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

## **2013 PROGRESS REPORT**

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NOVEMBER 16, 2013

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*Investigating the Interactions between Wolverines and Winter Recreation*  
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**WITH THE SUPPORT OF PROJECT PARTNERS AND COLLABORATORS INCLUDING:**

Payette National Forest  
Boise National Forest  
Sawtooth National Forest  
Idaho Department of Fish and Game  
University of Montana  
Brundage Mountain Resort  
Central Idaho Recreation Coalition  
Idaho State Snowmobile Association  
The Sawtooth Society  
The Wolverine Foundation  
US Fish and Wildlife Service  
And the winter recreation community of Idaho

To receive a copy of this report or other project information, see [www.forestcarnivores.org](http://www.forestcarnivores.org)

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# WOLVERINE – WINTER RECREATION RESEARCH PROJECT

## 2013 Progress Report

### EXECUTIVE SUMMARY

The wolverine's remote winter habitats were historically undisturbed by humans but the rise in popularity of backcountry winter recreation and advances in snowmobile technology have led to increases in both the footprint and intensity of human activities in wolverine habitats during winter. The potential effects on wolverine reproduction, habitat use and populations are of concern given the intrinsic vulnerability of this species.

We have completed four winters of research detailing the interactions between wolverines and winter recreation. The research includes GPS tracking of both wolverines and winter recreationists. This unique approach has been successful through collaboration with state and federal agencies, backcountry recreation coalitions and rural community businesses. Because wolverines occur at such low densities, we have worked in 3 different landscapes in central Idaho to build toward a robust sample of wolverines. To date, 18 different wolverines have been monitored and over 3000 GPS tracks of snowmobilers, backcountry skiers, heli-skiers and cat-skiers have been collected. Five of the wolverines (3 females and 2 males) resided in highly recreated landscapes. Six denning attempts across 6 adult females have been documented with two of these attempts failing during our monitoring. One failure occurred in a highly recreated landscape and the other failure was by an old female in poor health. Preliminary examination of the data collected indicates that wolverines tolerate overlap of recreation within their home ranges, but they also exhibit potential behavioral and energetic effects linked to recreation disturbance including increased wolverine movement rates and reduced resting periods in higher recreation areas and on high recreation days (e.g., Saturday, Sunday).

To provide needed answers to questions regarding wolverine responses to winter recreation, additional wolverines must be monitored in highly recreated landscapes. This will require a minimum of two additional field collection seasons. During the winter of 2013-14, we will be implementing the project in 3 study areas that have high winter recreation: continued GPS monitoring of wolverines on the Payette National Forests and implementation of two study areas within the Caribou-Targhee National Forest. We will continue to monitor wolverines through camera and DNA traps on the Sawtooth and Boise National Forests.



## INTRODUCTION

Wolverines are the largest terrestrial member of the Mustelidae or weasel family, weighing between 6 – 18 kg. In the continental United States, they are currently found in higher elevation habitats in the western Montana, central and northern Idaho, northwestern Wyoming, north-central Washington and northeastern Oregon. In February 2013, the U.S. Fish and Wildlife Service proposed to list the species as ‘Threatened’ under the Endangered Species Act (Dept. of Interior 2013). The USFWS publication provides extensive information on the ecology and known current status of the species and identifies some specific threats to wolverine persistence with the potential impacts of climate-related changes to snowpack and availability of denning of significant concern. In general, the life history characteristics of wolverine make it vulnerable to population impacts, including an extremely low birthrate (averaging only 1 kit per female every other year), very low density populations (0.3 – 6.2 wolverine/1000km<sup>2</sup>) and an estimated effective population size of 35 for Idaho, Montana and Wyoming (Schwartz et al. 2009).

Wolverines occupy large home ranges, with males covering as much as 500 mi<sup>2</sup> and female home ranges typically 200-300mi<sup>2</sup>. Wolverines remain active throughout the winter, traveling extensively across their home ranges in search of carrion that is their primary winter food source. In late February, pregnant female wolverines choose areas with deep snow such as north-facing slopes to dig tunnels down to jumbled talus boulders and fallen logs, creating insulated and safe havens for their 1-3 young. They maintain these snow-based dens through approximately mid-May; this dependence upon snow for denning and reproduction is one of the reasons that the USFWS proposes to list the wolverine under the Endangered Species Act. The loss of wolverine habitat from climate change has been predicted based on the modeled loss of spring (mid-May) snow due to temperature and precipitation changes (McKelvey et al. 2011). The snowpack likely also serves other important functions including preservation of carcasses or cached meat (Inman et al. 2012).

The rugged and remote habitats of the wolverine were naturally inhospitable to people and these areas were historically largely undisturbed by humans in the winter months. In many areas, wolverine habitats are no longer inaccessible to humans for winter activities. The growing popularity of winter backcountry recreation combined with advanced snowmobile technology and availability of other mechanized access options such as tracked vehicles (cat-skiing) and helicopters has resulted in winter recreation expanding across previously undisturbed and unreachable public lands.

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 wolverine, particularly in areas favored by females for reproductive denning (Carroll et al. 2001, Rowland et al. 2003, May et al. 2006, Copeland et al. 2007, Krebs et al. 2007). Currently, there is little scientific foundation for management of winter recreation for wolverine persistence and accounts of wolverine responses to human disturbance are primarily anecdotal and conflicting. Given the potentially vulnerable status of the species and the potential decision to list it under the ESA, there is increasing need and interest in developing a scientifically robust understanding of wolverine responses that can provide insights into approaches to management that ensure both winter recreation and wolverine populations may be sustained.

The goal of the Wolverine – Winter Recreation Study is to identify and evaluate wolverine responses to winter recreation. 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 approach to the research 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.

## PROJECT BACKGROUND

The project was initiated in 2009 with winter aerial surveys over 3 National Forests 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 was documented.

This research is led by the USFS Rocky Mountain Research Station and Round River Conservation Studies in partnership with the Payette, Boise, Sawtooth and Caribou-Targhee National Forests; Idaho Department of Fish and Game and the University of Montana. Several other organizations are collaborators on the project and provide logistical and financial support; these organizations include the Idaho State Snowmobile Association, The Wolverine Foundation and the Liz Claiborne Art Ortenberg Foundation.

Due to the extensive involvement of multiple entities, a ‘Science Team’ (Kim Heinemeyer, Round River Conservation Studies, John Squires, Rocky Mountain Research Station and Mark Hebblewhite, University of Montana) was established to ensure a robust scientific process is maintained. Jeff Copeland (retired Rocky Mountain Research Station wolverine biologist) also plays a key advisory role on the project.

This report provides a presentation of progress made in 2013 and summarizes some information collected across the last 4 years; please refer to earlier progress reports for more full reporting of the research to date.

## STUDY AREA DESCRIPTION

The project has focused on landscapes within Idaho on the Payette, Boise and Sawtooth National Forests and more recently within the Yellowstone region on the Caribou-Targhee National Forest (Figure 1):

- Two years on the Payette National Forest near McCall (2009-11) with continued monitoring through GPS collaring (2011-12) and camera/hair collection surveys (2012-13);
- One year on the Boise National Forest near Council (2010-11) with continued monitoring through GPS collaring (2011-12) and camera/hair collection surveys (2012-13); and
- Two years on the Sawtooth National Forest near Ketchum (2011-13). Prior to implementing the full study on the Sawtooth, during the winter of 2010-11 we undertook limited winter recreation monitoring and wolverine camera surveys to inform our 2011-12 efforts.
- Reconnaissance or limited study implementation included:
  - 2011-12 we completed wolverine camera trapping and intensive recreation monitoring through trail use counts, GPS handouts and aerial surveys in the Trinity Mountains near Featherville and north of the South Fork of the Boise River area (north of Fairfield), leading to a full study in the South Fork area of the SNF in 2013;
  - 2012-13, we conducted limited wolverine camera surveys and recreation monitoring including trail use counts and aerial surveys on the Caribou Targhee National Forest as a potential priority area for the study in 2014.



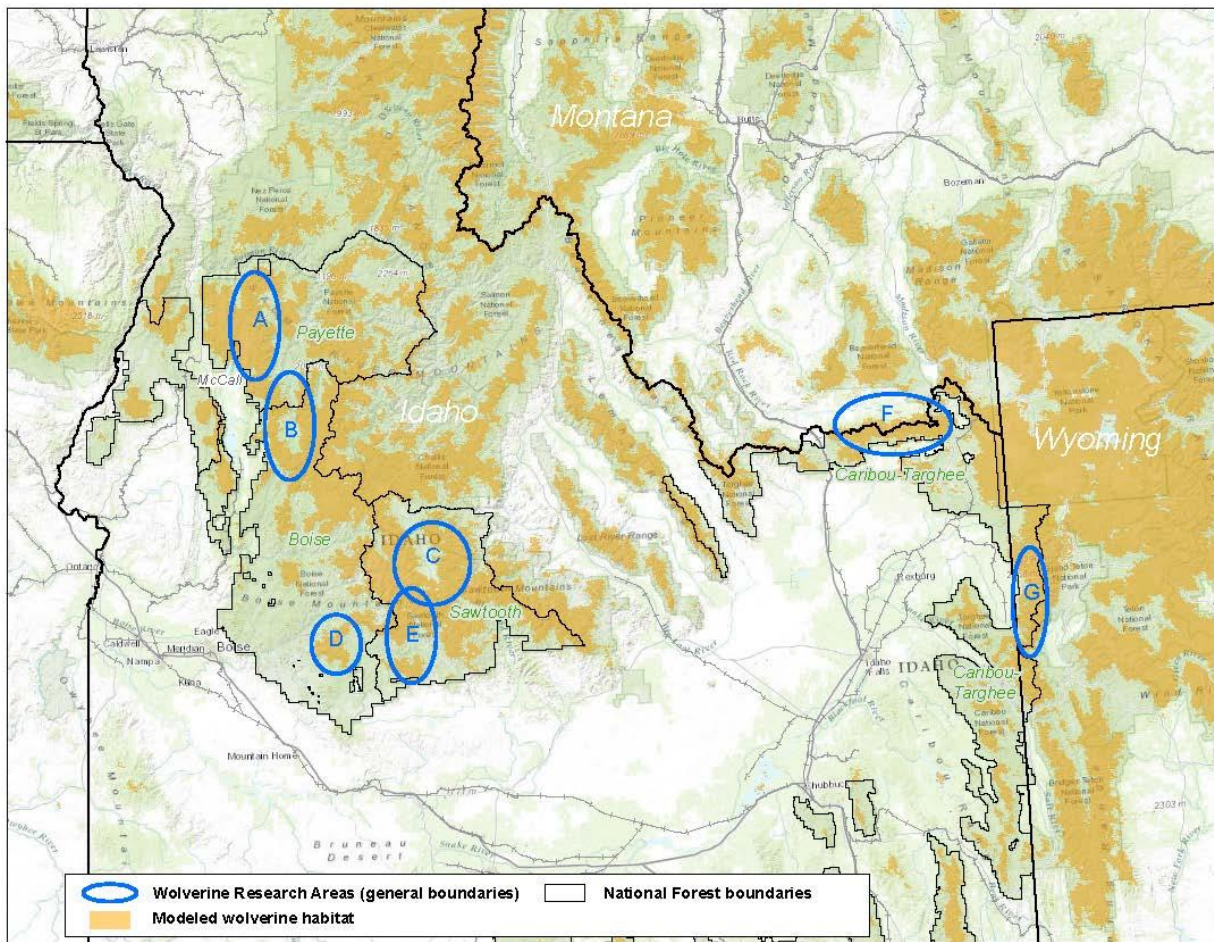


Figure 1. Idaho Wolverine-Winter Recreation Study Region and Study Areas: A) Payette National Forest near McCall, B) Boise National Forest near Cascade (North BNF), C) Sawtooth National Forest near Ketchum (North SNF), D) Boise National Forest near Featherville (south BNF) and E) Sawtooth National Forest near Fairfield (South SNF), f) the Caribou-Targhee National Forest in Island Park and G) The Caribou-Targhee National Forest near Victor.

## SUMMARY OF SELECTED INTERIM RESEARCH RESULTS

We have completed 4 winter field seasons including the monitoring of 18 wolverines with some individuals monitored for 2-3 sequential winters. Of these, 15 wolverines have sufficient data for an array of analyses and modeling while the others have limited information. The amount of recreation within the home ranges of individual animals is highly variable, ranging from 1% to close to 50% of their home ranges affected to some extent by winter recreation as recorded by our monitoring efforts (Table 1). To be able to answer key questions about the potential effects of winter recreation on wolverines, additional animals are needed at the higher end of the range of recreation disturbance levels. Still, preliminary data analyses are beginning to suggest some wolverine responses to winter recreation. Importantly, we have found that wolverines do reside in landscapes that have relatively high levels of winter recreation indicating that at the home range scale, wolverines are not excluded from these areas. We need to monitor additional wolverines in areas of high winter recreation to confirm this preliminary finding. It is unknown if and how these resident animals may mitigate for the disturbance and we are currently examining habitat use, movements and activities within home ranges. The challenge

remains to garner a sufficient sample size of individual wolverines in these recreated landscapes given the low density and large home ranges typical of the species.

Over the 4 winters we have documented 6 reproductive denning efforts by resident female wolverines, of which 4 were successful through the end of the winter field season in April 2013. Two denning females were in highly recreated landscapes; one of these failed in her denning attempt as indicated by abandonment of the den site and a notable change in her movement patterns to a lack of central point pattern typical of denning wolverines. The other reproductive failure was in an area of low recreation and was a female (F9) in extremely poor condition upon her capture in early February 2012.

Across all animals there appears to be a tendency for wolverines to be active during any part of the day with the highest activity levels during daylight hours (Figure 2). The diel activity pattern of denning females follows this pattern except for the 2 females that denned in highly recreated landscapes. These 2 females exhibited a diel cycle of inactivity during mid-day though other denning females have not shown this shift (Figure 3). Females may prefer to leave kits during daylight hours when ambient temperatures are higher and/or other risk factors are reduced. Daytime human disturbance may force the female to shift when she chooses to leave the kits unattended. Additional data on females within highly recreated areas is needed to test this hypothesis and to gather information on possible ramifications for successful reproduction.

We pooled data from all animals to explore movement responses to localized recreation levels. We found that movement rates notably increase when animals are found within higher recreated areas of their home range (Figure 4). Additionally, we have found that increased movement rates in these popular recreation zones are highest on the days of the week when recreation levels are high (i.e., weekends; Figure 5). Additional exploration of the data indicates that these increased movement rates are due to fewer resting (low movement) periods suggesting that animals are moving more frequently but not necessarily more rapidly in these recreated areas. Depending upon the amount of time a wolverine spends in these recreated portions of their home range and the relative amount of high quality habitat that is affected, there may be significant additive energetic effects on wolverines during the critical winter and denning periods.

## Wolverine – Winter Recreation Study, 2013 Progress Report

Table 1. Summary of wolverines captured and monitored over 4 years (January 2010-April 2013) on the Payette, Boise and Sawtooth National Forests as part of the Idaho Wolverine – Winter Recreation Study; individual animals monitored over multiple years are grouped as indicated by alternate shading.

Year	Animal	Dates	N	MCP Area (Km <sup>2</sup> )	% HR with Recreation	Study Area; Notes
2010	<i>F1*</i>	Jan 29 - Mar 31	965	380.9	40-50%	PNF
2011	<i>F1</i>	-	-	-	-	PNF; Collar failure
2012	<i>F1*</i>	Jan 15 - Mar 10	1718	441.6	40-50%	PNF
2010	<i>F2*</i>	Jan 30 - Mar 21	1050	243.0	20-30%	PNF
2011	<i>F2*</i>	Jan 25 - Apr 10	2106	266.4	20-30%	PNF
2010	<i>F3*</i>	Feb 20 - Apr 3	819	278.5	1-5%	PNF
2011	<i>F3</i>	-	-	-	-	PNF/BNF; Collar failure
2012	<i>F3*</i>	Feb 2 – Mar 3	1183		1-5%	PNF
2011	<i>F4**</i>	Jan 22 - Mar 16	1146	236.2	20-30%	PNF; subadult
2011	<i>F5*</i>	Jan 30 - Apr 2	1026	481.3	6-10%	BNF
2012	<i>F5</i>	Feb 7 – Feb 25	625		-	BNF
2012	<i>F7*</i>	Feb 5 - Mar 22	2002	415.5	6-10%	SNF
2012	<i>F8</i>	Feb 8 - Feb 8	3	-	-	SNF
2013	<i>F8*</i>	Feb 2 – Mar 30	1573	364.0	1-5%	SNF
2012	<i>F9*</i>	Feb 10 - Apr 26	1828	162.0	6-10%	SNF
2013	<i>F10**</i>	Feb 13 - Apr 7	2031	n/a	-	SNF; dispersed to PNF
2010	<i>M1*</i>	Jan 31 - Mar 10	1023	439.9	20-30%	PNF
2011	<i>M1*</i>	Jan 18 - Mar 17	1505	859.5	10-20%	PNF
2012	<i>M1</i>	Jan 14 - Jan 24	305	246.4	-	SNF
2010	<i>M2*</i>	Feb 5 - Apr 20	2079	1040.8	10-20%	PNF
2011	<i>M2*</i>	Feb 10 - Apr 3	1978	1426.2	10-20%	PNF
2010	<i>M3*</i>	Feb 11 - Apr 14	2356	993.5	1-5%	PNF/BNF
2011	<i>M3</i>	Mar 29 - Apr 8	416	785.3	-	PNF/BNF
2011	<i>M4</i>	-	-	-	-	BNF; Collar not recovered
2011	<i>M5</i>	-	-	-	-	PNF; Collar not recovered
2012	<i>M6*</i>	Jan 16 - Mar 11	2859	1119.3	1-5%	SNF
2012	<i>M7**</i>	Jan 17 - Feb 7	1084	47.5	-	SNF
2012	<i>M8*</i>	Jan 17 - Mar 24	2312	2127.7	6-10%	SNF
2013	<i>M9**</i>	Jan 22 – Apr 12	3217	n/a	-	SNF; subadult exploratory mvmts

\*Animal-years of resident animals with sufficient data (>3 weeks) for inclusion in RSF habitat modeling

\*\*Subadult animals that are likely not long term residents and/or showed exploratory or dispersal movements

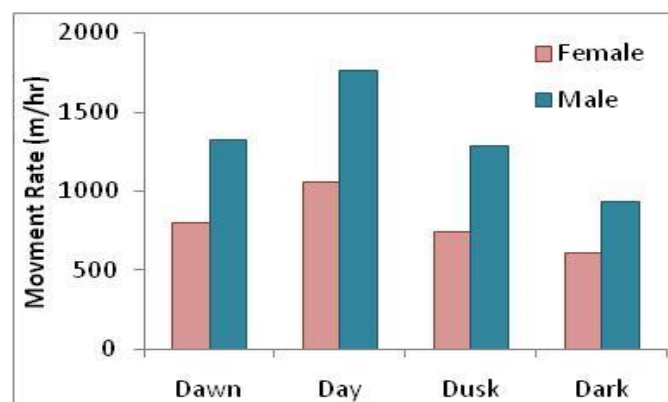


Figure 2. A sample of wolverine movement rates indicating when wolverines generally tend to be active during daylight hours but may be active at any time based on data collected as part of the Wolverine-Winter Recreation study

## Wolverine – Winter Recreation Study, 2013 Progress Report

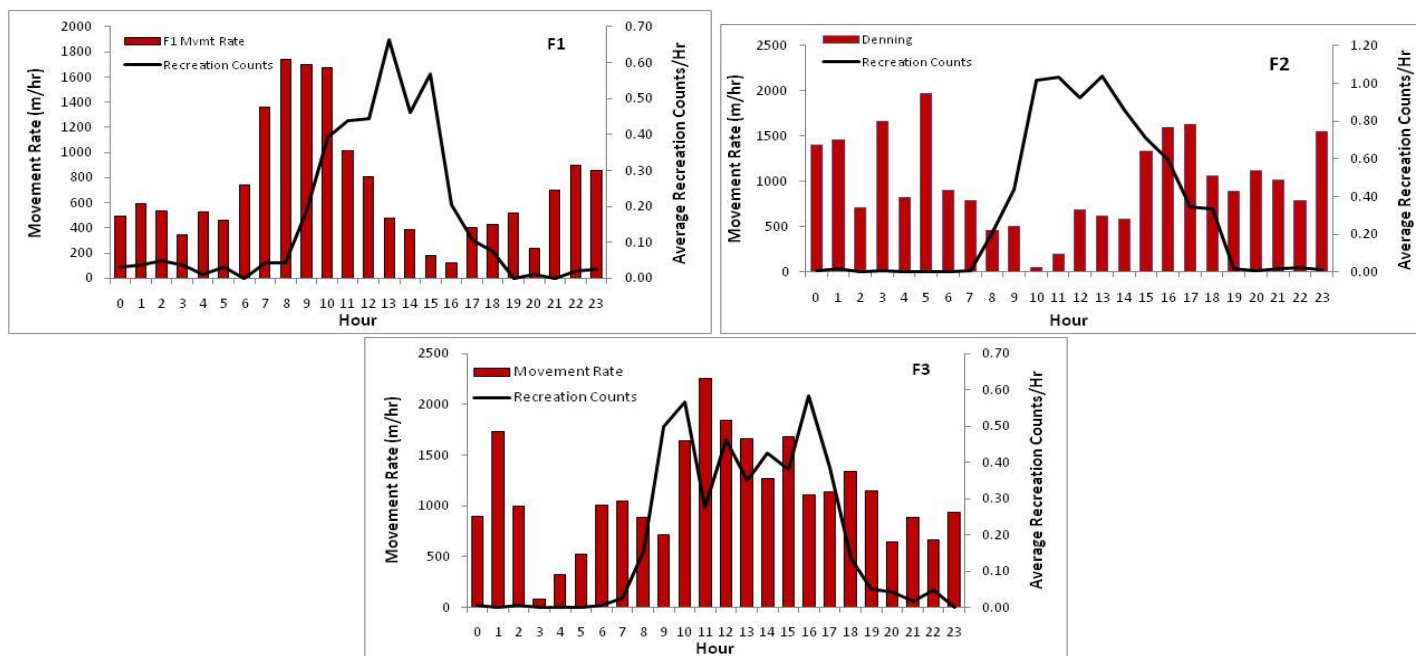


Figure 3. Activity patterns of female wolverines indicate that denning females may avoid leaving the den during periods of high disturbance. Females F1 and F2 who denned in highly recreated landscapes show low movements during the peak recreation times (shown as a solid black line); F3 who denned in an undisturbed landscape is most active during mid-day.

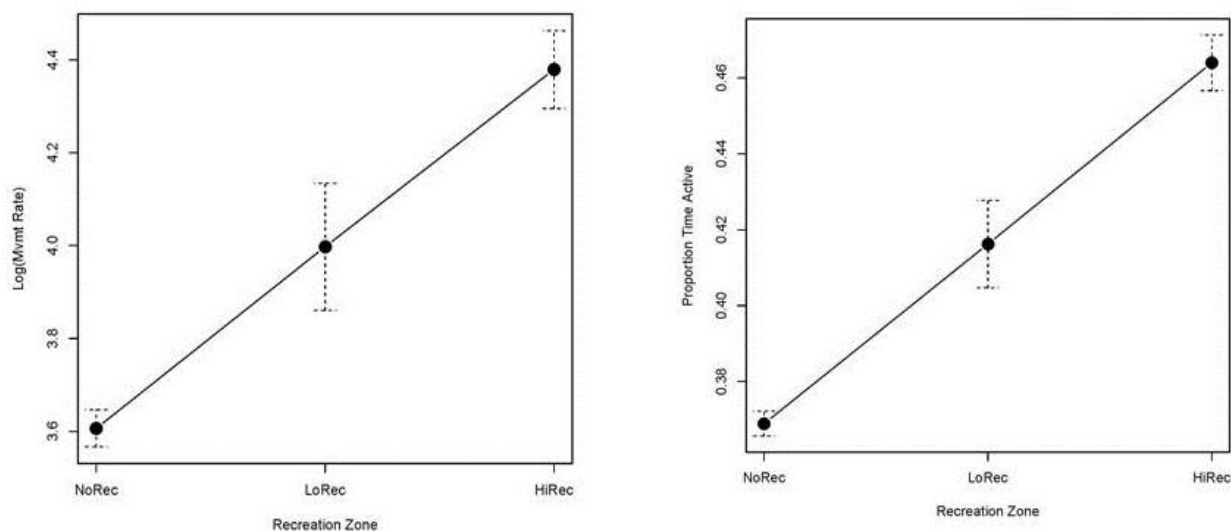


Figure 4. Preliminary results from an on-going study examining patterns in movement rates (left) and activity level (right) with 95% confidence intervals of wolverines within 3 classes of recreation zones representing relative levels of recreation activity, in central Idaho; data represent 12 wolverines monitored over 1 to 3 years from 2010-2012.



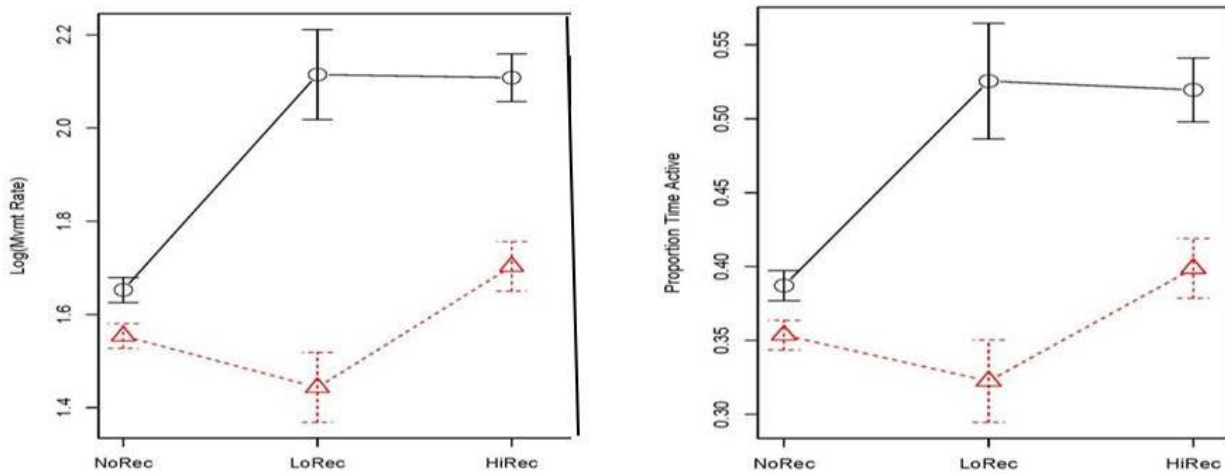


Figure 5. Preliminary results from an on-going study examining patterns in movement rates (left) and activity levels (right) with 95% confidence intervals of wolverines on low (triangles) and high recreation (circles) days and within 3 classes of recreation zones representing relative levels of recreation activity. Information from in central Idaho with data representing 12 wolverines monitored over 1 to 3 years from 2010-2012.

## 2012-2013 PROJECT EFFORTS

Over the winter of 2012-2013, we implemented the full study design including trapping and collaring wolverines, individual outreach for GPS data collection by recreationists, aerial recreation surveys and trail use counts at 2 study areas on the Sawtooth National Forest. Methods were consistent with prior study years as described in preceding progress reports (Heinemeyer et al., 2010, 2012). The larger of these 2 study areas, located north of Ketchum, covers 3 mountain ranges: the Sawtooth, Boulder and White Cloud Mountains. This was our second year of intensive work in this area and included setting and monitoring 8 log-style box traps, recreation outreach and monitoring 4 days per week across 4-6 winter recreation trailheads or parking areas, trail use monitoring using infra-red trail use counters and an aerial recreation survey. The second study area, located in the Smoky Mountains south and east of the Ketchum study area, was an effort to capture wolverines exposed to heli-skiing, winter cabin use and snowmobile activity occurring in this area. Four traps were built and monitored, and recreation monitoring occurred as described above for the northern study area. In the Smokey study area, a single recreation access point provides the primary access to winter recreationists.

The 12 traps were pre-baited in early December using road-killed deer and elk or beaver carcasses donated by trappers. Traps were set to capture animals for GPS collaring on January 7th, and monitored through February 20th when traps were locked open until March 19th to avoid capturing female wolverines in late pregnancy or early lactation. Traps were set from March 19th through late April to recapture animals and remove collars. All traps were equipped with satellite-based trap transmitters (Vectronics Aerospace, TT2 Globalstar Trap Transmitter) and a VHF-based trap transmitter (Telonics, Inc) as backup. All traps were physically visited and maintained every 2-4 days. The TT2 transmitters sent email and text messages immediately and then every 20 minutes after a trap was triggered. This allowed us to know precisely when an animal was captured and to efficiently deploy teams to check traps that had been triggered. Due to safety considerations, we avoided checking triggered traps after sunset or before sunrise. We made an exception to this rule during spring trapping in areas with lactating females.

We implemented limited wolverine and recreation monitoring in the McCall and Warm Lake study areas. These efforts focused on monitoring the presence and potential reproductive status of our known females and other wolverines in these important study areas while also maintaining baseline recreation monitoring. Wolverine monitoring included establishing 7 camera and hair-capture stations at our former trap-sites taking advantage of the tendency of wolverines to revisit these known food sources. Camera stations were established similar to the methods described in Magoun (2011). We completed an aerial search in March of areas where our known females had previously denned to search for potential denning activity. Recreation monitoring was completed through remote trail use counters at major trailheads across the area.

We also undertook recreation monitoring and limited wolverine monitoring at 2 sites on the Caribou-Targhee National Forest (CTNF) to provide information for the potential establishment of the study in this area in 2013-2014. One study area is along the western side of the Teton Mountains where we based one volunteer to work with the CTNF district biologist to establish and monitor 3 remote camera and hair capture stations and 6 remote trail recreation use counters. On the second site, 3 remote trail use counters were established at trailheads accessing the Centennial Mountains and monitored by the district biologist based in Island Park. Additionally, in early March, we completed a standardized grid-based aerial survey for recreation use across predicted wolverine habitats on the CTNF.

## WINTER 2012-2013 PRELIMINARY RESULTS

Wolverine Monitoring 2012-2013. Trapping success this year was low for wolverines as well as other commonly caught species such as marten and fox possibly due to the low snow conditions (Table 2). We captured 2 new wolverines: a subadult male (M9 or “Titus”) and a subadult female (F10 or “Olive”) and recaptured a resident female (F8 or “Julia”) who had slipped her collar early the prior season. During the spring trapping we captured M6 who was initially captured in 2012.

The adult female F8 was monitored from her capture on February 2nd until her recapture and collar removal on March 29 (Figure 6). She initiated denning behavior in early March. F8’s den site in the White Cloud Mountains was visited in August to document the den site location and collect hair that may identify kits through genetic analyses.

Subadult male M9 was captured on January 22nd and fitted with a GPS collar. The GPS collar was removed and replaced with a satellite-based collar on his recapture on April 4th to allow continued monitoring of his movement and potential dispersal within or away from the study area (Figure 6). M9 made an extensive exploratory movement outside the study area of approximately 180 km to the northeast then returned to the Boulder and White Cloud Mountains. He moved west in latter July and was found in the Smokey Mountains until large fires in the area may have pushed him north into the Sawtooth Mountains. Currently he appears to be stable in this area.

Subadult female F10 was captured and collared on February 13th. She ‘disappeared’ from the study area shortly thereafter, only to be found near the end of field season at a camera trap station in our McCall study area, an approximate movement of at least 200km (Figure 6). We set 2 of the traps we have in the McCall study area and captured F10 at the trap near the camera station on April 19<sup>th</sup>. We fitted her with a satellite-based collar to further monitor her movements. She maintained her residency in the McCall study area occupying an area similar to the home range of our first female F1. F10 slipped her satellite collar in June. We are awaiting genetic information on F10 to identify her parentage. In any case, if F10 maintains her residency in the McCall area, she represents a new female in an area that supports the highest levels of recreation found across our study areas. F1 has not been identified on any camera stations in 2012 or 2013 even though she was typically a common visitor to our sites in prior years.

Camera and hair collection efforts on the Payette and Boise NF yielded several photographs and hair samples of wolverines. We are still processing these data. The hair samples have been sent to the Rocky Mountain Research Station for genetic analyses. From photographs, we were able to identify M1 and F5. These resident animals were collared and

monitored between 2010-2012 and 2011-2012, respectively (Figure 7). Additionally, we captured photographs of F10 at a camera station on the Payette NF (Figure 8). We also obtained photographs of 2-4 other unidentified individuals for whom we are waiting genetic results.

Recreation Monitoring. The winter of 2012-2013 proved to be exceptional in terms of its sparse winter storms bringing little new snow to the central Idaho region and affecting the numbers of backcountry recreationists. Still, the winter season provided excellent information on the variability in the system relative to winter recreation levels and intensity (Figure 9). Winter recreation trends documented through our remote trail use counter data suggest that our study areas in the Sawtooth NF received lower snowmobile use but high backcountry ski use as compared to the prior year while our study area on the Payette NF (near McCall) and in the Warm Lake area of the Boise NF received average snowmobile use. Trail use count data is presented in Appendix I.

Overall, our number of GPS handouts to recreationists in the winter 2012-2013 was lower than in prior years even though our effort (staffing at trailheads) was similar (Table 3). This reflects the overall lower levels of snowmobile-based recreation during this odd snow year. Still, we collected 487 GPS recreation tracks and did outreach to over 1500 recreationists including snowmobilers, backcountry skiers, snowboarders and heli-skiers.

We completed an aerial survey of winter recreation in the Sawtooth NF study area to support validation of the GPS recreation tracks (Figure 10). This shows the spatially-limited but locally intense nature of winter recreation this season and will be used as validation of the spatial footprint and relative intensity of winter recreation suggested by the GPS data on recreation paths.

At the time of releasing our 2011-2012 Progress Report, data processing had not been completed for aerial surveys undertaken in the 2011-12 season in the PNF and SNF study areas. These surveys were completed in February and April on the SNF and in March on the PNF focusing on our study areas. The results of these surveys are provided in Appendix II.

Preliminary Study on the Caribou-Targhee National Forest. The highest levels of recreation use across the monitored sites were areas near Teton Pass in an area highly popular with backcountry skiers (Figure 11; Appendix I). All trail use counters set along routes primarily used by backcountry snowmobilers recorded relatively low counts. As we found in the Sawtooth study area (see above), snowmobile recreation on the CTNF may have been lower than normal in the areas we monitored (Figure 11) and the counts we obtained likely do not represent typical recreation levels (B. Aber, pers. comm.) expected in more ‘normal’ snow years. The relative average daily counts recorded along monitored trail systems across the PNF, SNF and CTNF/BTNF indicates that each study area provides a unique suite of winter recreation levels and diversity (Figure 12). While the overall numbers of snowmobile recreationists may be low this last winter on the CTNF, we expect larger numbers during years of more typical snowfall in the Island Park area. Despite the unusual winter we experienced, the aerial survey documented extensive winter recreation across the CTNF, with relatively intensive use in some areas including our 2 potential study areas (Figure 13). Camera surveys did not produce any evidence of wolverines in the southern areas where they were located.

## DATA ANALYSES

Data processing and preliminary analyses of data collected over the 4 winter field seasons are on-going. The science team (John Squires, Rocky Mountain Research Station; Kim Heinemeyer, Round River Conservation Studies; and Mark Hebblewhite, University of Montana) convened in Missoula, Montana in late June for a working session to review, discuss and explore the data and analytical approaches. We currently have multiple analyses underway including developing Resource Selection Function (RSF) models of wolverine habitat use at the home range and individual path

scales that include responses to recreation covariates; a characterization of winter recreation based on the extensive GPS recreation path data, remote trail use counts and aerial surveys; and development of a RSF of winter recreation. Using a RSF approach to modeling winter recreation use allows us to predict potential recreation ‘habitat’ and overlap with wolverine habitats.

## NEXT STEPS

Wolverines have large home ranges and are found in low densities. As a result, we are challenged by a small sample size of animals and particularly of females exposed to higher levels of winter recreation across a notable portion of their home range. The resident male and female animals we have monitored are critical to the project, as is identifying and monitoring additional animals in other highly recreated landscapes. In order to significantly advance our understanding of the potential effects of winter recreation on wolverines, we need to continue monitoring our known wolverines in highly recreated landscapes and find and monitor additional wolverines in other highly recreated landscapes.

We propose to complete at least 2 years of additional research in 2 new study areas located within the western Yellowstone region in Idaho and Wyoming: Centennial Mountains and surrounding habitats (CTNF) and the Teton Mountains (CTNF, Bridger-Teton National Forest and Grand Teton National Park). Each study area represents a region with high levels of recreation and known past occupancy by resident wolverines. We will implement the full study design at each site from December 2013-April 2014 and will hope to repeat this for a second year in 2014-15. Also, during 2013-14 and 2014-15, we will conduct preliminary analyses of wolverine-recreation interactions. This will allow us to finalize our analytical framework and to construct the necessary GIS data layers for the final analysis. Thus, we expect to complete drafts of peer-review publications and reports for the project by December 2015.

We will continue monitoring our resident animals across our study areas through a combination of GPS collaring, camera monitoring and aerial den searches. In particular, we will trap and collar wolverines in the highly recreated landscapes near McCall. Based on our monitoring information over the last 2 years, both our adult females in the highly recreated zone (F1 and F2) may no longer present and one of the adult males may also no longer present occupy the area. This information, if correct, suggests significant loss of resident animals. In addition, we have evidence of potential recruitment of new animals in portions of this area. Past intensive recreation monitoring in the area indicates consistent spatial patterns of recreation use and we will focus recreation monitoring on confirming these patterns using remote trail use cameras and 2 aerial recreation surveys. Continued monitoring on the Sawtooth and Boise NFs study areas will focus on remote camera and hair sampling.

Climate change modeling predicts a significant loss of wolverine habitats (McKelvey et al. 2011) and genetic-based movement suggests that the central Idaho region is a critical genetic linkage zone that may link northern US Rocky Mountain wolverine habitats to the Yellowstone region (Schwartz et al. 2009). To gather information on movement corridors in the region and to allow us to monitor the residency status of subadult animals, we propose to fit satellite-based collars on subadult animals recaptured in spring. Continued monitoring through the year will help us understand the distribution and movements of these non-resident animals across our study areas allowing us to plan the research efforts effectively. For example, based on the 200km dispersal of a subadult female from the Sawtooth NF study area to the Payette NF study area, we have evidence of a new resident female in one of the most highly recreated regions in Idaho.

In addition to field related activities, we are continuing to advance the analyses of existing data with specific focus on wolverine habitat use modeling and analyses of winter recreation patterns and predictions.



## Wolverine – Winter Recreation Study, 2013 Progress Report

Table 2. Summary of trapping effort and trapping success (trapnights/wolverine capture) for 4 winters, 2010-2013 across 3 study areas of the Wolverine-Winter Recreation Study.

Study Area-Year	No. of Traps	Total Trap Nights	Total Wolverine Captures	Trapping Success	Marten and Fox Captures
<b>Payette NF - 2010</b>	7	416	37	11.2	39
<b>Payette NF - 2011</b>	11	672	38	17.7	80
<b>Payette NF - 2012</b>	7	187	7	26.7	27
<b>Boise NF - 2011</b>	5	229	8	28.6	27
<b>Boise NF - 2012</b>	2	23	1	23.0	4
<b>Sawtooth NF - 2012</b>	10	409	14	29.2	48
<b>Sawtooth NF - 2013</b>	12	545	7	77.9	18

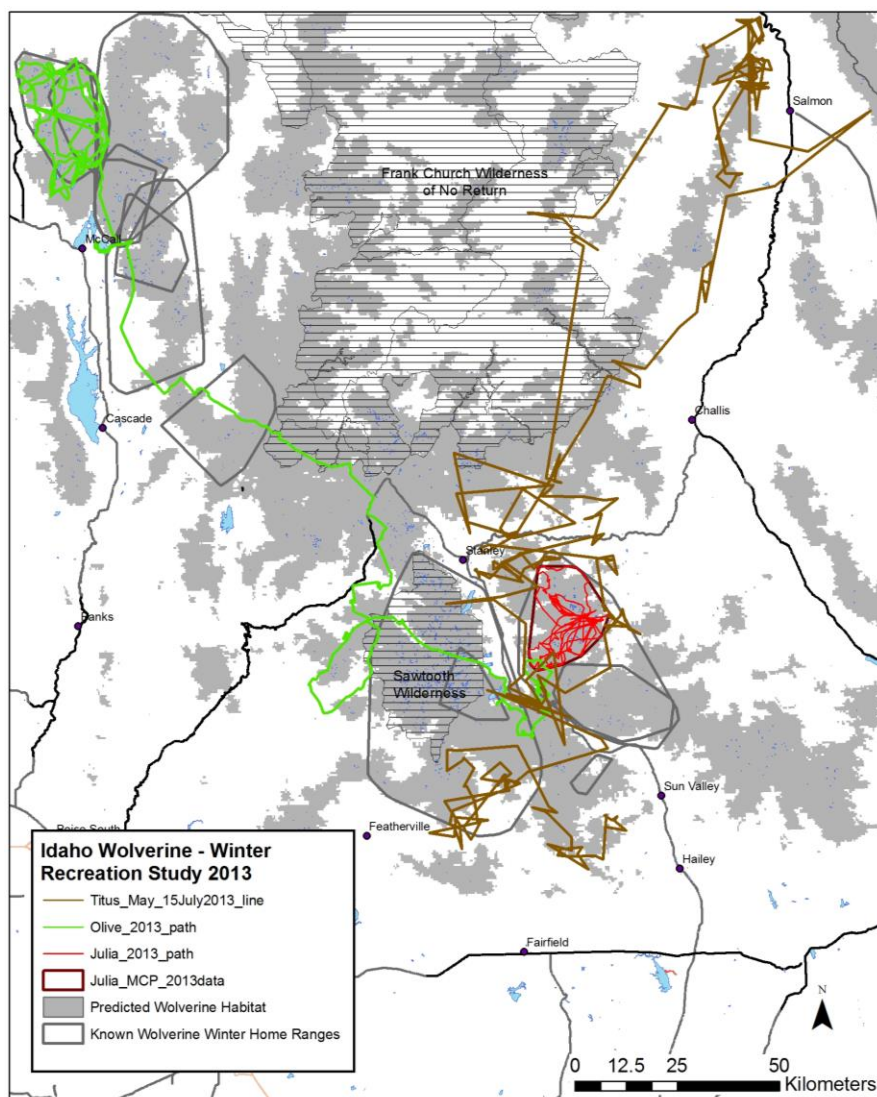


Figure 6. Movements of wolverines monitored in 2013 as part of the Idaho wolverine-winter recreation study



Figure 4. Photograph at a remote camera station on the Boise NF; this wolverine is identified as F5 based on her distinctive white right foot and white left front toe. Genetic analysis is being completed to confirm the identification.

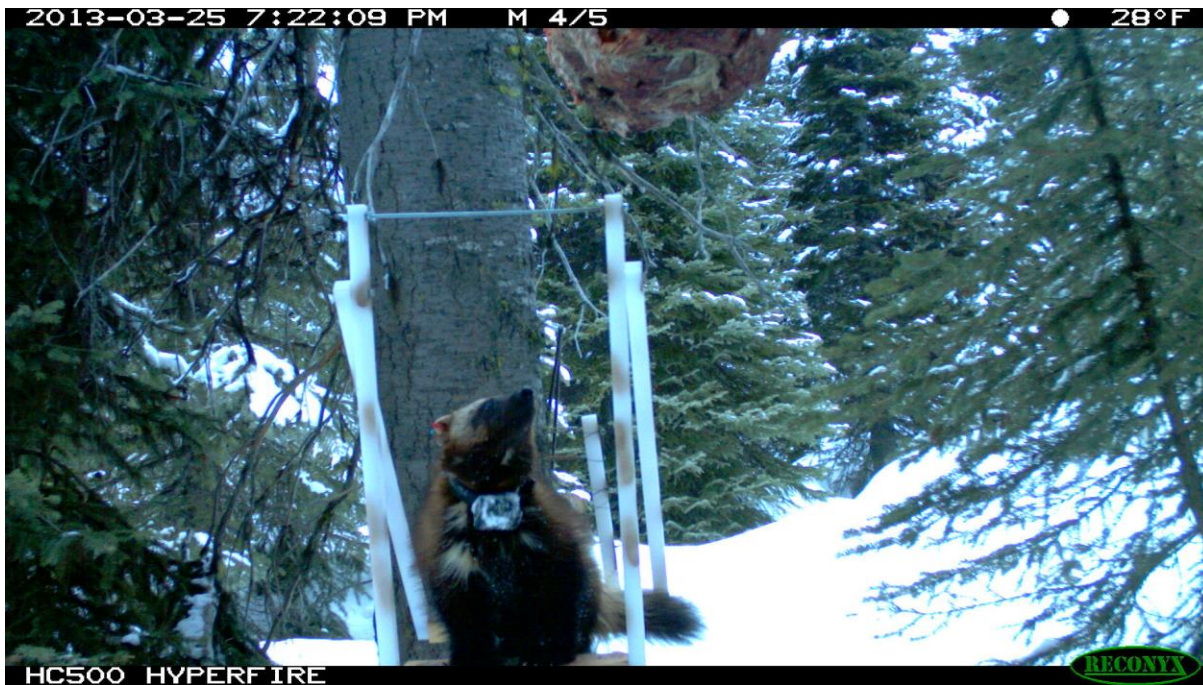


Figure 5. Photograph captured of F10 at a camera station on the Payette NF.

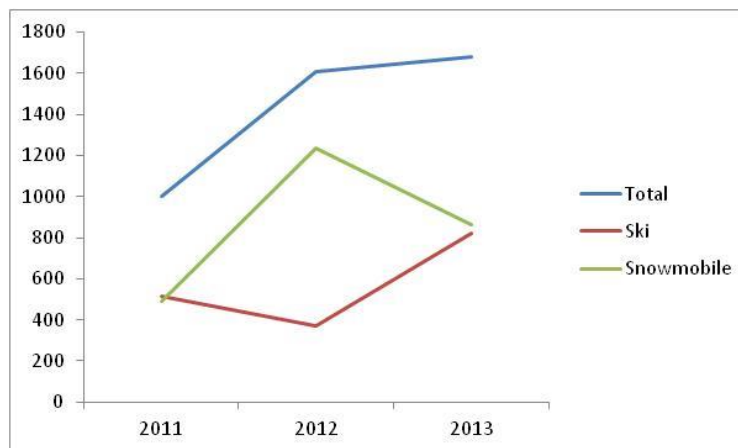


Figure 9. In the study area north of Ketchum, the number of backcountry skiers and snowmobilers varies year to year, likely influenced strongly by local snow conditions; data based on infra-red trail use counters.

Table 3. Summary of GPS recreation monitoring efforts and data collected 2010-2013 on the Idaho Wolverine-Winter Recreation Study.

Study Area - Year	No. Snowmobile Tracks	No. Ski Tracks	No. Guided Ski Tracks	No. Snowshoe Tracks	Total No. Tracks	Total Recreationists Represented	Lost Units	Refusals
Payette NF – 2010	644	46 <sup>a</sup>	24 <sup>b</sup>	-	714	2398	79 (10%) <sup>c</sup>	88 (10%) <sup>c</sup>
Payette NF – 2011	876	37 <sup>a</sup>	29 <sup>d</sup>	6	948	3251	314 (25%)	149 (11%)
N. Boise NF - 2011	71	-	-	1	72	228	18 (7%)	16 (6%)
S. Boise NF - 2012	148	1	-	2	151	683	8 (5%)	53 (25%)
Sawtooth NF - 2012	332	350 <sup>e</sup>	52 <sup>f</sup>	-	734	2549	135 (16%)	83 (9%)
Sawtooth NF – 2013	213	253 <sup>g</sup>	12	9	487	1715	82 (14%)	52 (9%)
<b>Total</b>	<b>2284</b>	<b>687</b>	<b>127</b>	<b>18</b>	<b>3106</b>	<b>10824</b>	<b>636 (17%)</b>	<b>441 (11%)</b>

<sup>a</sup>All are skiers using snowmobiles to access ski terrain

<sup>b</sup>Guided cat-skiing tracks

<sup>c</sup>Documentation incomplete; represents best estimate based on existing information

<sup>d</sup>This represents 25 guided cat-skiing tracks and 14 guided ski tracks using snowmobiles to access ski terrain

<sup>e</sup>Of the 350 skiers, 48 were skiers using snowmobiles to access ski terrain

<sup>f</sup>Guided heli-ski tracks

<sup>g</sup>Includes 5 snowboarders and 32 skiers using snowmobiles to access ski terrain



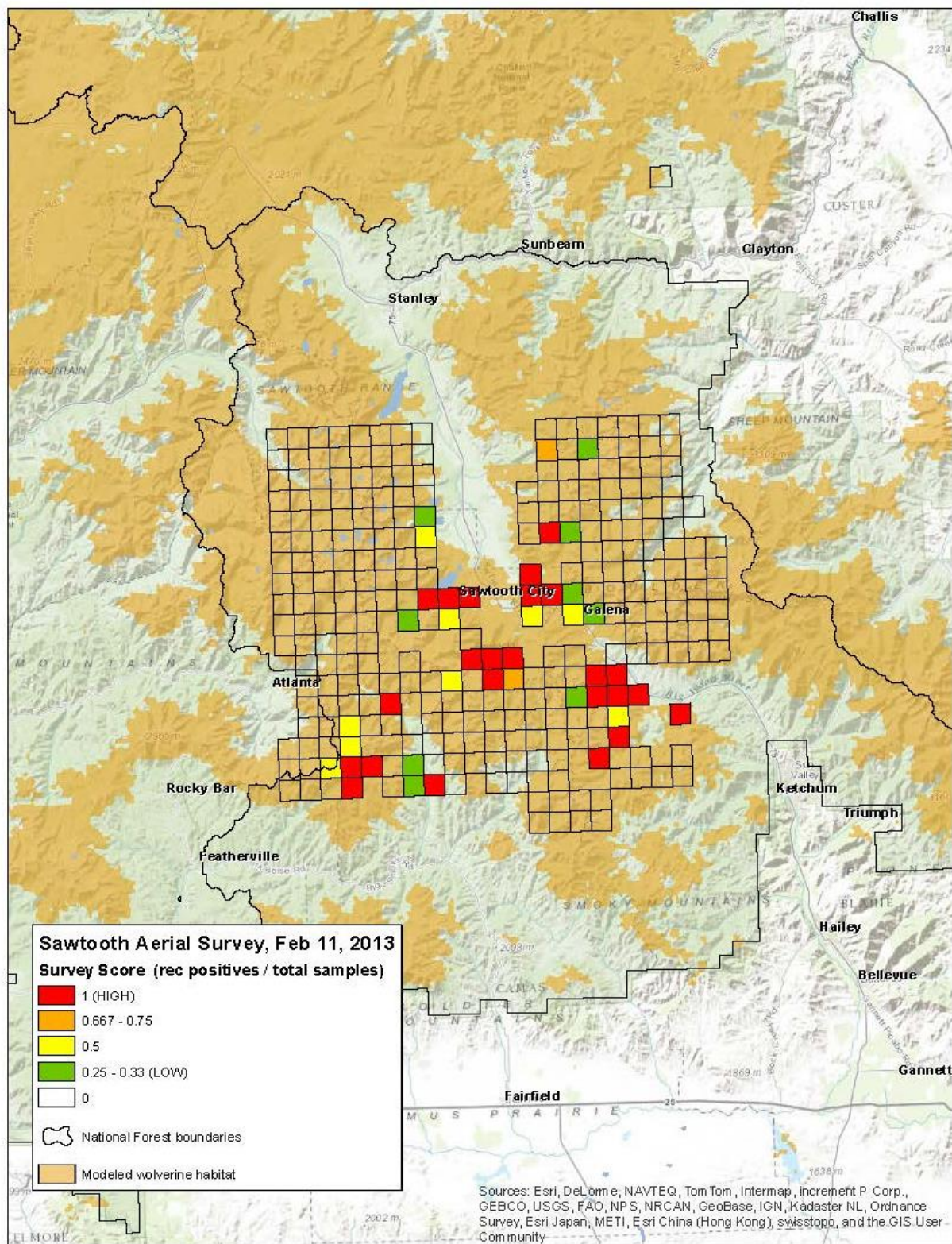


Figure 10. Aerial winter recreation survey completed in early February for the Sawtooth NF study areas.

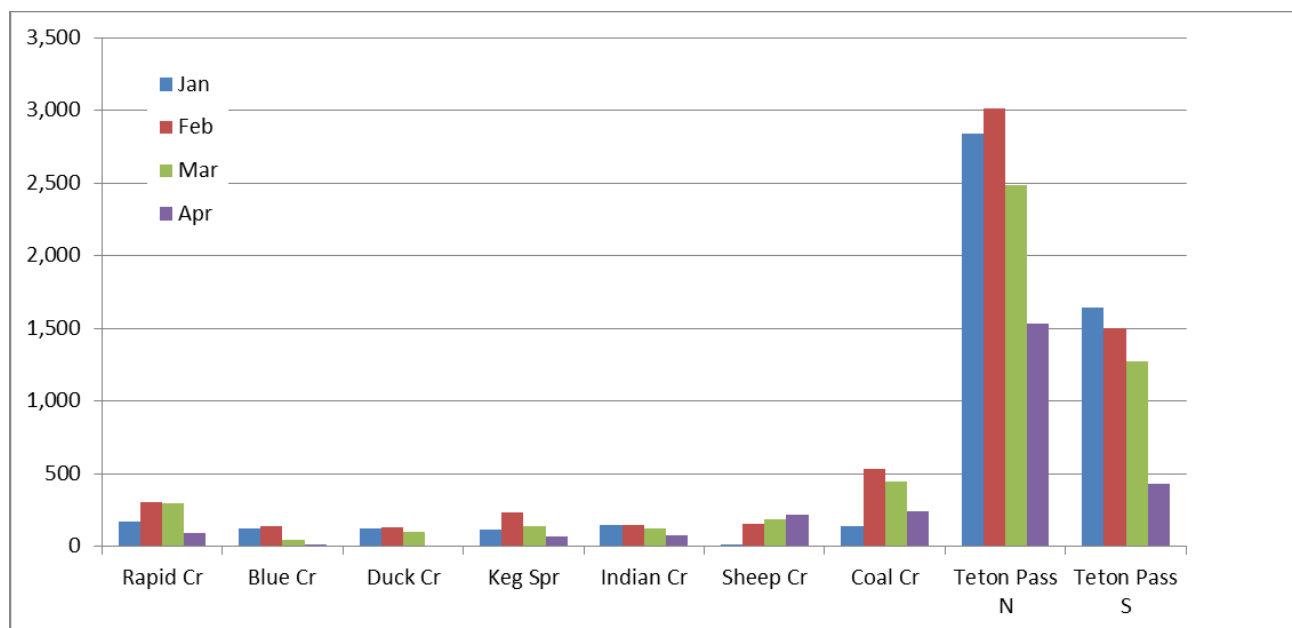


Figure 11. Estimated number of recreationists along a diversity of commonly used trails in the Island Park (Duck Cr, Blue Cr, Keg Spr), Palisades (Indian Cr, Sheep Cr) and Teton Basin (Rapid Cr, Coal Cr, Teton Pass N and S) Districts of the Caribou-Targhee National Forest; Island Park and Palisades District counters were placed on access routes primarily used by snowmobile recreationists and Teton Basin District counters were placed on access routes primarily used by backcountry skiers.

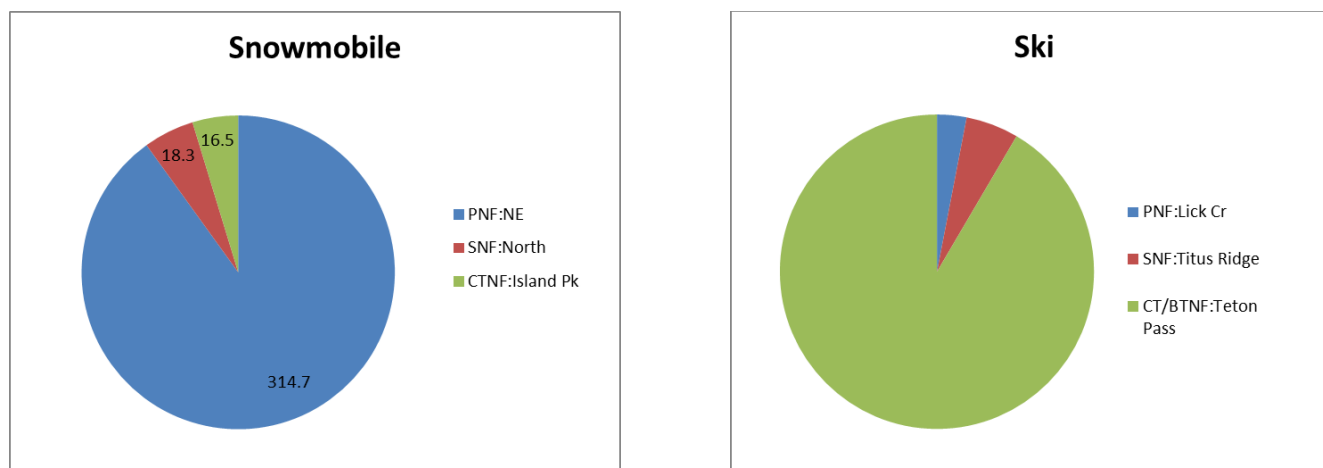


Figure 12. Pie charts showing the average daily counts recorded on infra-red trail use counters established along popular trails on the Payette, Sawtooth and Caribou-Targhee/Bridger-Teton National Forests.



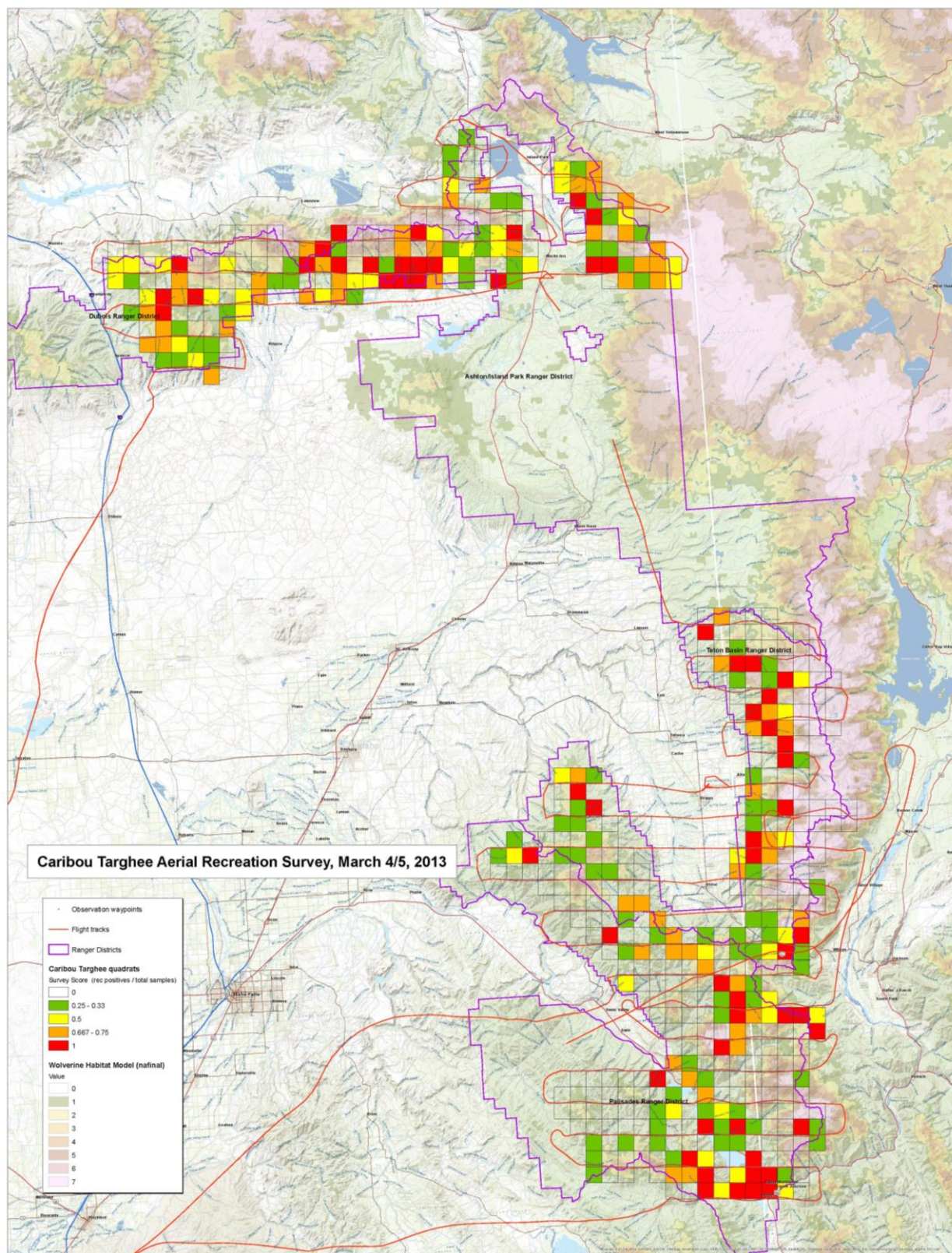


Figure 13. Results of an aerial winter recreation survey completed in late March on the Caribou-Targhee National Forest

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## APPENDIX I

Infra-red trail use counter monitoring information from the winter 2013 summarized by study area.

**TABLE I-1. TRAIL USE COUNTS COLLECTED FROM INFRA-RED TRAIL USE COUNTERS SET UP ALONG PRIMARY ACCESS ROUTES ON THE PAYETTE NATIONAL FOREST STUDY AREA NEAR MCCALL, IDAHO, 2013 WINTER.**

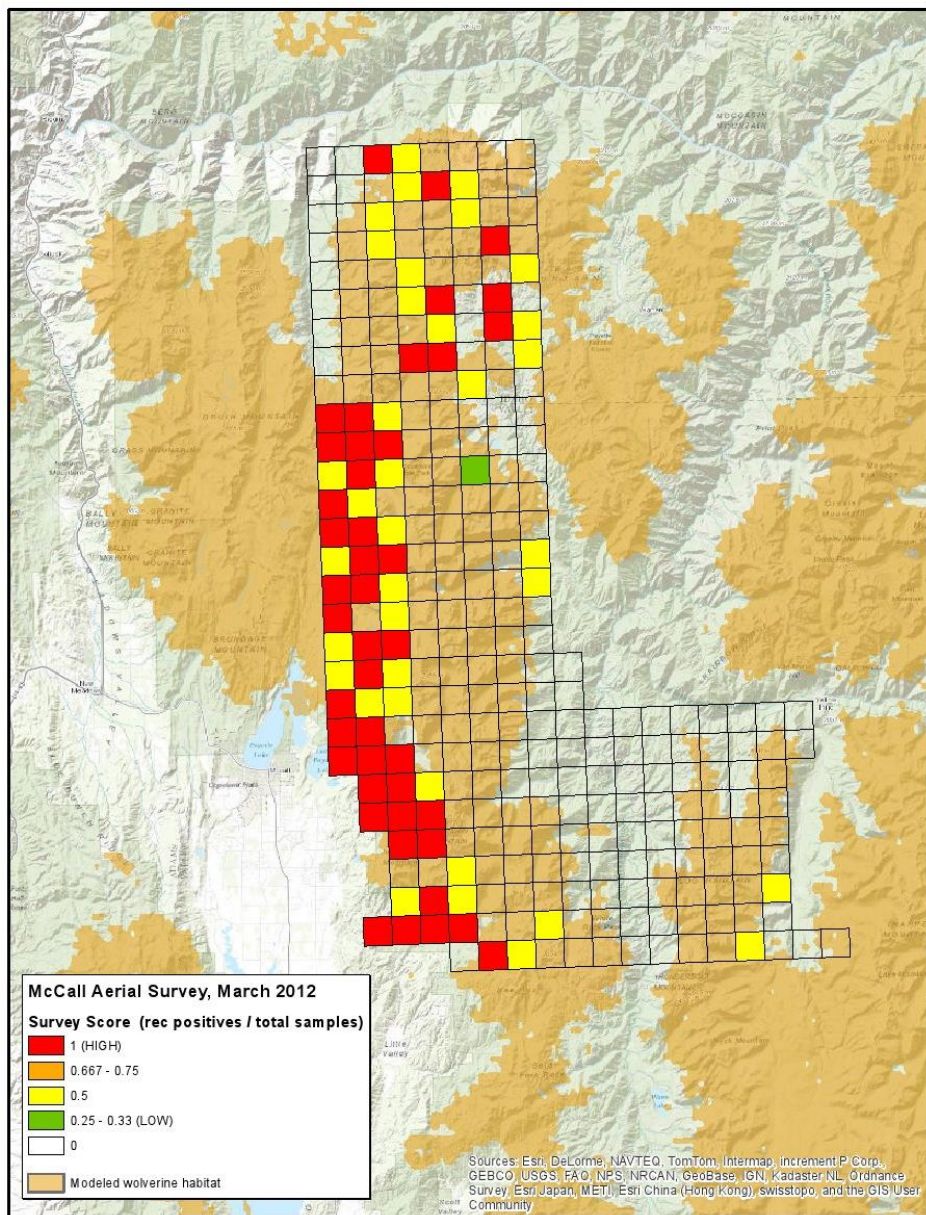
<b>Study Area</b>	<b>Site</b>	<b>Start</b>	<b>End</b>	<b>Count<sup>1</sup></b>	<b>Days with data</b>	<b>Average Daily Use</b>
<b>PNF</b>	<b>Lick Cr Trailhead</b>	1/1/13	4/7/13	600	96	6.2
	<b>Upper Elevation Trailhead</b>	1/1/13	4/8/13	6,012	97	62.0
	<b>Warren Wagon Trailhead</b>	1/1/13	2/1/13	2,139	31	69.0
<b>BNF</b>	<b>Clear Cr</b>	1/11/13	4/5/13	2,360	90	11.6
	<b>Curtis Cr</b>	1/11/13	4/5/13	360	88	4.1
	<b>Stolle Meadows</b>	1/11/13	4/5/13	378	93	4.1
	<b>Warm Lake Summit</b>	1/11/13	4/5/13	851	88	9.7
	<b>Pole Cr</b>	1/21/13	4/13/13	325	84	3.9
<b>SNF</b>	<b>4th of July</b>	1/22/13	4/13/13	211	83	2.9
	<b>Alturas</b>	1/17/13	4/13/13	117	88	1.6
	<b>Main Baker</b>	1/21/13	4/13/13	107	38	5.4
	<b>Beaver Cr</b>	1/22/13	4/13/13	173	56	5
	<b>Cross Parking</b>	1/15/13	4/13/13	1,528	95	16.1
	<b>Headwaters</b>	1/17/13	4/13/13	253	88	3.4
	<b>Mays Cr</b>	1/17/13	4/13/13	280	88	3.2
	<b>Titus Ridge</b>	1/15/13	4/13/13	820	96	11.1
	<b>Couch</b>	1/15/13	4/21/13	1,302	97	13.4
	<b>Salt Bounds</b>	1/15/13	4/21/13	241	97	2.5
	<b>Skunk</b>	1/14/13	4/21/13	50	98	0.5
	<b>Upper So. Fk</b>	1/26/13	4/21/13	284	86	3.3
<b>CTNF Centennial Mtns</b>	<b>Blue Cr</b>	1/23/13	4/8/13	325	76	4.3
	<b>Keg Springs</b>	1/23/13	4/8/13	562	76	7.4
	<b>Duck Cr</b>	1/23/13	4/7/13	365	75	4.9
	<b>Indian Cr</b>	1/26/13	4/14/13	495	79	6.3
<b>CTNF: Teton/Palisades</b>	<b>Coal Cr</b>	1/19/13	4/14/13	1,358	86	15.8
	<b>Rapid Cr</b>	1/30/13	4/14/13	859	75	11.4
	<b>Sheep Cr</b>	1/26/13	4/14/13	568	79	7.2
<b>BTNF: Teton Pass</b>	<b>Teton Pass N</b>	1/19/13	4/14/13	9,879	86	114.9
	<b>Teton Pass S</b>	1/19/13	4/14/13	4,846	86	56.3

<sup>1</sup> Count is the number of passes by the counters divided 2 to provide an estimate of number of recreationists. The count is divided by 2 based on the assumption that recreationists entering the study area also leave the study area by passing by a trail use counter.

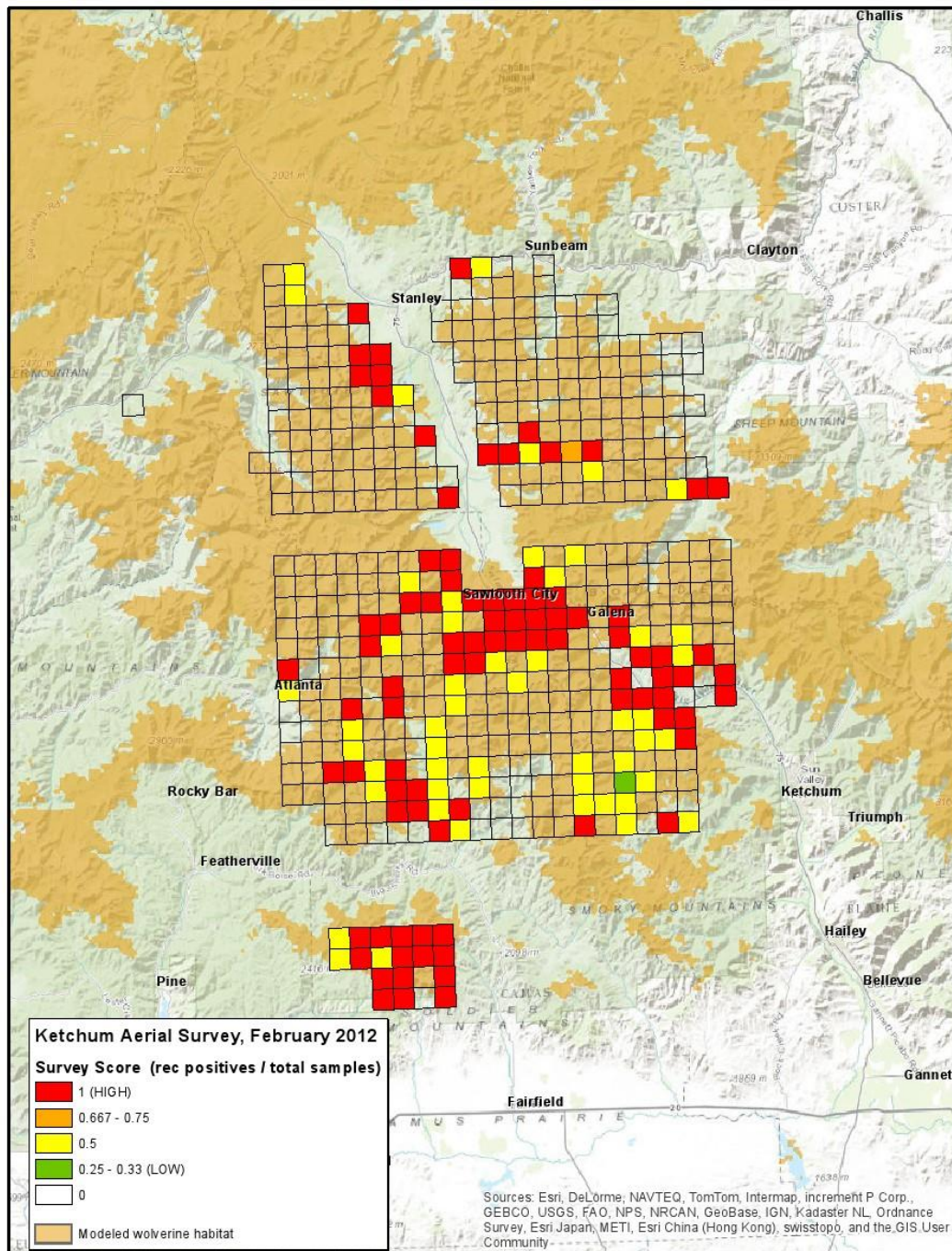


## APPENDIX II

Maps of aerial surveys completed on the Payette and Sawtooth National Forests in 2012. See Heinemeyer et al. 2011 for details on data collection and summary methods.

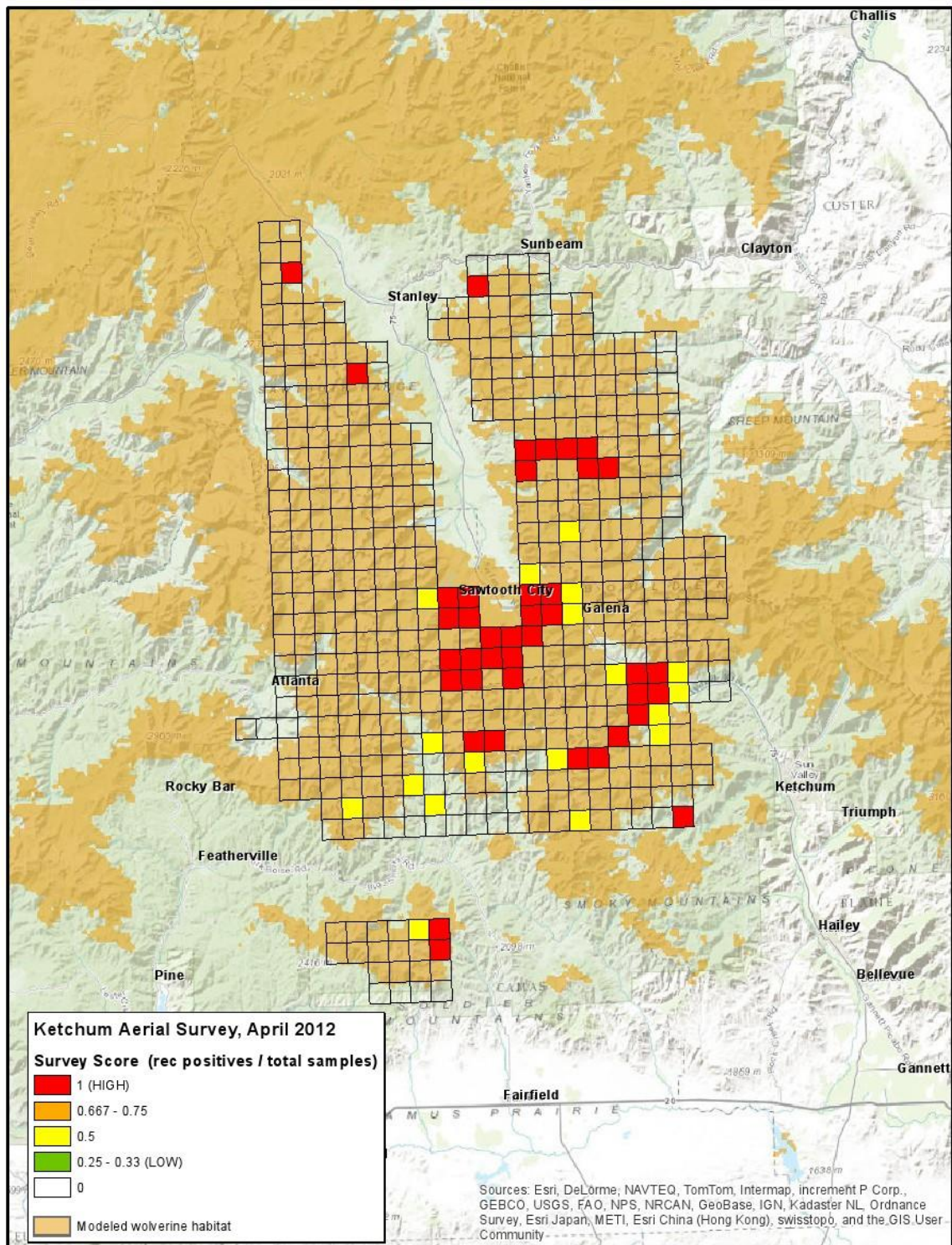


Appendix A-1. Aerial recreation survey results for the Payette NF study area in March 2012. The grid shown on the map was flown using methods described in Heinemeyer et al. 2011.



Appendix A-2. Aerial recreation survey results for the Sawtooth NF study area in February 2012. The grid shown on the map was flown using methods described in Heinemeyer et al. 2011.





Appendix A-3. Aerial recreation survey results for the Sawtooth NF study area in April 2012. The grid shown on the map was flown using methods described in Heinemeyer et al. 2011.