

Humans get in the way of mammal movement

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Mammals as these bears on a street in Poland tend to move much less in areas that are characterised by humans than in wilderness. Credit: Adam Wajrak

Humans modify natural landscapes in a variety of ways, from

constructing expansive cityscapes to fencing off otherwise untouched rangeland. A new study, co-authored by biologists at the University of Maryland, describes the extent to which highly modified landscapes impede the movement of 57 land-based mammal species from around the world. On average, these mammals cover about a third to half of the distance they would otherwise travel in wild, unmodified landscapes.

An international team of more than 100 co-authors published its findings in the January 26, 2018 issue of the journal *Science*. While many previous studies have examined individual species at local and regional scales, the new work is the first to integrate many species across the globe in a single analysis. According to the researchers, their findings could have far-reaching consequences for ecosystems and, as a result, for human society.

"The magnitude of the effects we observed was really surprising. The reduction of movement on a 10-day scale, that percentage drop was just phenomenal. In some cases, we saw a tenfold decrease in movement," said William Fagan, professor and chair of the UMD Department of Biology and a co-author of the study. "This is after accounting for other factors we already know to be important to animal movement, such as body size, diet and available food resources."

Most mammals are on the move every day, searching for food, shelter or a mate. In general, larger mammals like zebra move longer distances, while smaller mammals such as hares cover shorter distances. In this study, the researchers collated GPS-tracked movement data from 803 individual animals representing 57 mammal species from around the globe. They used the data portal, Movebank, which archives movement data from researchers across the world.

The researchers then compared these movement data to a metric called the Human Footprint Index, which assigns landscapes a rating that ranges

from zero (untouched natural areas) to 50 (dense urban cityscapes). The researchers' analysis primarily focused on areas with a rating of 36 or higher, comparing these data with baseline information from areas with an index of less than two.

The team also assessed each species' movements on a variety of time scales ranging from an hour to 10 days. On shorter time scales of less than a day, human-modified landscapes did not significantly affect the movement of most species. However, for observations ranging from a day to 10 days, most species reduced their travel distances by an average of at least half.

Human infrastructure such as roads, buildings, bridges and fences create physical barriers to animal movement. But the research also suggests another, somewhat paradoxical reason that mammals move less in human-dominated areas: resources such as food and shelter can be more plentiful.

"Our research suggests that two things are going on," said Eliezer Gurarie, a principal faculty specialist in the UMD Department of Biology and a co-author of the paper. "First, the world isn't as free to move around in. But for many animals it's also less necessary to range widely because humans can indirectly provide food and protection from large predators."



Yak in Bhutan. Credit: Dr. Sherub, Max-Planck-Institut für Ornithologie in Radolfzell

Gurarie points to the high numbers of white-tailed deer familiar to anyone in the Washington, D.C. metro area, coyotes found within the borders of Chicago, and fishers—a relative of weasels and ferrets—which are native to Canada and the northern United States.

"It was long thought that fishers needed old-growth forest to thrive," Gurarie said. "But fishers are doing extremely well, for example, around Albany, New York, where there are a lot of naïve squirrels and rabbits that don't know to avoid this predator."

Urban-dwelling fishers, much like urban deer and coyote, typically have

much smaller home ranges than their counterparts in wild areas.

While some species can cope with reduced movement in less wild landscapes, the researchers note that movement is also important for the ecosystem as a whole. Restricted movement can disrupt food webs, curtail the distribution of plant seeds and interfere with the transport of nutrients contained in animal waste and prey kills.

"It is important that animals move, because in moving they carry out important ecological functions like transporting nutrients and seeds between different areas," said Marlee Tucker, lead author of the study and a biologist at the Senckenberg Biodiversity and Climate Research Centre and Goethe University in Frankfurt, Germany. "If mammals move less this could alter any of these ecosystem functions."

Wild mammals can also clash with humans, causing problems that can range from unwanted grazing in crops and gardens to the spread of deadly diseases. Fortunately, land-use planners and developers can implement strategies to minimize conflicts.

"Concentrating development in certain areas can preserve more open space. It's also possible to leave corridors open for movement," said Fagan, who is also a research innovation scholar at the National Socio-Environmental Synthesis Center (SESYNC). "These corridors can be as simple as a tunnel under a road. Such measures allow mammals to live in the same landscape without suffering from reduced movement."

Fagan, Gurarie, Tucker and their colleagues note that the current study, while impressive in scope, is likely only the first of its kind. With access to large amounts of high-quality, globe-spanning data contained in public databases like Movebank, ecologists are keen to continue large-scale, data-driven studies on animal movement.

"This idea of compiling data on animal movement will open the door to new studies that include new species and that look for patterns and similarities in data," Fagan explained. "It creates opportunities to look more generally at how animal movement affects other environmental features. Some questions can only be asked by gathering together a lot of data. This is one of them."

More information: M.A. Tucker et al., "Moving in the Anthropocene: Global reductions in terrestrial mammalian movements," *Science* (2018). [science.sciencemag.org/cgi/doi ... 1126/science.aam9712](https://science.sciencemag.org/cgi/doi/10.1126/science.aam9712)

Provided by University of Maryland

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