwide Patterns of Ancestry, Divergence, and Admixture in Domesticated Cattle,” *PLoS Genetics* 10(3) (2014): e1004254.
- 26 Barker, *The Agricultural Revolution in Prehistory*, 384–386.
- 27 R. J. Fuller, and Lu Aye, “Human and Animal Power—The Forgotten Renewables,” *Renewable Energy* 48 (2012): 326–332.
- 28 Maria Ivanova, “The ‘Green Revolution’ in Prehistory: Late Neolithic Agricultural Innovations as a Technological System,” in *Appropriating Innovations: Entangled Knowledge in Eurasia, 5000–1500 BCE*, ed. by Joseph Maran and Philipp Stockhammer (Oxford: Oxbow Books, 2017), 40–49.
- 29 Jared Diamond, *Guns, Germs, and Steel: The Fates of Human Societies* (New York: Norton, 1999), 176–191. See also Crosby, *Ecological Imperialism*, 18.
- 30 Melinda A. Zeder, “Domestication and Early Agriculture in the Mediterranean