

Weather forecasts for the past

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Analysis of mammal teeth can reveal local environmental conditions. A new study employs data collected from Kenyan national parks over the past 60 years, combined with traits of the teeth of herbivorous mammals. The results were recently published in the journal *PNAS*.

In the new study, the annual rainfall and average temperatures in the national park were inferred from the teeth of herbivorous mammals. Such reverse engineering opens up new opportunities for interpreting fossil records.

Dental features reveal past weather

What is interesting about this research is that it shows that features in animal teeth are particularly good at detecting where the weather has been unfavourable for the species in question. Such weather conditions include long dry periods, heavy rains or exceptionally low temperatures—anything that could result in the animal's primary food source becoming unavailable, forcing the animals to turn to less preferred plants to survive.

The researchers were particularly interested in why animals were absent from a particular geographical area.

"African national parks frequently endure poor years, which seem to prevent the establishment of permanent populations of certain animals. Animals live where the conditions allow them to live and reproduce over the span of decades or centuries," says Mikael Fortelius, professor of

evolutionary palaeontology at the University of Helsinki.

This study was not about where elks or zebras live or what they eat, nor about what their teeth are like. All of this information can be found in previous research.

Mikael Fortelius has discovered how dental traits are connected to the environment. For example, how efficiently the tooth cuts, how well it can withstand wear or whether it can crush hard, woody plants. These characteristics can tell us which conditions specific animals need to survive.

Recent data from Kenyan national parks

Exact data on the number and geographical spread of the animals in Kenya's national parks have been collected over the course of the past 60 years.

The data used for the modelling in this study include:

- 1. the mammals in Kenya's 13 national parks,
- 2. dental traits, and
- 3. rainfall, temperature and the amount of vegetation.

"We calculated the average dental traits for each area and modelled them in relation to environmental factors. The model's generalisability was tested, and the predictability of individual environmental factors was compared," explains researcher Indr? ?liobait?, who was responsible for the modelling.

More information: Herbivore teeth predict climatic limits in Kenyan ecosystems, *PNAS*, www.pnas.org/cgi/doi/10.1073/pnas.1609409113

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