

Top predators could 'trap' themselves trying to adapt to climate change, study shows

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African wild dog pups. Credit: Bobby-Jo Vial

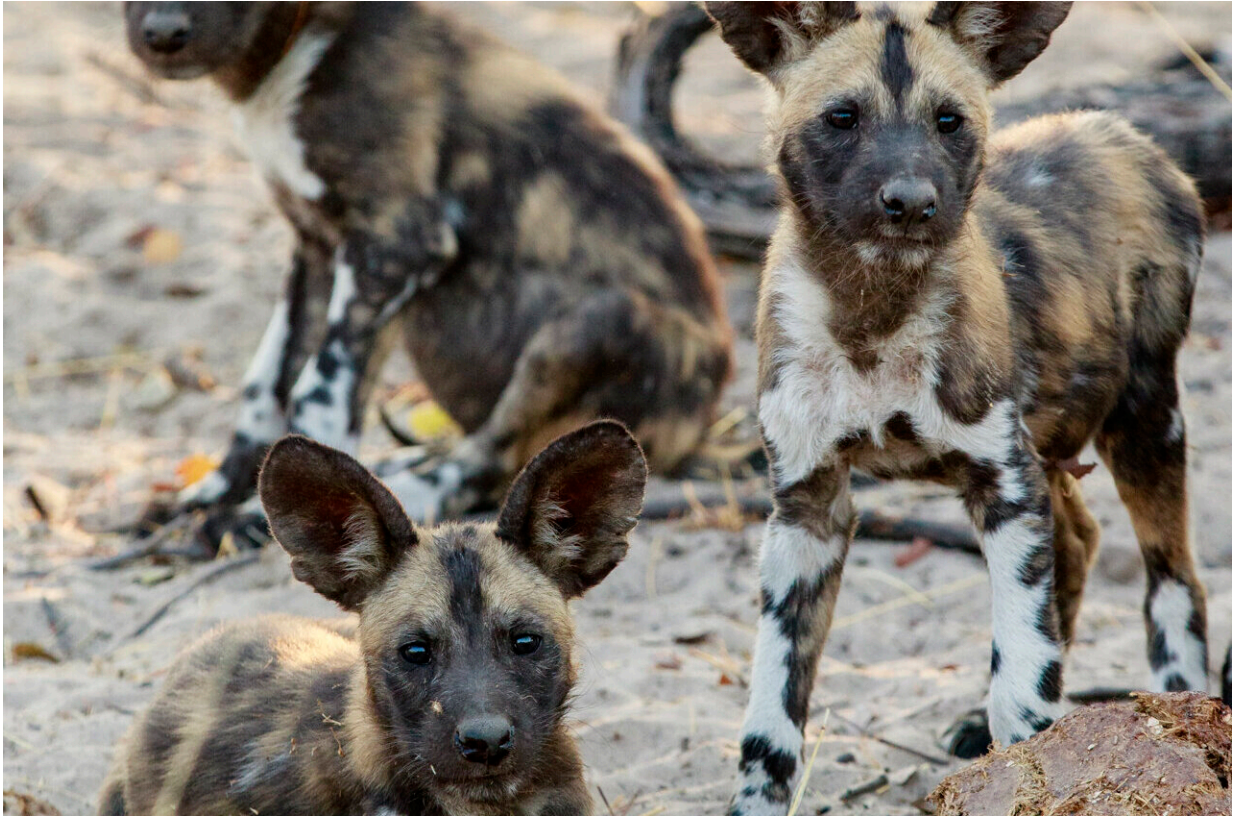
As climate change alters environments across the globe, scientists have discovered that in response, many species are shifting the timing of major life events, such as reproduction. With an earlier spring thaw, for

example, some flowers [bloom sooner](#). But scientists don't know whether making these significant changes in life history will ultimately help a species survive or lead to bigger problems.

A study published the week of June 27 in the *Proceedings of the National Academy of Sciences* shows for the first time that a [species](#) of large carnivore has made a major change to its [life history](#) in response to a changing climate—and may be worse off for it.

A team led by researchers at the University of Washington, in collaboration with Botswana Predator Conservation, a local NGO, analyzed field observations and [demographic data](#) from 1989 to 2020 for populations of the African wild dog—*Lycaon pictus*. They discovered that, over a 30-year period, the animals shifted their average birthing dates later by 22 days, an adaptation that allowed them to match the birth of new litters with the coolest temperatures in early winter. But as a result of this significant shift, fewer pups survived their most vulnerable period because temperatures during their critical post-birth "denning period" increased over the same time period, threatening the population of this already endangered species.

This study shows that African wild dogs, which are distantly related to wolves and raise young cooperatively in packs, may be caught in a "phenological trap," according to lead author Briana Abrahms, a UW assistant professor of biology and researcher with the Center for Ecosystem Sentinels. In a phenological trap, a species changes the timing of a major life event in response to an environmental cue—but, that shift proves maladaptive due to unprecedented environmental conditions like [climate change](#).



African wild dog pups. Credit: Bobby-Jo Vial

"It is an unfortunate 'out of the frying pan, into the fire' situation," said Abrahms. "African wild dogs shifted birthing dates later in order to keep pace with optimal cool temperatures, but this led to hotter temperatures during the denning period once those pups were born, which ultimately lowered survival."

The study demonstrates that species on high "trophic levels" in ecosystems—like [large predators](#)—can be just as sensitive to climate change as other species, something that scientists were uncertain about. Other research has shown that long-term warming can trigger phenological shifts, or shifts in the timing of major life events, in "primary producer" species like plants and "primary consumers" that

feed on plants, including many birds and insects. But, until now, scientists had never documented a climate-driven phenological shift in a large mammalian carnivore. Abrahms and her colleagues show that large predators can indeed exhibit strong responses to long-term climate change, even though predators are "farther removed" up the food chain.

For this study, the team analyzed more than three decades of data that they and collaborators collected on 60 packs of African wild dogs that live across a more than 1,000 square-mile region of northern Botswana. This species breeds annually each winter. After birth, pups spend about 3 months with their mother at the den before beginning to travel and hunt with the pack.



An African wild dog mother and pup. Credit: Bobby-Jo Vial

Abrahms and her colleagues analyzed the dates that African wild dog mothers gave birth to their litters each year, which is how they determined that adults gradually delayed breeding by about one week per decade over the 30-year study period.

"Although most animal species are advancing their life history events earlier in the year with climate change, this finding represents a rare instance of a species delaying its life history, and at a rate twice as high as the average rate of change observed across animal species", said Jeremy Cohen, a researcher at Yale University and the Center for Biodiversity and Global Change, who was not involved in the study.

Such a large shift is likely due to the rapid pace of warming in the region, and because African wild dogs have evolved to breed within a narrow "thermal window," according to Abrahms



An African wild dog mother and pups. Credit: Krystyna Golabek

The team used long-term demographic data to calculate how many pups survived the denning period each year. They discovered a correlation between temperatures during the denning period and survival: Warmer denning periods led to fewer pups recruiting to packs at the end of winter, which indicated that fewer pups survived the denning period.

Average daily maximum temperatures in the study [period](#) rose by about 1.6 degrees Celsius, or 2.9 degrees Fahrenheit, over 30 years. Over the same time frame, annual maximum temperatures spiked by 3.8 degrees Celsius—just over 6 degrees Fahrenheit.

The team could not have come to its unexpected conclusions without those decades of detailed field observations led by Botswana Predator Conservation, Abrahms said.

"We could only conduct this study because of the existence of this unique, long-term dataset for a large predator, which is really rare," said Abrahms. "It shows the value for this kind of data in studying how climate change will impact ecosystems."



An African wild dog mother and pups. Credit: Briana Abrahms



African wild dog pups. Credit: Krystyna Golabek

The study area in northern Botswana is part of the largest continuous habitat for African wild dogs, which are threatened by habitat fragmentation and loss, disease and conflicts with people. The International Union for Conservation of Nature [estimates](#) that there are only about 1,400 mature adults left in the wild.

"Large predators play extraordinarily important roles in ecosystems, but we still have a lot to learn about the implications of climate change for these animals," said Abrahms. "Big climate-driven shifts like the one we found may be more widespread in top predators than originally thought, so we hope our findings will spur new climate-change research on other

predator populations around the planet."



A pack of African wild dogs in Kruger National Park, South Africa. Credit: Bart Swanson

Co-authors on the study are Kasim Rafiq, a UW postdoctoral researcher in biology; Neil Jordan with the University of New South Wales; and J.W. McNutt with Botswana Predator Conservation.

More information: Long-term, climate-driven phenological shift in a tropical large carnivore, *Proceedings of the National Academy of Sciences* (2022). [DOI: 10.1073/pnas.2121667119](https://doi.org/10.1073/pnas.2121667119).

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