

Science You Can Use *in 5 minutes*

Trails and Tails: Using smart-phone GPS data to balance recreation and wildlife management

Did you know your cellphone's GPS locations can help us decipher how recreationists and wildlife overlap in time and space? Mark Ditmer, a research ecologist at the Rocky Mountain Research Station, and colleagues harnessed this cellphone-derived human mobility data to explore how managers can enhance recreation and protect wildlife in sensitive habitats.

"I'd say as ecologists, we've lagged behind in our ability to understand the dynamic human footprint," said Ditmer. "We have great data on where animals go and changes in

vegetation from satellites, but for a long time we've been overlaying static information from roads and buildings. Using these human mobility data allows human use to come alive to better understand where and when wildlife and recreationists overlap."

As anonymized collections of GPS points from several mobile apps and consenting users, human mobility datasets show near-real-time human movement. Understanding the use of national forests is surprisingly challenging since there are many different

access points across large landscapes. This data can help managers better balance responsible recreation with wildlife management in sensitive habitats. There are no monitored access points like there are in many national parks. As recreation skyrocketed during and after the pandemic, researchers wanted to know where, when, and how humans (knowingly or not) interacted with wildlife—on and off trail—in the front country and backcountry. How do these encounters influence wildlife behavior? "This was our first time integrating accurate spatial and temporal patterns of people actually using national forests," said Ditmer.

Leveraging more than five years of data, researchers explored [new ways to apply human mobility data for wildlife and recreation management](#). In the Sierra Nevada Mountains of California, these datasets illuminated unexpected timing, locations, and close encounters between humans and cougars. Two of nine cougars studied were located in close proximity to humans very frequently, whereas only one cougar had no human interactions. Zeroing in on an individual



Understanding human movement and wildlife interactions in national forests, like the Bridger-Teton National Forest in Wyoming, may help land managers while planning for wildlife in sensitive habitats and encourage responsible recreation. Forest Service photo by Mark Ditmer.

cougar's tolerance of humans enables land managers to mitigate potential future conflict—keeping animals and humans safe. With human mobility data we can improve the quality of life for wildlife in high-use human areas—from connecting fragmented habitats to safeguarding sensitive spots where wildlife birth, hatch, or rear their young.

For example, winter in Wyoming's Teton Mountain Range forces bighorn sheep to endure reduced forage and deep snow, so land managers close key areas to recreation. The [human mobility datasets showed that people respected signage for mandatory closure zones](#). The few who ventured into voluntary closure zones spent less than 15 minutes. Once closures lifted, people flocked in (over 250% increase).

The research team also used human mobility data to learn if [mule deer were more responsive to human or cougar presence](#). They found that deer used humans as a shield from predation. But they also reacted to humans as the dominant threat during certain times of the year and day. Deer adapted their behavior around the frequency of human interactions—habituation details previously impossible to obtain.

Human mobility data has some limitations. Total visitor counts are only relative estimates and are reliant on people sharing their locations with mobile applications. Additionally, while GPS locations are collected in the backcountry without reception, the rate of GPS fixes collected are more frequent in areas with coverage.

The opportunities to apply this adaptable data tool are vast. “It could be transformative for wildlife, land, and [recreation management](#),” said Ditmer. Human mobility data can enable managers to craft tailored species conservation goals and responsible recreation plans. Land managers are invited to reach out to Ditmer and his team to further explore the use of human mobility data on their unit.

Management Considerations

- Human mobility data can be a powerful tool for managing wildlife in sensitive habitats while supporting recreation opportunities. Use of these datasets can help to better anticipate and prevent human-wildlife conflict through strategic education and outreach using signs, and both in-person and digital public education campaigns.
- Human mobility data can inform wildlife landscape connectivity planning with near real-time data to better understand animal migration amid human barriers like trails and roads.
- Land managers can use human mobility data to better understand recreation types, frequencies, and locations occurring in sensitive ecosystems. This information can inform public access guidelines as they relate to wildlife conservation goals.

Further Reading

Abernathy, H.N.; Ditmer, M.A.; et al. 2025. [A case for human mobility data applications in wildlife management](#). Journal of Applied Ecology. 62:1636–1646.

Sergeyev, M.; Ditmer, M.A.; et al. 2025. [Leveraging human mobility data to assess recreational activity across the United States' most visited National Forest](#). Journal of Outdoor Recreation and Tourism. 52: 100973.

Ditmer, M.A.; Zeller, K.A.; et al. 2026. [The landscape of no worries? Increased recreation exposure decreases the landscape of human fear in wildlife](#). Biological Conservation. 315: 111718.

Kantor, S.; et al. 2025. [How Human-Generated Noise Disrupts Wildlife: The unseen impact of outdoor recreation](#). Science You Can Use Bulletin, Issue 71. Fort Collins, CO; U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 11 p.

Featured Scientist

[Mark A. Ditmer](#) is a Research Ecologist for the Rocky Mountain Research Station who focuses on applied wildlife data science.

[Annabelle Moore](#) is the author of this Science You Can Use.



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