

# Information Crossfile\*

## SUMMARIES

### The climatic envelope: Understanding the thermo-geographic range of the mighty wolverine

**THE AUTHORS OF THIS STUDY POSE THE QUESTION:** How does environmental temperature and snow cover affect the geographic range in which the wolverine (*Gulo gulo*) can survive and reproduce? Past research associated wolverine reproductive denning and snow cover on a small scale (15 dens), but it did not explore how this association could limit the wolverine over its entire range. The methods that Copeland et al. (2010) used to answer the question provide an instructive scientific and anecdotal dissection of the “bioclimatic envelope” model of species distribution. According to the authors, the bioclimatic envelope model is often criticized for not accurately reflecting biotic factors such as the behavior and physiology of the target species, thus leading to overly simplistic correlations between geographic range and climatic requirements. Copeland et al. (2010), with “reliable understandings” of the wolverine’s geographic range and its climatically linked biological needs, such as the species’ obligate reliance on the spring snowpack, vouch that they have evaluated whether the wolverine’s current range is consistent with climatic conditions without such gaps in knowledge. Furthermore, the authors address the limitations of the bioclimatic envelope model by comparing model results with on-the-ground research.

Wolverine live throughout the Arctic and in subarctic areas and boreal forests of Eurasia and North America, and their bodily apparatus is adapted to those environs: a compact body carried by broad plantigrade feet and insulated by a dense coat enables quick travel through soft snow. In particular, the snow cover during peak denning season, early February to early May, provides a thermal blanket that aids the survival of young wolverines—but is it absolutely critical to wolverines’ reproductive denning habitat? And is the wolverine’s range limited by a mean temperature in that region? To find out, Copeland et al. (2010) surveyed spring snow cover over a seven-year period in the Northern Hemisphere, gained from satellite imaging data, and cross-referenced that information with precise wolverine den locations tracked by the Scandinavian wolverine den monitoring program and all known den locations in Finland and North America. Also evaluated were the upper thermal limits of the species: average maximum August temperatures for the years 1950–2000 and summer wolverine sightings. The results, encompassing 562 wolverine den sites in all, show that 97.9% of the den sites occurred in areas

where spring snow was present at least one of seven years. That is, virtually all wolverine reproductive dens in the study occurred within the spring snow coverage. A few sites outside of the spring snow coverage had adequate snowdrifts to accommodate reproductive dens though the snow areas were negligibly small.

The spatial agreement of wolverine den locations with summer temperature coverage supports the hypothesis that wolverines redistribute to cooler environments during hot summer months in southern portions of their range. When the deep, persistent snow surrounding their dens diminishes upon earlier spring snow melt and increasing summer temperatures, the availability of summer habitats may be reduced—a direct threat to the wolverine’s breeding viability and geographic distribution.

As the polar bear copes with waning ice floes, the wolverine may struggle with reduced snow coverage. The authors note that “significant reductions in spring snow cover associated with climate warming have already occurred in some portions of the wolverine’s range in the contiguous United States,” which could lead to a reduction in wolverine habitat and an associated loss of connectivity between populations. Though the wolverine is notoriously averse to human development, the authors suggest that physiological investigations into critical temperatures for the wolverine could be important for understanding and anticipating the potential impacts of climate change on wolverine distribution and survival.

## Reference

Copeland, J. P., K. S. McKelvey, K. B. Aubry, A. Landa, J. Persson, R. M. Inmann, J. Krebs, E. Lofroth, H. Golden, J. R. Squires, A. Magoun, M. K. Schwartz, J. Wilmot, C. L. Copeland, R. E. Yates, I. Kojola, and R. May. 2010. The bioclimatic envelope of the wolverine (*Gulo gulo*): Do climatic constraints limit its geographic distribution? *Canadian Journal of Zoology* 88:233–246. doi:10.1139/Z09-136.

—Jonathan Nawn and Amy Stevenson

\*Information Crossfile synthesizes selected publications relevant to natural resource management. Unless noted, articles are not reviewed by reference source author(s).