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Data on human and wildlife movement during the pandemic suggest new ways for us to coexist

For thousands of years, humans have shaped the world around us, leaving other animals to adapt to the activities of the industrious ape. But new research shows how animals also respond directly to our physical presence.

Scientists at UC Santa Barbara, the Smithsonian's National Zoo and Conservation Biology Institute and Yale University analyzed GPS tracking data from 37 animal species, paired with cellphone location data from across the United States. The study, published in Science, revealed that animals' responses to human presence vary widely from species to species and how modified the habitat is, suggesting that more nuanced approaches to wildlife management and animal conservation may be possible.

"Humans have complicated effects on wildlife — from our physical presence to how we reshape habitats — but we can't understand our full impact without information on both," said co-lead author Ruth Oliver, an assistant professor in UCSB's Bren School of Environmental Science & Management.

When COVID-19 lockdown policies went into effect, they changed the way humans moved around. This gave the research team a rare opportunity to separate the

effects that landscape modification, versus human presence, have on animal movements. During the same period in 2019 and 2020, the team analyzed GPS data from 4,581 individual mammals and birds across the continental U.S. on a weekly basis. But to measure the presence of humans, the team needed a more precise method than what is typically available.

Publicly accessible data on human movements and location is hard to come by. As a result, scientists studying human–animal interactions typically examine proxies for human presence such as urbanization, agriculture and, in the context of the COVID-19 pandemic, lockdown status. Yet these proxies do not offer a precise account of human movement itself. So, the research team used anonymized geolocation data from people's cell phones at a neighborhood-level resolution. This is the first study to use this to investigate the effects of human presence on animal movement.

"The cell phone data we used was made available to researchers during the pandemic to help reveal the impacts of COVID-19 shutdowns," said co-lead author Scott Yanco, a research ecologist at the Smithsonian's National Zoo. "Typically, private companies hold onto these, which made this a rare opportunity for us to quantify how human presence impacts wildlife, and to demonstrate that there is more to consider than just land modification to create robust conservation plans."

Entangled effects

The team studied human impacts on the physical area covered by each individual animal and each individual animal's environmental niche, a concept that describes how an animal interacts with habitats and resources. The team found that, for most species, the effect humans have on wildlife cannot be understood without considering our presence as well.

The paper revealed that 57% of the species studied were impacted by human presence and landscape modification. For 67% of the mammal species and 68% of the bird species, human presence correlated with changes in the extent of the area they occupied or the size of their environmental niche.

For many species, the degree to which one variable — landscape modification or human presence — affected an animal interacted with the effect of the other. About 67% of mammal species and 41% of bird species responded to landscape modification and human presence by shrinking their habitat, with the greatest

sensitivity to human presence in landscapes that were less modified, such as a national park versus a city.

Reactions varied widely between species. Unlike other animals in the study, wolves responded to humans by expanding their habitats, possibly due to their fraught history with us and a desire to spread out and away from human activity. White-tailed deer, meanwhile, expanded their niches as landscape modification increased but shrank them as human presence increased; sandhill cranes showed the opposite response.

“These findings highlight the critical importance of species-based conservation,” Oliver said. “Every species has different habitat requirements, has its own particular behavioral tendencies and faces unique threats. Effective conservation requires that we understand the particular challenges that each species faces.”

This study is a part of the COVID-19 Bio-Logging Initiative, which brought together researchers from around the world to investigate how wildlife responded to the pandemic lockdowns, a period they termed the “anthropause.” Previous work by this initiative has revealed widespread behavioral changes in mammals globally, dramatic shifts in marine traffic patterns and the importance of measuring human movements in understanding wildlife responses to the Anthropocene (the time period when human activities have had an environmental impact on the Earth). Collaboration between 600 different partners brought together 1 billion location fixes from around 13,000 animals to investigate how humans affect wildlife.

The findings from this study highlight how GPS data from the initiative and from mobile devices can enable more nuanced and targeted approaches towards conserving wildlife. The data enable researchers to distinguish the interactions between human infrastructure and individual species from the effect of our physical presence on the animals in question.

Oliver’s group is now looking into how anthropogenic changes to landscapes and the climate affect wildlife mortality. “Our current study shows that animals change how they use space and resources, but we don't know if these changes are helping them adapt or are a sign of stress,” she pointed out. “Our group is now digging into that question by asking whether animals that change their behavior in response to

human pressures are at greater or lower risk of dying."

The pandemic provided an opportunity to study human impacts in a way that hadn't been possible before, which means conservation policies never had the benefit of these insights on human–animal interaction. "Our results give me some optimism that we can achieve wildlife-coexistence through more nuanced policies that more smartly consider where and when we need to give animals space," Oliver said.

This story was written in collaboration with Ben Marcus at the Smithsonian. Read their release here.

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About UC Santa Barbara

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