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Jodi Bush
U.S. Fish and Wildlife Service
Montana Ecological Services Field Office
585 Shepard Way, Suite 1
Helena, MT 59601

Subject: Re-opened comments concerning the proposed listing of wolverines as *threatened* under the Endangered Species Act and the establishment of a Nonessential Experimental Population of the North American wolverine in Colorado, Wyoming, and New Mexico (Federal Register Notice (Vol. 78, No. 23 / Monday, February 4, 2013)

Dear Jodi Bush,

As I understand, the comment period for the proposed federal listing of wolverine in the contiguous U. S was extended due to disagreement among peer-review scientists. As a scientist that provided peer-review comments, I am compelled to provide additional clarification to help others understand the differences in scientific opinions. My initial comments differed most substantially from those provided by Bob Inman and Audry Magoun. Thus, in my present comments, I provide additional clarification of points of science that differed most from these scientists.

My peer-review comments do not endorse or refute the need to list wolverine as a federally protected species. My role was to evaluate whether the U.S. Fish and Wildlife Service (USFWS) used best science in their interpretation of wolverine ecology. I based my comments on the research experience I gained as a Principal Investigator of wolverine studies in Montana and Idaho, and my understanding of the pertinent literature. I focused my peer-review comments on scientific issues, but I acknowledge that my remarks may also address some policy given the nature of the issue.

Before I clarify points of science, however, I am obliged to correct a gross misrepresentation of a paper on which I served as lead author - "Squires, J. R., J. P. Copeland, T. J. Ulizio, M. K. Schwartz, and L. F. Ruggiero. 2007. Sources and patterns of wolverine mortality in western Montana. Journal of Wildlife Management 71:2213-2220." Dr. Inman stated in his peer-review comments that the USFWS should discount Squires et al. (2007) because, "*researchers reportedly stated something to the effect of wolverines should not be trapped in Montana and our research is going to prove it*" in a public meeting. As the sole authorized spokesperson for the study, I say unequivocally that this statement is both untrue and unprofessional. During our wolverine research in southwestern Montana, I provided formal presentations to 3 local communities (Anaconda, MT; Jackson, MT; and Dillon, MT), all located within our study area. These are small ranching communities that had a high interest in our activities. The public's response to all talks was supportive and respectful, and trapping was never mentioned during any question-answer session following the presentations, to the best of my recollection. Any comments made by others associated with our study in various forums are hearsay and unsubstantiated.

The pattern of wolverine mortality reported in Squires et al. (2007) was based on 36 wolverines from 2 study areas in western Montana and one study area on the Idaho–Montana border. Contrary to Dr. Inman's statements, most wolverines (22 individuals) included in Squires et al. (2007) occupied areas with low trapping pressure, including 19 individuals from Glacier National Park where trapping was prohibited and 3 from the Clearwater Study Area on the Montana-Idaho border; wolverine trapping was also prohibited in Idaho. The 14 wolverines included from southwestern Montana were distributed across 4 mountain ranges (Beaverhead, Pioneer, Anaconda-Pintler, Flint Creek Mountain Ranges). Based on this representative sample, Squires et al. (2007) concluded, "*If populations are exploited, we suggest that wolverine harvest be managed by individual mountain ranges or small groupings of mountain ranges. The intent of managing at this fine scale is to reduce harvest to within biologically defined limits in recognition of the increased vulnerabilities of wolverines owing to their low fecundity and low population numbers in small mountain ranges. Our results indicate that few individuals occupy small mountain ranges, which argues that harvest rates need to be conservative (<1 wolverine/yr [possibly through rotating temporary closures] for the 4 mountain ranges comprising the Pioneer study area).*" Consistent with this recommendation, Montana Fish, Wildlife, and Parks (MFWP) restructured wolverine harvests statewide to ensure that trapping mortality was conservative and spatially well distributed. I applauded MFWP's restructured harvest both publically and privately, and I believe their actions improved the species' conservation and management in the Northern Rockies. Thus, the only mention of trapping that I made in my initial peer-review comments for the proposed rule was in regards to the 10(j) status proposed if wolverines were reintroduced into Colorado. I stated, "*predator control in Colorado is highly regulated and the NEP areas in Wyoming and New Mexico are relatively small in spatial extent. Therefore, I agreed with the logic provided (p7898) that a proposed special 4(d) rule regulating incidental take was unnecessary for the 10(j) area.*"

POINTS OF SCIENCE

1) Was the USFWS justified in assessing climate impact to wolverines based on models that used a 15 May cutoff for persistent spring snow?

In their peer-review comments, Inman and Magoun claimed it was inappropriate for the USFWS to assess climate impacts based on literature that modeled spring snow to 15 May. Both reviewers provided reasons why this date was inappropriate based on their understanding of wolverine biology. In addition, these reviewers also implied that observations of wolverines outside the area delineated by the persistent spring-snow isopleth somehow discredited the underlying science. Apparently there was confusion in rectifying the insights developed through scientific modelling with a scientist's understanding of wolverine biology.

Clearly, wolverines are snow-adapted animals with many physical attributes that allow them to persist in areas of deep winter snow. These adaptations include low foot loadings, frost resistant fur, thermoneutrality at very low temperatures, denning in deep snow (Magoun and Copeland 1998, Copeland et al. 2010), and a travel gait that allows extended movement across deep-snow landscapes. There is no question that wolverines are snow-adapted and that snow

provides important cover for wolverine dens (Magoun and Copeland 1998). It is also true that land managers and regulators need to delineate a species' distribution as an important step in conservation planning. Thus, Aubry et al. (2007) investigated the distribution and broad-scale habitat relationships of wolverines in the contiguous United States based on general climate conditions, vegetation, topography, and spring snow. Aubry (2007) found that a model based on persistent spring snow (15 May) was the best fit to historical records of wolverines in the contiguous U.S.

Copeland et al. (2010) expanded the work of Aubry et al. (2007) by determining whether persistent spring snow (15 May) and temperature defined a bioclimatic envelope for wolverines. Copeland et al. (2010) found that a model based on persistent spring snow was effective in spatially defining den habitat across the northern hemisphere. Copeland et al. (2010) also demonstrated that the area delineated by persistent spring snow was a good proxy for year-round habitat use of wolverines, as evidenced by radio telemetry. Thus, McKelvey et al. (2011) was justified in using persistent spring snow as the appropriate layer to evaluate climate effects on wolverine habitat. Models that incorporate persistent spring snow (15 May) provide predictions that are spatially explicit and that fit empirical data. The USFWS was correct in their use of McKelvey et al. (2011) as the best science available to evaluate the putative impacts of climate change on wolverines. For a more in-depth discussion of issues associated with this modeling, see: Attachment - RMRS Scientists Response to Montana Fish Wildlife and Park Public Comments on Wolverine ESA Decision: A misinterpretation of RMRS Science.

Spatial models that predict how wildlife use habitat are never 100% correct. They are hypotheses that can be tested with empirical data. The fact that a given wolverine den or observation is found outside the area defined by the spring snow (15 May) isopleth does not disprove a model, in fact, such deviations are expected. Aubry et al. (2007) developed their wolverine models based on the *a priori* assumption that persistent snow through 15 May could predict wolverine occurrence because it generally corresponded to the end of denning. Copeland et al. (2010) then demonstrated that a model based on spring snow (15 May) provided an excellent fit to wolverine dens across the northern hemisphere. For example, 97% of known dens across 2 continents are within areas of persistent snow. It was also found that the snow model identified areas of wolverine-use during non-snow periods. It is rare in wildlife science that a model with a single covariate, like spring snow, fits so well with empirical data across a species' life history. Just as important, the 15 May snow model does not mistakenly include areas that are not wolverine habitat. Therefore, the model is also exceedingly "efficient" in delineating wolverine habitat in general across broad spatial scales.

There are no competing hypotheses of how wolverines may respond to climate change that are both predictive and spatially explicit. Inman et al. (2012) proposed that wolverines required cold micro-sites to refrigerate food resources, especially when feeding young. This is a valid hypothesis, but "refrigeration" for food storage was not scientifically tested nor modeled spatially across broad landscapes based on empirical data. It is also logical that climate change that reduced persistent spring snow would also reduce "refrigeration." Thus, the USFWS had no scientific basis or justification to consider "refrigeration" (Inman et al. 2012) as an alternative hypothesis to McKelvey et al. (2011) when considering putative climate effects on wolverines.

The persistent snow model to 15 May is exceptionally effective in defining wolverine habitat year-round, and there are no other published models that use an alternative definition of "persistent spring snow."

2) *Was the effect of climate change over estimated by up to 75% (Bob Inman Review Comments - page 5) because snow retention on north, high-elevation aspects was ignored?*

Microsites of accumulated snow, like avalanche zones and drifted north slopes, may remain in wolverine home ranges even given climate change. However, we do not understand how patchy, shallow, or discontinuous snow across a wolverine's home range will impact reproductive success or population persistence. We do know that wolverines currently reproduce in a zone of persistent, largely continuous spring snow. There is no evidence that wolverines occupy or are expanding into lower elevation zones in the western U.S. with discontinuous snow cover (Copeland et al. 2010, McKelvey et al. 2011). The degree that wolverines can tolerate a reduction in snow cover and increased ambient temperatures with climate change and still maintain persistent populations is unknown, but decreased snow and warming temperatures are expected to be a negative influence. McKelvey et al. (2011) used a down-scaled global climate model to evaluate climate impacts to wolverine. This provided the most resolute model then available to evaluate climate effects across the distribution of wolverines in the contiguous U. S. It was not possible to evaluate climate impacts at the scale recommended by Dr. Inman due to limitations in existing global climate models and to our limited understanding of the species' tolerance to shallow and/or more patchy snow.

3) *Was the potential effects of human overutilization for commercial, recreational, scientific, or educational purposes accurately portrayed?*

Wolverines are especially vulnerable to human-caused mortality due to their low fecundity and low density across broad landscapes. Dr. Inman states, " *Here and in other popular and professional literature, two studies are frequently invoked as evidence of the mortality from wolverine trapping being "additive," and mismanagement of wolverines by the state of Montana; these are Krebs et al. 2004 and Squires et al. 2007. However, under sufficient scrutiny these works do not suggest either of these things as occurring in Montana."* The Krebs et al. (2004) paper questioned by Inman was a synthesis of 12 radio telemetry studies of wolverines that represented trapped and untrapped populations. Krebs et al. (2004) documented 62 mortalities from 239 wolverines and concluded that trapper harvest was additive to natural mortality. In addition, Lofroth and Ott (2007) documented that wolverine harvest from 1985 – 2004 was sustainable for most of British Columbia, Canada, but they documented overharvest in 15 of 71 population units. In Montana, Squires et al. (2007) documented that harvest from trapping reduced annual survival from 0.80 to 0.57. Thus, a thorough reading of the best science clearly demonstrates that wolverines are susceptible to additive mortality from harvest given the species' low density, low fecundity, and ease of trap-capture due to their proclivity to feed on carrion baits during winter. See introductory remarks for additional review of Squires et al. (2007).

4) *Did the USFWS correctly portray the historical distribution and suitable habitat of wolverine in the contiguous U. S.?*

Dr. Inman states (Inman Summary Comments, page 2), "*In trying to discern records differentiating populations from occasional dispersers, Aubry et al. 2007 and the proposed rule turn to supporting evidence in the form of overlaying the records with suitable habitat. The problem with this method is that it involves a good deal of circular logic. First, the historical records are used to define suitable habitat, and then suitable habitat is used to discern whether historical records represent populations or not.*" This is an inaccurate interpretation of Aubry et al. (2007) in my opinion. There are limited historical data of wolverine in the Great Lakes region, which constrains current scientific understanding of the species' historical distribution in the region. This uncertainty was clearly recognized and addressed by Aubry et al. (2007). Aubry et al. (2007, page 2154) stated that spring snow failed to explain the occurrence of wolverine in the Great Lake states. The wolverine historical records used for this paper were collected during 1827 – 1960. These records were then compared to snow data from 1967 to 2005. Aubry et al. (2007) hypothesized that climate conditions may have changed between the historical record and current spring snow conditions, and cited (page 2154) documentation from Canada that the range of wolverines had receded further to the north of the Great Lakes by 1900. In Aubry et al. (2007), the authors stated that wolverines might have been present historically in the Great Lakes. However, they did not attempt to draw conclusions on whether or not these wolverine records represented resident populations or extra-limital distributions based on stated study objectives. Therefore, Aubry et al. (2007) did not employ "circular logic" in their conclusions, but provided the best scientific documentation of wolverine in the Great Lakes given the very limited wolverine data available for that region.

In conclusion, the scientific disagreement among peer-reviewers does not in my opinion negate the science as reported by the USFWS in the proposed rule. The basic conclusion that wolverines may be detrimentally impacted by climate change is consistent with best available science. Thank you for the opportunity to provide peer-review comments.

Regards,

John R. Squires
Research Wildlife Biologist
Wildlife and Terrestrial Ecosystems Program
U.S. Forest Service
Rocky Mountain Research Station
800 E. Beckwith Ave.
Missoula, MT, 59801

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