

Birth rate, competition are major players in hominid extinctions

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Modern human mothers are probably happy that they typically have one, maybe two babies at a time, but for early hominids, low birth numbers combined with competition often spelled extinction.

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Primates evolved in the Paleocene and Eocene when worldwide climate was less seasonal. The beneficial environment allowed primates to evolve as relatively brainy animals that reproduce slowly. However, when climate changed so that tropical forests shrunk and the environment became patchy, many species including primate species became extinct.

"While past primate populations moved with the forest, early hominid cultures 2.5 million years ago show signs of the ability to live in marginal areas and live on more dynamic, seasonal landscapes," Jablonski told attendees today (Feb. 16) at the annual meeting of the American Association for the Advancement of Science in San Francisco.

Through time, the human lineage evolved to fill a wide variety of ecological niches, but those species that filled narrow environments, were less able to withstand the effects of climate change. *Paranthropus boisei*, a Pleistocene hominid, thrived around 2.5 million years ago, but disappears from the fossil record a million years ago. *Paranthropus boisei* became extinct when it was unable to compete with other mammals.

A specialized feeder, *Paranthropus boisei* dined on hard objects like seeds, tubers and bones. While it had a variety of food sources, they all required the crunching, grinding force of its teeth. Unfortunately, bush pigs and hyenas had great grinding and crushing teeth, too, and went after the same food. *Paranthropus* could not compete because it produced one offspring a year at most, while the others had large litters and could increase their populations at a much faster rate. *Paranthropus* simply could not compete reproductively and could not alter its choice of food.

"We find that the early members of the genus Homo who succeeded were super ecological opportunists," says Jablonski. "They would eat vegetation and scavenge, kill small animals and forage." Cultural adaptations helped these opportunists to take advantage of whatever food was available. But culture did not seem to help the Neandertal. Tremendously successful from about 200 to 50 thousand years ago, they suffered a gradual decrease and extinction from about 30 to 26 thousand years ago.

"Neandertal was extremely adept culturally," says Jablonski. "They had big brains, a wide variety of tools and were extremely successful as active, aggressive hunters of large game. We see evidence of hunting, kill sites, butchery and even herding off cliffs. We find thrusting spears and butchering knives." The Neandertal encountered increasing environmental seasonality with longer cold seasons and shorter periods of warm weather. Leading up to and during the last glacial maximum about 18,000 years ago, the grassy plains disappeared, taking with them the animals that relied on large expanses of grass for grazing. These animals were the prime food source for Neandertal.

At the same time, modern Homo sapiens experienced the same reduction in large animal game, but switched to also fishing, snaring small mammals like rabbits and capturing turtles and birds.

"Rather than being a specialized large mammal predator, modern humans would eat anything they could get their hands on. They eked out a living even if it meant eating grasshoppers or whatever," says Jablonski. "Even with this, modern humans barely hung on from 12 to 16,000 years ago.

"Why did Neandertal not adapt culturally?" she asks. "Why did they not start eating bunnies? They did begin fishing." Jablonski believes that competition from modern humans was already too strong. The environment was marginal and modern humans were already foraging and small-animal collecting. "I think they were out-competed at the very end," says Jablonski. "Modern humans simply did it better, more nimbly."

She adds that modern humans may have had storage capabilities that Neandertal did not. There is evidence that modern humans did have the capacity to store food and water in the late Pleistocene. No evidence exists that Neandertal could store either.

Both Neandertal and modern humans suffered from the primate curses of single births widely spaced. For Neandertal, cultural adaptation was not sufficient to overcome and compete with modern humans, just as *Paranthropus boisei* could not compete with the likes of bush pigs and hyenas. "Can we, today, control our cultural behavior to ensure our environmental success," says Jablonski. "Can we control growth and population density, or come up with new technology to overcome the problems we will face from the global climate change we have created?"

"We clearly have the cultural ability to do either," says the Penn State researcher. "But both require forethought and planning to face the demographic and climate change. A degree of honesty, our species is not known for."