WOLVERINE – WINTER RECREATION RESEARCH PROJECT:
INVESTIGATING THE INTERACTIONS BETWEEN WOLVERINES AND WINTER RECREATION

2014 PROGRESS REPORT

OCTOBER 27, 2014

KIMBERLY HEINEMEYER
ROUND RIVER CONSERVATION STUDIES
284 W 400 N, SUITE 105
SALT LAKE CITY, UTAH 84103

AND

JOHN R. SQUIRES
ROCKY MOUNTAIN RESEARCH STATION
ROOM 263, FEDERAL BUILDING
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WITH THE SUPPORT OF PROJECT PARTNERS AND COLLABORATORS INCLUDING:

BOISE, BRIDGER-TETON, CARIBOU-TARGHEE, PAYETTE AND SAWTOOTH NATIONAL FORESTS
IDAHO DEPARTMENT OF FISH AND GAME
LIZ CLAIBORNE ART ORTENBERG FOUNDATION
THE WOLVERINE FOUNDATION
UNIVERSITY OF MONTANA
GRAND TETON NATIONAL PARK
WYOMING DEPARTMENT OF GAME AND FISH
US FISH AND WILDLIFE SERVICE
IDAHO STATE SNOWMOBILE ASSOCIATION
BRUNDAGE MOUNTAIN RESORT
GRAND TARGHEE RESORT
JACKSON HOLE MOUNTAIN RESORT
CENTRAL IDAHO RECREATION COALITION
DEFENDERS OF WILDLIFE
THE SAWTOOTH SOCIETY
THE WINTER RECREATION COMMUNITIES OF CENTRAL IDAHO AND WESTERN YELLOWSTONE.

To obtain additional project information, see www.forestcarnivornes.org

ACKNOWLEDGEMENTS

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The project would not have been possible without individuals within our partnering agencies having tirelessly assisted the project in numerous ways. In particular, we thank Diane Evans Mack and Rob Cavallaro (IDFG), Tammy Fletcher (Caribou-Targhee National Forest), Ana Egnew (Payette NF), Lisa Nutt and Joe Foust (Boise NF), Robin Garwood (Sawtooth NF) and Gary Hanvey and Kerry Murphy (Bridger-Teton NF) for diligently ensuring the success of the project. We thank Jeff Copeland (The Wolverine Foundation) for the many ways he assists and advises us. We are indebted to Mark Hebblewhite (University of Montana) for his advice and guidance as a member of our science team. We also want to thank Mark Drew, IDFG Veterinarian for his assistance and time in training us and helping us safely anesthetize wolverines. Many Forest Service and IDFG staff have helped us – we thank you all for your assistance and support.

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The backbone of the research is high quality data collection under sometimes challenging conditions, and we are indebted to our hard-working 2014 field crew: Blakeley Adkins, Matt Amick, Isaac Babcock, Anne Blackwood, Grace Carpenter, Chris Cole, Jeff Copeland, Danielle Fagre, Sierra Groves, Dylan Hopkins, Lindsay Jones, Rollie Jones, Shannon Jones, Suzanne Johnston, Matt Kasprzak, Chris Klingler, Kyle Krapster, Tulley Mackey, Alex May, Cy McCullough, Nick Miller, Ryan Mong, Celina Moreno, Katy Nelson, Zoe Nelson, Rachel Rubin, Molly Shuman-Goodier and Jarrod Zweigart. Their commitment, professionalism and good humor have made the project not only successful, but also good fun.

We thank the hundreds of recreationists who agreed to carry funny little orange data loggers while out having fun and who took the time to return them to us. Your contribution provides a critical foundation to the project.

Finally, we thank the wolverines, some who also carried funny, little data loggers for us, and who have taught us so much.

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WOLVERINE – WINTER RECREATION RESEARCH PROJECT
2014 Progress Report

EXECUTIVE SUMMARY

We have completed 5 winters of research detailing the interactions between wolverines and winter recreation, including the GPS tracking of both wolverines and winter recreationists in 3 study areas in central Idaho and 2 in the western Yellowstone. We have successfully gathered movement and habitat use information on 17 wolverines and collected over 4,500 tracks of winter recreationists. Heinemeyer and Squires 2013 details past efforts and this report updates that information with data and analyses completed in 2014. We seek continued support from The Wolverine Foundation as we enter into the final year of field data collection followed by a year of data analyses, reporting and outreach with agencies and stakeholders.

In 2014, we undertook an ambitious wolverine and recreation monitoring effort across 3 study areas and captured and GPS collared 8 wolverines. We collected nearly 2,000 GPS tracks including both backcountry skiers in the Teton Mountains and snowmobilers in the Centennial and Henry Mountain ranges in areas that overlap GPS-collared wolverines and potential wolverine habitats. We compiled these new data with our prior data as we continue data exploration. As we have suggested previously, wolverines appear to tolerate winter recreation in their home ranges, including denning females. Based on our preliminary findings, potential wolverine habitats that have even high levels of winter recreation may support resident wolverines despite the potential human disturbance. However, wolverines exposed to higher levels of winter recreation within their home range may show avoidance of these recreated areas, suggesting potential threshold effects. While these 'high recreation' wolverines may avoid recreated areas, they are still found within locally intense recreation areas 22% of the time but with elevated movement rates. Wolverines that reside in lower recreated landscapes are only found within high-recreated areas 6% of the time but show much higher movement rates than their 'high recreation' cousins. Additionally, we find that denning females show much higher movement rate increases in response to high recreation areas than non-denning females. There appears the potential for some level of habituation but energetic implications are clearly an area of additional research and analyses as we seek to understand these complex interactions.

We require an additional year (winter 2014-15) of field research in the western Yellowstone area and hope to also continue monitoring resident wolverines in our central Idaho study areas. This will be followed by a year (2016) of data analysis, reporting and outreach to agencies and stakeholders.

INTRODUCTION

The growing popularity of winter backcountry recreation has resulted in winter recreation expanding into previously undisturbed and unreachable public lands that represent the high quality wolverine habitats. The potential effects of winter recreation on wolverine reproduction, behavior, habitat use and populations are unknown but there is concern regarding the effects of winter recreation on the species, particularly in areas favored by females for reproductive denning (Greater Yellowstone Coordinating Committee 1999, Carroll et al. 2001, May et al. 2006, Copeland et al. 2007, Krebs et al. 2007). Even in Canada, which could be considered the North American stronghold for the species, wolverine status was changed to 'Special Concern' in May 2014 with increased winter recreation use combined with sensitivity of denning females listed among the primary reasons for this change (www.cosewic.gc.ca).

The goal of the Wolverine – Winter Recreation Study is to identify and evaluate wolverine responses to winter recreation. The project was initiated in 2009 with winter aerial surveys in central Idaho to identify and map the presence of wolverine as well as motorized and non-motorized winter recreation (Copeland 2009). These surveys identified areas of extensive recreation use within potential wolverine denning habitat, and wolverine presence in some of these areas of overlap. In the winter of 2010, the field-based research effort began with GPS monitoring of both wolverines and winter recreationists in areas where overlap between wolverines and winter recreation occurs.

The USFS Rocky Mountain Research Station and Round River Conservation Studies lead the study in partnership with the National Forests and the Idaho Department of Fish and Game. We also work with Wyoming Game and Fish and the Grand Teton National Park in areas were the study falls within these jurisdictions. We have developed a research effort that is uniquely collaborative across federal and state agencies, non-government organizations, winter recreationists and local businesses. This collaborative research approach is critical not only to the success of data collection efforts but also to build opportunities for collaborative and creative problem solving when research-based management actions are considered.

Over the 5 years of field data collection, we have monitored the movements and habitat use of 9 females and 8 male wolverines with an additional 1 female and 4 males collared but data not successfully gathered. This report focuses on data collection and analysis completed in 2014; a summary of prior efforts is available in Heinemeyer and Squires 2013.

2014 FIELD EFFORTS

STUDY AREAS

The 2014 field effort was multi-faceted and included continuing the monitoring of wolverines and winter recreations at various levels of intensity across our study areas in central Idaho (Boise, Payette and Sawtooth National Forests) while focusing the core of our effort to complete a first full year of data collection in 2 study areas in the western Yellowstone region of Idaho and Wyoming.

The new study areas in the western Yellowstone fell across 3 federal jurisdictions and 3 states. The 'Island Park' study area includes the Centennial and Henry Mountains south of the Idaho-Montana state line and on the Caribou-Targhee National Forest (NF). The GPS-equipped wolverines and recreationists frequently travelled north into Montana and onto the Gallatin NF in the Henry Mountains. The Teton study area encompasses the Teton Mountains which fall within the Caribou-Targhee and Bridger-Teton NFs and Grand Teton National Park, in both Idaho and Wyoming (Figure 1).

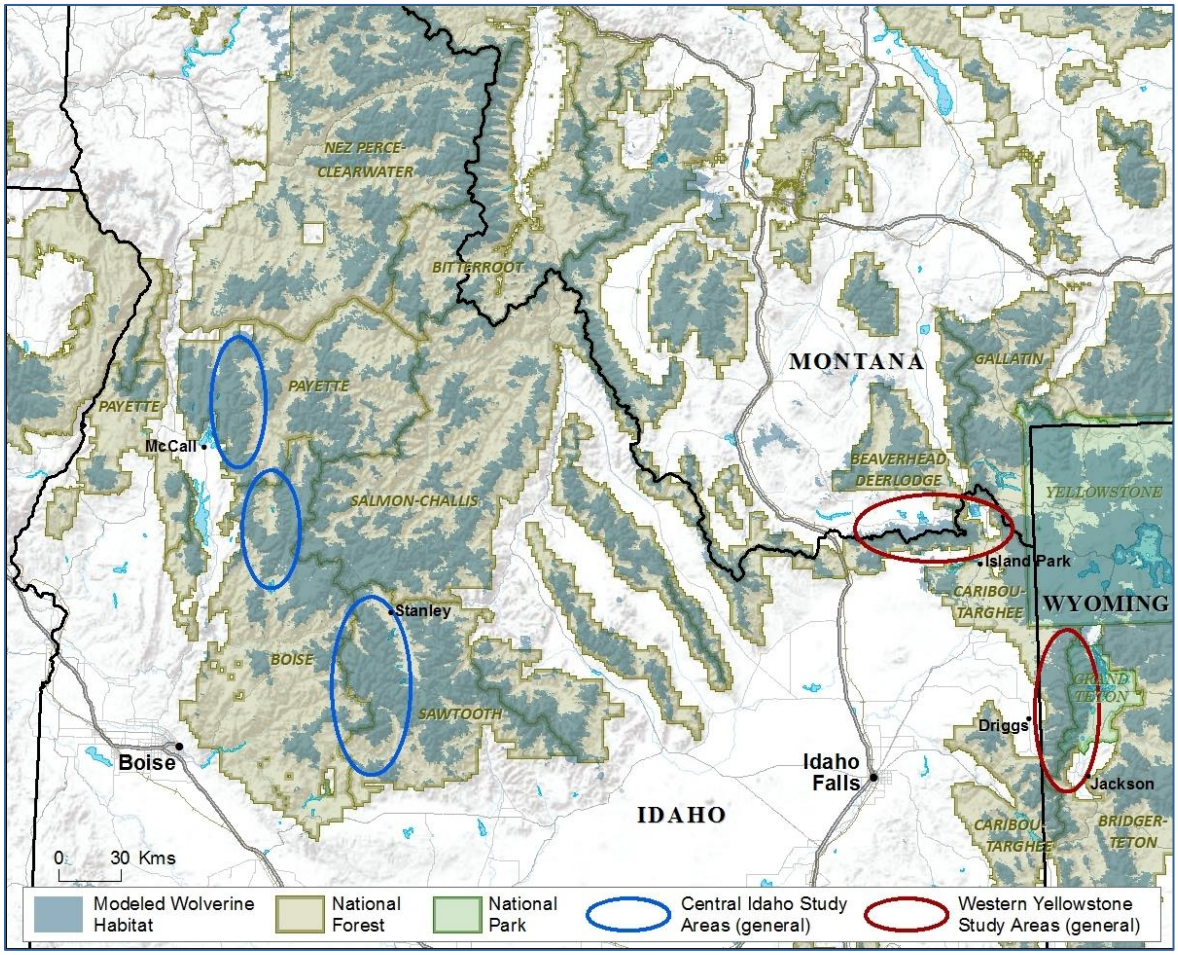

Figure 1. Idaho Wolverine-Winter Recreation Study Region and Study Areas: Central Idaho study areas on the Payette, Boise and Sawtooth National Forests indicated by blue circles, western Yellowstone study areas indicated by red circles.

WOLVERINE GPS COLLARING

Salmon Mountains Study Area. In central Idaho, we focused trapping efforts in the Salmon Mountains near McCall. The winter represented our 4th year collaring animals for intensive data collection in this popular winter recreation area over the course of 5 winter field seasons (we did not trap here in 2013). We were rewarded for our commitment to this important study area, capturing and collaring 3 adult female and 2 adult male wolverines (Figure 2). Traps were open between January 8 and February 20 prior to closing for denning season; during this time we recaptured some animals multiple times for a total of 8 wolverine captures in 184 trap-nights (Table 1). Of these, 2 females and one male were animals we have previously monitored including M1, our first male collared on the project in 2010 and F3 a female also initially collared in 2010. One of these females, F10, was an animal born in the White Cloud Mountains north of Sun Valley and collared there by our team as a subadult in 2012. We documented her ~100-mile dispersal from there to the Salmon Mountains where she established a home range that was nearly identical in spatial extent as the original F1 female who had been monitored in the area for 3 years (2010-2012) but has not been seen in 2 years. The new female F10 had her first kits this winter, likely fathered by M1 based on her home range within his territory. She chose a den within a drainage that was not visited by recreationists but is close to high levels of snowmobile recreation (Figure 2). In early September, we visited her now-abandoned den located in a large boulder field of a cirque basin (Figure 3) and collected and have submitted scat and hair samples for DNA analyses in hopes of identifying kits and their parentage.

Also in the Salmon Mountains, we collared a new male, M12 who appears to have replaced both M2 and M3 who have not been identified in recent winters. Male M12 occupies a home range covering a vast 2316 km^2 (913 mi^2) which is the largest home range we have documented (Figure 2). We ran live traps and camera traps in the territory originally occupied by F2, but it appears to still be vacant after F2 disappeared more than 2 years ago. We were pleased to fit another GPS collar on F3 who was originally captured in 2010 when she successfully denned in a remote, non-recreated portion of the study area. Since then, we have continued to monitor her but have not seen evidence of additional reproductive effort.

Overall, we have witnessed a significant turnover of animals in these mountains, with 4 of our original 6 resident animals gone, replaced to date by only 2 new animals leaving a couple territories potentially vacant. These animals are exposed to high snowmobile recreation (Figure 2) and represent very important individuals to the research effort – including documenting residency, reproductive efforts and behavioral responses (e.g., movements, activity, habitat use).

Western Yellowstone Study Areas. In our new western Yellowstone study areas, we built new or repaired existing wolverine box traps in the Centennial, Henry and Teton Mountains on the Caribou-Targhee NF. We captured and collared 3 animals: 1 adult male in the Teton Mountains and a male and a female both in the Henry Mountains (Figure 4). The Teton male carries an implant transmitter from a prior research project, and we are waiting upon genetic analyses to identify this individual.

It is interesting that we did not capture more wolverines in these areas of known historic occupancy. In the Tetons, our trapping was limited to the west side of the mountain range and it is possible that there could be female wolverines that reside primarily in the eastern portions of the range. For the winter of 2015, we have applied for research permits to expand our trapping effort into Grand Teton National Park, providing access to the east side of the mountain range. We found no verified evidence of wolverines in the Centennial Mountains despite significant live-trapping effort in January and February (Table 1) followed camera-trapping through late March. The only potential evidence of wolverine presence was a possible track seen from fixed wing aircraft and thus identified with limited confidence. This mountain range is key habitat for wolverines as connectivity between the Yellowstone Ecosystem and the central Idaho complex of habitats (e.g., McKelvey et al. 2009, Idaho Department of Fish and Game 2014) and has been assumed by managers to support wolverines.

Table 1. Summary of trapping effort during January-February 2014 within each of the primary mountain ranges or study areas: for each species, the total number captured (including recaptures of the same animal) is listed first and the capture success rate is indicated as (captures/100 trap nights).

	Total Trap Nights	Wolverines	Marten	Fox
McCall (10 traps)	184	8 (4.3)	4 (2.2)	1 (0.5)
Tetons (6 traps)	255	2 (0.8)	4 (1.6)	9 (3.5)
Henrys (1 trap)	39	5 (12.8)	3 (7.7)	0 (0)
Centennials (5 traps)	174	0 (0)	2 (1.1)	0 (0)

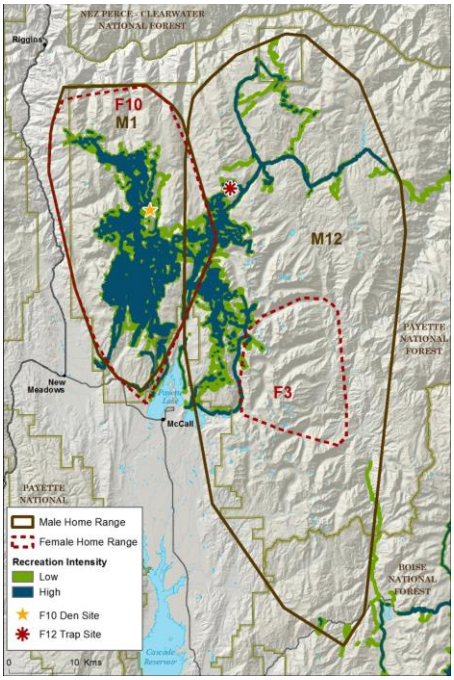

Figure 2. Home ranges of wolverines monitored in the winter of 2014 in the Salmon Mountains near McCall, Idaho with the estimated winter recreation footprint based on GPS recreation tracks: blue indicates median or higher density of recreation tracks while green indicates recreation track density of less than median. One female F12 was collared (location shown), but has not been relocated; another female, F10, denned in late February and her approximate den site is shown.

Figure 3. Female wolverine F10 denned in a large boulder talus slope in the upper reaches of a small drainage.

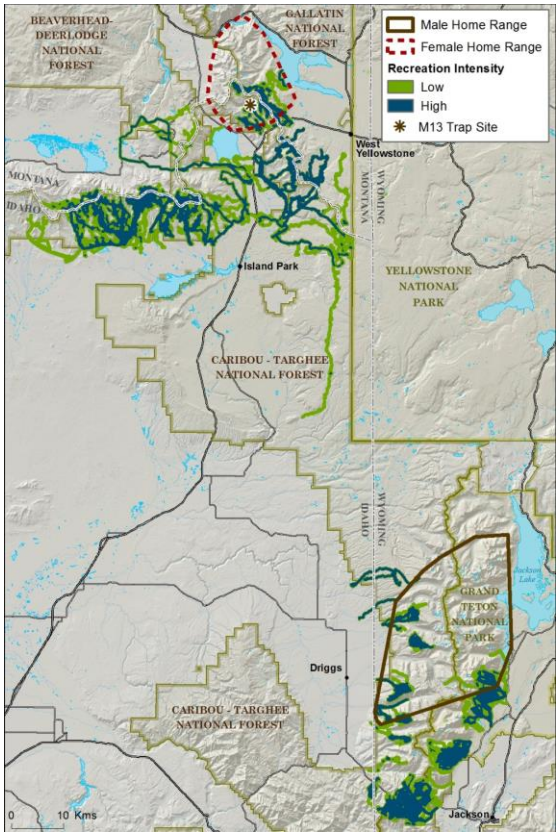

Figure 4. Home ranges of one male wolverine in the Tetons and one female wolverine in the Henry Mountains monitored in the winter of 2014 with the estimated winter recreation footprint based on GPS recreation tracks: blue indicates median or higher density of recreation tracks while green indicates recreation track density of less than median. One male M13 was collared in the Henry Mountains (location shown), but slipped the collar and no location data were collected.

Camera and Hair Collection Sampling

We used camera and hair collection sets to monitor wolverines in portions of our study areas on the Sawtooth, Boise and Payette NFs in central Idaho and also used camera traps to supplement live-trapping efforts in our new study areas in western Yellowstone. From the effort in central Idaho, we have identified known animals we have previously GPS monitored and potentially new animals; we are waiting upon genetic results to confirm the identity of these animals.

Camera trapping and hair-snare sites were used in western Yellowstone to extend our ability to identify new animals beyond our live-trapping efforts. Cameras were placed at trap sites in mid-February when live-traps were disabled for the denning season and cameras were maintained at traps not re-opened in mid-March. In addition, we added a new camera-trap site to the far western portion of the Centennial Mountains to ensure we had adequately covered potential habitats through the mountain range. All trapping in our western Yellowstone study areas, including camera-trapping, ended in early April prior to grizzly bear emergence to avoid any conflict with the bears. We photographed our known 3 wolverines on our cameras in the western Yellowstone study areas but did not identify new animals from the effort.

Recreation Monitoring

We undertook intensive recreation monitoring in our new western Yellowstone study areas, collecting 1,502 GPS tracks of backcountry skiers and the occasional snowmobiler in the Teton Mountains and 443 GPS tracks of snowmobilers in the Centennial-Henry Mountain study area (Figure 4). The GPS tracks provide high quality track information that can be used

at multiple spatial and temporal scales to evaluate wolverine responses (Figure 5) Based on our array of remote trail use counters, these GPS tracks represents a sample from an estimated more than 28,000 backcountry skiers and snowmobilers in the Teton Mountain study area and more than 23,000 snowmobilers in the Centennial-Henry Mountain study area. These levels of winter recreation exceed our highest levels recorded in the Salmon Mountains near McCall (which averages approximately 10,000 recreationists passing by our counters each winter). The high recreation in the western Yellowstone study areas confirms the importance of continuing our efforts in these new areas where wolverines have been present in the past and we assume are currently present in higher numbers than we were able to document this last winter.

We also completed an aerial-based winter recreation survey using methods described in Heinemeyer et al. 2011 for the Centennial, Henry, Teton and Snake River Ranges of the western Yellowstone and the Salmon Mountains near McCall (Appendix I). These aerial surveys use a standardized sampling approach to provide an independent estimate of the extent and relative intensity of winter recreation. These data will be used when working with the GPS track data to identify any information gaps or inconsistencies. For the Salmon Mountains, this data will be used to assess the prior GPS track data collected relative to the 2015 recreation patterns captured by the aerial surveys.

BASE DATA ACQUISITION AND PROCESSING

The eventual habitat modeling requires spatial data sets that span multiple jurisdictions and data owners. We invested significant effort over the summer to find, assess and compile most or all the primarily environmental and human infrastructure base layers into consistent data sets spanning multiple jurisdiction including 3 states, multiple National Forests and Grand Teton National Park. These base layers include land cover (vegetation cover, type, seral stage, etc), vegetation characteristics (e.g., NDVI, brightness and greenness indexes), terrain (elevation, slope, aspect, ruggedness), hydrology, roads, trails and snow-groomed routes.

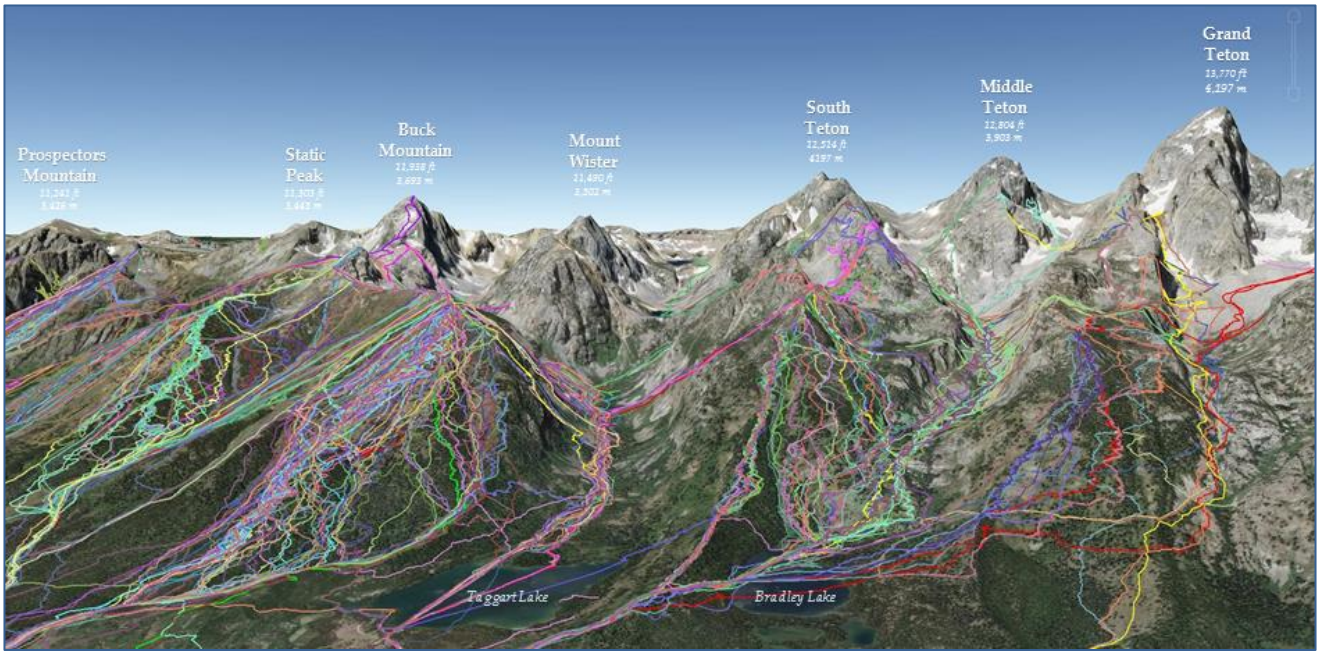

Figure 5. An example of the GPS recreation tracks collected by backcountry skiers in Grand Teton National Park during the winter of 2014; the male wolverine monitored in the Tetons travelled through this area.

PRELIMINARY ANALYSES

We have explored spatial and temporal patterns in the movements of wolverines relative to varying levels of snowmobile recreation intensity (we do not have sufficient sample size of animals exposed to backcountry ski activity to undertake analyses yet). Emerging patterns will help us refine our hypotheses and analyses.

Home range scale. For each study area, we estimated the winter recreation footprint based on our recreation GPS tracks, and from this we calculated the proportion of each wolverine home range that was within this footprint (e.g., Figure 2, 4). We found that across our animals, there was wide variability in their individual exposure to winter recreation from wolverines having less than 5% of their home range in recreation footprint to some wolverines having greater than 50% of their home range with snowmobile recreation. As we have suggested previously, wolverines appear to tolerate winter recreation in their home ranges, including denning females. Based on our preliminary findings, potential wolverine habitats that have even high levels of winter recreation may support resident wolverines despite the potential human disturbance.

We created an index of relative wolverine use of the recreation footprint by defining the *expected use* as equal to the proportion of each individual home range that was within the recreation footprint (assuming random use of the home range). We then classified each wolverine GPS location as in or out of the recreation footprint and calculated the proportion of locations that fell within the recreation footprint (i.e., estimated *realized* use of the recreation footprint). We calculated the difference between the realized and expected use of the recreation footprint for each wolverine (n=18). Summarizing this difference graphically by the amount of recreation within home range along the x-axis suggests there may be increasing avoidance of winter recreation areas as the amount of the home range affected by winter recreation increases (e.g., Type 3 selection, Johnson 1980; Figure 6). This is not a statistical approach, and additional analyses will control for potentially important variation. For example, we have not accounted for potential habitat differences between where people choose to recreate and habitats selected by wolverines, or if recreationist preferences change in areas with high competition for fresh snow leading to less overlap with potential wolverine habitats. Pursuing these lines of analyses may provide insights into variability in wolverine responses to winter recreation across different landscapes.

Individual movements. In prior reports, we presented preliminary analyses that suggests wolverines (n=12) exhibit higher movement rates and higher activity levels when they are in high recreation areas, with this effect most pronounced on weekends when the highest levels of recreation tend to occur (Figure 7). With our increasing sample size, we undertook some additional exploration of these patterns. We found that the reproductive status of the females may affect their potential response winter recreation with females who are denning (n=6) having a stronger response (i.e., higher movement rates) when in a high recreation zone than do females who are not denning (n=9) (Figure 8). These data are pooled across females based on the individual's denning status in each winter season and females that have been monitored for multiple years may have data in both categories if we monitored them in both denning and a non-denning years (total individual females included is 10 of which 5 have data for both denning and non-denning years).

We also found that the response to recreation may depend upon how much recreation an animal is exposed to within its home range. Animals that have more limited exposure (n=13) may respond more strongly when they are in a high recreation area compared to animals who are exposed to these higher levels of recreation across a large portion of their home range (n=5; Figure 9). This suggests some level of habituation by animals living in a highly recreated home range. Again, these analyses are preliminary but suggest the importance of understanding the potential for habituation, for of incorporating energetic costs into our analyses and the need to assess the ecological significance of identified responses not simply the statistical significance.

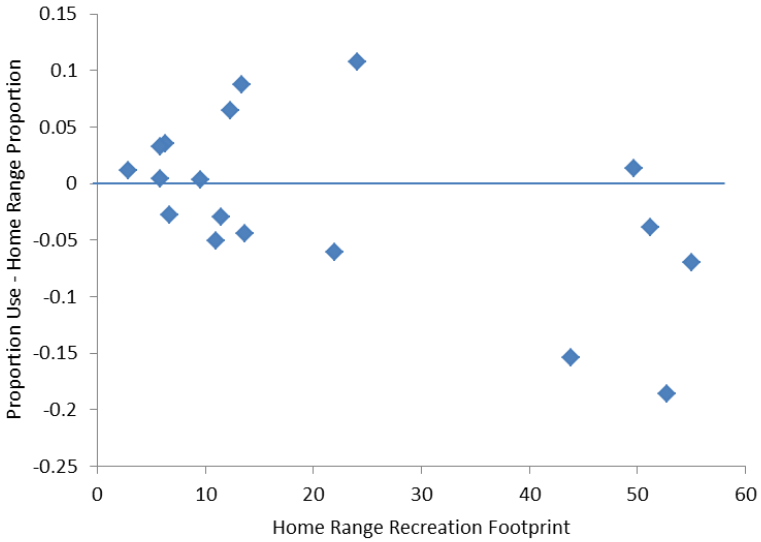

Figure 6. Difference between wolverine use of the recreation footprint and expected use based on amount of recreation within individual home ranges plotted based on percent of recreation within home range for wolverines monitored between 2010-2014; line at zero on the Y-axis represents expected difference if use of recreation footprint were random, values above zero represent higher use than expected and values below line represent lower use than expected.

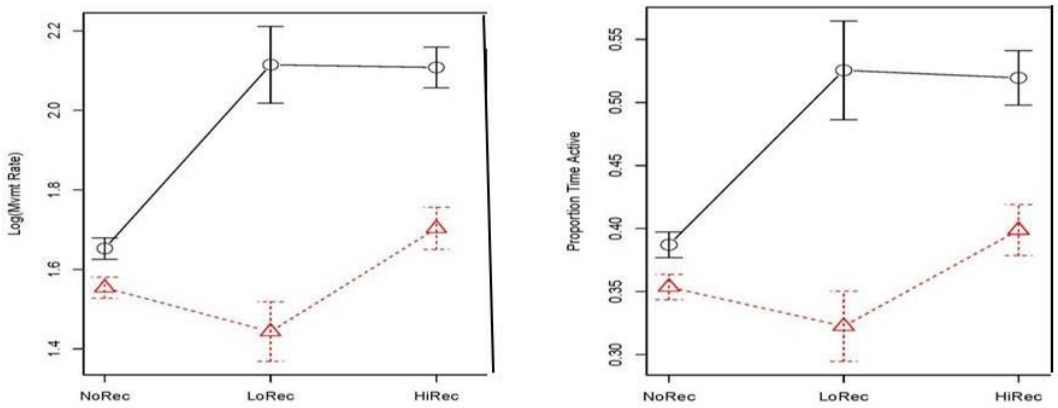

Figure 7. Preliminary results from an on-going study examining patterns in movement rates and activity level with 95% confidence intervals of wolverines on low (triangles) and high (circles) recreation days and within 3 classes of recreation zones representing relative levels of recreation activity. Data are from central Idaho, representing 12 wolverines monitored over 1 to 3 years from 2010-2012. *From Figure 5 in the 2013 Progress Report.*

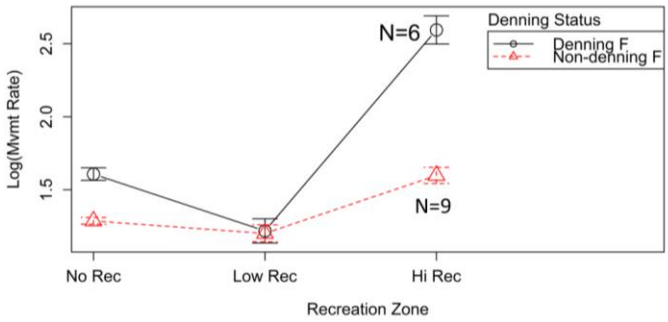

Figure 8. Movement rates of 6 denning and 9 non-denning female wolverines in areas classified as having no, low or high levels of winter recreation.

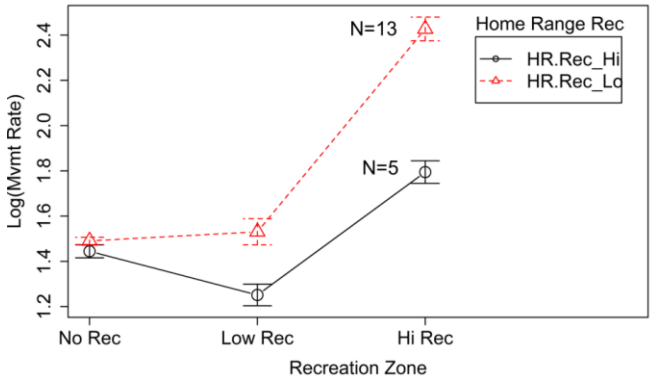

Figure 9. Wolverine movement rates classified by the amount of winter recreation within its home range (high recreation home range has >30% recreation) and by the local level of recreation at the GPS locations used to calculate movement rate data.

NEXT STEPS

We propose to complete one additional winter of research in the 2 new western Yellowstone study areas. Each study area supports high levels of recreation and known past occupancy by resident wolverines. While we had limited success capturing wolverines in these areas in 2014, we believe there remains high potential for animals to reside in these areas. Following the field collections in 2015, we will assess the need for an additional season in 2016 and only pursue additional collection if a focused and critical need is identified (e.g., female(s) residing in high recreation areas that are likely to den in 2016). Recreation monitoring will be implemented in 2015 to provide a second year of data including GPS handouts, remote trail use counts and aerial recreation surveys in our 2 western Yellowstone study areas. In addition, we will continue monitoring wolverines in our central Idaho study areas through remote camera and DNA collection combined with aerial den searches to document reproductive effort as resources allow. We may also continue limited recreation monitoring in some of our central Idaho study areas primarily through remote trail use counters. Analyses, report preparation and outreach to agencies and stakeholders are expected to take a year following the completion of the data collection and are anticipated to occur in 2016.

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APPENDIX I

Aerial recreation surveys were completed in each study area where trapping of wolverines was undertaken during the 2014 field season. An aerial recreation survey was completed for the western Yellowstone area including the Centennial, Henry, Teton and Snake River Ranges on January 24, 2014 (Figure I-1, Figure I-2). The methodology is described in detail in Heinemeyer et al. 2011, and is based on repeated point presence surveys that provide a relative intensity score within 2.5 km^2 grid cells. We were unable to complete the survey along the eastern portion of the Teton Mountains because of unsafe wind conditions. We attempted to fly a second survey on multiple occasions but weather conditions or snow conditions were repeatedly unsuitable. We completed 2 aerial recreation surveys in the Salmon Mountains study area near McCall as our primarily data collection on the spatial extent and relative intensity of recreation in 2014. These surveys occurred on January 27 and April 3, 2014 (Figure I-3). These data will be used to assess and validate the use of prior GPS track-derived recreation patterns when assessing wolverine responses.

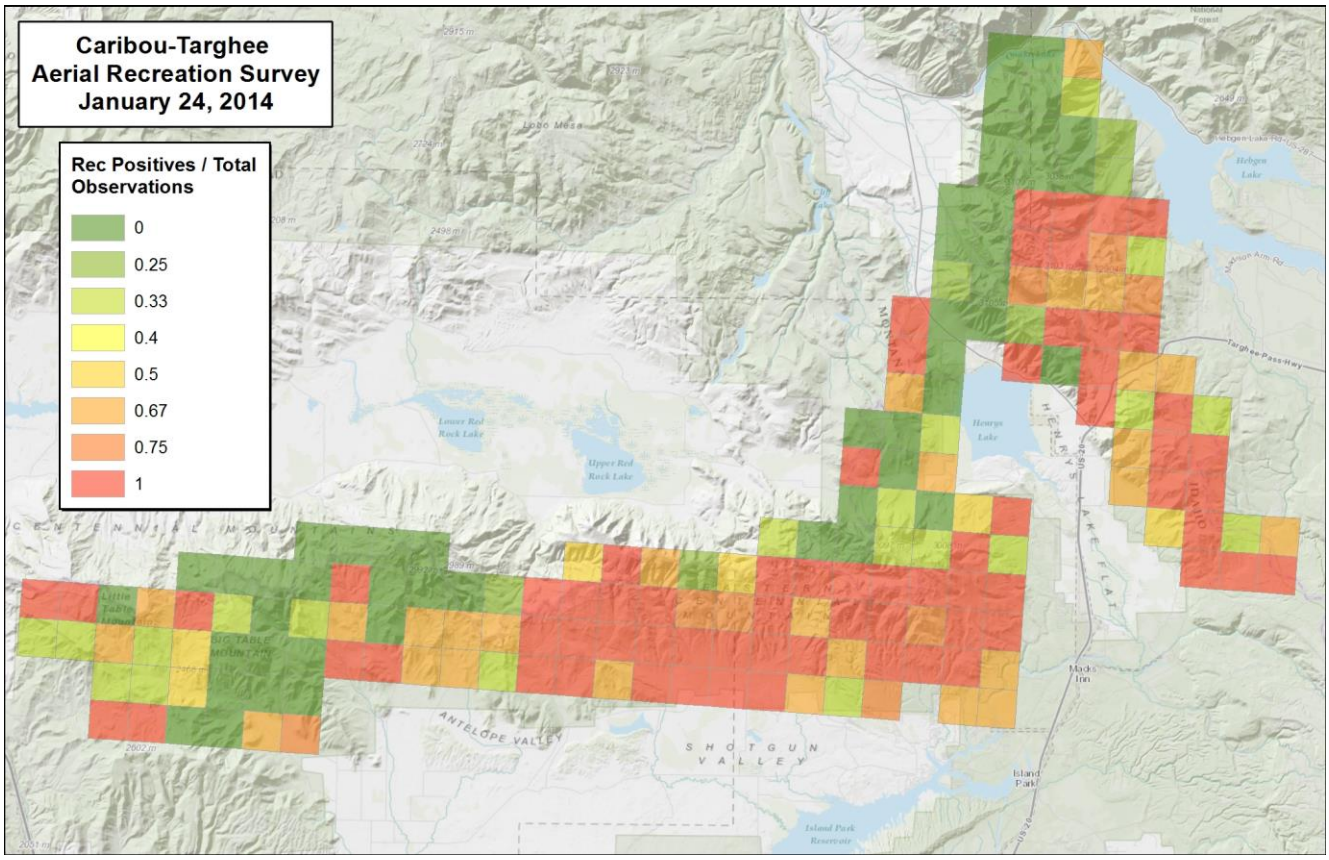

Figure I-1. Aerial winter recreation survey in the Centennial and Henry Mountains of the western Yellowstone using standardized survey protocols (Heinemeyer et al. 2011); the score is the percent of repeated presence observations that scored positive for recreation tracks within each 2.5 km^2 grid cell.

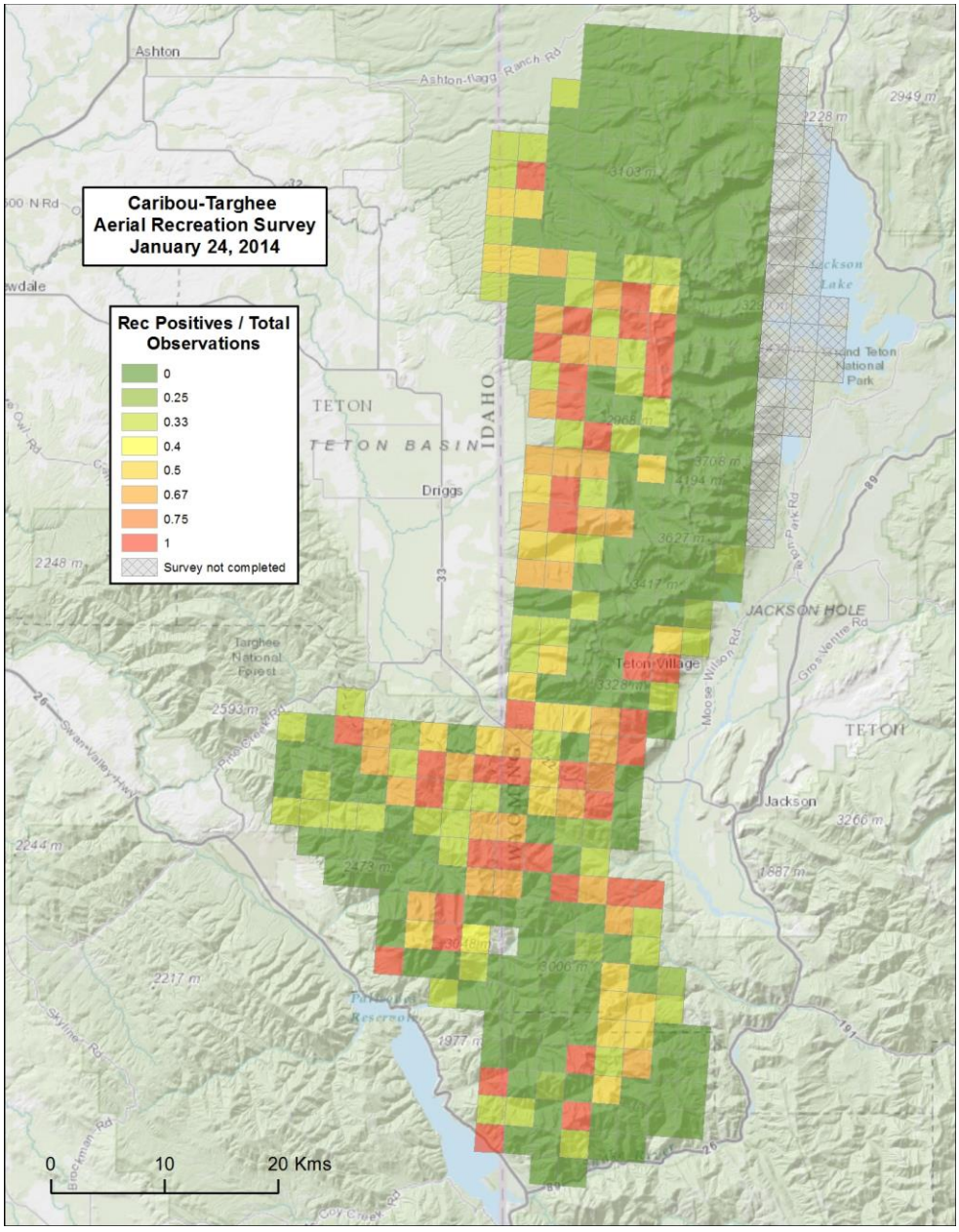

Figure I-2. Aerial winter recreation survey completed for the Teton and Snake River Range using standardized survey protocols (Heinemeyer et al. 2011); the score is the percent of repeated presence observations that scored positive for recreation tracks within each 2.5 km^2 grid cell and grey shaded cells represent areas along the eastern portion of the Tetons where weather caused the survey to be cancelled.

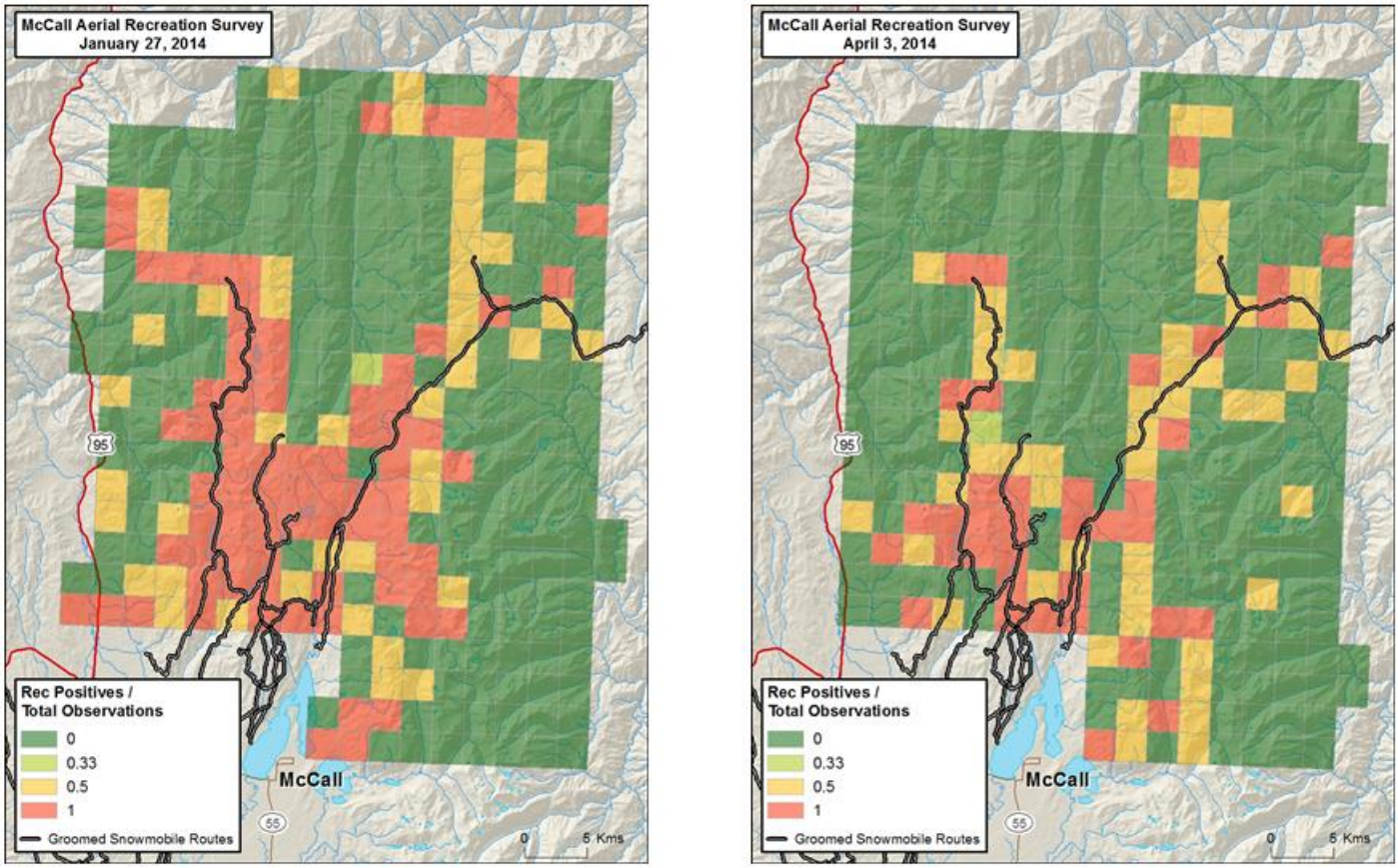

Figure I-3. Aerial winter recreation survyes completed in the Salmon Mountains near McCall, Idaho using standardized survey protocols (Heinemeyer et al. 2011); the score is the percent of repeated presence observations that scored positive for recreation tracks within each 2.5 km^2 grid cell.