Forest Carnivore Monitoring in the Southwestern Crown of the Continent:

2015 Progress Report

Summary: In 2015, we surveyed 76 grid cells using snow tracking and deployed 161 bait stations across the Southwestern Crown landscape. We detected lynx in 19 grid cells and identified 17 individuals (13 males, 4 females) through genetic sampling. We detected wolverine in 33 grid cells and identified 15 individuals (8 males, 7 females) through genetics. We did not detect any fisher in 2015. We discuss how this information can and should be used. Survey efforts are continuing in the SW Crown in the winter of 2016.

Introduction: In the winter of 2012, members of the Southwestern Crown Collaborative (SWCC) Wildlife Working Group began systematic, landscape-scale carnivore monitoring efforts within the Southwestern Crown-of-the-Continent (SW Crown) landscape. A previous report (available here: http://www.swcrown.org/wp-content/uploads/2015/01/2012-2014-SWCC-Carnivore-Monitoring-Report-Final1.pdf) summarized monitoring efforts from the first three winters, 2012-2014, and this report adds results from the winter of 2015. This monitoring project was designed to provide a baseline of the current distribution of the focal species in the SW Crown and to allow for tracking changes in that distribution over time.

The initial objectives identified for the project were to:

- Develop a better understanding of the distribution of forest carnivores, with a focus on lynx, wolverine, and fisher, across the project area, and to see if that distribution changes over the course of the Forest Service's Collaborative Forest Landscape Restoration Program (CFLRP).
- Collect genetic material from the three focal species to establish important baseline information (individual identification and sex, sub-population genetics) and add to the existing body of knowledge of these species in the Northern Rockies.
- Better understand travel routes and coarse habitat selection for these species.
- Make a concerted effort to survey roadless and wilderness areas that have received very little survey effort to date.

- Complement ongoing research and monitoring efforts in the region, including reporting on wolf pack activity and lynx habitat mapping efforts.
- Identify "hot spots" where more intensive research could be conducted (e.g., GPS collar deployment to study specific habitat use).
- Improve the cost effectiveness of surveying forest carnivores at large scales and over time.
- Raise community awareness/increase support among partners and the general public for forest carnivore conservation.

Methods: The SW Crown carnivore project utilizes multiple non-invasive survey methods to maximize our ability to detect multiple species across a large landscape in an efficient and cost effective manner. We combine multi-species snow track surveys with non-invasive DNA collection methods (bait stations) and motion-sensor cameras. In order to standardize the approach across the SW Crown, a 5 x 5 mile grid (roughly 8 km x 8 km), which represents an area slightly smaller than an average female lynx home range, was overlaid on the entire landscape. There are 129 grid cells that at least partially intersect the SW Crown landscape (see Figure 4), and about 80 of those are fully or mostly in the SW Crown boundary. Those grid cells were targeted to conduct snow track surveys and deploy hair snare bait stations to monitor target carnivore species and meet the project objectives. Genetic samples were sent to the Forest Service's Rocky Mountain Research Station (RMRS) in Missoula to determine species and individual.

2015 Survey Effort

In 2015, we surveyed a total of 76 grid cells (Table 1 and Figure 1) across 51 days in January-March. We partnered with the Bureau of Land Management to add the Garnet Mountains adjacent to the southern part of the SW Crown landscape. We deployed a total of 161 bait stations across 70 grid cells with an average of 48 days of deployment per station (Table 2).

Table 1. Snow-track survey effort from 2012-2015 for all target species.

Year	Number of survey days	Number of grid cells[a] surveyed at least once	Total miles surveyed[b]	Average miles/grid cell/survey[c] (range)
2012	41	65	1115	3.2 (1.0 - 9.6)
2013	51	73	1011	3.6 (1.0 - 10.0)
2014	52	62	1240	4.0 (1.0 - 10.0)
2015	**51**	**76**	**1722**	**6.1 (1.0-22.5)**

[a] There are 129 grid cells that at least partially intersect the SW Crown landscape, and 87 of those have their majority in the SW Crown boundary.
[b] Includes revisits to the same survey route.
[c] The average value used here is based on the number of miles covered on snowmobile or foot in each grid cell per survey effort, including revisits to the same grid cell.

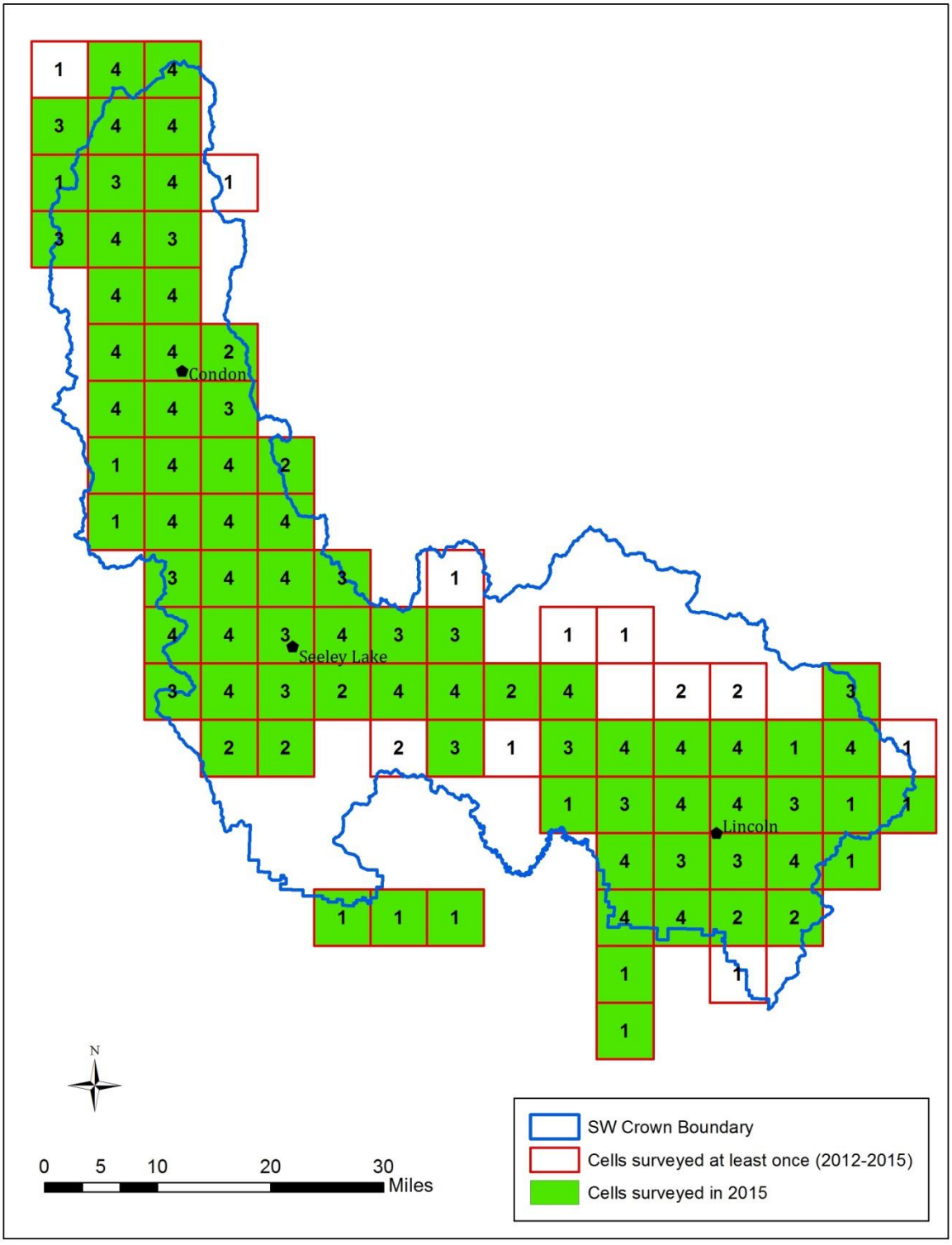

Figure 1. Survey effort by grid cell across all years. Green cells were surveyed in 2015. The number within each grid cell indicates the number of years that grid cell was surveyed over the four-year period of this monitoring effort.

Table 2. Summary of bait stations and hair snares deployed from 2012-2015.

Year	Number of bait stations or hair snares	Number of grid cells[a] with at least one bait station or hair snare	Avg. number of bait stations/grid cell	Avg. number of days of bait station deployment (range)[b]
2012	368 hair snares	62	5.9 hair snares	25.5 (18-46)
2013	162 bait stations	77	2.1 bait stations	44 (19-121)
2014	107 bait stations	51	2.1 bait stations	47 (13-87)
2015	**161 bait stations**	**70**	**2.3 bait stations**	**48 (14-170)**

[a] There are 129 grid cells that at least partially intersect the SW Crown landscape, and 87 of those have their majority in the SW Crown boundary.
[b] Fisher hair snares were used in 2012.

Lynx Results

In 2015, we detected lynx in a total of 19 grid cells (Table 3 and Figure 2). The total number of cells has been relatively consistent across all four years. In 2015, tracks were identified in 17 cells and two additional cells were added through bait stations. However, of the 17 individuals identified through genetic samples in 2015, four were identified strictly through samples from bait stations (Table 4). The area north of Seeley Lake continues to be the most consistent area for detections. No lynx were detected in the Garnet Mountains.

We have now identified a total of 26 unique lynx across 41 grid cells in our landscape across all years (Figure 2). All but five of these individuals are new to the RMRS genetic database (Table 4). We have identified over three times as many males as females. This may partly be due to the behavior of males and females at bait stations (e.g., females may be more cautious or males may dominate a bait station). However, genetic samples from track surveys should be unbiased in sex ratios and we still had 8 males to 4 females.

Table 3. Lynx detections in the SW Crown from 2012-2015 by detection method.

Year	Grid cells w/ track detections[a]	Grid cells w/ bait station detections[b]	Total number of grid cells w/ detections (both methods)	Total number of individuals[c]
2012	19	n/a	21	4 (3m, 1f)
2013	20	5	21	7 (5m, 2f)
2014	19	10	19	13 (10m, 3f)
2015	**17**	**10**	**19**	**17 (13m, 4f)**
Total unique	39	15	40	26 (19m, 7f)

[a] Track identifications with High or Moderate confidence. There are 129 grid cells that at least partially intersect the SW Crown landscape.
[b] From bait station genetics results. In 2012, fisher hair snares were used, which were not designed to detect lynx.
[c] From genetics results. See Table 4 for information on individuals.

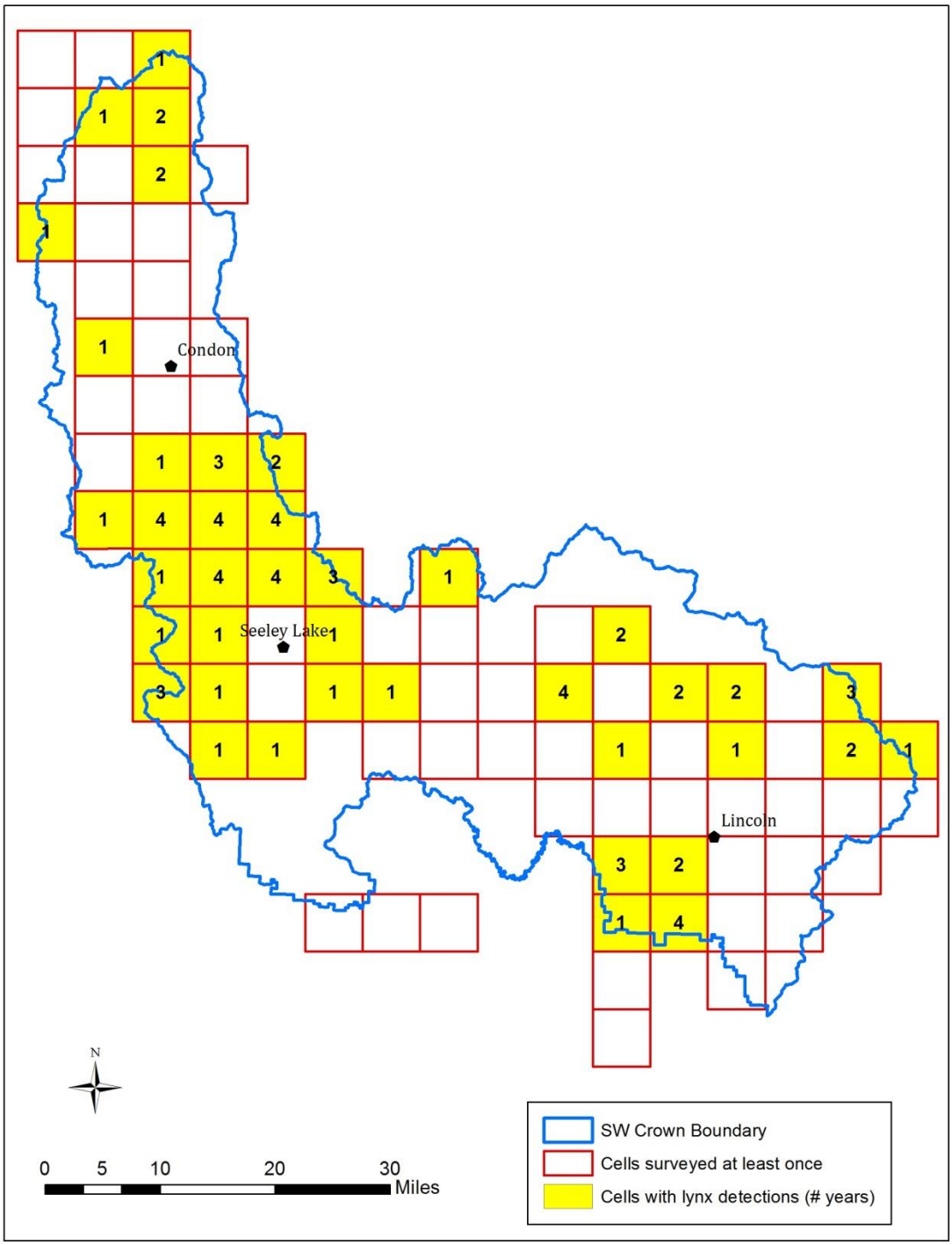

Figure 2: Survey effort and detections for lynx across the SW Crown from 2012-2015. Cells shaded yellow represent those with lynx detections in at least one year. Detections are from track surveys and/or bait stations. The number inside the cell indicates the number of years lynx were detected in the cell (out of a maximum of 4). Individuals could not be identified in all cells due to: samples from backtracking may not have been found, lynx in a grid cell may not have visited a bait station, or the DNA samples were of too low of quality.

Table 4. Sex, grid cell, Forest Service District, initial detection study, and method of detection of individual lynx identified through genetic samples from track surveys and bait stations 2012-2015.

Lynx ID	Sex	First Year Detected	Grid cells	District	No. Years Detected (longevity)	Study First Identified	2012[a]	2013		2014		2015	
							Snow track	Snow track	Bait Station	Snow track	Bait Station	Snow track	Bait Station
M059	Male		2163 2222	Seeley	3	RMRS			2163		2163		2222, 2163
M080	Male		2048 2105	Swan, Seeley	3	RMRS			2105	2048	2048, 2105	2048	2048, 2105
M092_M174	Male		2045	Seeley	2	RMRS					2045		2045
M147	Male		2104, 2105	Seeley	3	RMRS			2104, 2105	2104		2104	2104
M163	Male		2542	Lincoln	1	RMRS				2542	2542		
SWCC_12_LynxM01	Male	2012	2106	Swan	1	SWCC	2106						
SWCC_12_LynxM02	Male	2012	2446	Seeley	1	SWCC	2446					2446	
SWCC_12_LynxM03	Male	2012	2595 2687	Lincoln	1	SWCC	2595			2687			
SWCC_12_LynxF04	Female	2012	2104	Seeley	1	SWCC	2104						
SWCC_13_LynxM05	Male	2013	2546	Lincoln	1	SWCC		2546					
SWCC_13_LynxF06	Female	2013	2164	Seeley	3	SWCC		2164			2164	2164	
SWCC_13_LynxF07	Female	2013	2055	Swan	1	SWCC		2055					
SWCC_13_LynxM08	Male	2013	2164	Seeley	2	SWCC		2164			2164		
SWCC_14_LynxF09	Female	2014	2045	Seeley	1	SWCC				2045	2045		
SWCC_14_LynxF10	Female	2014	2164	Seeley	2	SWCC					2164	2164	2164
SWCC_14_LynxM11	Male	2014	2163	Seeley	1	SWCC					2163		
SWCC_14_LynxM12	Male	2014	2686 2687	Lincoln	2	SWCC					2686, 2687	2686	
SWCC_14_LynxM13	Male	2014	2104 2163 2164	Seeley	2	SWCC					2104	2163	2163, 2164
SWCC_15_LynxM14	Male	2015	2046	Seeley	1	SWCC							2046
SWCC_15_LynxM15	Male	2015	2165	Seeley	1	SWCC							2165
SWCC_15_LynxF16	Female	2015	2542	Lincoln	1	SWCC						2542	

SWCC_15_LynxM17	Male	2015	1993	Swan	1	SWCC							1993
SWCC_15_LynxM18	Male	2015	2104	Seeley	1	SWCC						2104	
SWCC_15_LynxM19	Male	2015	2105	Seeley	1	SWCC						2105	
SWCC_15_LynxM20	Male	2015	2687	Lincoln	1	SWCC						2687	
SWCC_15_LynxF21	Female	2015	2045	Seeley	1	SWCC						2045	2045

[a] In 2012, fisher hair snares were used, which were not designed to detect lynx.

Wolverine Results

In 2015, we detected wolverine in a total of 33 grid cells (Table 5). This is similar to the previous year, though we almost doubled the number of detections through bait stations in 2015. We also identified more individuals through genetics in 2015. We have now identified 22 unique wolverines in the SW Crown landscape, all but three of which are new to the RMRS database (Table 6). Cells are distributed across all three districts, though the Mission Mountains appear to be a consistent location. No wolverines were detected in the Garnet Mountains.

Table 5. Summary of wolverine detections using both track surveys and bait stations, 2012-2015.

Year	Grid cells w/ track detections[a]	Grid cells w/ bait station detections[b]	Number of grid cells w/ detections (both methods)	Number of individuals[c] (males, females)
2012	9	1	10	1 (1f)
2013	12	9	16	10 (4m,6f)
2014	29	16	31	11 (5m, 6f)
2015	**24**	**27**	**33**	**15 (8m, 7f)**
Unique	42	34	47	22 (11m, 11f)

[a] There are 129 grid cells that at least partially intersect the SW Crown landscape.
[b] From genetics results. In 2012, fisher hair snares were used, not multi-species bait stations.
[c] See Table 6 for information on individuals.

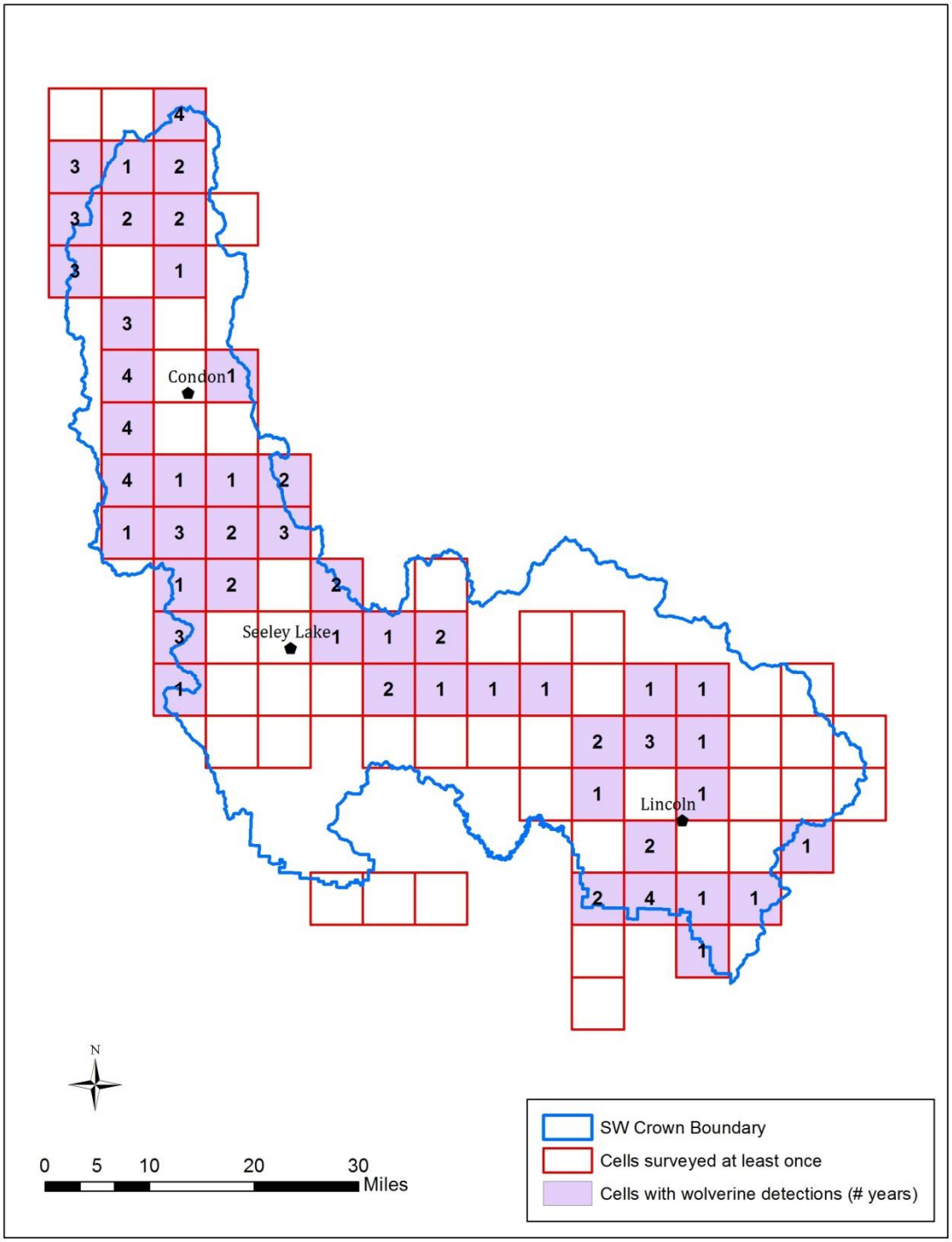

Figure 3: Survey effort and detections for wolverine across the SW Crown from 2012-2015. Cells shaded purple represent those with wolverine detections in at least one year. Detections are from track surveys and/or bait stations. The number inside the cell indicates the number of years wolverines were detected in the cell (out of a maximum of 4). Individuals could not be identified in all cells due to: samples from backtracking may not have been found, wolverine in a grid cell may not have visited a bait station, or the DNA samples were of too low of quality.

Table 6. Sex, grid cells, Forest Service District, initial detection study, and method of detection of individual wolverine identified through track surveys and bait stations 2012-2015.

Wolverine ID	Sex	First Year Detected	Grid cells	District	No. Years Detected	Study First Identified[a]	2012[b]	2013		2014		2015	
							Bait Station	Snow track	Bait Station	Snow track	Bait Station	Snow track	Bait Station
BDF10-M6	Male		2492 2495 2542 2639 2684	Lincoln	2	WTU				2542	2495, 2542		2492, 2542, 2639, 2684
HFW10-M3	Male		2492	Lincoln	1	WTU				2492			
HFW12-F7	Female		2492 2542	Lincoln	1	WTU				2492	2492, 2542		
SWCC_13_GuloM01	Male	2013	2590	Lincoln	1	SWCC			2590				
SWCC_13_GuloF02	Female	2013	1994	Swan	1	SWCC			1994				
SWCC_13_GuloF03	Female	2013	1996 1997 2046 2048 2104	Seeley, Swan	3	SWCC		1996	1996, 1997	2104, 2046	2048, 2104		2048
SWCC_13_GuloF04	Female	2013	1996 1997	Swan	1	SWCC		1997	1996, 1997				
SWCC_13_GuloF05	Female	2012	2164 2221 2222 2545	Seeley, Lincoln	4	SWCC	2545		2164	2221	2222	2164	2164
SWCC_13_GuloF06	Female	2013	1945	Swan	3	SWCC		1945	1945	1945	1945		1945
SWCC_13_GuloM07	Male	2013	2046	Seeley	1	SWCC			2046				
SWCC_13_GuloM08	Male	2013	1945 1994 1995 1996 2048 2104	Swan, Seeley	3	SWCC			1994		1994, 2048, 2104		1945, 1995, 1996
SWCC_13_GuloM09	Male	2013	1947	Swan	3	SWCC			1947		1947	1947	1999,

			1999 2000										2000
SWCC_13_GuloF10	Female	2013	2164	Seeley	2	SWCC			2164				
SWCC_14_GuloF11	Female	2014	2054 2056	Swan	2	SWCC				2056	2054, 2056		2056
SWCC_14_GuloF12	Female	2014	1994 1997 2056 2108	Swan	2	SWCC					1994, 1997, 2056, 2108	1994	1997
SWCC_15_GuloM13	Male	2014	2108 2339 2393 2495	Seeley, Lincoln	2	SWCC					2108	2339, 2393	2495, 2339
SWCC_15_GuloM14	Male	2015	1994 2048	Swan	1	SWCC						1994, 2048	
SWCC_15_GuloM15	Male	2015	1945 1946 1947 1999 2000	Swan	1	SWCC						1999	1945, 1946, 1947, 1999, 2000
SWCC_15_GuloF16	Female	2015	2054	Swan	1	SWCC							2054
SWCC_15_GuloF17	Female	2015	2045	Seeley	1	SWCC							2045
SWCC_15_GuloM18	Male	2015	2056	Swan	1	SWCC							2056
SWCC_15_GuloM19	Male	2015	2545	Lincoln	1	SWCC							2545

[a] WTU is Wild Things Unlimited.

[b] In 2012, no wolverine track genetics samples were collected and fisher hair snares were used, which were not designed to detect wolverine.

2015 Fisher Results

Fisher: Similar to years 2012-2014, no fishers were detected in the SW Crown in 2015.

Additional Carnivore Species

We also collected considerable data on non-target carnivore species during our surveys. The distributions of bobcats and martens are shown in figures 4 and 5. Both species were widely distributed across the landscape, with bobcat detections in 46 cells and marten in 62 cells. We also collected track survey data on mountain lions and wolves (not shown here).

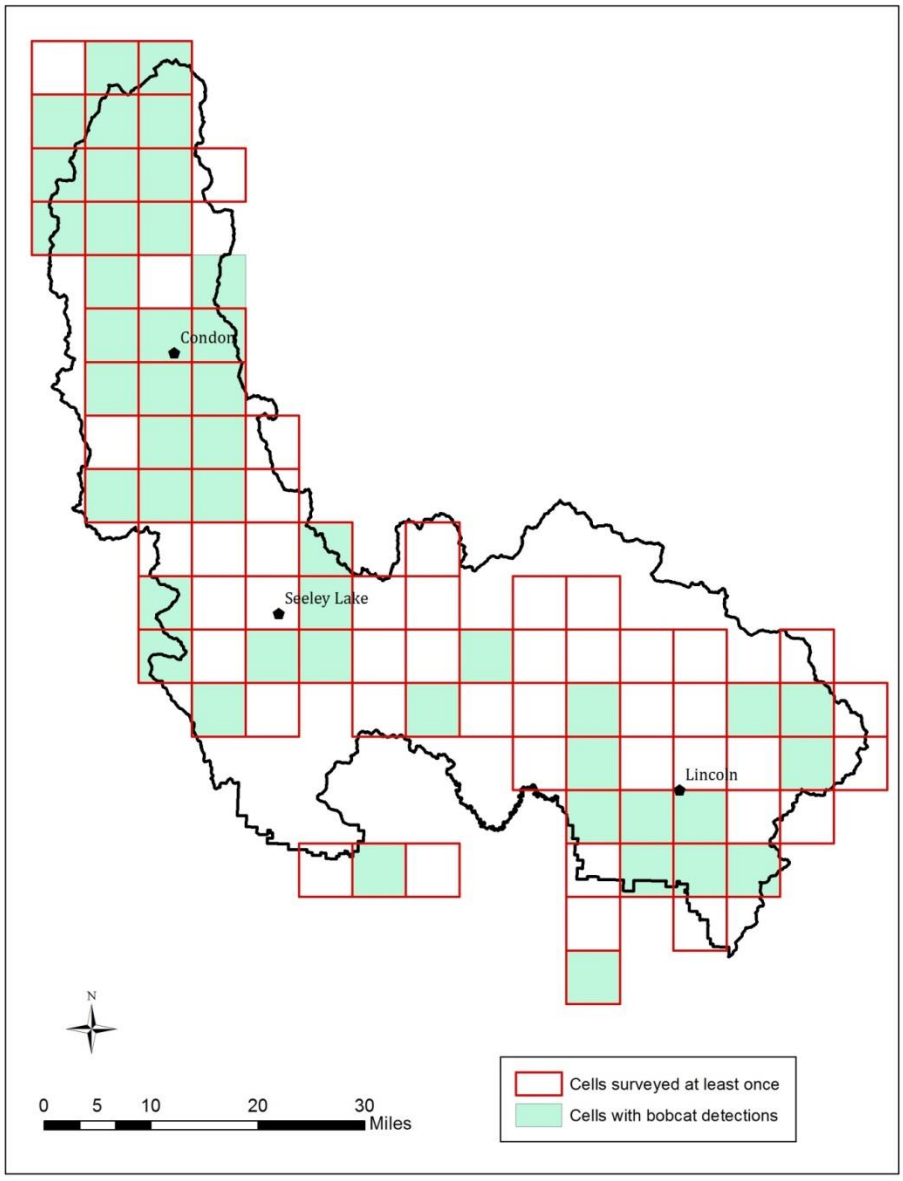

Figure 4: Grid cells with detections for bobcat from 2012-2015. Shaded cells represent those with bobcat detections in at least one year. Detections are from track surveys and/or bait stations. Shaded cells not surveyed once for tracks, had bait stations just inside the cell boundary.

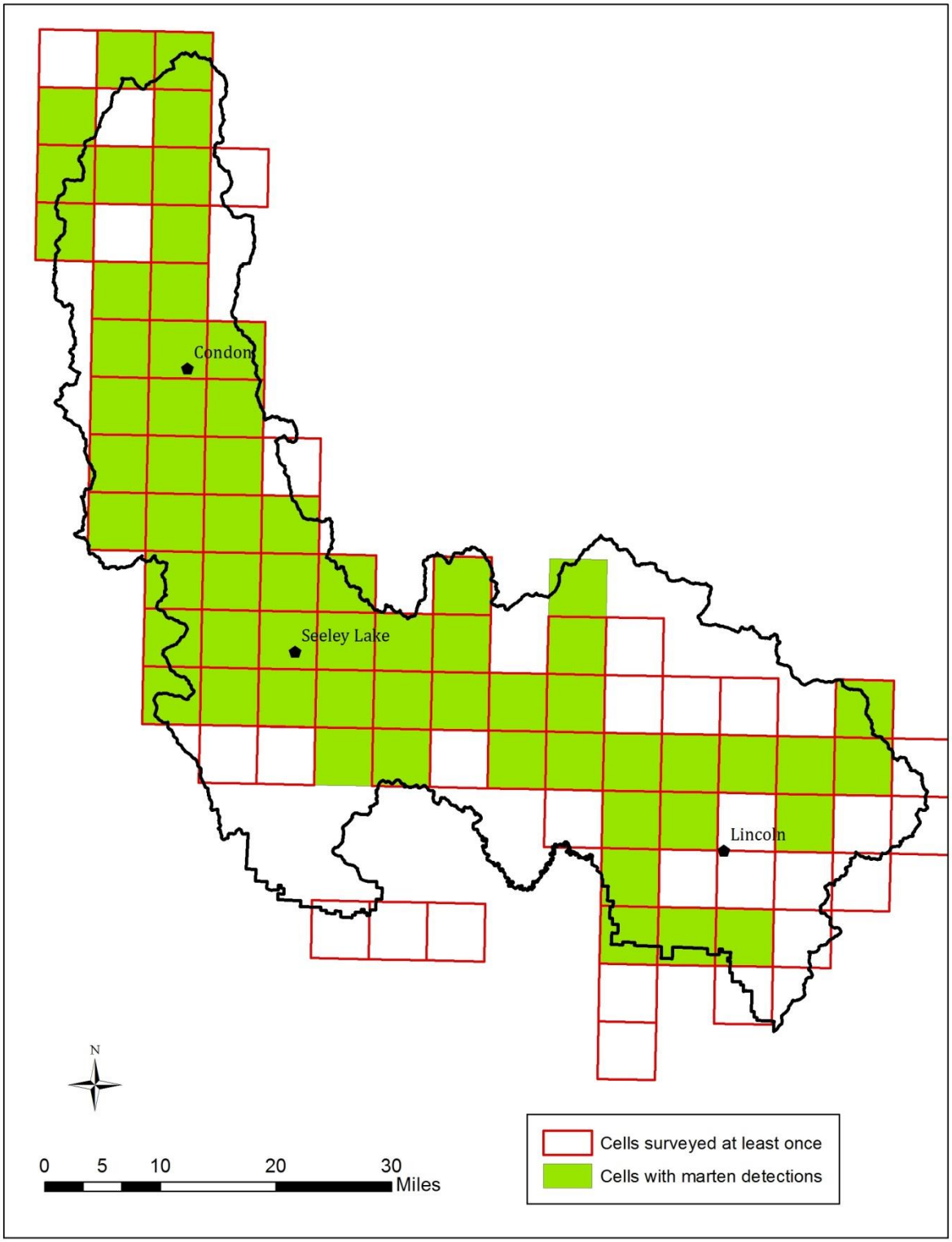

Figure 5: Survey effort and detections for marten across the SW Crown from 2012-2015. Shaded cells represent those with marten detections in at least one year. Detections are from track surveys and/or bait stations. Shaded cells not surveyed once for tracks, had bait stations just inside the cell boundary.

2013-2014 Wolverine Relatedness

In 2015, we asked RMRS to analyze the existing (2013-2014) wolverine genetic samples for relatedness. Table 7 shows which pairs could potentially have a parent-offspring relationship. Those pairs with a "yes" share alleles at all 17 loci evaluated (which a parent and offspring would have). However, this does not necessarily mean this relationship is indeed the case (they could be siblings or cousins or unrelated), and that is why it is important to bring data and knowledge from the field (e.g., locations, cameras, individuals traveling together, etc.) when thinking about how likely these relationships would be. We will be taking a closer look at relatedness results for both lynx and wolverine in a future report. ("SWCC" was removed from identification numbers to save space).

Table 7. Potential for genetic relatedness of individual wolverines identified in the SW Crown from 2013-2014.

Individual	13_GuloM01	13_GuloF02	13_GuloF03	13_GuloF04	13_GuloF05	13_GuloF06	13_GuloM07	13_GuloM08	13_GuloM09	13_GuloF10	14_GuloF11	14_GuloF12	HFW10-M3	BDF10-M6
13_GuloM01	*													
13_GuloF02	no	*												
13_GuloF03	no	no	*											
13_GuloF04	no	no	no	*										
13_GuloF05	no	no	no	no	*									
13_GuloF06	no	no	yes	no	no	*								
13_GuloM07	no	no	no	yes	no	no	*							
13_GuloM08	no	no	no	yes	no	no	no	*						
13_GuloM09	no	no	no	no	no	yes	no	no	*					
13_GuloF10	no	no	no	no	yes	no	no	no	no	*				
14_GuloF11	no	no	yes	no	no	no	no	no	no	no	*			
14_GuloF12	no	no	no	no	no	yes	no	no	no	no	yes	*		
HFW10-M3	no	no	no	no	no	no	no	no	no	no	no	no	*	
BDF10-M6	no	no	no	no	no	no	no	no	no	no	no	no	no	*
HFW12-F7	no	no	no	no	no	no	no	no	no	no	yes	yes	yes	no

How the data can be used

The Southwestern Crown Collaborative (SWCC) Wildlife Working Group has collected significant data on meso-carnivores, especially lynx and wolverine, throughout the Southwestern Crown landscape from 2012-2015. This information can be, and has been, used for multiple purposes. Here, we summarize some of the potential uses of this data and provide examples of how it is already being used.

1. **Effectiveness monitoring:** This monitoring project was first initiated to help the SWCC determine if the abundance and distribution of important wildlife populations changes during the implementation period of the Collaborative Forest Landscape Restoration Program (CFLRP). One of the goals of the CFLRP is to improve wildlife habitat and this monitoring project was designed to meet the desire of "effectiveness" monitoring at the landscape scale. We understand that it is difficult to connect changes in wildlife populations, especially those with large home ranges, directly to specific management actions because of many different factors (e.g., climate variability, wildfires, management actions on private land, etc.). However, monitoring population changes over time can help determine if conditions are improving or possibly deteriorating across a landscape. If we monitored only habitat components and not the species themselves, we would not know how the species was responding to current conditions. Now that we have a solid baseline of data from early in the 15-year CFLRP monitoring window, we can repeat the efforts at the end to see if conditions have improved for these species across the landscape.

2. **Project planning:** Lynx and wolverine detection locations can be used when deciding where management actions should occur. They can help identify areas of potential use by these species and where improvements to habitat may be appropriate. For example, some units being considered for treatment may be removed if regular use of the area by a species is known. Conversely, an area without observations could be considered for treatments that may improve conditions for a species.

   Example: Management for every wildlife species can't be accomplished on every single acre. The carnivore monitoring can provide some coarse scale prioritization for where focal species occur across the SWCC. For example frequency of lynx detections can be combined with information from local habitat knowledge, elevation, and habitat type to determine where other species may take precedent (managing for big game winter range vs. Lynx). While the difference in habitat could be obvious, monitoring unlikely habitats is a valuable way of further supporting we are accurately identifying the full range of potential lynx habitat. Alternately, lynx detections year-after-year, may let project designers to proceed with care when planning projects that impact lynx foraging habitats within the WUI.

3. **Effects analyses:** Observations can also be used in effects analyses for Environmental Assessments and Environmental Impact Statements conducted under the National Environmental Policy Act (NEPA). The frequency of track observations

   Example: The Flathead Forest Plan has a viability requirement for wildlife species. Commenters on the Cold Jim project suggested that the project may threaten American marten viability (viability here is considered to mean risk of extinction) on the Flathead Forest. This monitoring project provided recent information that marten had been detected throughout the entire SWCC. While distribution does not speak directly to viability, this information combined with the small scale of the Cold Jim project and the Cold Jim Project's habitat analysis, better supports the context of the biologist's conclusion that viability of marten would not be threatened.

   Also, the Flathead Forest Plan has a monitoring objective that the USFS will monitor carnivore distribution. The SWCC carnivore monitoring fulfills this statutory obligation.

4. **Landscape planning:** At the landscape scale, the data and results have the potential to inform a wide variety of regional management efforts. Some of these include (but are not limited to): the development of new Forest Plans under the 2012 Planning Rule; the Blackfoot and Swan Landscape Restoration Project (BSLRP) being conducted for the SW Crown landscape; the development of collaborative restoration projects by local restoration committees or the SWCC; or the evaluation of lands included in Wilderness Inventories under Chapter 70 of the 2012 Forest Planning Rule.
5. **Regional monitoring:** Region 1 of the U.S. Forest Service is considering using our methods to expand carnivore monitoring efforts across a wider geographic area to meet monitoring requirements. We have tested and improved our methodology over several years and believe these methods could be effectively implemented through partnerships throughout the region. We have already expanded our efforts onto land managed by the BLM and will start to work on land owned by The Nature Conservancy this next year. Gathering data from a much larger region can help put local results into context (e.g., What areas are most important? Where are places of connectivity between suitable habitat patches?).
6. **Use by other agencies:** These data can be used to inform management planning for these species by other federal and state agencies, such as the U.S. Fish and Wildlife Service (USFWS) and Montana Fish, Wildlife & Parks, which are mandated to conserve and manage wildlife populations.

   Example: Our lynx data was recently compiled, summarized, and provided to the USFWS in response to a call for data. USFWS are reviewing the species status and our data is likely to be some of the most rigorous data available in the region.
7. **Research efforts:** These data can be used as a starting point for many different research topics.

   Examples: Species observations can help guide researchers, including work being done by John Squires at the Rocky Mountain Research Station (RMRS), for trapping and collaring individuals to answer larger management questions. The genetics data for our landscape could be analyzed by RMRS with data from other regional efforts (e.g., surveys in Glacier National Park, the Cabinet/Purcell Mountains, and Canada) to look at gene flow in the larger Northern Rockies region.
8. **Educational and outreach efforts:** The monitoring project and its data can be used for many different educational efforts. Lessons from the field, such as learning tracks and videos from bait stations, have been shared with a wide audience and created an appreciation for wildlife species that few people get to observe. The data, at least at the grid cell scale, could potentially be used in classroom exercises.

   Examples: Presentations to local communities such as Swan Valley Community Center, Natural History Center in Missoula, Wildlife in the West Class at Swan Valley Connections; professional conferences: MT Wildlife Society (2015), MT SAF Missoula (2015), Meso-Carnivore Monitoring Workshops (2014, 2015), multiple press articles in local and regional papers.

Next steps

Survey efforts were completed in the SW Crown in the winter of 2016, though results are not yet analyzed. In 2016, surveys were also conducted on adjacent BLM lands in the Garnett Mountains and on lands recently acquired by The Nature Conservancy to the southwest of the SW Crown landscape. In the coming year, we plan to spend substantial time analyzing the data from the first four years (2013-2016, not counting the 2012 pilot year). We will complete a final baseline report and potentially publish the results of our efforts.