United States Department of Agriculture

Forest Service

Rocky Mountain Research Station

P.O. Box 8089
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File Code: 4200

Date: 06/12/01

Dear Lynx Steering Committee Members:

re. "Management of Canada Lynx in the Cascades Geographic Areas of Oregon and Washington", a White Paper prepared by the US Fish and Wildlife Service.

The attached review is limited primarily to statements in the White Paper that specifically reference our work or our conversations. There are a number of logical flaws, improper citations, and misunderstandings contained in the White Paper. However, from a scientific standpoint, the major problems we had with this document lie outside of our specific comments and are discussed below.

As we noted in Chapter 8, and again in our review of the White Paper, lynx data obtained from Oregon were both few in number and low in reliability. Although we drew no conclusions in Chapter 8 about the residency status of lynx anywhere in the contiguous U.S., neither the information we considered in Chapter 8, nor the new occurrence records presented in the White Paper, provide an empirical basis for contradicting the conclusion drawn by Verts and Carraway (1998) in their species account for lynx in Oregon, which reads: "Published reports...of the need to preserve certain regions of Oregon for lynxes notwithstanding, no evidence of self-maintaining populations of lynxes in the state exists".

Furthermore, we believe there are numerous flaws in logic and deductive reasoning contained in the White Paper. In a deductive process, is it inappropriate to draw conclusions before collecting and evaluating the data. If one does, it is inevitable that data will be collected selectively to support the pre-conceived conclusion. Apparently, the authors of the White Paper are convinced that resident populations of lynx have occupied a broad array of coniferous forest habitats throughout Oregon and Washington, both historically and currently, even though there is no compelling body of empirical evidence to support such assertions. Accordingly, the authors seem to have gathered information primarily for the purpose of supporting these beliefs, while ignoring the body of empirical evidence that strongly indicates otherwise. As Verts and Carraway (1998) concluded, and as our assessment of available lynx occurrence data presented in both Chapter 8 and the White Paper indicate, there is no compelling body of verifiable evidence to suggest that resident populations of lynx have ever occurred in Oregon or western Washington.

In the White Paper, there are a number of logic sequences that appear to have been followed solely to support the authors' pre-conceived conclusions. For instance, they cite Hodges (Chapter 7) as stating that understory density, rather than species composition, is most important for hares. They then use this to impugn current habitat associations for hares, and to suggest hares use other habitats where the understory is dense. By following this logic, one can then argue that chaparral, or a plethora of other brushy habitats are snowshoe hare habitat. What's wrong with this argument is that Hodges conclusions are taken out of context. **Given that an area supports hares**, her statement is correct, based on the extant literature. Her statement says nothing about expanding the areas where hares are found by creating brush, nor does it imply that brushy areas *per se* are hare habitat. Similar arguments are used out of context to support expanding the designation of lynx habitat to include dry Douglas-fir and lodgepole pine types, as well as low-elevation riparian areas.

Much is made in the White Paper about bounty records, and the data the authors have compiled from both western and eastern regions of Washington and Oregon is both impressive and perplexing. One of the things that biologists must do when analyzing data that bears on a particular question is to evaluate data from as many different sources as possible, and look for consistent patterns that collectively reveal underlying truths. When the majority of available evidence leads to a certain conclusion, but another piece of evidence strongly contradicts that body of information, it is simply poor science to conclude that the anomalous data must be true since it fits a pre-conceived conclusion, and that the rest of the body of evidence must be misleading. Rather, the biologist must ask "why do these anomalous data not fit the rest of the data?" A good example of how this deductive process should be applied to questions regarding the status of lynx in the Pacific Northwest are the DNA detections reported by John Weaver in 1998. Weaver deployed hair-snag pads throughout the Cascade Range from northern Washington to southern Oregon. The results he reported from these surveys were also both impressive and perplexing: 5 detections of lynx were made at more or less evenly spaced intervals from the northernmost survey site to the southernmost survey site. These results strongly contradicted everything we knew about the status of lynx populations in the Pacific Northwest. Because detection rates from this technique are relatively low (i.e., only a small proportion of a population will be detected with this technique) Weaver's results indicated that there were resident populations of lynx occurring throughout the Cascade Range in both Washington and Oregon. In fact, after becoming aware of these results, various environmental organizations made exactly this claim and called for a moratorium on logging throughout the Cascades to protect lynx habitat. Because the biologists who commissioned these surveys did not simply accept these results as fact without some form of objective verification, Weaver was eventually forced to provide samples that could be independently tested at other DNA labs. Weaver's samples failed this test and all of his detections were eventually proven to be unreliable. Scientific progress occurs through the repeated verification of research results, not by accepting anomalous and unverifiable data as truth.

As we explained in Chapter 8 of the lynx book, and is well established by other anomalous records (e.g., 2 lynx museum specimens from Nevada in 1916), the

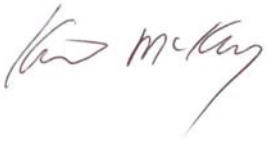
occurrence of lynx beyond the boundaries of their range (i.e., the geographic area in which we know there are resident, reproducing populations of lynx) is not unexpected. What the authors of the White Paper fail to grasp is that it is not simply the presence or absence of verified records from an area that informs us whether or not lynx are resident in that area, it's the presence or absence of a substantial body of corroborating empirical evidence of the presence of a population of lynx in that area. Thus, some of these bounty records are probably genuine and probably come from the area from which they were reported but accepting all of them or even many of them as reliable records of lynx occurrence means that you must also conclude that lynx were resident and relatively common throughout both states for most of the 20th century. As with Weaver's DNA detections, however, because these records contradict everything we know about lynx in the Pacific Northwest, we must question their validity. Bounty records are notoriously unreliable and, unfortunately, are unverifiable. Who can say if the individuals paying the bounties were capable of distinguishing pale bobcats from lynx?; according to Grinnell et al. (1937) even mammalogists have difficulty doing so.

A glaring omission from the analyses in the White Paper is any discussion of the failure of organized attempts to gather verifiable evidence of their occurrence in Oregon. Extensive standardized survey efforts have been conducted throughout the Cascade Range and in many other coniferous forest habitats in the Pacific Northwest, using both remote cameras and DNA hair-snag pads. Not a single verifiable detection of lynx has been produced from these survey efforts anywhere in the Pacific Northwest, except in the northeast Cascade Range in Washington, where detections using both techniques have been numerous. Consequently, what the combined body of available evidence regarding the history and status of lynx in the Pacific Northwest tells us is that the **only** places in Oregon or Washington which we can state with certainty ever contained resident populations of lynx are in northeastern Washington, and include the northeast portions of the Cascade Range, the Okanogan Highlands, and some peninsular mountain ranges, such as the Kettle Range. There is no empirical basis for concluding that lynx have ever been part of the resident vertebrate faunas anywhere else in Oregon or Washington. Consequently, it is simply poor science to use additional unverified and unreliable occurrence data that was obtained through a heroic effort unequaled in any other state, and which strongly contradicts all other available information on the history and status of lynx in Washington and Oregon, to convince the resource management agencies responsible for managing lynx habitat that resident, but undetectable, populations of lynx occur in Oregon and western Washington. Biological interpretations that are not supported by a preponderance of available empirical evidence are beliefs masquerading as science, and should be recognized as such.

Lastly, there are issues associated with professional courtesy. In the White Paper, comments were attributed to McKelvey that were inconsistent with his statements. The pers. comm. on page 7, suggesting that we treated radiotelemetry-derived data differently in different areas (see Specific Comments), as well as many others that appeared in the circulated draft, was collected during a telephone conversation in which McKelvey was not made aware that the conversation would be used in this manner, nor were the subsequent pers. comms. provided to McKelvey for confirmation that the statements

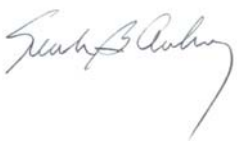
were correct. Additionally, M. Lenz is cited (pers. comm.) as stating that lynx are known to use dry Douglas-fir types in the Wenatchee National Forest. McKelvey spoke with Ms. Lenz recently, and she informed us that she has no recollection of making this statement concerning dry Douglas-fir forests. Furthermore, she also did not know that portions of her conversation might end up in print. She informed McKelvey that she was misquoted, and that the Douglas-fir types she considered to be lynx habitat were the wettest types, immediately adjacent to alpine fir. She was quite upset that her name had been used to justify statements that she didn't make and that, in fact, she disagreed with. Because this attributed statement concerning the use of dry Douglas-fir types was used to support the inclusion of a plethora of dry forests as potential lynx habitat (Appendix F; another example of the logic flaws discussed above), this misunderstanding is substantive. The extent to which other pers. comms. have been misrepresented by the authors is unknown.

Sincerely,



Kevin S. McKelvey
Research Ecologist

and



Keith B. Aubry
Principal Research Wildlife Biologist

The following is a discussion of all statements attributed to Chapters 8, 10, or McKelvey pers. comm. in "Management of Canada Lynx in the Cascades Geographic Areas of Oregon and Washington", a White Paper prepared by the US Fish and Wildlife Service.

In the White Paper, 2 chapters in:

Ruggiero, L. F., K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires. (Tech. Eds.). Ecology and conservation of lynx in the United States. Univ. Press of Colorado. Boulder, CO. 480 pp.

are referred to as (McKelvey et al 2000). These are:

Chapter 8: McKelvey, K. S., K. B. Aubry, and Y. K. Ortega. 2000. History and distribution of lynx in the contiguous United States. Pages 207- 264 *in* L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires (tech. eds.). Ecology and conservation of lynx in the United States. Univ. Press of Colorado. Boulder, CO. 480 pp.

Chapter 10: McKelvey, K. S., Y. K. Ortega, G. M. Koehler, K. B. Aubry, and J. B. Brittell. 2000. Canada lynx habitat and topographic use patterns in north central Washington: a reanalysis. Pages 307- 336 *in* L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires (tech. eds.). Ecology and conservation of lynx in the United States. Univ. Press of Colorado. Boulder, CO. 480 pp.

In the following discussion we refer to these as Chapter 8 and Chapter 10, respectively.

General comments

When we wrote Chapter 8, we had no pre-conceived ideas about where one might draw the outer boundaries of either the historical or current distributional range of lynx in the United States. Our goals were to collect data from all pertinent sources in all states where lynx had been reported to occur, and to do so as consistently and as intensively as time, resources, and the availability of occurrence data allowed. When we were done, we assembled the data, described the results from each state, and conducted limited analyses of the associations between lynx occurrence records and broad forest cover types and elevation zones. Lynx data obtained from Oregon were both few in number and low in reliability: there were only 12 verified records (as defined in Chapter 8), many of which were in habitats that did not correspond with those occupied by resident populations of lynx in other portions of its range; half (36/72) of the spatially referenced occurrence records (verified and unverified) were sighting reports, and in Chapter 8 we warned that data from Oregon should therefore be considered less reliable. For comparative purposes, Nebraska, South Dakota, and North Dakota (i.e., states where we can say with a high degree of certainty that resident populations of lynx do not occur) have 13, 10, and 16 verified records, respectively; and the proportions of visual sightings in Maine, Montana, and Washington (i.e., states where we know resident populations of lynx

occur), are 7%, 7%, and 5%, respectively. While a good deal of new occurrence data has been collected, none of the new data presented in this paper substantively changes the *quality* of our understandings of lynx in Oregon. For Oregon, no new verifiable evidence (pelts or other physical remains, photographs, high-quality track casts, DNA data) have been discovered.

Museums, resource agencies, biologists, trappers, hunters, and a vast number of outdoors people have been collecting data on the vertebrates of Oregon and western Washington (including lynx) for over 150 years. More recently, extensive standardized survey efforts have also been conducted throughout the Cascade Range and in many other coniferous forest habitats in the Pacific Northwest, using both remote cameras and DNA hair-snag pads. Not a single verifiable detection of lynx has been produced from these survey efforts anywhere in the Pacific Northwest, except in the northeast Cascade Range in Washington, where detections using both techniques have been numerous.

Much is made in the White Paper about bounty records, but any early trapping or bounty records are intrinsically unreliable. In Chapter 8, we only discuss trapping data in those states where we had confirmation from knowledgeable individuals that the lynx reports were largely lynx, and the numbers reported were reasonably reliable. No such information is provided concerning the collected bounty records. Novak et al. (1987) warn about confusion between lynx and bobcats in early records, and in the Pacific Northwest, these problems are particularly acute. For this reason, we excluded trapping data for Idaho from our analyses in Chapter 8 due to potential confusions between lynx and large gray bobcats. In their account for the pallid wildcat of northeastern California (*Lynx rufus pallescens*) Grinnell et al. (1937) state that the differences between the California wildcat (*L. r. californicus*), which occupied most of the remainder of the state, and the pallid wildcat "are so great that many individuals of the pallid wildcat have been reported as Canada lynx...". They also report that "Other names [for the wildcat] with obvious derivations, such as bobcat, lynx or link, lynx cat, and spotted lynx, are applied in different localities or to different phases of color or size in one locality. ...The term Canada lynx has been applied to extra large specimens of wildcat from California, but to our knowledge, no member of that quite distinct species has ever occurred wild in the state".

Furthermore, since monetary gain was involved, individuals collecting bounties may have brought animals in from another region, where bounties were not being offered, or they may have brought skins to a different county if the bounty payment was higher there than the payment being offered in their county. There are many other potential problems associated with these kind of data, which may explain why, although they were undoubtedly aware of their existence, neither Bailey (1936) nor Verts and Carraway (1998) made use of bounty records in their monographs on the mammals of Oregon.

Specific comments

Quotes from the White Paper are in italics.

Page 2. *Was the analysis conducted in Chapter 8 of the Science Report intended to be applied to habitat mapping at the local site-specific level?*

No. We never mapped habitat *per se.* We do not feel that Kuchler or Bailey vegetation layers are of sufficient resolution for this. However, we do feel that in general we were able to contain most of the locations in a relatively small area, and that this area made biological sense for the organism. There were some local "misses" such as the Blue Mountains and southern Colorado due to changes in type. In all cases, when asked, we have counseled that habitat decisions should be made using as much local information as possible, involving the biology of the lynx and snowshoe hare, as well as snow conditions and any other pertinent factors that are supported biologically.

Page 7. *Confirmed lynx reports have been documented on both sides of the Cascade crest in Oregon and Washington (Dalquest 1948, McKelvey et al. 2000, Stinson 2000, Verts and Carraway 1998).*

We do not know what is meant by "confirmed" in this statement, but as far as we can tell, the records referred to here are not **verified** records as defined in Chapter 8 of the Lynx book. We list 1 verified record (1974) west of the Cascades. It was found in a residential area in the Willamette Valley of west-central Oregon.

Page 7. *There also appear to be some inconsistencies in how data was used from state to state. For example, Appendix 8.1 of the Science Report states that telemetry locations of individual animals from the Washington study areas were used (McKelvey, pers. comm. 2000), but only the initial trap locations were included for a similar study in Minnesota. In addition, trapping data may not have been considered valid in areas where records for lynx are scarce, even when bobcat and lynx records were tabulated separately.*

The pers. comm. listed is inaccurate. This was based on a telephone conversation unrelated to this document in which McKelvey was asked a number of questions about mapping. The authors never checked with us to ascertain whether the stated communication was accurate. It is not. We used the same rules for radio telemetry data wherever they occurred. The rule was 1 location per cat per year. We also disagree with the inference (that is expanded elsewhere in the document), that we "biased" the sample by loading it with telemetry locations. We did not. A brief check between Table 1 in Chapter 8 and the number of telemetry locations in Chapter 10, will verify that while there were 842 radiolocations, the total "physical remains" shown in Table 1 for the state of Washington is 144. This number contains pelts and other remains, photographs, DNA identifications based on hair snagging, as well as radiotelemetry locations. Trapping data

were included where we were aware of the existence of these records and where we confirmed that the records were reliable.

Page 10. *...and they use a variety of mixed conifer and hardwood forests in the Great Lakes and Northeastern geographic areas (McKelvey et al. 2000).*

More properly, lynx occurrence records are located in a variety of vegetation types in the Great Lakes States and the Northeast.

Page 11. *Lynx habitat in the Montana study area differs significantly from that on the Okanogan National Forest (McKelvey et al. 2000); habitat on the Okanogan differs from habitat in northern Idaho (T. Layser, USFS, pers. comm.); and lynx habitat in northern Idaho differs from that in Colorado (G. Patton, FWS, pers. comm.). Plant associations vary from forest to forest, so perhaps it may be more useful to assess the early seral or existing structural characteristics of a stand in order to determine if it provides lynx/hare habitat rather than simply focusing on the potential vegetation/plant association. The inclusion/exclusion of certain forested plant associations should be based on site-specific knowledge and expertise provided by biologists that are familiar with the local area, habitat, plant associations, prey availability, and snow depths.*

We did not compare lynx habitat between study areas. However, we would concur that habitat associations are likely to vary from area to area. See Chapter 14 for a detailed assessment of this phenomenon.

Page 14. *The large scale assessment of lynx habitat associations, found in Chapter 8 of the Science Report, indicates that 79 percent of the lynx occurrences were within the Douglas-fir and spruce/fir forests (of the Rocky Mountain Conifer forest type) and the subalpine fir/mountain hemlock forests (of the Pacific Northwest Conifer forest type). These broad vegetation types overlap many different plant associations. The land management units are directed to use figure 8.20 as the outer boundary of lynx habitat. This figure incorporates approximately 67 percent of the lynx occurrences and was derived using an elevational cut-off of 4000 feet, and the Lenahan groupings for Rocky Mountain Conifer. The broadscale maps and percent of occurrences calculated in Chapter 8 were for the entire western United States and may not be accurate for individual geographic areas*.

These statements are essentially correct.

Appendix A, page 1. *McKelvey et al (2000) listed 12 verified reports and a total of 72 lynx occurrences for Oregon, but currently there are nearly 100 lynx sightings (visual observations and tracks) that have been reported (Attachments F). Most of these reports were from the Mt. Hood, Willamette, Umpqua, Rogue, Fremont, Deschutes, Ochoco,*

Malheur, Umatilla, and Wallowa-Whitman National Forests. A third of all the sighting reports are verified or reliable sightings. There are 25 sighting reports of lynx on the west side of the Cascade crest, mainly from the mountain hemlock and Pacific silver fir vegetation zones on the Mt. Hood and Willamette National Forests. There is a confirmed report of a juvenile female (1974) and two highly reliable recent reports (1998 and 1999) from the Willamette National Forest.

The number of records in Oregon was probably inflated at the time we produced the report because active efforts were underway to gather anecdotal data. These efforts have continued, and additional anecdotal data have been gathered since the report was finalized. In Chapter 8 we caution that "...Colorado and Oregon have a high proportion of visual data (Table 8.1), and patterns in these states should be considered to be less reliable." We would suggest that the addition of new visual sighting data to this database does little to alleviate this problem. An additional distinction needs to be drawn. The White Paper's semantics and ours differ. In the quote, above, they state "A third of all of the sighting reports are verified or reliable sightings." According to the definition we presented in Chapter 8, few if any of these data would be considered "verified". A detailed description of why these semantic differences are important is found in Chapter 8, pages 208-209.

Note: the next three citations are part of an extended argument to suggest that habitats we considered to be anomalous were, in fact, not. Anomalous is defined as "Departure from the normal form, order, or rule." We believe that this is an accurate description of all of the locations described in this section.

Appendix A, page 2. *McKelvey et al. (2000) suggest that some of the lynx records in Oregon were likely from dispersing or transient individuals because they were trapped in anomalous habitats.*

We specifically suggest that all of the recent verified occurrences are in anomalous habitats. Our verified records carry more weight than do visual sightings, which may or may not be lynx.

Appendix A, page 2. *One of the lynx that McKelvey et al. (2000) refer to as being in "anomalous" habitat was taken near Drewsey, Oregon in January, 1993. Natural Resources Conservation Service snow survey data shows that when the lynx was killed, the snow pack was three times the average depth for that month. The location where the lynx was shot consists of more than six square miles of dense, shrubby lowland riparian vegetation extending in a wide, flat swath along the Malheur River as it emerges from conifer forests on the Malheur NF. Small mammals and birds are numerous in the riparian area. Lynx commonly forage in riparian willow/alder thickets (Bailey et al 1986, Murray et al 1995, Parker et al 1983, Poole 1994) so this site is similar to lynx habitat used in other areas. The value of streams and moderate slopes was also*

recognized by McKelvey et al. (2000) who found that lynx use increased significantly with increasing stream density and decreasing slope.

Concerning the last citation: The statement is correct (Chapter 10, page 324). However, this pattern is associated with utilization of lodgepole types (alpine fir climax) in the winter. See page 326 for a formal check on this understanding. That is, because lynx were choosing lodgepole types in the winter, probably because these types contained the highest densities of snowshoe hares (See Figure 10.10A), and because lodgepole pine was found in areas with moderate slopes and high stream densities, lynx were also associated with these physical variables. To use these results to support the idea that a low-elevation willow thicket is lynx habitat is clearly an incorrect inference.

Appendix A, page 2, 3. *Two other lynx sightings in "anomalous" habitats are mentioned by McKelvey et al. (2000); one in northeast Oregon near the confluence of Fence Creek and the Imnaha River (March 1964), and the other in western Oregon near Albany (October 1974). Both sites are within riparian corridors that may have been used for connectivity, exploratory movements, and/or for alternate foraging opportunities.*

Any number of things are possible, but such speculations serve little purpose when no empirical evidence is available to support them. All we know for sure is that a lynx was collected once in each of these localities, and that additional verifiable evidence of the presence of lynx in these areas, either historically or currently, is lacking.

Appendix A, page 3. *McKelvey et al. (2000) also correlated the dates that several Oregon specimens were collected with patterns of lagged synchrony in Canadian populations. The majority of National Museum of Natural History (NMNH) lynx specimens from Oregon and Washington were submitted by bounty hunters (C. Ludwig, NMNH, pers. comm.). The U.S. Biological Survey only collected specimens in Oregon from 1893 - 1915 (Verts and Carraway 1998). Federal, state, county, and independent bounty hunters were active during the same time period (C. Ludwig, NMNH, pers. comm.). In Oregon, mammal collections made for museums tended to be sporadic and opportunistic at best, so it is not possible to conclude that museum collection efforts were consistent or uniform in any state during any time period (Verts and Carraway 1998; C. Ludwig, NMNH, pers. comm.). Fluctuations in the fur market also caused trapper effort to vary depending on demand, so correlations between the collection of lynx specimens in Oregon and lagged synchrony with Canadian populations are questionable and may be entirely coincidental.*

The most recent verified records for the following states are as follows: MN = 1993, NH = 1992, **OR = 1993**, UT = 1991, WI = 1993. This is the "post-pulse" time frame. Given that this phenomena occurs and is well documented across Canada and in the northern tier states (Chapter 8, 232-242), we argue that it is reasonable to conclude that unusual records in anomalous habitats coincident with these pulses are therefore more likely to reflect cyclic pulses of transient individuals. In the early 1960's, after one of the 2 largest

pulses in the 20th century, many lynx were killed in North Dakota (Adams 1963). In evaluating this phenomenon, it would be foolish to ignore the timing of the mortalities. We emphasize again that an individual occurrence record, in and of itself, means little. If unverified, it could be a misidentification, or have the wrong spatial/temporal association. For instance, a person can buy a stuffed lynx from Cabella's and subsequently claim that it was shot in Mississippi. Furthermore, our verified records could represent pets, fur-farm escapees, transients, or residents. Of all of these possibilities, however, the last is of greatest interest to lynx conservation.

Appendix F, page 1. *McKelvey et al. (2000) stated that lynx showed strong selection for the lodgepole pine class in winter, with 53 percent of the telemetry locations in this class for winter and 48% in summer when using the fuels map. All other forest classes were* $\leq$ *15 percent. Using geographic information system (GIS) classifications, 39 percent of the locations in winter were in the lodgepole pine class with 33 percent in summer compared to the subalpine fir class with 25 percent of locations. McKelvey et al. (2000) showed the strong preference of lynx to the lodgepole pine types, particularly when the Fuels mapping process is used to delineate habitat. McKelvey et al. (1990) also found that one of four lynx with greater than 50 locations distributed across seasons and covering more than 500 days showed use of vegetation classes that differed significantly from availability within its home range: one lynx (#104090) selected the lodgepole pine class (based on the fuels map) in winter* ($X^2 = 6.0$, $df = 1$, $p < 0.02$) *and avoided the subalpine fir class (GIS map) in summer* ($X^2 = 4.5$, $df = 1$, $p < 0.04$).$\cong$ *Visual representations of lynx preference for lodgepole pine over other vegetation types for this study can be found in Figures 10.4,10.6,10.7, and 10.8 of McKelvey et al (2000).*

With the exception of a typo (McKelvey et al. 1990), this is a reasonably accurate synopsis of our conclusions. Note, however, that the Lodgepole-Alpine Fir split in these data is associated with stand age. Alpine fir stands are older.

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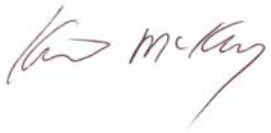

Kevin S. McKelvey

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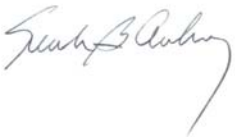

Keith B. Aubry