



US Forest Service R&D PNW Research Station

Project Title: Wolverine range, habitat requirements, and the potential effects of climate change on their distribution

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Project Description: We used historical occurrence records for the wolverine in the contiguous U.S. to determine their current and historical distribution, and investigate broadscale habitat relations. We then used a suite of ecologically based variables to propose a fundamental distribution for the wolverine throughout its circumboreal range based on the hypothesis that wolverine distribution is constrained by their association with persistent spring snow cover, and an upper limit of thermoneutrality (i.e., their bioclimatic envelope). We used satellite imagery to create annual, cloud-free images of persistent snow cover from 24 April to 15 May (the end of the wolverine denning period), and used temperature data to investigate the wolverine's summer thermal-tolerance limits. We compared resulting climatic models with spatial data for wolverine den sites in North America and Scandinavia, telemetry locations from western North America, and our contemporary understanding of the wolverine's worldwide distribution. We are currently using results from these analyses to predict the potential effects of global warming on wolverine range in southern boreal forests.

Current accomplishments:

- The historical range of the wolverine in the western mountains of the contiguous U.S. was much more insular and restricted in habitat conditions than previous interpretations have indicated. Our analyses indicate that resident populations of wolverines occur primarily in areas with snow cover that persists through mid-May at the end of the wolverine denning period. In the mountains of the western contiguous U.S., these climatic conditions are limited to high-elevation areas in the Rocky Mountains, Cascade Range, and Sierra Nevada, resulting in an archipelago of suitable habitat conditions.
- During both winter and summer, habitat use by wolverines is spatially concordant with areas of persistent spring snow cover, especially at the southern extent of their range. Strong similarities between the distribution of spring snow cover and our contemporary understanding of the wolverine's worldwide distribution suggests that spring snow cover provides a reliable single-variable model for defining the wolverine's climatic requirements and, consequently, their geographic range.
- Preliminary findings indicate that global warming will adversely affect wolverine population persistence and distribution in southern boreal forests.

Project Deliverables:

Aubry, K.B., K.S. McKelvey, and J.P. Copeland. 2007. Distribution and broadscale habitat relations of the wolverine in the contiguous United States. *Journal of Wildlife Management* 71:2147-2158.

Schwartz, M.K., K.B. Aubry, K.S. McKelvey, K.L. Pilgrim, J.P. Copeland, J.R. Squires, R.M. Inman, S.M. Wisely, and L.F. Ruggiero. 2007. Inferring geographic isolation of wolverine in California using ancient DNA. *Journal of Wildlife Management* 71:2170-2179.

Manuscripts in review:

J.P. Copeland, K.S. McKelvey, K.B. Aubry, A. Landa, J. Persson, R. Inman, J. Krebs, E. Lofroth, H. Golden, A. Magoun, M.K. Schwartz, J.R. Squires, J. Wilmot, C.L. Copeland, and R.E. Yates. 2009. The bioclimatic envelope of the wolverine: Do environmental constraints limit their geographic distribution? *Journal of Biogeography*.

Project Outcomes: Our study provides important new insights into the nature of the wolverine's ecological niche in North America. The wolverine is strongly associated with habitat conditions that become increasingly fragmented in more southerly regions. Consequently, there is a much greater potential for wolverine populations in southern boreal forests to become isolated than has been recognized previously. In such forests, the bioclimatic envelope of the wolverine is closely associated with the distribution of persistent spring snow cover. If current trends in global warming continue, the extent of spring snow cover in montane regions will shift upwards in elevation and shrink in extent, increasing the fragmentation and isolation of their populations. Such events may directly impact wolverine reproductive success and population connectivity, and threaten their persistence in the contiguous U.S. Our research provides an empirical basis for identifying the most likely areas for wolverine persistence, and habitat corridors that may be critically important for maintaining population connectivity in a warming climate.