

# Why do elephants and tigers still roam in India? Study offers clues

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Tropical Asia and Africa are the only regions on Earth that retain diverse populations of large, land-dwelling mammals, such as elephants, rhinos, and big cats. A new study co-authored by Yale researcher Advait M.

Jukar suggests that the persistence of mammalian megafauna in the Indian Subcontinent is related to the great beasts' long coexistence there with homo sapiens and other human ancestors.

The study, published in the journal *Palaeogeography, Palaeoclimatology, Palaeoecology*—and based on a novel dataset drawn from 51 fossil sites in present-day India—documents a low-magnitude [extinction](#) that began about 30,000 years ago. That was about 30,000 years after [modern humans](#) arrived in the Indian Subcontinent.

The analysis provides the first direct and independent test of the "co-evolution hypothesis," a commonly held theory that the magnitude of an extinction correlates with the amount of time that large mammals coexist with humans and their hominin ancestors, the researchers said.

"During the past 100,000 years, people have been implicated in the extinction of large, land-dwelling mammals all over the world, but Indian megafauna proved more resilient and, as in Africa, have co-existed with humans for much longer periods than in other regions," said Jukar, a Gaylord Donnelly Postdoctoral Associate at the Yale Institute for Biospheric Studies and the study's lead author. "Our work supports the idea that some large species co-evolved with [human ancestors](#), adapting to their presence and developing behaviors that helped them cope with how they altered the habitat."

Jukar co-authored the study with S. Kathleen Lyons and Peter J. Wagner of the University of Nebraska-Lincoln, and Mark D. Uhen of George Mason University.

Not all large mammals on the Indian Subcontinent survived, of course. The researchers document the extinctions of *Palaeoloxodon namadicus* and *Stegodon namadicus*, two species of elephant; *Hexaprotodon* sp., a hippopotamus; and *Equus namadicus*, a zebra-like horse. They also show

the extirpation, or local extinction, of ostriches, which survive elsewhere, and the "pseudo-extinction" of the Indian aurochs—the wild ancestor of the domestic zebu cattle that thrive in India today. The four extinctions represent about 4% of mainland India's mammalian fauna and 20% of its mammalian megafauna, animals weighing more than 50 kilograms, or 110 pounds. Human activity combined with the species' limited ranges and slow reproduction rates contributed to these extinctions, Jukar said

The extinction rate in India over the past 50,000 years is comparable to that of eastern and southern Africa, but 2.5 times smaller than in South America and 4 times smaller than in North America, Europe, Madagascar, and Australia, according to the study. The researchers noted that India's extinction pattern is strikingly similar to that of Africa, where humans first evolved, lending support to the co-evolution hypothesis. (The first hominins— a group that includes modern humans and all our immediate ancestors—arrived in India about 1.7 to 1.5 million years ago.) The researchers conclude that, as in Africa, land-dwelling megafauna provided remarkably resilient to human pressures. They found that the presence of other hominins had little to no impact on the Indian Subcontinent's animal life and posit that early humans may have preferred to hunt smaller prey, such as primates or rodents, to megafauna.

The researchers also analyzed the role of contemporary climate change trends—including temperature fluctuations and varying monsoon intensity—on the extinction pattern. While changes in climate may have elevated the extinction risk for species that were dependent on annual water sources, such as *Hexaprotodon* sp., the researchers found that climate change alone does not explain the low-magnitude but strongly size-biased extinction that they documented. The researchers noted that all of the extinct species they identified had survived periods of drought.

The researchers also note that Asian elephants, tigers, and other large

mammals in India had extensive ranges extending from Turkey to Southeast Asia, which improved their chances of survival. The extinct species' ranges, however, were limited to the Indian Subcontinent, the researchers explain. They note that some species, including the Asian elephant, are known to inhabit refugia—areas that offer protection during drought and other periods when conditions become unfavorable.

The fact that India's [large mammals](#) have proven resilient to the presence of humans is no excuse to become lax about conservation, Jukar cautioned.

"Today's mammals are facing many of the same pressures that these extinct mammals faced, but they are confined to smaller and smaller ranges," he said. "Climate change and the human activities that caused the extinctions we've documented are now accelerating at unprecedented rates. If we ignore these factors, we will lose the elephants, rhinos, and tigers that have survived."

**More information:** A.M. Jukar et al, Late Quaternary extinctions in the Indian Subcontinent, *Palaeogeography, Palaeoclimatology, Palaeoecology* (2020). [DOI: 10.1016/j.palaeo.2020.110137](https://doi.org/10.1016/j.palaeo.2020.110137)

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