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Coarse-scale surveys for wolverine distribution and habitat in Interior Alaska

Craig Gardner
Jim Lawler

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This is a progress report on continuing research. Information may be refined at a later date.

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ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 25526
Juneau, AK 99802-5526

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PRINCIPAL INVESTIGATORS: Craig Gardner and Jim Lawler, National Park Service

COOPERATOR: None

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STATE: Alaska

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I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

Wolverines (*Gulo gulo*) are found throughout Interior Alaska (Manville and Young 1965) but little is known about distribution patterns, densities, and habitat preferences. As a result, wolverine management and mitigation decisions in Interior Alaska have been based on inferences from harvest data and incidental observations by biologists and trappers. Sole reliance on these sources of information without empirical population and distribution information is problematic.

In Interior Alaska during recent years, industrial and recreational activities have increased (Fairbanks Gold Mining, Inc. 2004; Alaska Department of Natural Resources 2006). The effects of these activities on wolverines are not known but in other areas in North America, wolverine populations have declined due to human disturbance (Weaver et al. 1996; Banci and Proulx 1999).

Hatler (1989) suggested that appropriate, responsive management requires a better understanding of the nature, extent, and correlates of wolverine occurrence. Distributional surveys could generate habitat-relation models that would improve our understanding of factors affecting wolverine distribution in Interior Alaska. These models would be very useful in ensuring adequate management for wolverine populations and their habitats.

In 2004 the Alaska Department of Fish and Game (ADF&G) and National Park Service (NPS) investigated broad-scale wolverine distribution and habitat requirements in Interior Alaska. We examined wolverine distribution, landscape parameters and inter-specific associations for wolverines on a regional scale. Our objectives were to: 1) establish a baseline map of wolverine distribution in central and eastern Interior Alaska, 2) design a sampling scheme adequate to detect changes in wolverine distribution that managers could easily use, and 3) determine if habitat associations could be identified that would reliably explain wolverine presence. Achieving these goals would benefit wolverine management in Interior Alaska by providing quantifiable and scientifically defensible data on which to base management decisions.

II. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

In March 2003, wolverine experts discussed future wolverine management and research needs and agreed that identifying habitat parameters that are common to all wolverine ranges was important and should be a research priority (Carnivores 2002 wolverine workshop).

During winter 2002–2003, Magoun et al. (unpublished data) tested a survey technique designed to determine wolverine distribution and habitat parameters over a large area in Ontario, Canada. The study area encompassed about 450,000 km^2 and was subdivided into 1,000 km^2 hexagon sample units, approximating the size of a male wolverine's home range. The area was stratified on 3 variables: 1) presence of woodland caribou, 2) probability of snow being retained in April, and 3) ruggedness of the terrain. A transect approximately 32 km long through each selected hexagon was surveyed. Observers recorded the presence of wolverine, caribou, moose, lynx, fisher, wolves, snowshoe hares, human presence, and noted topographical features and dominant vegetation types within the hexagon.

In 2005, Magoun et al. (2007) redesigned their approach to determine extent of wolverine distribution and area of occupancy in a 50,000 km^2 area by using aerial survey and hierarchical modeling. They changed their sampling units to 100 km^2 hexagons which approximated the minimum home range of resident female wolverines (Banci 1994). Their use of smaller sample units was to improve the spatial characteristics of occurrence. Their objectives that were most pertinent to our study were: 1) produce a baseline map of wolverine distribution, and 2) define the extent of occurrence and area of occupancy as objective metrics. These data can be used as a baseline reference to compare future patterns of wolverine distribution.

III. APPROACHES USED AND FINDINGS RELATED TO THE OBJECTIVES AND TO PROBLEM OR NEED

OBJECTIVE 1: <u>Determine wolverine distribution in central and eastern Interior Alaska.</u>

<u>Methods</u>. We partitioned the 180,000-km^2 study area into a grid of 180 1,000-km^2 hexagon sample units. Sample unit size was chosen to approximate a male wolverine's home range in Interior Alaska (Gardner 1985; Whitman et al. 1986; Banci 1987). Sample units were aerially surveyed using a Piper Super Cub (PA-18) during 8 February–7 March 2006 flown at 140–300 m above ground level at about 120 km/hr. We only surveyed on days with sunny or bright overcast skies when winds were <32 km/hr. We waited at least 24 hours following snowfalls of >5 cm or windstorms with sustained wind speeds >50 km/hr. We had no upper limit of days following snowfall or wind. We

considered a wolverine to be "detected" if wolverine tracks were observed in the survey unit.

Survey units were systematically sampled by flying a transect through the sample units using the coordinates of the midpoints of the edges, and the coordinates of the center point of the hexagon. The hexagon shape provided flexibility and efficiency in surveying because there were 6 edges that were equal distance from the center point. A transect would enter a hexagon on one bearing, fly to the center of the hexagon and then choose 1 of 5 bearings to complete the transect. Hexagons were sampled successively by using the ending point of one transect as the starting point for the next. The distance across the hexagon was 32 km but we surveyed using a flight path that minimized time spent over habitats (i.e., dense spruce stands) or other natural features (concentrated caribou tracks) where wolverine track detection was improbable and maximized the time spent in areas that looked promising for wolverine tracks (e.g., drainages, ponds, forest openings), and to follow any questionable tracks to confirm identity. For this reason, actual flight distances in sample units varied between units but rarely exceeded 2–3 km. The most important component of the technique was track identification. The teams spent as much time needed to verify track identity including back and forward tracking and landing. Similar to Magoun et al. (2007), we followed any questionable tracks until we observed the wolverine characteristic 3 track lope or until it became obvious the track was not made by a wolverine. Tracks that remained questionable were discarded and not used in analysis to avoid false positives (Sargeant et al. 2005).

Detection of wolverine tracks is imperfect. To improve our estimate of wolverine absence/presence we used multiple transects through a sample unit to estimate occurrence and detection probabilities (Magoun et al. 2007). Following descriptions in MacKenzie (2005) we used the removal method where we would sample a sample unit 1 time collecting habitat data and searching for wolverine tracks. If evidence of wolverines were not located during the first transect, we would fly up to 3 additional transects searching for wolverine tracks but would stop once a wolverine was detected. Completing 4 transects through the hexagon would subdivide the study area into 166.7 km^2 blocks. Studies conducted in North America found that resident female home range size averaged 100–400 km^2 and were smaller than those of resident males and transient animals (Banci 1994). Completing 4 transects minimized the chance that few, if any, potential home ranges would not be included in a survey route. Each transect line within the unit was about the same length but followed a different bearing.

We used the hierarchical spatial-model and codes presented by Magoun et al. (2007) to determine probabilities of occurrence of wolverine tracks. We followed methods outlined by Sargeant et al. (2005) to determine detection probability. We compared model results with historical trapping records to identify any anomalies.

Results. We surveyed 149 (82.8%) of the 180 sample units over 10 days during 8 February–12 March 2006. Of the 149 sample units, 118 (79.1%) were surveyed once, 11 (7.4%) twice, 14 (9.4%) 3 times, and 6 (4.0%) 4 times. We found wolverine tracks in 112 (76.2%) of the units of which, detection occurred 88.4% following 1 survey transect and 97.3% following 2. No detection of wolverine tracks occurred during a fourth transect. Our detection probability estimate for finding wolverines if present was 86.3% for 1 search, 98.1% for 2, 99.7% for 3, and 99.9% for 4 searches through a sample unit.

There was some evidence that detection probabilities were higher for surveys conducted after 15 February and if caribou were not concentrated but the differences were not significant. Overall, we found wolverine tracks in blocks of contiguous sample units (≥10 sample units) in the eastern and northwestern portions of the study area (Figure 1). Wolverine tracks were not found in a 15-block cluster of sample units in the vicinity of Fairbanks (Figure 1).

We found strong evidence of occurrence (probability of occurrence>0.80; Sargeant et al. 2005) in 67.8% of the 180 sample units and strong evidence of absence (<0.20) in 11.7%, and weak evidence of either presence (0.50–0.80) or absence (0.20–0.50) in 20.6% indicating strong spatial structure throughout the study area (Figure 2). Of the 37 sample units with weak evidence or presence or absence, 22 (59.5%) were not surveyed. Magoun et al. (2007) recommended that ≥70% of the sample units should be units with either strong evidence of presence or strong evidence of absence to ensure an unambiguous estimate of wolverine distribution. In our study area, 79.7% of the sample units had strong evidence of presence or absence.

Following Magoun et al. (2007), we defined area of occupancy and core range as those survey units with occurrence probabilities >0.20 and >0.50, respectively. Our estimate of area of occupancy was as 59,000 km^2 (88.3%; Figure 2) and core range, 147,000 km^2 (81.7%; Figure 3) within the 180,000-km^2 study area. These data indicate that wolverines are generally distributed throughout Interior Alaska except in the vicinity of Fairbanks; Alaska's second largest city. Wolverine occurrence based on our survey generally agreed with occurrence patterns based on trapping records except that our data were able to fill in information gaps due to little to no trapping occurring in some of the remote areas in Interior Alaska.

OBJECTIVE 2: <u>Determine habitat parameters on a landscape scale in Interior Alaska and develop a habitat model to help identify which habitat variables are most correlated with wolverine presence.</u>

To determine if habitat associations could be identified that would reliably explain wolverine presence, we gathered information using direct observation or observation of tracks, of the presence of caribou (*Rangifer tarandus*), Dall sheep (*Ovis dalli*), fox (*Vulpes vulpes*)/coyotes (*Canis latrans*), gallinaceous birds (*Bonasa umbellus*, *Tympanuchus phasianellus*, *Dendragapus canadensis* and *Lagopus* sp.), lynx (*Lynx canadensis*), marten (*Martes americana*), moose (*Alces alces*), otters (*Lontra canadensis*), snowshoe hares (*Lepus americanus*), wolves (*Canis lupus*), snowmachines and human structures within the sample unit. We used a digital elevation model in a geographical information system (GIS; ArcMap 9) to determine mean elevation and calculate a measure of terrain ruggedness in each hexagon. We used these variables to examine landscape and interspecific correlates that predict the occurrence of wolverines by developing a predictive logistic regression model for the units surveyed. Our dependent variable was the detection or nondetection of wolverine tracks in each sample unit. Independent variables considered in the logistic regression models included presence of wolves, caribou, marten, Dall sheep, lynx, snowshoe hares, gallinaceous birds, snowmachine trails, human structures, and elevation and terrain ruggedness. We used Akaike's Information Criterion to rank candidate models and chose the model with the lowest Akaike score as the best model (Anderson et al. 2000). We also evaluated if abundance of these factors and not just presence affected wolverine presence by assigning abundance categories.

We found some evidence that wolverine presence was positively correlated with terrain roughness, elevation, and marten and negatively correlated with human presence and wolves. However, we were not able to construct a model that reliably correlated wolverine presence and habitat features probably due to the large size of the study units in relation to distribution of the habitat parameters.

IV. MANAGEMENT IMPLICATIONS

Our study provided a baseline map with an unambiguous estimate of wolverine distribution in Interior Alaska including estimates of the extent of wolverine occurrence and core ranges. This information can be used by managers to monitor changes in wolverine distribution and core areas of occupation by comparing future results with our baseline information. One of the benefits of this technique is that it can accommodate differences in skill level of surveyors but to be comparable between years and teams it will be imperative to conduct repeat transects to determine detection probabilities in order to compare to our baseline results.

V. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN FOR LAST SEGMENT PERIOD ONLY

JOB/ACTIVITY 5: Data analysis and reports

Analyzed data and completed the Federal Aid Final Research Report. We completed a preliminary draft of an article to be submitted to a scientific journal.

VI. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THE LAST SEGMENT PERIOD, IF NOT REPORTED PREVIOUSLY

None.

VII. PUBLICATIONS

Gardner, C., J.P. Lawler, X. Chen, and K. Kellie. (in prep.). Using coarse-scale wolverine distribution surveys and occurrence probability modeling to monitor wolverine distribution patterns in Interior Alaska.

VIII. RESEARCH EVALUATION AND RECOMMENDATIONS

Methods used allowed us to adequately establish a baseline map of wolverine distribution in central and eastern Interior Alaska. The sampling intensity used will allow managers to track with acceptable confidence wolverine distribution changes in occurrence and core areas. Our sampling intensity was not adequate to determine habitat factors that explained wolverine distribution patterns. To better understand habitat relationships to wolverine distribution in Interior Alaska, we recommend reducing the sample unit size to 100 km^2 and follow methods described in Magoun et al. (2007). Reducing the size of the sample unit would also provide better resolution of spatial characteristics of occurrence and may give the manager better insight on affects of industrial or recreational activities on wolverines.

IX. APPENDIX

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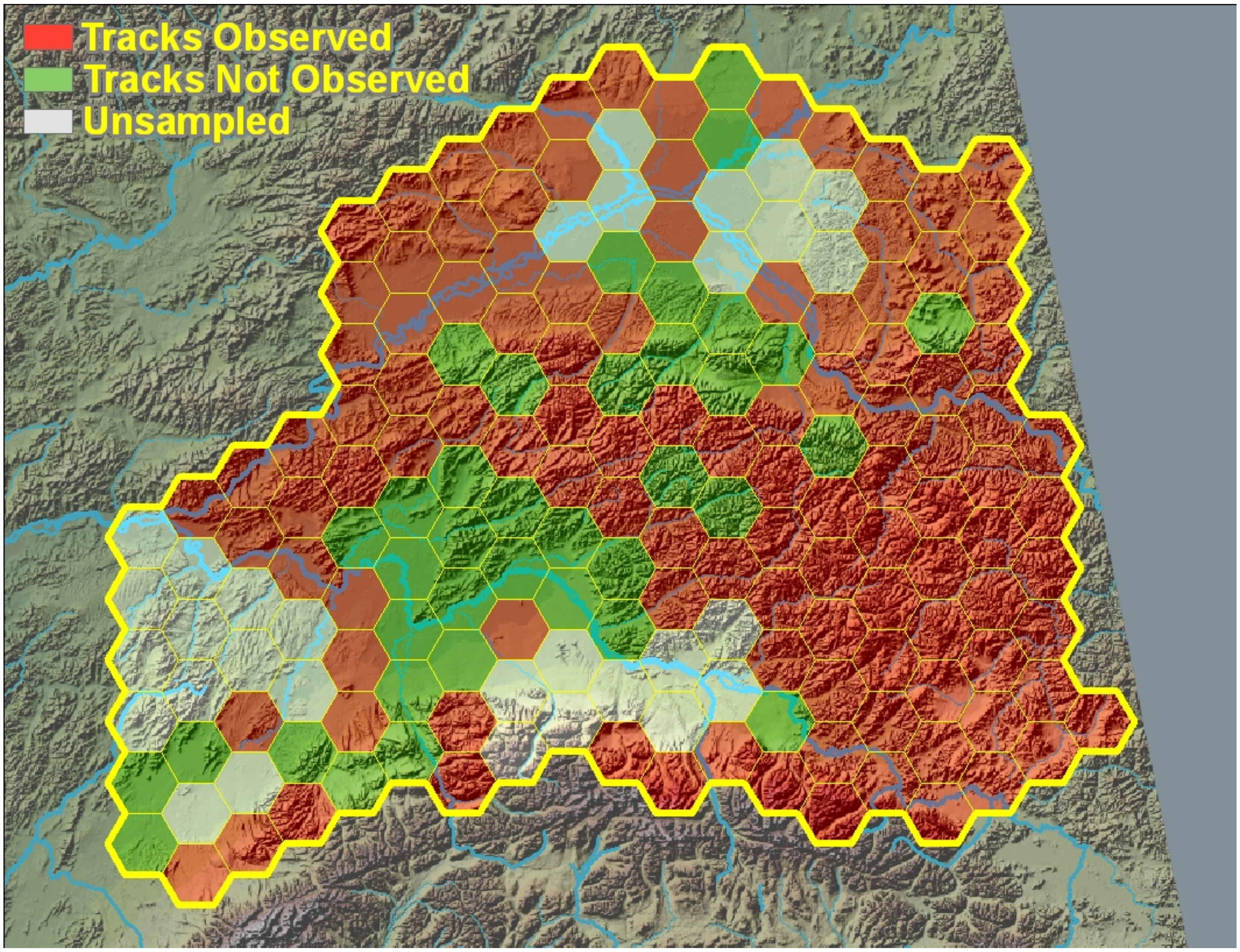

Figure 1. Distribution of surveyed sampling units with and without detected wolverine tracks

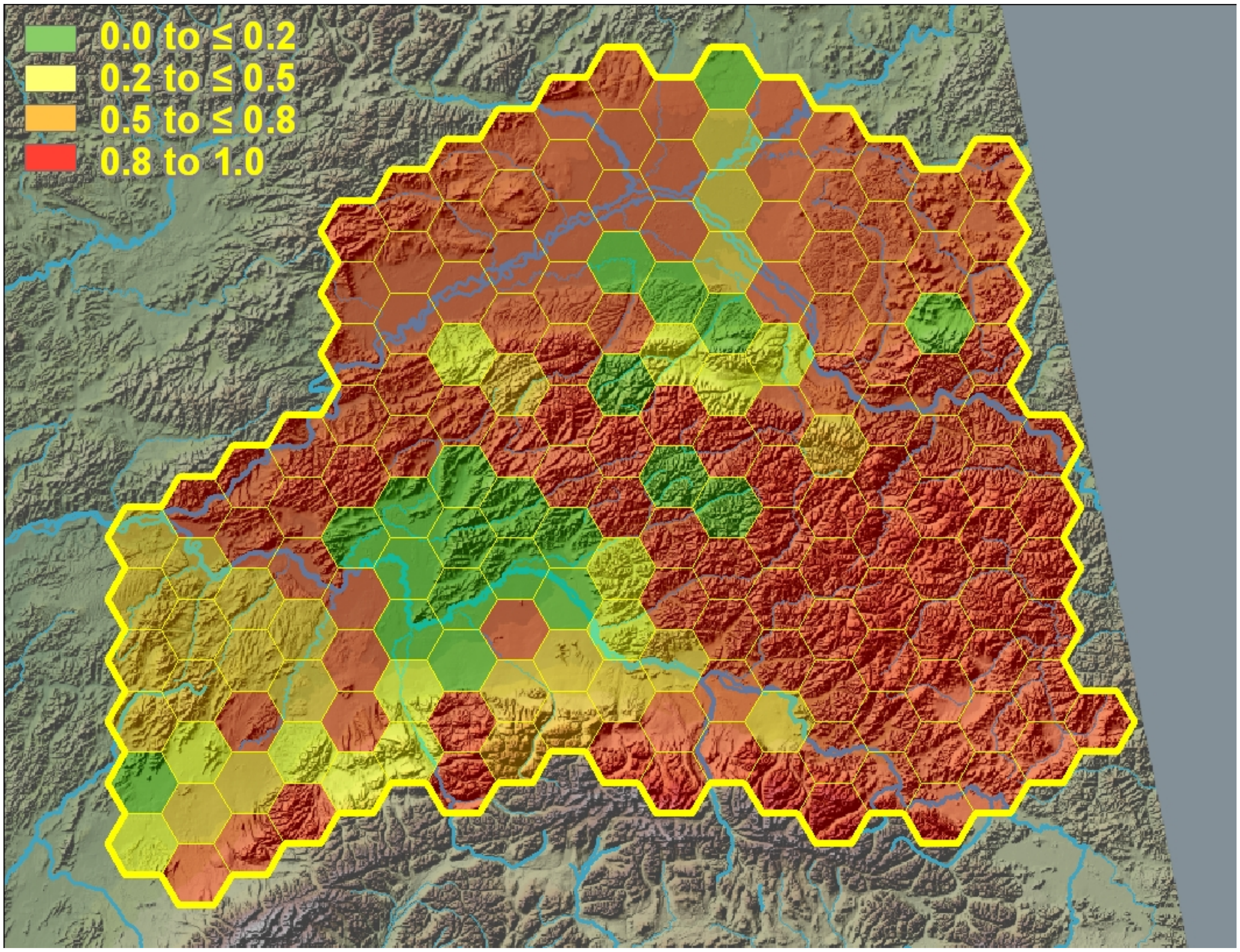

Figure 2. Estimated area of occupancy (occurrence probabilities>0.20) based on occurrence and detection probabilities

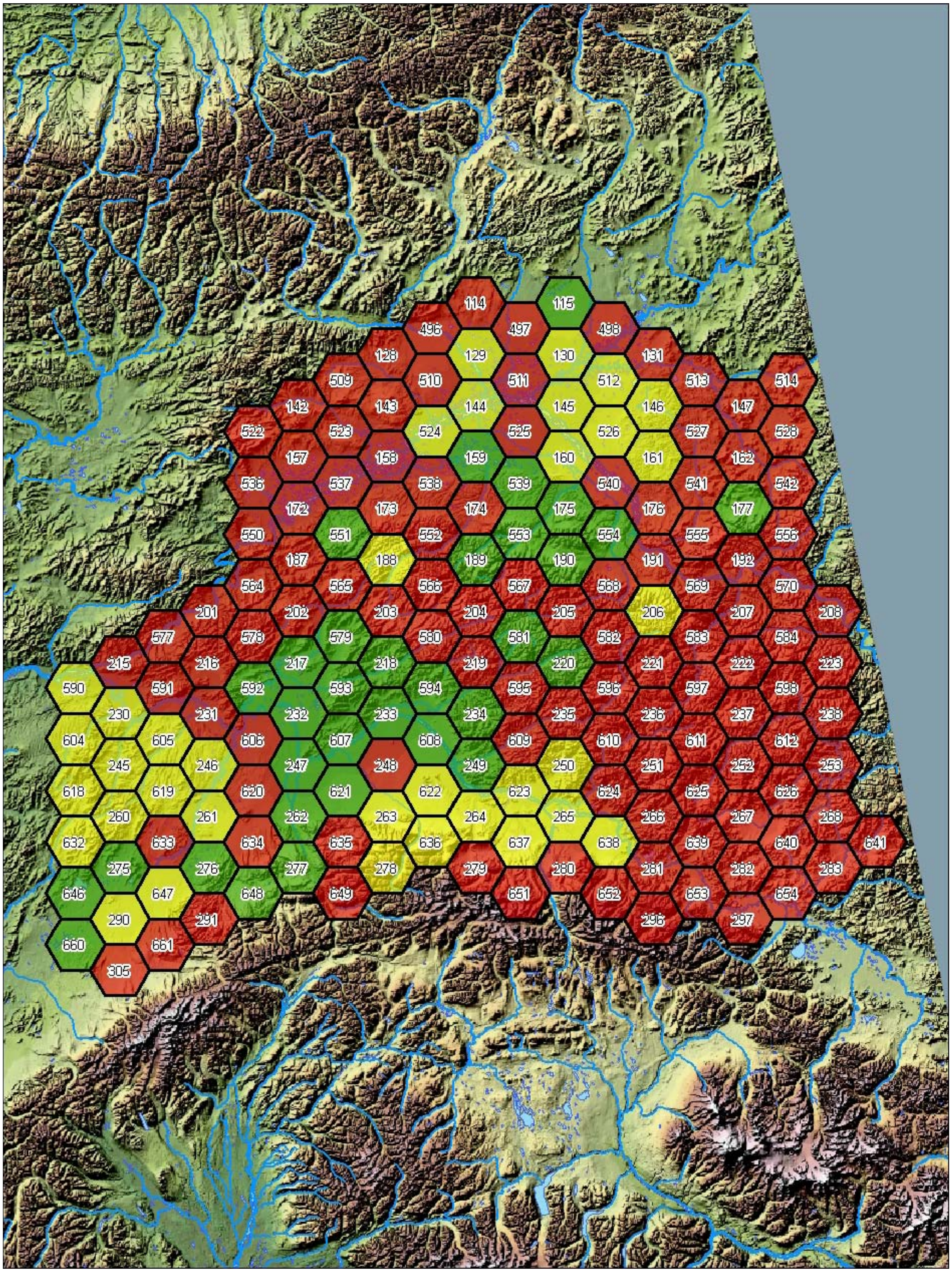

Figure 3. Estimated distribution of core range (occurrence probabilities >0.50) based on occurrence and detection probabilities

PREPARED BY:

Craig L. Gardner
Wildlife Biologist III

SUBMITTED BY:

Mark E. McNay
Research Coordinator

Laura A. McCarthy
Publications Technician II

APPROVED BY:

Clayton R. Hawkes
Federal Assistance Coordinator
Division of Wildlife Conservation

Douglas N. Larsen, Director
Division of Wildlife Conservation

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