Humans are not off the hook for extinctions of large herbivores – then or now

8 April 2019, by René Bobe And Susana Carvalho

Hippos at Gorongosa National Park. Credit: Brett Kuxhausen, Author provided, Author provided

What triggered the decline and eventual extinction of many megaherbivores, the giant plant-eating mammals that roamed the Earth millions of years ago, has long been a mystery. These animals, which weighed 1,000kg or more and included the ancient relatives of modern elephants, rhinos, hippos and giraffes, reached a peak of diversity in Africa some 4.5m years ago during the Pliocene epoch (between 5.3m and 2.6m years ago). After this, their numbers slowly declined, in a trend that continued into the Pleistocene (2.6m years ago to roughly 11,000 years ago).

Both the Earth's climate and hominins – our early human ancestors – have in the past been blamed for this change. However, a recent paper argued that the gradual extinction of megaherbivores occurred because of long-term environmental changes and that developments in hominin behaviour – such as wielding tools and using fire – did not impact megaherbivore decline.

While this seems to be true of the early decline in megaherbivore population, we argue that our ancient human ancestors may well still have contributed to more recent megaherbivore extinctions. What's more, we're repeating the pattern today.

Ancient hominins in a land of giants

The genus *Australopithecus* is among the best known hominins from the Pliocene. Dating as far back as 4.2m years, they shared food and water-rich woodland and grassland environments with a dozen species of large herbivores, including three giraffids, two hippos, two species of rhinoceros and five species of proboscideans – a trunked and tusked group of animals that includes modern elephants and extinct mammoths and mastodons.

Kanapoi, Kenya, where 4.2m year old Australopithecus was found. Credit: René Bobe, Author provided, Author provided

Australopithecus were omnivorous – but there is no evidence that they hunted large mammals. In fact, its likely that megaherbivores played a beneficial ecological role for these early hominins. Thousands of years of grazing and migration gradually opened up wooded environments, which created the perfect blend of woodland and grassland in which early

hominins thrived. In these Pliocene landscapes, our ancestors and the ancestors of modern elephants, rhinos, giraffes and hippos coexisted in relative harmony.

Gorongosa National Park. Credit: Brett Kuxhausen, Author provided, Author provided

However, major climatic and environmental changes were to separate the fates of hominins and megaherbivores. Starting in the late Miocene epoch (the period just before the Pliocene), and continuing into the Pliocene and subsequent Pleistocene, ocean waters started cooling, atmospheric CO_2 started decreasing and, in eastern Africa, grasslands began expanding, reducing woodland cover. There is also evidence of increasingly frequent fires.

Early hominins such as *Australopithecus*, comfortable in both grassland and woodland environments, were well-adapted to these changing climatic and environmental conditions, as shown by their rich fossil record at several sites in Africa. However, megaherbivore species that were only comfortable in wooded environments struggled to survive.

Changing behaviour of hominins

By the time more sophisticated hominins such as *Homo erectus* emerged 1.8m years ago, megaherbivores had already been in decline for more than two million years, according to the recent study's authors. But that doesn't mean that *Homo erectus* didn't hammer the final nails into the collective megaherbivore coffin. We believe that current archaeological records are too poor to document the effects that hominin behavioural innovations such as tool use had on large mammal extinctions in the Pleistocene period.

For example, we don't know how the early use of fire – likely as much as 1.5m years ago – influenced landscapes and foraging patterns of large herbivores. There is also no clear indication as to when hominins started hunting large herbivores. Could they have hunted large mammals during droughts, as some carnivores do today? We believe that the question of what role hominins such as *Homo erectus* had in the decline of megaherbivores remains open, despite the recent study's findings.

As we approach more recent periods of Earth history, there's strong evidence that our species, *Homo sapiens*, played a major role in the wave of global megaherbivore extinctions that occurred toward the end of the Pleistocene era, between about 50,000 and 10,000 years ago. By this time, hominins were expanding over much of the globe and had become sophisticated hunters of large animals. It was during this period that species of mastodons, woolly rhinos and giant ground sloths, among many others, were finally wiped out.

A new wave of extinction

Of course, in modern times, humans are responsible for causing such profound biodiversity losses that we may be undergoing a "sixth mass extinction", a calamity comparable to the worst biodiversity crises in Earth's long history of 4.5 billion years. The current evidence shows that

human encroachment and hunting are collapsing the natural environments of large herbivores such as elephants, rhinos, giraffes and hippos, sending their populations spiralling into decline.

But in the sea of bad news of ongoing extinctions and habitat degradation, there are some islands of hope that all is not lost. At the southern end of East Africa's Great Rift Valley, Gorongosa National Park in Mozambique is witnessing a renaissance of biodiversity, with populations of elephants, hippos and other mammals actually increasing. Gorongosa shows us that with long-term planning and collaboration with local populations it is not too late to allow degraded ecosystems to recover and that – if given the opportunity – nature has an astonishing capacity for resilience.

Understanding the current biodiversity crisis from the perspective of deep time may help guide our efforts to conserve and restore the ecosystems we need for our own survival. Modern species of elephants, hippopotamuses, giraffes and rhinoceroses are survivors from the deep past. Elephantids appeared in the fossil record of eastern Africa at about the same time as the first hominins and probably helped to shape the landscapes where our hominin ancestors thrived. It is paradoxical that the single surviving hominin species is now driving modern-day megaherbivores, along with many other forms of life, to extinction. We do so at our peril.

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