LAND MARK
Adventure Science on American Prairie Reserve

2014 Landmark Q1 Report
Prepared by
Adventurers and Scientists for Conservation
June 10th, 2014

http://www.adventurescience.org/landmark.html

Abstract:

Land**mark** is an ongoing collaboration between Adventurers and Scientists for Conservation (ASC) and the American Prairie Reserve (APR). This project is designed to gather information to aid the Reserve's management team in understanding multiple parameters related to wildlife usage and interaction with the landscape.

Our use of emerging technologies and "Adventure Scientist" volunteers to collect data brings a unique variety of backgrounds and skills to bear in assisting this highly ambitious conservation effort.

In our initial two months of survey work, nine Adventure Scientists surveyed transects totaling 426 miles, resulting in the documentation of 3,443 animal observations, 227 human artifacts, 23 measurements of hydrologic features, 9 badger holes, 4 dead animals, 3 grouse collisions with fences, and more. Additionally, the Adventure Scientists spent 22 hours spotting from high points on the Sun Prairie property, yielding 108 wildlife observations. Moreover, twenty-three remote sensing camera stations were installed along fencelines and maintained at regular intervals, providing a total of 859 documented wildlife observations which were recorded in HD video.

Major components of our work throughout the initiation period of this project include fine tuning our methodology and identifying the most useful components of the collected data. We have refined our methods and worked to ensure reliable data collection.

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This document is intended to present the data we have collected in a manner that is digestible to both an academic and non-scientist crowd and is supplemented with digital maps, photography, videos, and other interactive materials which are available upon request.

Project Overview and Goals

Adventurers and Scientists for Conservation (ASC) and the American Prairie Reserve (APR) have joined forces to create an innovative collaboration called Land**mark.** This is an ongoing effort to collect a multitude of information that can be used by a variety of stakeholders to improve decision making on and surrounding the Sun Prairie property of the American Prairie Reserve. Our goal is to move toward biodiversity centered management along the "Freese scale" including increasing wildlife abundance and decreasing fragmentation of the Reserve.

Our efforts placed crews consisting of six individuals at a time, who lived full-time on the American Prairie Reserve beginning in early February 2014. Throughout the months of February and March, crews hiked transects that were between 8-11 miles, searching for wildlife and wildlife signs in addition to collecting data on human artifacts, hydrologic features, grouse collisions with fencelines, and more. Additionally, crews placed and maintained 23 remotely triggered camera traps in an effort to better understand wildlife interactions with fences.

In addition to the collection of scientific data, we have placed a strong emphasis on recording the aesthetics and experience of being on the prairie. Throughout the inaugural months of this endeavor, volunteers have endured temperatures as low a -23°F and have faced snow, wind, sleet, and mud. Throughout their time on the Reserve, volunteers regularly documented their experiences through social media, blogging, and video diaries.

This effort brings non-scientists to work collecting scientific information, hence our methodology has included extra precautions to ensure the integrity of the data collected.

Project Design

Volunteer Recruitment

Beginning in November 2013, ASC launched a recruiting website, created blog posts, and leveraged social media to solicit applications for volunteers. Posts were also aired on Gregg Treinish's (ASC's Executive Director) National Geographic blog, the NOLS listserve, the Texas A&M (TAMU) website, as well as the Society for Conservation Biology's webpage. By January, more than 40 people had applied for the first 12 positions. Crewmembers were selected by December 15th for a February 3rd start date. A total of 92 people had applied to the project before March 31st.

Volunteer Screening - Who is an "Adventure Scientist"?

ASC screened and selected applicants based on several factors, including the following:

1. Backcountry experience

Initial applicants were required to demonstrate that they could safely operate in the extreme conditions that February and March bring to the prairie. Applicants were screened based on prior outdoor experience through a series of questions that were designed to illustrate how an individual would handle difficult situations.

2. Prior experience working in remote conditions and/or on a team
Applicants with experience in other challenging environments (Peace Corps, field work in Alaska, work in Yellowstone and Glacier National Parks, etc.) were given priority because of the remote setting of the project and necessity of sharing close quarters on the Reserve.

3. Prior scientific experience
Because of the large applicant pool, we were able to select for individuals who had prior data collection experience. The ASC model is based on placing non-scientists into opportunities to contribute to conservation through data collection. However, especially in the beginning of the Land**mark** project, we felt that some built-in leadership would be a strong addition to crews.

4. Creative interests (writing, photography, videography)
One of our strong desires with Land**mark** is to document the aesthetics and the experience of traversing and living on the prairie. Crew members were selected with with an eye towards building a team with a variety of media skills. Over time their recorded experiences will form a narrative of living and working on an expanding wildlife reserve.

5. Interest in conservation
Walking 12 miles in zero degree weather requires a strong work ethic, but also a sense of purpose. We gave priority to crew members who demonstrated a strong interest in conservation.

6. Sense of adventure
Intangible, but critically important, this quality of spirit was a commonality to members of the winter crews. Crew members were selected who had a history of pursuing new experiences and personal challenges.

Volunteer Stint Length and Stipend
During February and March, nine Adventure Scientists contributed more than 1,675 hours of work to the Land**mark** project. Individual crewmembers volunteered an average of 5.6 weeks and worked an average of eight hours per day.

One of the ways we have worked to maintain consistency with data collection is to encourage "holdovers" from crew to crew who can provide leadership and guidance to incoming crew members. Four individuals were "holdovers" moving into March.

Crew members were offered $300 to cover expenses while living on the prairie.

Oversight

At the beginning of each month, ASC staff conducted an intensive two-day training session during which volunteers learned project protocols and practiced these protocols in a hands-on supervised manner.

Volunteers were then expected to continue data collection with regular check-ins with ASC staff. ASC staff members were readily available for troubleshooting over the phone and made four independent visits to the reserve during the months of February and March. Additionally, phone calls were scheduled once per week between APR, ASC, and the Land**mark** crews.

ASC staff regularly monitored incoming data, which was available over the web and updated on a daily basis thanks to the use of tablets to collect the data. This provided the opportunity to catch any inconsistencies and to troubleshoot them on a daily basis.

Several crew members had had extensive leadership and scientific data collection experience prior to joining Land**mark** crews.

Background, Justification and Methods
Equipment

Throughout all aspects of Land**mark**, data have been recorded using Google Nexus 7 tablets, customized "GoFomz", Garmin Etrex 20 GPS units, Canon sx50 cameras, compasses, state-of-the-art rangefinders, Brunton binoculars and spotting scopes, and a tape measure. Data were uploaded on a daily basis via a satellite internet connections available at the "Lazy J Ranch."

Our tablets are equipped with 8MP cameras and GPS sensors. Various softwares have been installed to ensure uniformity, simplicity, and usability.

The use of emerging technologies in data collection helped to ensure the accuracy of data collected and enabled us to troubleshoot inconsistencies with data on a daily basis.

Wildlife Transects
Transect placement/selection

The Sun Prairie section of the APR (31,000 acres) was divided by ASC staff into nine transects of similar length and difficulty and routed to provide between .5 and 1-mile resolution coverage of the entire Sun Prairie property. Starting and ending points for transects were chosen primarily based on accessibility from roads and with a desire to maintain a <1 mile distance that volunteers would need to walk on either end of a transect.

Transects were refined based on volunteer input that only became available after transects had been walked a minimum of one time.

Transects were generally 8-11 miles in length and were followed via GPS tracks; the GPS tracks served as a guideline for crew members to follow. Transects were hiked six times per three month season, generally twice per month, by teams of two observers who were instructed to record the following:

1. Animal Observations
2. Human Artifacts
3. Badger Holes
4. Hydrologic Features
5. Russian Olive Trees
6. Carnivore Signs
7. Other Waypoints of Interest

Crew members made additional observations from existing roads. These were recorded as transects that are labeled as "driving/other."

1. Animal Observations
Background and Justification
Many species abundances on the Reserve are unknown and believed to be below carrying capacity (Kunkel and Austin 2014). Additionally, very little fine scale and local data are currently available for these species (Kunkel and Austin 2014).

Our Q1-2014 objective was to determine local seasonal density or relative use of each species utilizing the Sun Prairie property through raw counts of species observed with distance and angle also recorded. Future analysis will be conducted using "DISTANCE" software to determine the density and variance of use by these species.

Method
Crew members were trained on differences between several species that had potential to be observed on the Sun Prairie property, with special attention given to similar appearing species such as white-tailed deer, mule deer, and pronghorn. Upon observation of a living animal, multiple parameters were recorded using GPS-enabled tablets that auto-populate location and date/time fields, coupled with Garmin handheld GPS units, Canon sx50 superzoom cameras, compasses, and electronic rangefinders that provide consistency when estimating distance to any given animal. It should be noted that all distance data recorded before March 22nd, 2014 is recorded as an estimate due to difficulties with our rangefinders. After March 22nd, 2014, upgraded rangefinders (Vortex Optics Ranger 1000) were used and should be considered accurate.
Observers were instructed to record their location at the time of sighting and to obtain a bearing and distance from the location in which an animal was first observed.

When counting numbers of animals, each individual observer on the transect was instructed to count silently and once each team member had his/her count, numbers were shared and averaged.

Habitat types were recorded at the location the observer was standing when he/she viewed the animal, not at the location of the animal itself. This was done to avoid guessing, especially when animal observations took place from large distances away.

Weather and ground conditions were recorded at the moment of initial animal sighting.

All crew members were instructed to obtain a photo of the animal if possible using Canon sx50 cameras that were provided to each team of two observers.

In order to better understand species identification reliability, and acknowledging that each individual observer brings various levels of identification skills, we required that the reliability of each observation be recorded on a 1-3 scale where 1 = sure, 2= probable , and 3 = not sure. We have chosen to display all observations in the maps on our results sections; however, we encourage others to be aware of these reliability rankings when utilizing raw data.

In cases where duplicate observations were suspected (mostly this occurred with bison observations), crew members were instructed to record only 1 sighting per 0.25 mile. While it is possible that an individual or group of animals moving across the Reserve were counted more than once due to being observed by more than one Land**mark** crew, we felt this occurrence was highly unlikely due to the fact that crews walking transects on the same day were often miles apart at any given time and only able to observe wildlife from their singular location within in a vast landscape. Additionally, because direction of travel, bearing, and distance was recorded, we are further able to eliminate suspected cases of dual counting.

2. Human Artifacts
Background and Justification
Human artifacts including trash and archeological artifacts have been observed throughout the Sun Prairie property. Our objective is to record locations of these objects in order that they might be removed or protected by APR staff as needed.

Method
Human artifacts were defined as any man-made object present on the Reserve with the exception of standing fences. This includes trash, farming equipment, discarded or dilapidated fences, Native American relics, well heads, and more. Objects were recorded regardless of age, size, or other factors.

To avoid duplicating entries of individual artifacts observed on repetitive transects, volunteers refer to an ever-evolving set of notes on each transect which outlines what has previously been recorded.

Observations of objects not previously documented were recorded with photo and GPS enabled tablets.

Subjective assessments as to whether items can be moved by hand were intended to aid the Reserve team in assessing the equipment that may be needed should they choose to remove any of the objects.

Counts of the number of items present at any given location were the result of individual counts conducted by each team member present which were then averaged and recorded.

3. Badger Holes
Background/Justification
Limited data currently exists statewide on badgers whose numbers are likely low due to prairie fragmentation and loss of prairie dogs (Clark 1982). Our objective is to begin establishing a baseline of badger relative abundance through a combination of animal observations and documentation of their holes.

Methods
Crew members received training on the size, shape, habitat and additional signs that may be present near badger entrance or exit holes. All crew members were instructed to err on the side of caution and to record suspected badger holes even if the observers were not sure about the species responsible for the hole. As a result, some holes may be recorded as badger holes when they are in fact the result of the actions of other species.

Holes were measured for length and width across the hole-center.

All observations were recorded with GPS and photo-enabled tablets.

4. Stream Flows
Background and Justification
Water is often in short supply throughout northeast Montana (NOAA 2014). Our objective was to gain a temporal and spacial distribution of water flowing across the Sun Prairie in order to determine what, if any effect this might have on wildlife behavior throughout the property.

Methods
Crew members were instructed to record all observations of water encountered during transects that was present in naturally occurring sources. Stock ponds were not recorded.

Observers ranked the presence of water using the following five categories:

1. Standing Puddles
2. Flowing Trickle

3. Flowing Up to One Foot Deep
4. Significant Current More Than One Foot Deep
5. Waist-Deep Flow

Stream flow waypoints were recorded with a photo and GPS-enabled tablet.

In all cases, photos were taken to assist with observations.

5. Russian Olive Trees
Background and Justification
Russian Olive Trees, which are present on the Sun Prairie property are considered an invasive species, and concerns exist that they could out compete native species (Katz 2003). Our objective was to record locations of these trees and present them to the Reserve team for future control as needed.

Method
Crew members received training on identification of this invasive species mostly through images of trees.

When trees were encountered during transects, each team member was instructed to estimate the height of the tree. The results were averaged and recorded along with the tree location and a photo.

6. Carnivore Signs and Collections
Background and Justification
Little is currently known about the current abundance of carnivores utilizing the Sun Prairie property (Kunkel and Austin 2014). Our objective is to assess level of use and abundance of carnivores throughout the property.

Method
Crew members received basic training in carnivore scat and track identification and were instructed to record observations of animal signs related to bobcat, cougar, swift fox, and black-footed ferret. Observers were instructed to err on the side of caution and to record observations that were potentially related to the species listed above. As a result, several observations may have been recorded of other species and independent verification of carnivore signs should be made by professionals.

When plausible, DNA samples were collected in unused plastic bags that were turned inside out to use as collectors. Samples were then placed inside the initial bag, then into a secondary bag and sealed. If samples contained moisture, they were removed from the bags, dried on newspaper or other paper towels overnight, and subsequently returned to bags or, if necessary, placed in new bags.

GPS locations of collection sites were recorded on GPS-enabled tablets and undisturbed specimens were photographed prior to collection with a scale object in frame.

7. Other waypoints of interest

Crew members were instructed to record observations of animal signs, apparent grouse collisions with fences, and/ or anything else they noticed while on transects that might

have been considered of interest to the Reserve team or others.

When observations were related to wildlife, observers were instructed to make a best guess of the species responsible. These guesses are intended to assist with identification and should not be considered reliable species identifications.

All observations were recorded on GPS and photo-enabled tablets.

Camera Trapping on Fences
Background and Justification
To hold bison while ensuring ready passage of other wildlife, APR has implemented the use of high voltage (3,000 – 9,000 volts) electrified fences consisting a barbed top wire, a smooth and electrified second wire, a barbed third wire, and a smooth and raised bottom wire. Our objective in Q1 2014 was to record observations of wildlife interacting with these fences on HD videos in order to observe whether various species appeared to cross or avoid APR's perimeter fences.

Location Selection - Perimeter Fences
Using GIS maps obtained from APR staff, eighteen general areas were selected near intersections of riparian habitat with perimeter fences that surround the Sun Prairie property of the Reserve. These sites were selected with the hope of observing a variety of charismatic species that typically utilize riparian areas. Crews then located these pre-selected waypoints using Garmin handheld GPS units and hiked along the fence in the immediate vicinity of these points looking for areas that met the following criteria:

1. Largely clear of brush and tall grasses that could provide false-triggers.
2. Areas that contain natural features that might concentrate wildlife traffic.
3. Areas showing a high concentrations of tracks in snow that was present for much of the initial months of the Land**mark** project.

An additional five cameras were placed at areas of high wildlife traffic identified by tracks in snow or mud, or from hairs caught on fence barbs. These placements were not standardized and are distributed in grassland, sagebrush and riparian zones.

Perimeter fences consist of both barbed and smooth wire, with the second wire electrified with high-voltage. The lowest rungs of these fences were originally placed at 18 inches and designed to permit the safe and easy passage of wildlife.

Camera Placement

Cameras were placed on vertical metal fence posts above the top rung. Early in the month of February, a system was developed involving a foam anchor that allowed us to tighten the camera and adjust the lens direction easily. Early observations that were taken before this tightening process showed camera movement due to high winds and various wildlife species licking or rubbing the cameras.

Lens Direction

Cameras were generally placed facing north and east to minimize false triggers from glare.

Camera Servicing

In order to ensure functionality, cameras were visited on average of every two weeks. Weather and road conditions were the most consistent factors in making the duration between services variable.

Memory cards were changed with each servicing, and, if needed, batteries were replaced.

Camera Settings

Cameras were set as follows:

CAMERA SETTING:	SET TO:
Mode:	Video
Image Size*:	5M Pixel
Image Format*:	Full Screen
Capture Number*:	3 Photo
LED Control:	Medium
Camera Name:	(this should be the camera site number)
Video size:	1280x720
Video length:	30S
Interval:	5S
Sensor level:	Auto
NV shutter:	Low
Camera mode:	24 hours
Format:	Execute
TV out:	NTSC
Time stamp:	On
Set clock:	(chose set to set the time and date)
Field scan:	Off
Coordinate Input:	On (enter lat/long location of the camera site)
Video sound:	On
Default set:	Cancel

Fence Interactions

Wildlife observations caught on camera were categorized three ways based on individual interactions with fences: no interaction (NI), deterred (D), and crossing (C). Any activity not explicitly captured in the video clip was not assumed to have taken place. Partial crossings and cases without an approach to a fence received a "NI" label. A "C" was counted as such only when the entire body crossed the

plane of the fence. Each fence crossing (C) was labeled to specify if the animal went over (O), under (U) or through (T) the fence. The O, U, or T was only assigned to observations that were clear and obvious in each clip. Interactions received a "D" label when an animal started to cross a fence and then ran in the opposite direction.

When more than one animal was present in an individual clip, their interactions were documented as separate observations. Because we could not identify individuals with any degree of accuracy from one recording to the next, even when we suspected repeated observations of the same animal from one recording to the next, they were counted as independent observations.

Scoping
Background and Justification
Scoping data was collected to supplement animal observations recorded during transects. Stationary positioning and observations are commonly used in determining animal abundance and densities (Gese 2001).

Methods
Location Selection
Scoping sites were chosen based on visibility of the surrounding terrain. Hills that provided at least 180-degrees of visibility were considered acceptable as observation points.

Teams of two volunteers remained at each chosen location for three hours. Using a combination of high-powered spotting scopes and binoculars that were provided to the project by ASC sponsor Brunton Outdoors, the teams scanned for wildlife and recorded each animal sighting as a wildlife observation.

Distance to individual or group center was recorded early in February using Simmons LRF 600 Laser Rangefinders, which we found to be unsuitable for use on the flat landscape of the prairie, and later with Vortex Optics Ranger 1000 rangefinders.

Bearings to individual or group centers were recorded using a standard hand compass.

Numbers of animals present were counted silently by each individual observer and averaged.

Results and Discussion

Transects

Land**mark** crews drove a total of 76 miles and hiked 350.1 miles on a total of 51 transects. Each transect was surveyed on average, four times.

Animal Observations

A total of 351 individual wildlife observations were made of 3,443 animals between February 3 and March 31, 2014, including observations of 14 different species. Our average was more than 8 animal sightings per mile. Observations are grouped below by family.

Users of this data should be aware that substantial spatial sampling bias is likely present in the data due to limited coverage, repetition of our transects, and from the repeated use of existing roads.

It should be noted that all distance data recorded before March 22nd, 2014 is recorded as an estimate due to difficulties with our rangefinders. After March 22nd, 2014, upgraded rangefinders were used and should be considered accurate.

Table 1. Summary of animal observations by species.

	Species	Observations	Largest Group	Avg. Group Size
Ungulates:	Bison	1618	120	12
	Mule Deer	713	51	9
	Whitetail Deer	102	12	6
	Pronghorn	628	120	29
	Elk	8	6	3
Carnivores:	Coyote	17	2	1
Sm. Mammals:	Porcupine	1	1	1
	Desert Cottontail	2	1	1
	Prairie Dog	44	12	4
	White-Tailed Jackrabbit	1	1	1
Birds:	Sharp Tail Grouse	143	20	6
	Greater Sage Grouse	139	60	9
	Ring Necked Pheasant	26	9	3
	Golden Eagle	1	1	1
	Burrowing Owl	1	1	1

	Species	Observations	Largest Group	Avg. Group Size
Ungulates:	Bison	1618	120	12
	Mule Deer	713	51	9
	Whitetail Deer	102	12	6
	Pronghorn	628	120	29
	Elk	8	6	3
Carnivores:	Coyote	17	2	1
Sm. Mammals:	Porcupine	1	1	1
	Desert Cottontail	2	1	1
	Prairie Dog	44	12	4
	Jack Rabbit	1	1	1
Birds:	Sharp Tail Grouse	143	20	6
	Greater Sage Grouse	139	60	9
	Ring Necked Pheasant	26	9	3
	Golden Eagle	1	1	1
	Burrowing Owl	1	1	1

Camera Traps

Twenty-three remotely triggered camera traps recorded a total of 859 animals between February 3 and March 31, 2014. Several observations of birds, rodents, and other species that we believed to be of little importance to the Reserve management team were intentionally omitted from the following results.

Table 2. Summary of camera trap results by species indicating animal behavior.

	Species	Observations	Behavior		
			Crossed Fence	Deterred	No Interaction
Ungulates:	Bison	558	67	1	509
	Mule Deer	82	14	0	34
	Whitetail Deer	67	22	2	43
	Pronghorn	6	2	0	4
	Elk	17	2	2	13
Carnivores:	Coyote	13	3	1	6
Sml Mammals:	Desert Cottontail	49	16	1	32
	White-Tailed Jackrabbit	2	1	0	1
Birds:	Sharp Tail Grouse	1	0	0	1
	Greater Sage Grouse	23	3	0	20

Bison:

Throughout the observation period, bison movements were restricted by the use of electrified fences surrounding the eastern side of the Sun Prairie property.

Transects - As was expected, the vast majority of sightings were concentrated inside the fenced area. Two bison bulls were observed in the western pasture, these bulls had crossed into this pasture during the fencing of this pasture last fall. Crews recorded a total of 131 independent bison observations between Feb 3 and March 31, 2014. Included in these observations were a total of 1,618 animals. Our largest single herd count consisted of

120 animals. The average herd size was 12 animals.

Cameras - Bison were observed at eight distinct camera traps. A total of 588 animals were observed, of which 67 crossed the fence (two cameras had open fences and all crossings took place at these openings), 1 bison was deterred by the fences, and 509 had no interaction with the fences. An additional 11 animals were observed on 2 cameras that did not include fences.
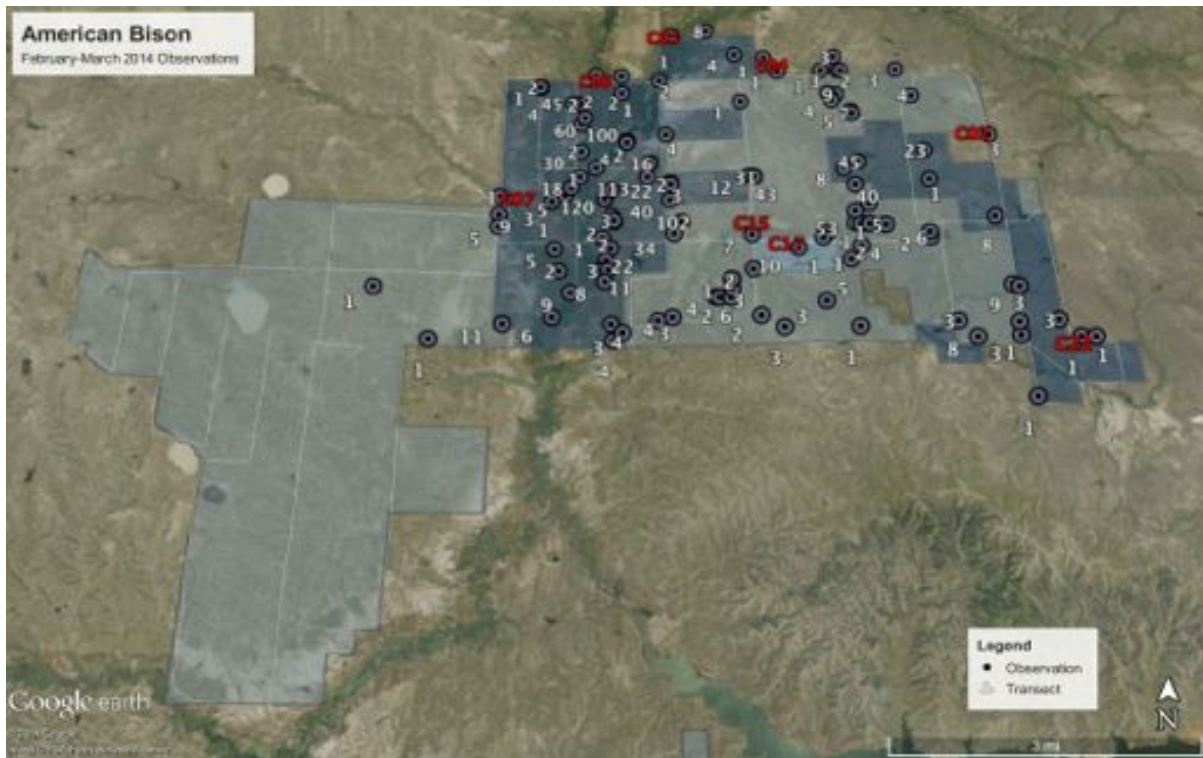
Figure 1. Bison observations with numbers indicating the size of the group.

Mule Deer:
Mule deer were observed throughout the Sun Prairie property and appeared to be more densely concentrated on the western portion of the property.   Several mule deer were aware of cameras and often they backed away from them.

Transects - Crews recorded a total of 78 mule deer observations, which amounted to a total of 713 animals. Our largest single herd count consisted of 51 animals. The average herd size was 9 individuals.

Cameras - Mule deer were observed at five of the camera locations, with 41 independent observations amounting to a total of 82 animals. Of the animals observed, 14 crossed fences, no animals were deterred by the fences, and 34 did not interact with fences.   Of the mule deer that crossed the Sun Prairie fences, 4 crossed over, 10 crossed under, and none crossed directly through the fence.

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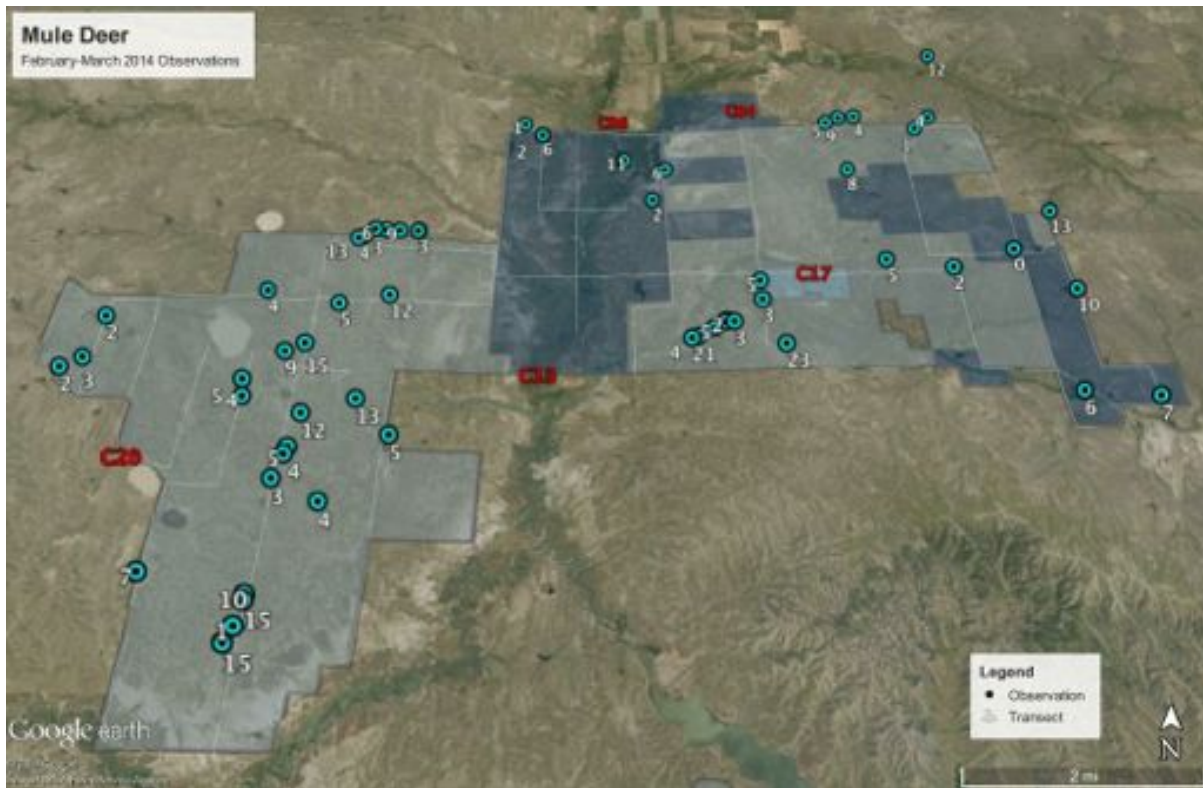
Figure 2. Mule deer observations with numbers indicating the size of the group.

White-Tailed Deer:
White-tailed deer observations were strongly concentrated towards the north central portion of the Sun Prairie property and were not observed at all in other portions of the property.

Transects - Crews recorded a total of 18 independent white-tailed deer observations, amounting to a total of 102 individual animals. Our largest single herd count consisted of 12 animals. The average herd size was 6 animals.

Cameras - White-tailed deer were observed at five of the camera traps and 38 independent observations, amounting to a total of 67 animals that were recorded. Of these animals, 22 crossed fences, 2 animals were deterred by the fences, and 43 had no interaction with the fences. In several instances (especially near camera C06) on the cameras, crossing under the bottom wire appeared difficult for white-tailed deer. Of the white-tailed deer that crossed the Sun Prairie fences, 10 crossed over, 12 crossed under, and none crossed directly through the fence.
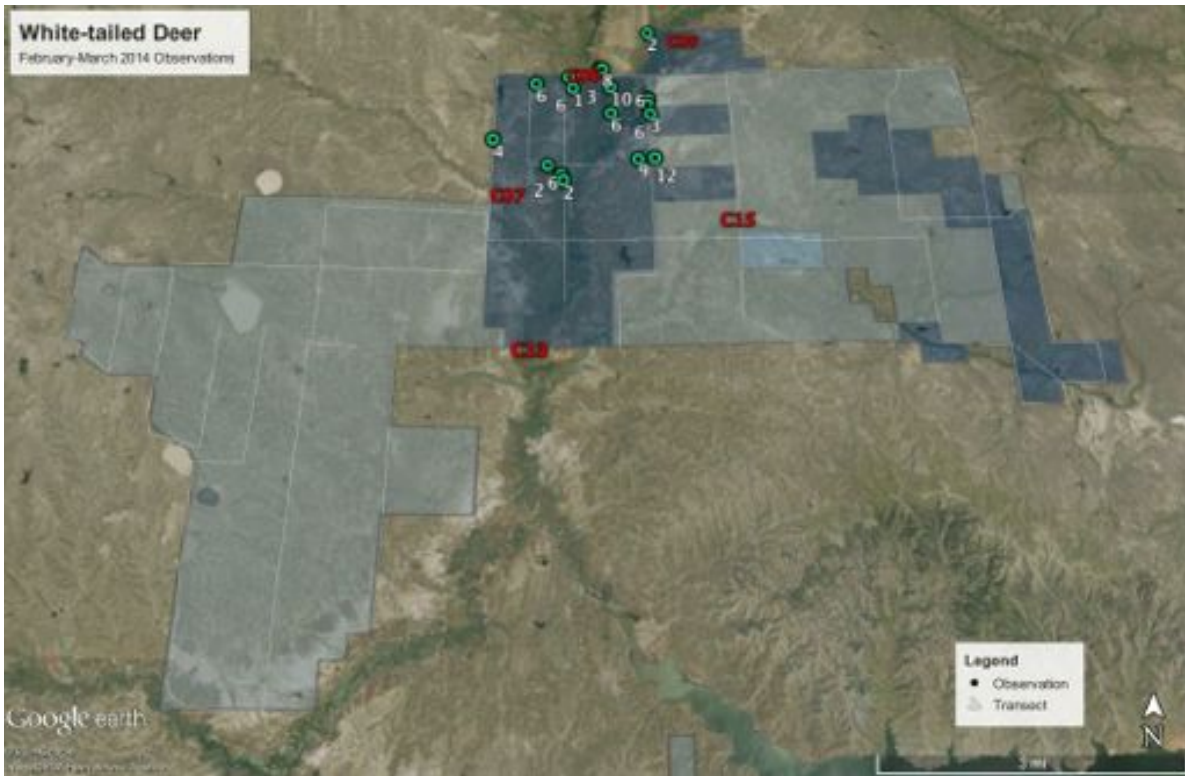
Figure 3. White-tailed deer observations with numbers indicating the size of the group.

Pronghorn:
Pronghorn were observed throughout the Sun Prairie property, though there appeared to be a stronger concentration in the northern portions of the property.

Transects - Crews recorded a total of 22 independent pronghorn observations, which amounted to a total of 628 animals. Our largest single herd count consisted of 120 animals. The average herd size was 29 animals.

Cameras - A total of 6 pronghorn were observed at 4 camera traps. Of those animals, 2 crossed the fence, none were actively deterred by the fences, and 4 had no interaction with the fences. Of the pronghorn that crossed the Sun Prairie, both crossed under the bottom wire.
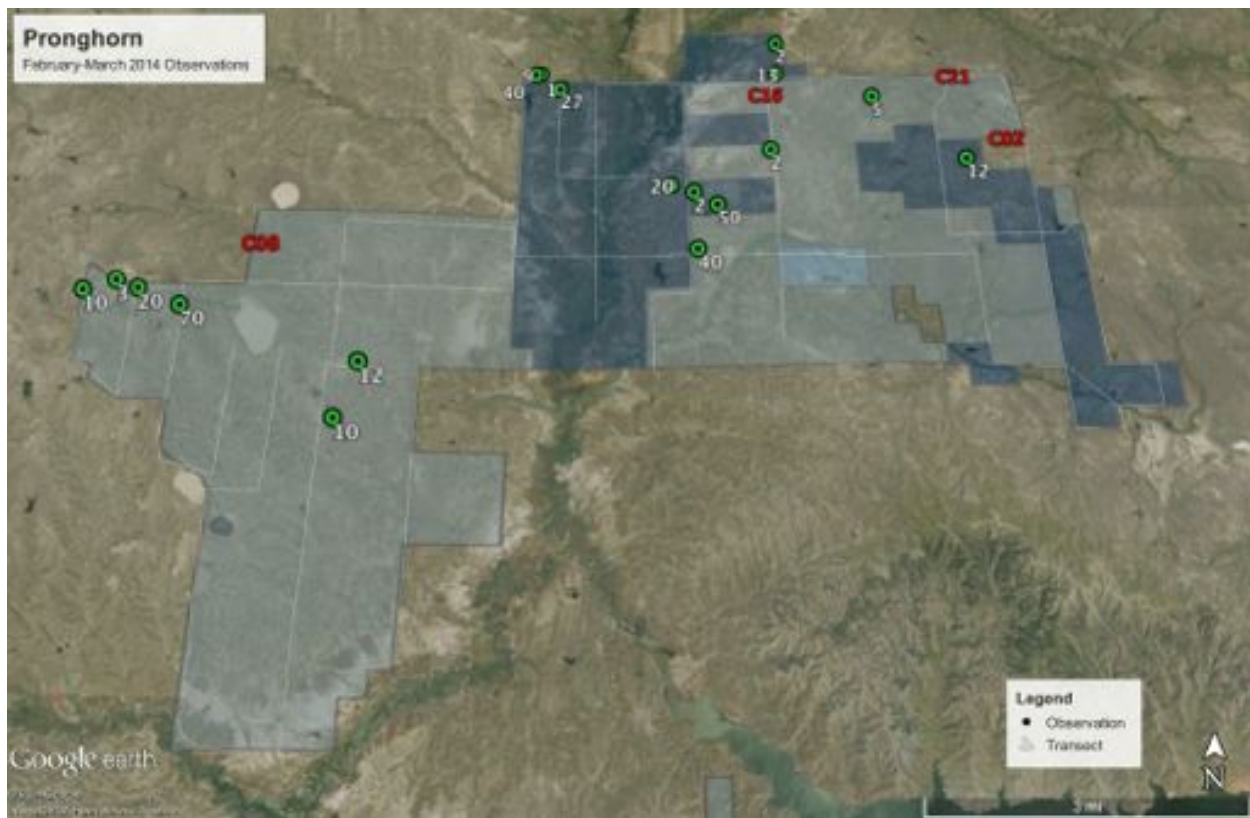
Figure 4. Pronghorn observations with numbers indicating the size of the group.

Elk:

Elk were observed in the southernmost portions of the Sun Prairie and in far lower numbers than other ungulates present on the Reserve.

Transects - Crews recorded a total of three independent elk observations while walking transects, which amounted to a total of 8 individual animals. Our largest single herd count consisted of 6 animals. The average herd size was 3 animals.

Cameras - Elk were observed at two of the camera traps, with 13 independent observations amounting to a total of 17 animals that were observed. Among the elk observed, 2 crossed fences, 2 animals were deterred by the fences, and 13 had no interaction with the fences or a slight touch of the fence (4). Both elk that crossed fences did so directly through the fences. In several cases, elk appeared to notice cameras and backed away slowly while staring at them. These same elk do, however, appear to remain near those cameras for quite some time.
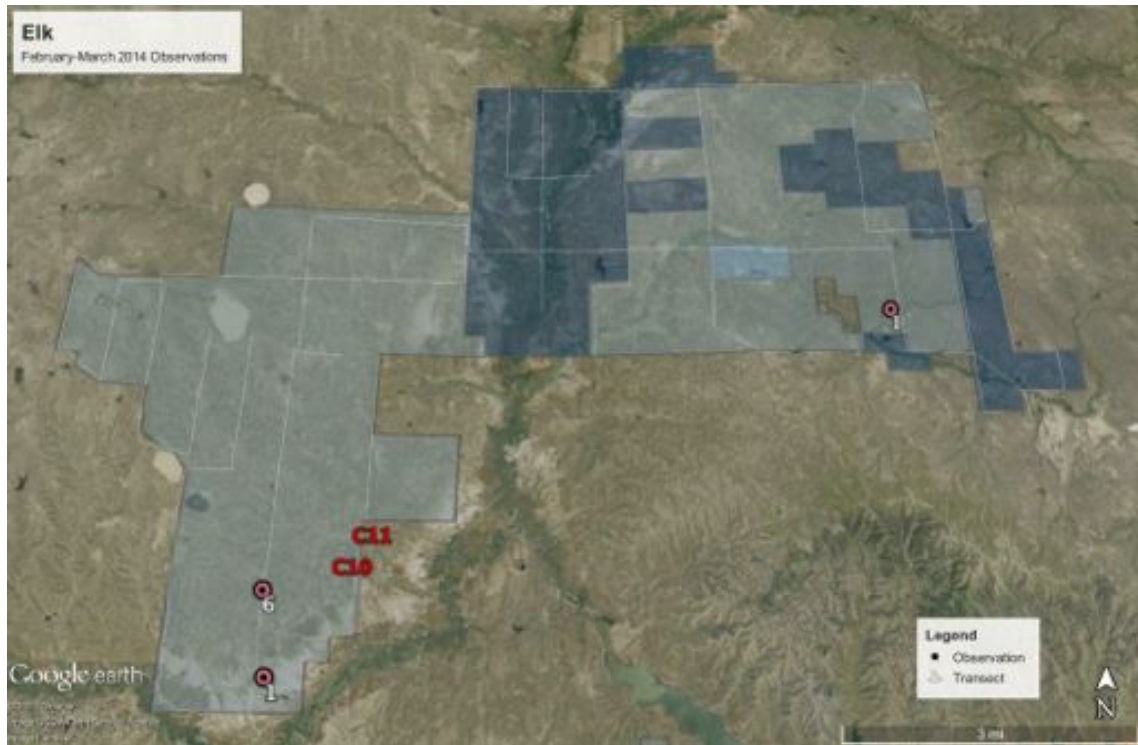
Figure 5. Elk observations with numbers indicating the size of the group.

Coyote:
Coyotes were observed throughout the Sun Prairie property with the vast majority being observed as lone individuals.

Transects - Crews recorded a total of 15 independent coyote observations, amounting to a total of 17 individual animals. The largest group size was 2 animals and the average group size was 1 animal. Only two observations were of more than one animal.

Cameras - Coyotes were observed at nine of the camera traps with 13 independent observations. A total of 13 animals were observed, of which 3 crossed fences, 1 animal appeared to be deterred by the fences, and 6 had no interaction with the fences observed on camera. The 3 remaining animals were observed on a camera that did not include fences in the field of view. Several of the coyotes observed on camera appeared to take particular note of the cameras and 3 ran away from these cameras after looking directly at them.
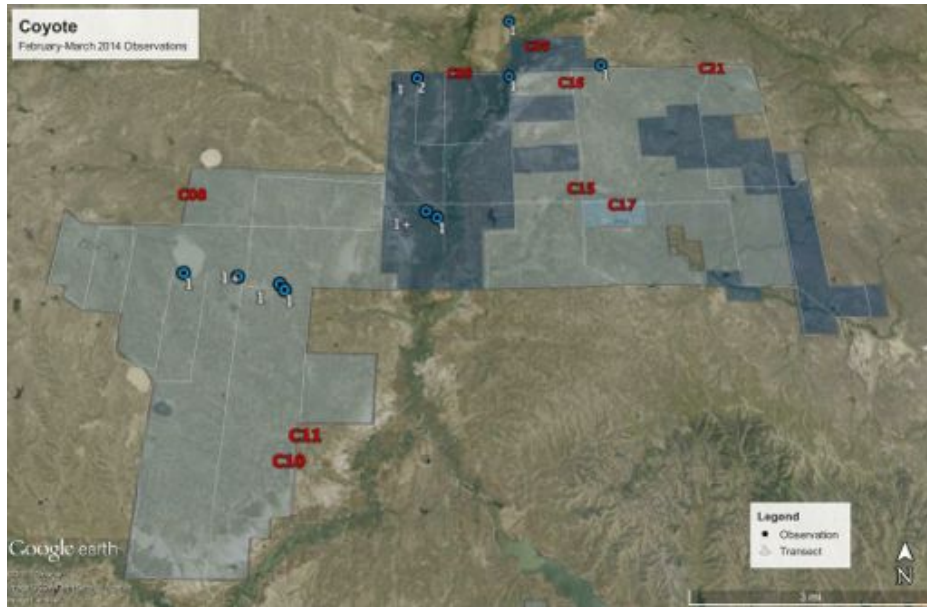
Figure 6. Coyote observations with numbers indicating the size of the group.

Raccoon:

Transects - No raccoon were observed during transects.

Cameras - Raccoon were observed at one of the camera traps with 5 independent observations.
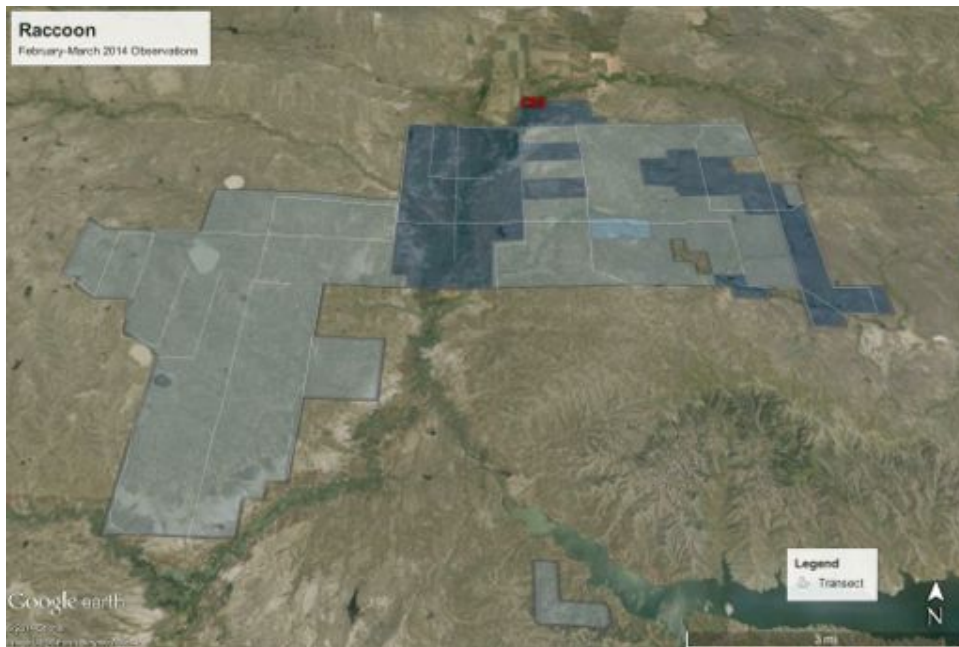
Figure 7. Racoon observations

Porcupine:

Transects - Three porcupines were observed in the central deeded portion of the Sun Prairie. All observations occurred mid-day and all were solo individuals.

Cameras - While one porcupine was observed on the cameras prior to the study period, none were present on cameras between February 3rd and March 31st and therefore is not displayed below.
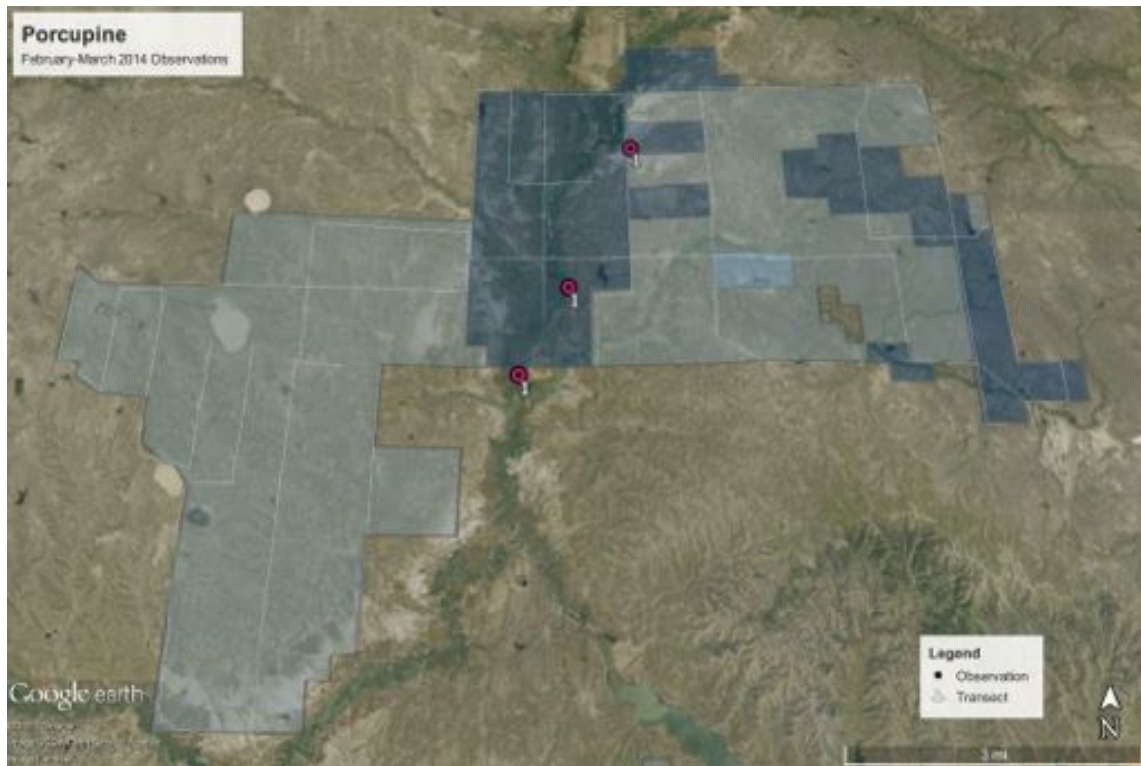
Figure 8. Porcupine observations with numbers indicating the size of the group.

Desert Cottontail:

Desert Cottontail were observed spread widely throughout the Sun Prairie.

Transects - Crews recorded a total of 2 independent desert cottontail observations, amounting to a total of 2 individual animals.

Cameras - Desert Cottontail were observed at nine of the camera traps, with 47 independent observations amounting to a total of 49 animals observed.
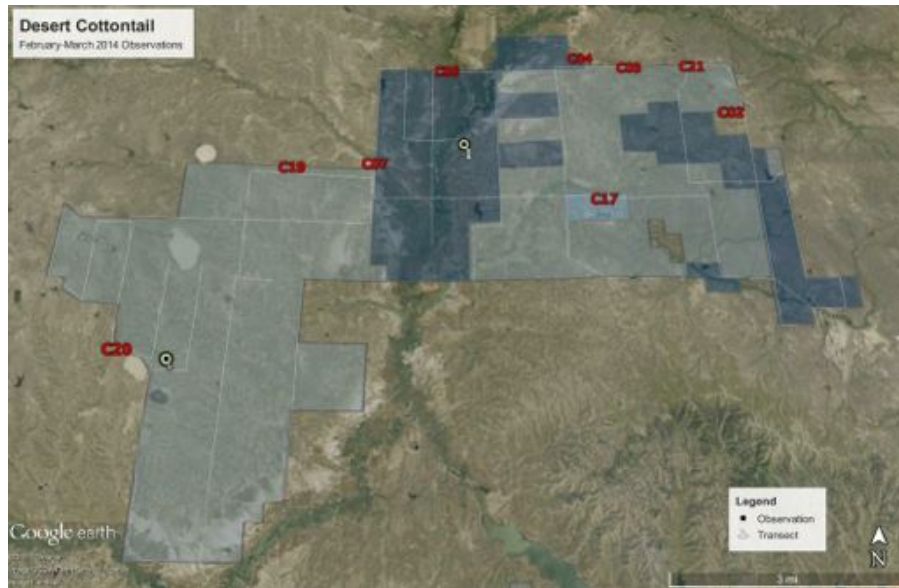
Figure 9. Desert cottontail observations

White-tailed Jackrabbit
3 observations of a White-tailed Jackrabbit were recorded on the property.

Transects - Crews recorded one observation of White-tailed Jackrabbit while hiking transects.

Cameras - Two observations of White-tailed Jackrabbit were observed on camera 7.
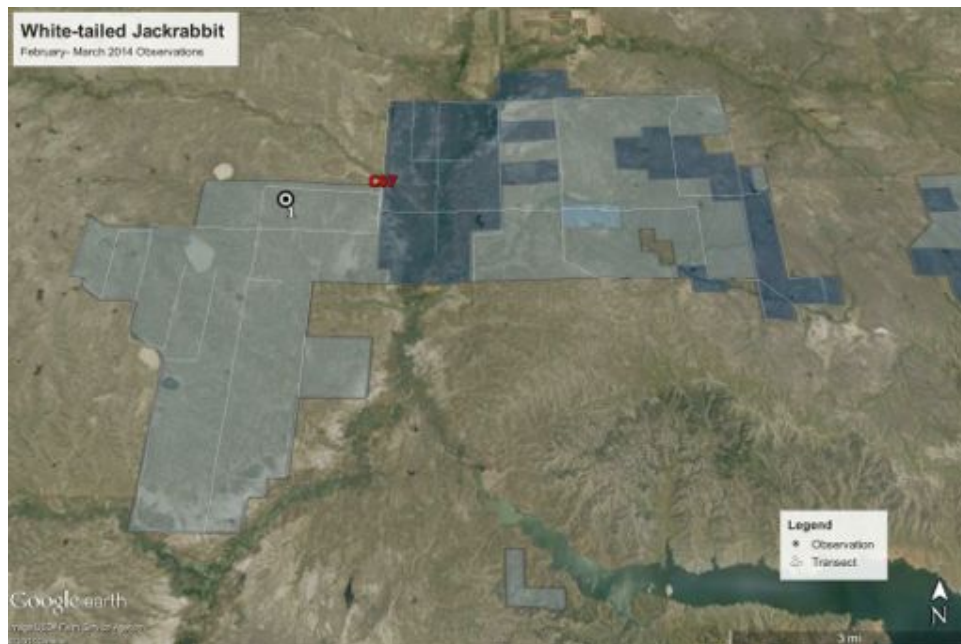
Figure 10. White-tailed Jackrabbit observations

Black-Tailed Prairie Dog:
Prairie Dogs were observed primarily in the central portion of the property, with one large town being observed on the eastern portion of Sun Prairie.

Transects - Crews recorded a total of 12 independent Black-Tailed Prairie Dog observations, amounting to a total of 44 individual animals (that were counted). Our largest single group count consisted of too many animals too count (>100).
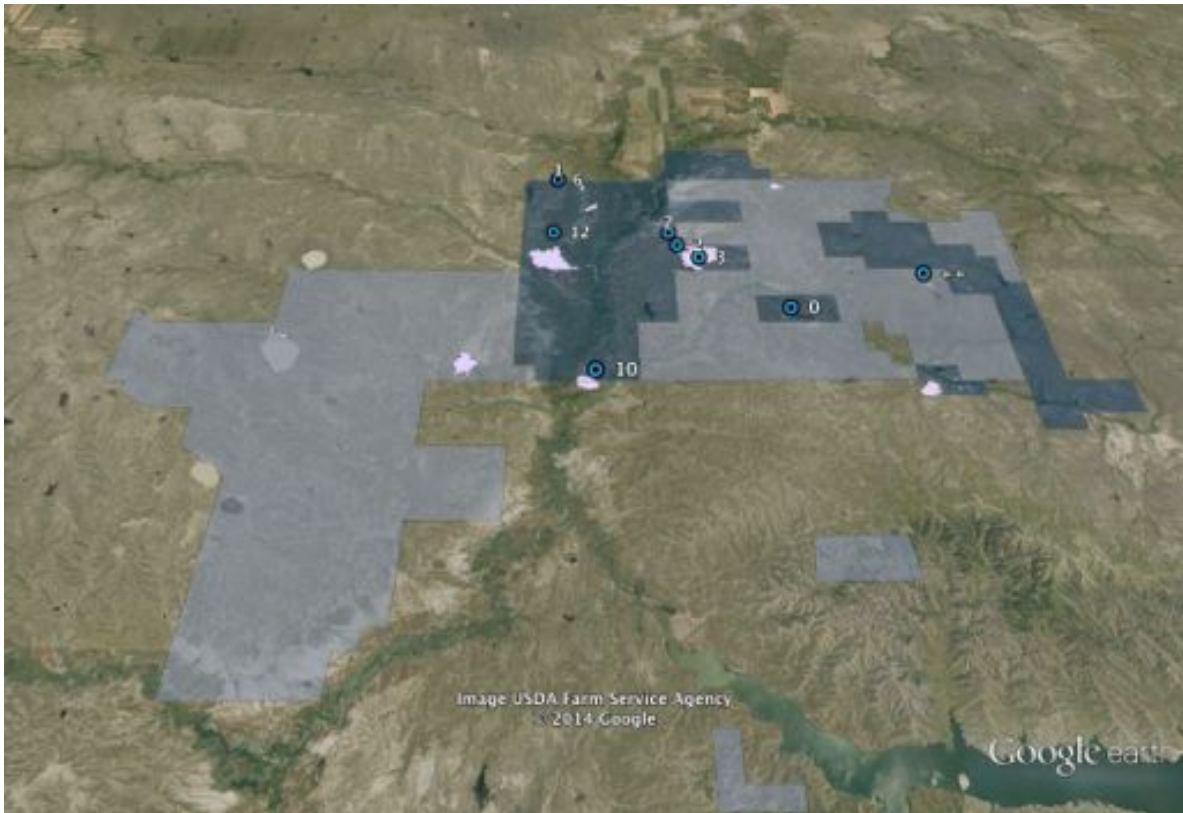
Figure 11. Black-tailed prairie dog observations with numbers indicating the size of the group, and pink areas indicating previously known prairie dog towns.

Sharp-Tailed Grouse:
Transects - Crews recorded a total of 24 independent sharp-tailed grouse observations, amounting to a total of 143 birds. Our largest single flock count included 20 birds. The average group size was 6 grouse.

Cameras - One individual sharp-tailed grouse was observed at camera C06.
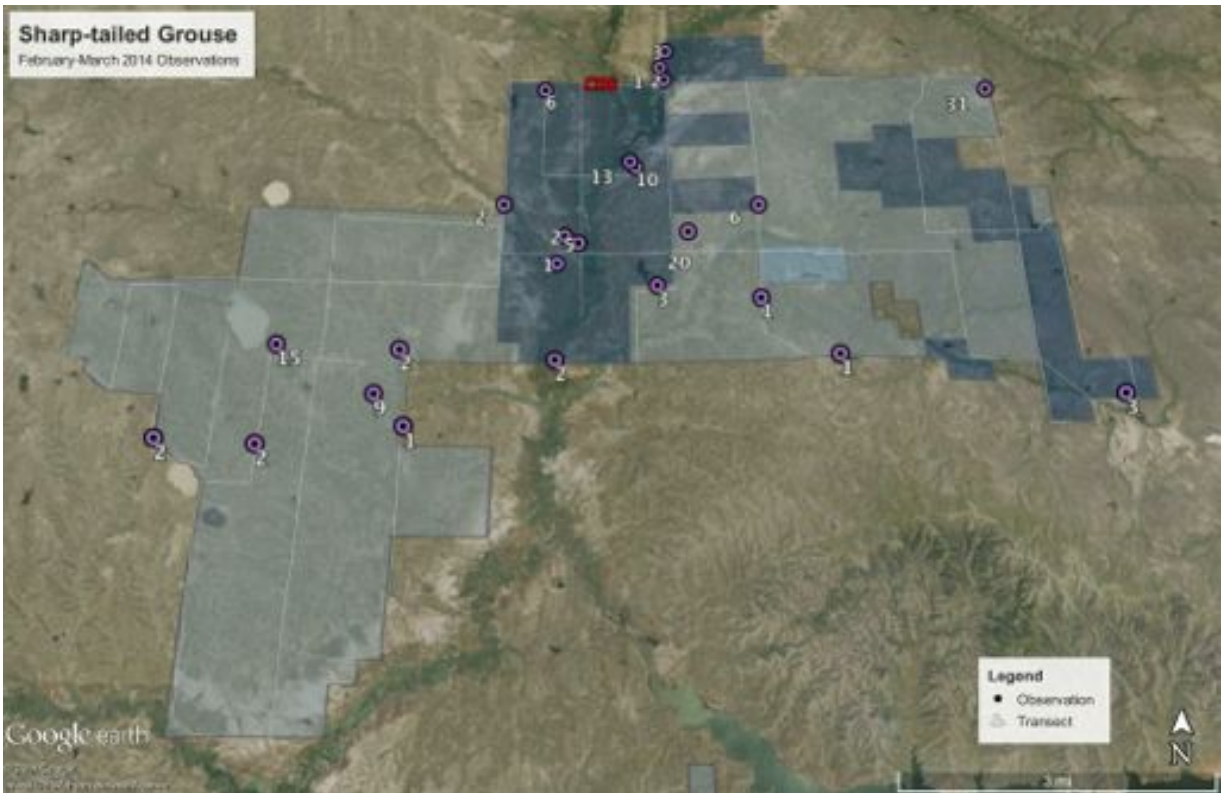
Figure 12. Sharp-tailed grouse observations with numbers indicating the size of the group.

Greater Sage-Grouse:
Greater Sage-Grouse observations occurred in higher concentrations towards the eastern edge of the Sun Prairie property.

Transects - Crews recorded a total of 15 independent Sage-Grouse observations, amounting to a total of 139 birds. Our largest single flock size consisted of 60 birds. The average flock size was 9 birds.

Cameras - Greater Sage-Grouse were observed at two of our camera traps. A total of 23 birds were observed at these two cameras. Of the birds observed at camera traps, 18 appear to be males. It was not possible to distinguish whether 5 of the birds were a male or female.

Figure 13. Greater Sage-Grouse observations with numbers
indicating the size of the group.

Ring-Necked Pheasant:

Transects - Crews recorded a total of 8 independent ring-necked pheasant observations, amounting to a total of 26 individual birds. Our largest single flock count consisted of 9 animals. The average flock size was 3 birds.

Cameras - Ring-necked pheasants were observed at nine of the camera traps with 3 independent observations, amounting to a total of 3 birds were observed. All three birds were males.

Figure 14. Ring-necked pheasant observations with numbers indicating the size of the group.

Burrowing Owl:
One burrowing owl was observed near a prairie dog town on the eastern side of the property during a transect.
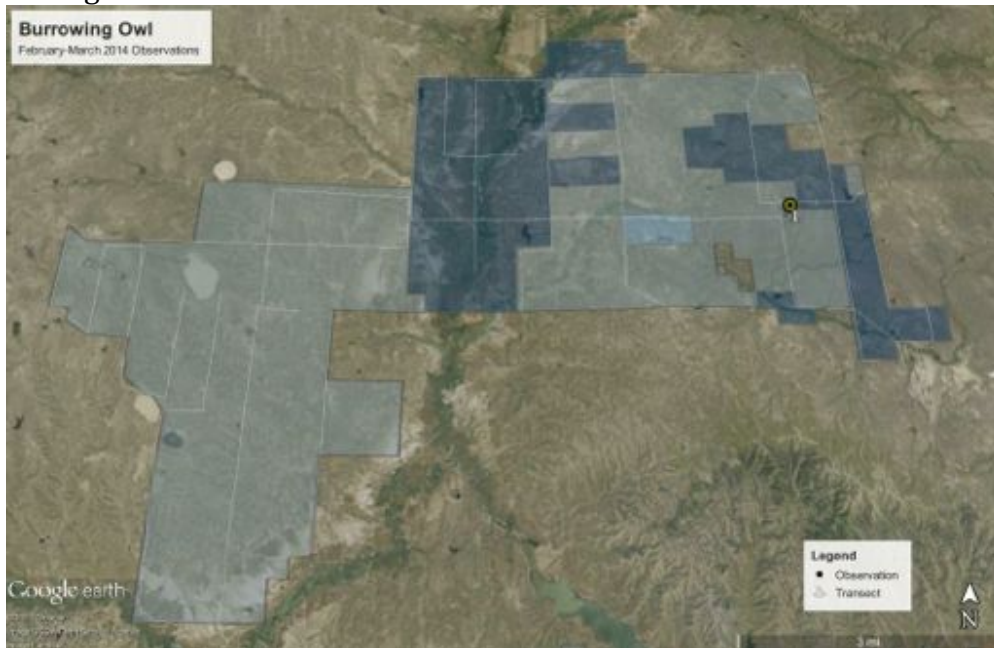
Figure 15. Burrowing owl observations with numbers indicating the size of the group.

Golden Eagle:

One golden eagle was observed in the north central portion of the reserve during a transect.
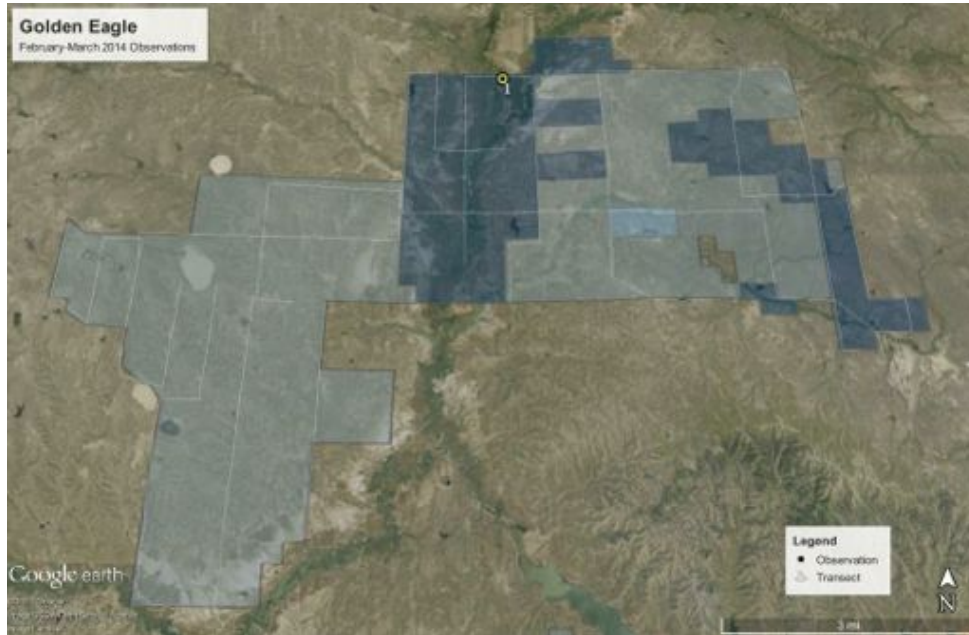
Figure 16. Golden eagle observations with numbers indicating the size of the group.

Dead Animals:

While several bones were observed, only intact carcasses or easily identifiable species were recorded. Dead animals that were recorded included two bison, one painted turtle, and one elk skull.
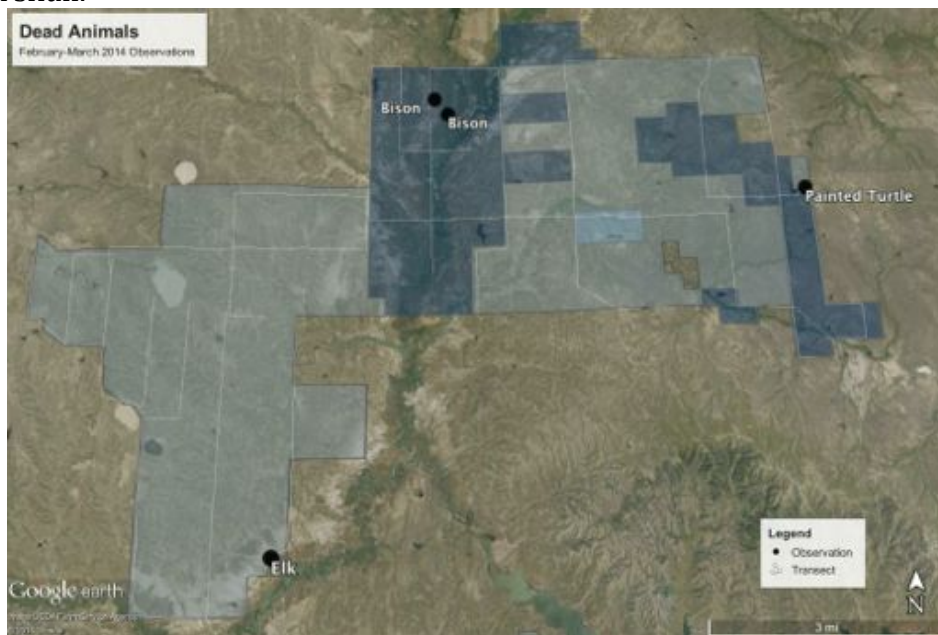
Figure 17. Dead animal observations with species indicated.

Human Artifacts:

Human artifacts were seen throughout the reserve while walking transects. Artifacts were considered anything left from humans and included structures, machinery, garbage, etc. In total there were 25 independent observations of human artifacts. Of those, 12 were of garbage of various types (fencing, tires, etc.), 8 were structures (wells, windmills, signs, etc.), 4 were leftover equipment (e.g. abandoned farming equipment), and 1 was a grave site. All were marked and described for either cleanup and removal or protection, whichever was appropriate.
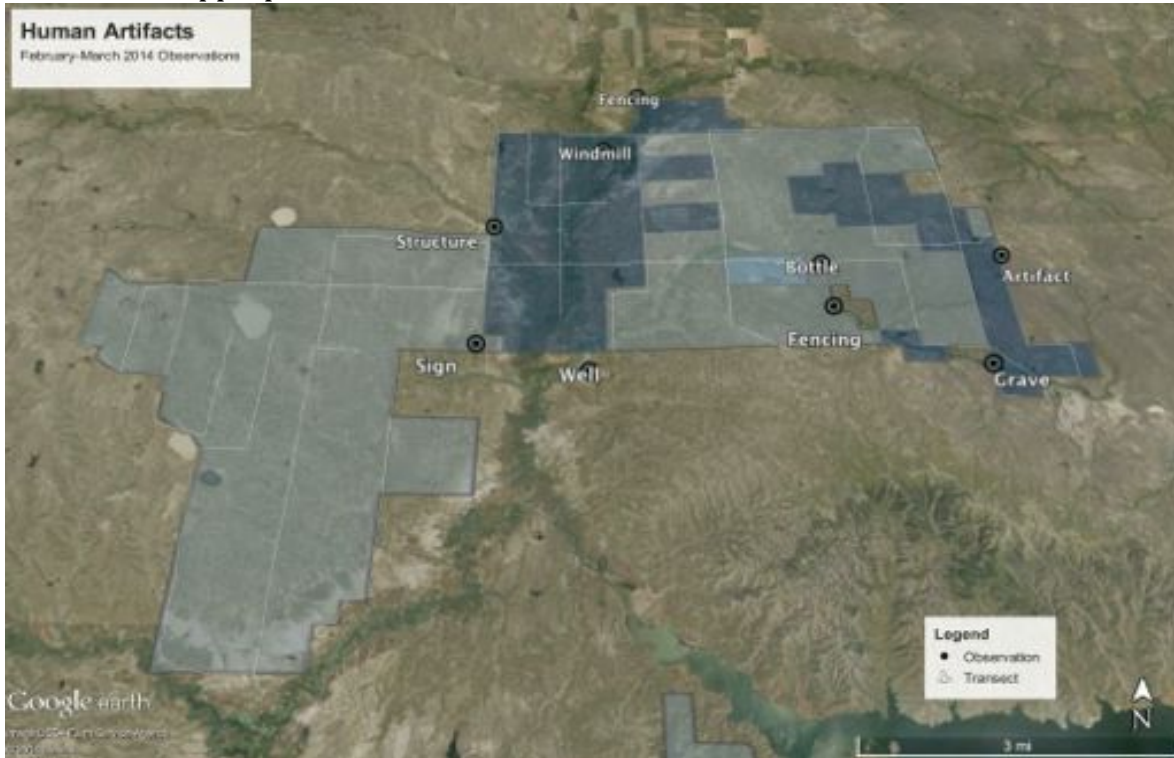
Figure 18. Human artifact observations with descriptions of artifact type indicated.

Badger Holes:

Volunteers marked badger holes across the reserve when walking transects. Five distinct badger holes were observed while on transects. All observations included photographs which are available in the digital supplemental data.
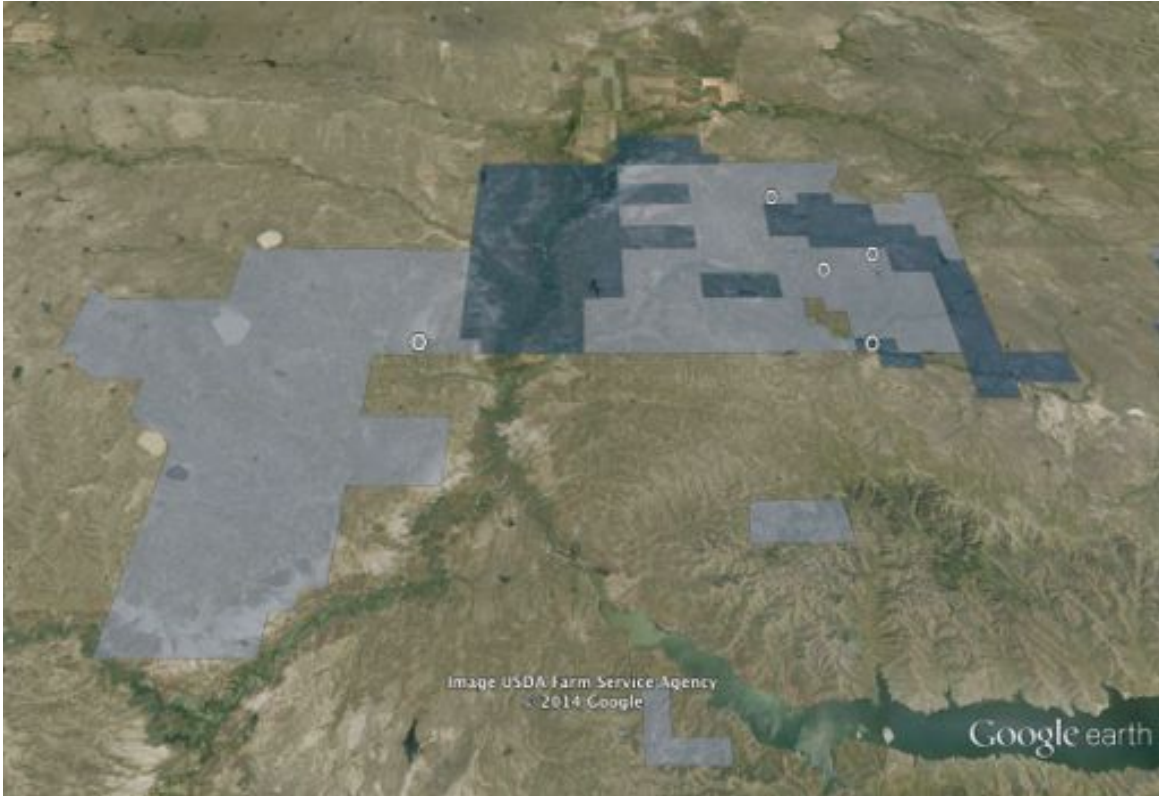
Figure 19. Badger hole observations.

Hydrologic Features:
Understanding stream flow across the Reserve is important, as many of the streams are ephemeral and only flow periodically throughout the year. Volunteers recorded the hydrologic features of Sun Prairie by estimating water depth. Results are shown in figure 19 where larger icons depict deeper streams and higher flow rates.

The following categories were used to distinguish between flow and depths:

1. Standing Puddles
2. Flowing Trickle
3. Flowing Up to One Foot Deep
4. Significant Current More Than One Foot Deep
5. Waist-Deep Flow
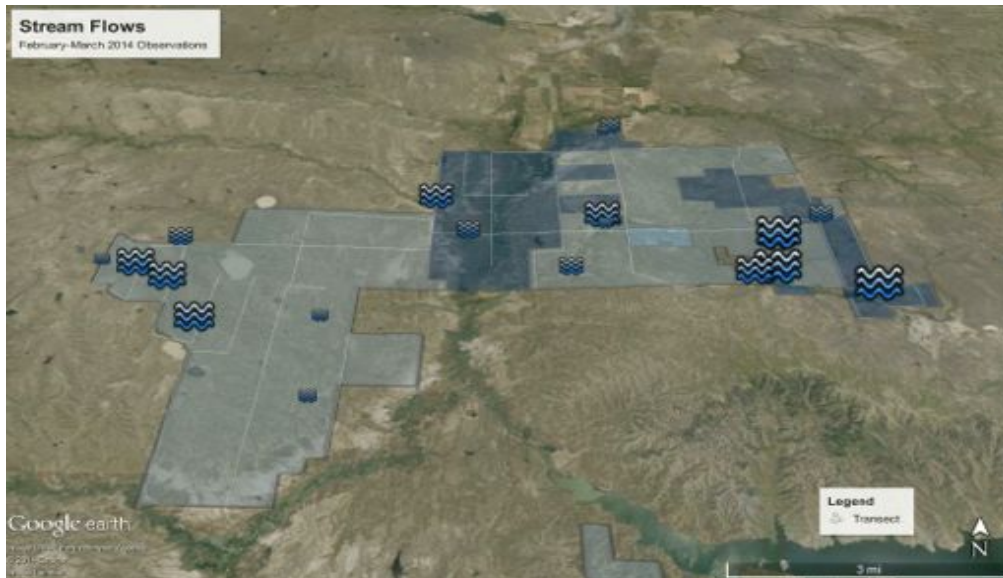
Figure 20. Hydrologic feature observations with size indicating depth of flow
.

Russian Olive Trees:
No Russian Olive Trees were found during February or March.

Other Waypoints of Interest:

Broken Fences - Ten broken fences were observed on Sun Prairie's fences. Their locations are visible below. Photos are available of each on supplemental digital data.
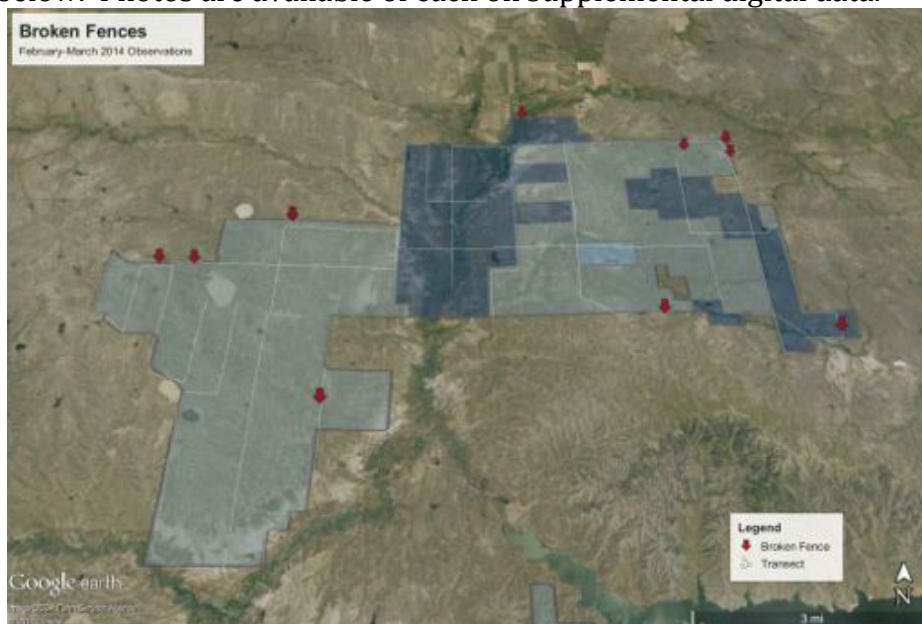
Figure 21. Arrows indicate breaks in the external fence line of the Sun Prairie.

Grouse Collisions:

Three collisions were observed where grouse had apparently collided with fences. We were unable to determine species based on feathers alone, and an expert should be consulted to distinguish between grouse species observed.
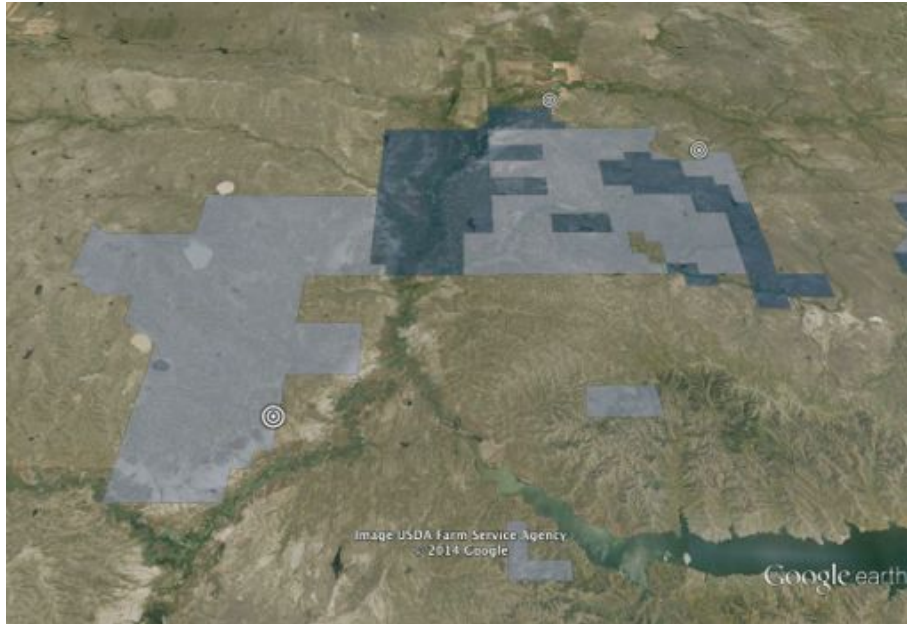
Figure 22. Where evidence of grouse/fence interaction has been observed.

Camera Trapping:

Camera traps were set up throughout Sun Prairie primarily to investigate wildlife-fence interactions. Cameras were regularly maintained and crew members visited each camera approximately every two weeks to replace memory cards and check batteries. Camera locations are shown in figure 23. A summary of the camera trap observations by species can be found in table 2.
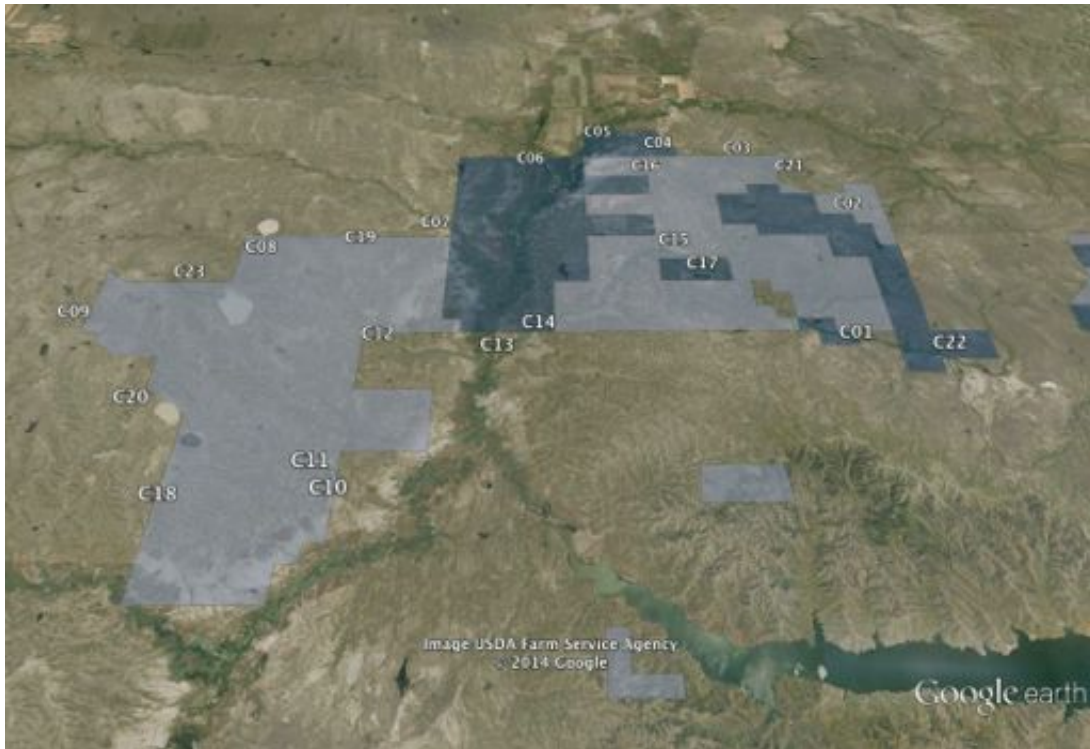
Figure 23: Camera sites on internal and external reserve fence lines.

Spotting:

High points were selected throughout Sun Prairie for scoping wildlife as an additional way to survey wildlife. Spotting took place at four distinct stations, and stations are shown in figure 24. Through 21.8 hours of spotting at four distinct spotting sites, Land**mark** crews recorded 18 independent wildlife observations that included 148 animals. Table 3. provides a summary of the species observed.

Table 3. Summary of species observed at spotting locations.

	Species	Number Animals Observed	Largest Group	Avg. Group Size
Ungulates:	Bison	90	48	8
	Mule deer	12	12	12
	White-tailed Deer	6	6	6
Sml Mammals:	Porcupine	1	1	1
	Prairie Dogs	1	1	1
Birds:	Duck	4	2	2
	Canada Geese	35	35	35
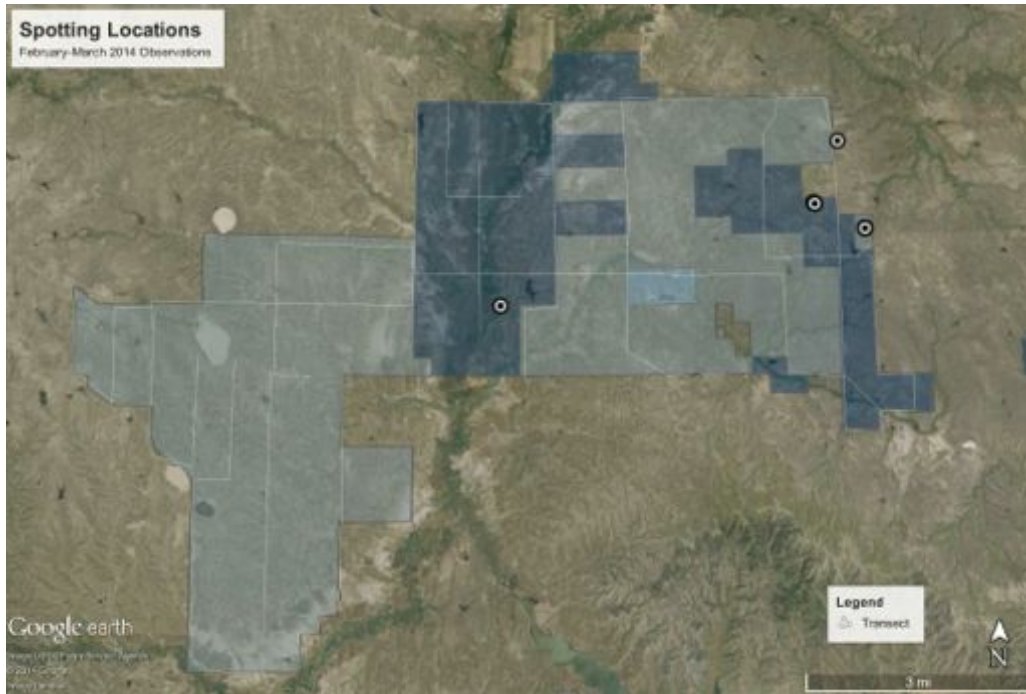
Figure 24: High points designated as scoping sites.

Additional Notes
Observer Reliability
In its initial phase, the Land**mark** project has been wildly successful. We have had full rosters of volunteers, have successfully collected thousands of wildlife observations including interactions of numerous wildlife species with fences, and offer here actionable information for the Reserve teams. Undeniably, scrutiny about the validity of wildlife data collected during citizen science research is common. We view Land**mark** as an opportunity to show that when done properly, data collected by non-scientists can be defendable, reliable, and incredibly useful.

We have experienced multiple challenges and have worked to overcome them in several ways.

Crew members are trained thoroughly at the beginning of each month to identify wildlife species common to the American Prairie Reserve. However, each Landmark volunteer has a different background in wildlife identification and their knowledge varies widely. Crew members work together to make positive identifications of plants and animals, photograph the species for data validation when possible, and note any uncertainty. Likewise, counts and distances to wildlife often must be approximated, especially when there are large groups of animals or they are far away. However, estimates are always made collaboratively by Land**mark** volunteers to reduce uncertainty, and estimations are noted in the data sheets. With this in mind, all Land**mark** crew members are thoroughly trained with a specific emphasis on avoiding errors that could commonly be made, such as between similar-sized ungulates or small mammals. All data collected is done so under the close

supervision of ASC staff. When any doubt exists, Land**mark** volunteers are instructed to err on the side of caution and document each observation extensively, meaning that in most cases our data is verifiable through more than one method. For example, when possible, each observation is paired with a photograph for data validation. We have verified many sightings and find our field data to be quite accurate. All observation photos are available in the digital data supplements. Additionally, the use of technology such as tablets, GPS units, rangefinders, and our ability to observe data collected on a daily basis all mean that observer error is greatly minimized through auto-populating data fields, drop down menus, and constant verification of data.

Weather and road/hiking conditions can make the goal of walking transects and servicing remote cameras every two weeks difficult. Volunteers must navigate adverse conditions, but make every effort to meet that goal and keep on schedule. Crews are given flexible days to accommodate such delays and are instructed to note any deviations from the schedule.

Each camera site requires its own considerations to avoid false-triggers and ensure capture of useful data. As the crews become more familiar with each site, the sensitivity and placement are being adjusted for the best results.

We have found that several memory cards have failed to record data or become unreadable upon collection. We are working to find the best solutions for this issue.

We have found that many challenges exist when reverse geocoding photographs and have found ways to bypass this obstacle that have allowed this to become more efficient.

Implications of data/results

As this is report contains only our first two months of data collection, it is premature to draw any firm conclusions and this report will serve to assess and adapt our methods and analysis of data. We believe data collected to date indicates that our sampling of a few species may eventually provide enough data to estimate local seasonal and local density (e.g. grouse and deer via DISTANCE analysis). For some species the scale we are sampling is probably too small to determine density and thus including more Reserve units may better allow determination of relative use and abundance (pronghorn, coyote). We are continuing data collection this spring/summer quarter to get a better sense of these issues.

We will add camera sites along standard (non electrified) barbed wire fence to compare animal crossing rates to our electrified fences.

We will record any occurrences of some select imperiled species including swift fox.

Future Opportunities
We have identified several opportunities to maximize the potential of this project and offer the following as potential additions to the current scope of the Land**mark** project. Any additions must be coordinated between management of APR and ASC. These include but are not limited to the following:

- *Guided outings with donors, students, and community members:*
  ASC can provide opportunities for large and small groups on the Reserve that will fully engage a variety of individuals in our ongoing data collection effort and provide them the opportunity to engage intimately in the conservation and landscape. These outings would be appropriate for groups ranging from students 11 years-old to corporate groups and donors.

- *Database and data management solutions:*
  Data management is a major undertaking for a project of this scope. ASC can develop and provide data management solutions to make accessing and organizing the data generated by the project as seamless and easy as possible for APR. By designing a customized database and regularly updating and maintaining it we can provide near real-time access to Land**mark** data beyond its raw form.

- *Website management:*
  Similar to data management, ASC can provide website design and management services for a dedicated Land**mark** page that would include interactive maps; regularly updated blogs that include storytelling, videos, and photography; social media; and more.

- *Expansion to other portions of the Reserve:*
  Currently the Land**mark** program focuses on the Sun Prairie region of APR. ASC could replicate the Land**mark** program to other areas of the Reserve, providing simultaneous data collection using common protocols across multiple properties.

- *Education program to engage students around the world:*
  ASC has successfully developed and implemented educational programing (curriculum development, live streaming Q&A's to classrooms, etc.) for past projects. Building on previous success, we can tailor educational programming for students to learn about and engage with the Northern Great Plains, as well as the Reserve and Land**mark**.

- *Visual media:*
  ASC can provide additional visual media coverage of the Land**mark** to engage a wider audience.

Acknowledgements
Launching this project in such a short time frame (three months from initiation to launch) would not have been possible without the support of many people. First, we'd like to thank the pioneering Land**mark** crews for their trust and sense of adventure. Thomas Ward, Rob Pudner, Colleen Ferris, Cayley Faurot-Daniels, Anthony Mancuso, Amanda Smith, Beth Schadd, Merrill Warren, and Ryan Rock launched a historic project we know will be far better thanks to their hard work. It takes a tremendous leap of faith to travel to the Northern Great Plains in the middle of the Montana winter. The first crews established a

stone-solid foundation of hard work, camaraderie, and good decision making on which future crews will build.

We'd also like to thank the Reserve team, James, Lars, Ellen and Damien, for welcoming the crews and the ASC staff. The conversations over shared meals and around bison pens have been one of the highlights of the work.

The crews would like to thank John and Kirsty Stewart for their neighborliness on the prairie. From roping lessons, to crock pot loans, local beef, riding along to doctor calves, true stories, and good company. The friendship has been a highlight of the experience for the crews.

We would sincerely like to thank Kyran Kunkel, Curt Freese, Lance Craighead, Brent Brock, and Randy Matchett for your guidance on project design and scientific rigor.

Special thanks to Greg Tsarias for the use of several of his photos in this report.

Finally, thanks are due to the entire team at the American Prairie Reserve for their support of the collaboration. From fried chicken dinners to discussions about data protocols, photo editing, human resources and strategic planning, Land**mark** has benefited from the attention and contributions of individuals across the APR staff.

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Appendix 1 - (Sample Data Sheets)

Camera Trapping Entry Form

LAND MARK — Adventure Science on American Prairie Reserve

Date: _____ Camera #: _____

Camera Type:

Location:

Is the Camera Functioning Properly (Yes/No):

Time/Date Correct on Camera (Yes/No):

    If Wrong Record Date/Time on Camera:

Video or Photo:

Number of Images on Camera (Photo):

Elapsed Time (Video):

Battery Percentage Remaining:

Trigger Interval:

Camera Trigger Sensitivity:

Direction of Lens (0-360):

Notes:

Name (1): _____ Name (2): _____

Waypoint Entry Form

LAND MARK — Adventure Science on American Prairie Reserve

Date: _____ Transect #: _____

Weather:

Ground Conditions:

Species Name:

Waypoint Name:

Location:

Distance to Center of Animal Group (Yards):

Compass Bearing (0-360) to Center of Animal Group:

Animals:

Health of Animal(s):

Animal Behavior:

Age Group of Youngest Animal(s):

Direction of Animal Travel:

Habitat Type:

Did you capture a photo?

Additional Notes:

Name (1): _____ Name (2): _____

DNA Collection Form

LAND MARK — Adventure Science on American Prairie Reserve

Date/Time: _____ Transect No: _____

Carnivore Transect Name:

Suspected Species:

Sample Type:

Waypoint Name:

Location:

Photo w/ Scale:

Notes:

Name (1): _____ Name (2): _____

Carnivore Transect Summary Form

LAND MARK — Adventure Science on American Prairie Reserve

Date/Time: _____ Transect No: _____

Carnivore Transect Name:

Suspected Species:

Time Start: _____ Time End: _____

Starting Location: _____ Ending Location: _____

Primary Direction Traveled: _____ Miles Traveled: _____

Waypoints Recorded:

1:	2:	3:	4:
5:	6:	7:	8:
9:	10:	11:	12:
13:	14:	15:	16:
17:	18:	19:	20:

Track Narrative (Animal Behavior Derived From Track):

Notes:

Name (1): _____ Name (2): _____

LAND MARK
Adventure Science on American Prairie Reserve

Human Artifact Entry Form

Date/TIme: Transect No.

Waypoint Name:

Location:

# of Items:

Can Items Be Moved By Hand (Yes/No):

What is your best guess of what it is?

Photo:

Additional Notes:

Name (1):   Name (2):

LAND MARK
Adventure Science on American Prairie Reserve

Fence Crossing Form

Date:

Start Time: End Time:

Latitude: Longitude:

Fence Transect Name:

Distance Walked:

Current Ground Conditions:

Number of Fence Crossings Observed:

What Species Did You See Tracks of That You Were 100% Sure About?:

Notes:

Name (1):   Name (2):

LAND MARK
Adventure Science on American Prairie Reserve

Stream/River Flow Form

Date/Time: Transect No:

Location:

How Much Water Is In the Stream?

0: None
1: Standing Puddles
2: Flowing Trickle
3: Flowing
4: Significant Current More Than One Ft. Deep.
5: Waist Deep Flow

Notes:

Name (1):   Name (2):

LAND MARK
Adventure Science on American Prairie Reserve

Russian Olive Entry Form

Date/Time: Transect No.:

Waypoint Name:

Location:

Distance to Olive Tree:

Compass Bearing to Center of Stand:

# of Olive Trees:

Height of Largest Tree:

Did You Capture a Photo (Yes/No):

Notes:

Name (1):   Name (2):

Appendix 2 - Animal Observation Data

Bison:

Observation	Date and Time	Transect No.	Location Latitude (deg)	Location Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer

	Date/Time	Type	Latitude	Longitude	Count	Distance	Behavior	Movement		Weather	Ground	Observer
120	3/19/14 11:08	Other/Driving	47.79203006	-107.7072746	2	350	Stationary	Stationary	Yes	Clear/Calm	Dry	Colleen Ferris
121	3/25/14 9:52	TT06	47.7849004	-107.7353702	1	400+	Grazing/Feeding	Stationary	No	Windy	Dry	Beth Schadd
122	3/25/14 9:56	TT09	47.7549982	-107.7545493	34	284	Grazing/Feeding	Stationary	No	Windy	Dry	Ryan Rock
123	3/25/14 10:46	TT06			9	400	Walking	SW	No	Windy	Dry	Beth Schadd
124	3/25/14 10:47	TT09	47.7595833	-107.799625	9	214	Grazing/Feeding	Stationary	No	Windy	Dry	Ryan Rock
125	3/25/14 11:00	TT06	47.7819885	-107.7059934	5	400+	Grazing/Feeding	Stationary	No	Windy	Dry	Beth Schadd
126	3/25/14 11:03	TT06	47.7813634	-107.7056364	7	400+	Stationary	Stationary	No	Windy	Dry	Beth Schadd
127	3/25/14 11:38	TT06	47.7609068	-107.7043684	1	25	Grazing/Feeding	Stationary	No	Windy	Dry	Beth Schadd
128	3/25/14 11:46	TT06			2	350	Grazing/Feeding	Stationary	No	Windy	Dry	Beth Schadd
129	3/25/14 12:21	TT09	47.7699114	-107.7745916	1	100	Stationary	Stationary	No	Windy	Dry	Ryan Rock
130	3/25/14 13:09	TT06	47.7380792	-107.7341081	2	50	Grazing/Feeding	Stationary	Yes	Clear/Calm	Dry	Beth Schadd
131	3/25/14 13:23	TT06	47.7419867	-107.7438942	6	400	Laying Down	Stationary	No	Windy	Dry	Beth Schadd

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Mule Deer:

Observation	Date and Time	Transect No.	Location Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
59	3/6/14 10:43	TT06	47.7775	-107.708611	8	200	Ran Away	N	No	Cloudy	Snow	Merrill Warren
60	3/6/14 13:17	TT06	47.741944	-107.744444	18	400	Ran Away	S	Yes	Windy	Snow	Merrill Warren
61	3/10/14 14:12	TT02	47.989642	-107.9775524	3	180	Ran Away	S	Yes	Cloudy	Muddy	Cayley Faurot-Daniels
62	3/19/14 10:36	Other/Driving	47.79266387	-107.7037086	4	400	Ran Away	S	Yes	Clear/Calm	Dry	Coleen Ferris
63	3/22/14 8:23	TT03	47.7298579	-107.8532931	5	400+	Ran Away	SW	No	Clear/Calm	Snow	Coleen Ferris
64	3/22/14 8:38	TT01	47.7315045	-107.894339	2	200	Ran Away	N	No	Cloudy	Snow	Cayley Faurot-Daniels
65	3/22/14 9:45	TT03	47.6976568	-107.8636242	7	130	Stationary	Stationary	Yes	Snowing	Snow	Ryan Rock
66	3/22/14 11:44	TT03	47.6880675	-107.8640299	15	400+	Stationary	Stationary	No	Clear/Calm	Wind Blown Ice/Snow	Coleen Ferris
67	3/22/14 12:56	TT03	47.7167039	-107.8406274	5	400+	Ran Away	NE	No	Cloudy	Snow	Ryan Rock
68	3/23/14 10:02	TT02	47.747694	-107.8240072	12	400	Grazing/Feeding	Stationary	Yes	Snowing	Snow	Merrill Warren
69	3/23/14 11:03	TT02	47.762734	-107.819442	18	300	Ran Away	N	No	Cloudy	Snow	Merrill Warren
70	3/23/14 12:11	TT04	47.72019	-107.81901	5	400	Grazing/Feeding	Stationary	Yes	Clear/Calm	Wind Blown Ice/Snow	Cayley Faurot-Daniels
71	3/25/14 11:39	TT09	47.7914729	-107.7947473	1	300	Ran Away	W	No	Windy	Dry	Merrill Warren
72	3/25/14 11:55	TT06	47.75508	-107.70378	5	300	Grazing/Feeding	Stationary	No	Windy	Dry	Beth Schadd
73	3/25/14 13:02	TT06	47.7367873	-107.7310338	23	200	Crossed a Fence	S	Yes	Windy	Dry	Beth Schadd
74	3/25/14 13:25	TT06	47.7421516	-107.7439504	2	400	Ran Away	E	No	Windy	Dry	Beth Schadd
75	3/25/14 13:34	TT06	47.7394865	-107.7506349	4	250	Stationary	Stationary	No	Windy	Dry	Beth Schadd
76	3/26/14 8:43	TT01	47.741748	-107.8863859	2	200	Ran Away	NW	Yes	Clear/Calm	Dry	Merrill Warren
77	3/26/14 9:00	TT03	47.6936739	-107.8417627	15	400	Walking	SE	Yes	Clear/Calm	Dry	Ryan Rock
78	3/26/14 11:14	TT03	47.7267275	-107.8524215	4	200	Grazing/Feeding	Stationary	No	Clear/Calm	Dry	Beth Schadd

White-Tailed Deer:

Observation	Date and Time	Transect No.	Location Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	2/8/14 14:16	TT05	47.7663214	-107.7802731	2	80	Ran Away	N	No	Windy	Wind Blown Ice/Snow	Cayley Faurot-Daniels
2	2/8/14 16:19	TT05	47.7870861	-107.7780652	1	90	Ran Away	NW	No	Windy	Snow	Rob Pudner
3	2/8/14 16:26	TT05	47.7897467	-107.779125	6	45	Ran Away	N	No	Windy	Snow	Rob Pudner
4	2/10/14 14:41	TT09	47.7696532	-107.7846243	6	400+	Ran Away	NE	No	Clear/Calm	Wind Blown Ice/Snow	Thomas Ward
5	2/10/14 17:26	Other/Driving	47.7813494	-107.7674928	6	400+	Ran Away	NE	Yes	Clear/Calm	Snow	Rob Pudner
6	2/12/14 8:39	Other/Driving	47.8006104	-107.7568955	2	18	Laying Down	E	Yes	Clear/Calm	Snow	Cayley Faurot-Daniels
7	2/12/14 8:49	Other/Driving	47.7874286	-107.7675489	10	180	Ran Away	E	Yes	Clear/Calm	Snow	Amanda Smith
8	2/12/14 13:33	TT07	47.7674614	-107.7807954	2	370	Ran Away	E	No	Windy	Snow	Tony Mancuso
9	2/12/14 16:02	TT05	47.7811011	-107.7566203	3	400+	Ran Away	E	No	Windy	Snow	Tony Mancuso
10	2/18/14 7:01	Other/Driving	47.791801	-107.769642	8	300	Ran Away	S	No	Windy	Dry	Thomas Ward
11	2/18/14 8:44	Other/Driving	47.77084652	-107.760304	9	400+	Grazing/Feeding	SE	No	Windy	Wind Blown Ice/Snow	Tony Mancuso
12	2/20/14 9:40	Other/Driving	47.79185048	-107.7706187	3	175	Ran Away	S	No	Clear/Calm	Dry	Thomas Ward
13	2/21/14 12:46	TT09	47.7751239	-107.7995625	4	100	Laying Down	N	Yes	Windy	Muddy	Cayley Faurot-Daniels
14	3/3/14 13:11	Other/Driving	47.78337272	-107.7573805	6	400+	Ran Away	W	No	Clear/Calm	Snow	G Ryan
15	3/5/14 9:44	TT05	47.7710514	-107.7556924	12	20	Ran Away	E	Yes	Cloudy	Snow	Merrill Warren
16	3/5/14 10:24	TT05	47.7844951	-107.7571067	6	250	Ran Away	E	No	Cloudy	Snow	Cayley Faurot-Daniels
17	3/6/14 12:51	TT09	47.787967	-107.788333	6	250	Ran Away	NE	No	Cloudy	Snow	Ruan Rock
18	3/16/14 10:45	Other/Driving	47.78468204	-107.7571858	10	50	Ran Away	NE	No	Windy	Muddy	Beth Schade

Pronghorn:

Observation	Date and Time	Transect No.	Location Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	2/4/14 16:01	TT05	47.86355503	-107.8296952	80	0	Ran Away	S	No	Clear/Calm	Wind Blown Ice/Snow	F Tony
2	2/4/14 16:01		47.86364178	-107.8298047	80	0	Ran Away	S		Clear/Calm	Wind Blown Ice/Snow	F Tony
3	2/5/14 17:29	Other/Driving	47.8635356	-107.8294541	120	200	Ran Away	SE	No	Clear/Calm	Dry	A Thomas
4	2/8/14 10:33	Other/Driving	47.7430725	-107.8781061	70	400+	Ran Away	E	No	Clear/Calm	Wind Blown Ice/Snow	D Colleen
5	2/10/14 10:04	TT99	47.7545398	-107.7545816	40	360	Grazing/Feeding	S	Yes	Clear/Calm	Wind Blown Ice/Snow	A Thomas
6	2/10/14 10:46	Other/Driving	47.76356	-107.74939	30	400+	Stationary	W	No	Clear/Calm	Snow	F Tony
7	2/12/14 13:39	TT29	47.7917263	-107.7950061	40	400+	Ran Away	W	Yes	Clear/Calm	Wind Blown Ice/Snow	A Thomas
8	2/14/14 14:39	Other/Driving	47.76623962	-107.7551251	2	400+	Laying Down	Stationary	No	Clear/Calm	Wind Blown Ice/Snow	C Amanda
9	2/14/14 14:54	Other/Driving	47.7885141	-107.7898501	27	400+	Grazing/Feeding	Stationary	No	Cloudy	Wind Blown Ice/Snow	F Tony
10	2/18/14 7:13	Other/Driving	47.76776903	-107.7609519	20	400+	Ran Away	N	No	Windy	Wind Blown Ice/Snow	F Tony
11	2/18/14 7:34	Other/Driving	47.7885382	-107.7898637	5	400+	Grazing/Feeding	N	Yes	Windy	Dry	C Amanda
12	2/19/14 10:44	TT07	47.77191122	-107.6859942	12	260	Ran Away	SW	Yes	Windy	Wind Blown Ice/Snow	D Colleen
13	2/20/14 8:51	TT01	47.7475513	-107.894225	3	400+	Grazing/Feeding	Stationary	No	Clear/Calm	Wind Blown Ice/Snow	D Colleen
14	2/20/14 9:21	TT01	47.7456842	-107.9015663	10	200	Grazing/Feeding	Stationary	No	Clear/Calm	Wind Blown Ice/Snow	C Amanda
15	2/21/14 12:48	TT06	47.79188948	-107.7124573	13	300+	Ran Away	W	No	Cloudy	Dry	A Thomas
16	2/21/14 14:01	TT06	47.77480193	-107.7352175	2	300+	Ran Away	NE	No	Cloudy	Dry	A Thomas
17	2/24/14 9:36	Other/Driving	47.74608523	-107.8886756	20	400+	Ran Away	W	No	Clear/Calm	Snow	E Cayley
18	2/28/14 13:13	TT03	47.7236792	-107.8387331	10	300	Grazing/Feeding	Stationary	Yes	Clear/Calm	Wind Blown Ice/Snow	F Tony
19	3/6/14 10:25	TT06	47.786111	-107.707778	5	400	Ran Away	S	No	Cloudy	Snow	Merrill Warren
20	3/6/14 12:30	TT09	47.791633	-107.796267	9	400+	Ran Away	S	Yes	Cloudy	Wind Blown Ice/Snow	Cayley Faurot-Daniels
21	3/10/14 11:45	TT12	47.733383	-107.834550	12	400+	Crossed a Fence	W	Yes	Clear/Calm	Muddy	Colleen Ferris
22	3/16/14 12:01	Other/Driving	47.79885103	-107.7318709	2	250	Grazing/Feeding	Stationary	No	Windy	Muddy	Beth Schade

Elk:

Observation	Date and Time	Transect No.	Location Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	2/13/14 13:18	TT03	47.67999444	-107.8394758	1	0	Other	NW	Yes	Clear/Calm	Wind Blown Ice/Snow	Amanda Smith
2	2/13/14 13:55	TT03	47.69263604	-107.8417566	6	400+	Ran Away	S	Yes	Clear/Calm	Wind Blown Ice/Snow	Tony Mancuso
3	2/19/14 11:19	TT08	47.74111505	-107.6895315	1	0	Other	S	Yes	Windy	Dry	Amanda Smith

Coyote:

Observation	Date and Time	Transect No.	Location Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	2/3/14 23:23	TT05	47.9859749	-107.9784481	2	120	Ran Away	S		Windy	Wind Blown Ice/Snow	
2	2/6/14 11:27	Other/Driving	47.7359969	-107.8599727	1	260	Ran Away	NE	No	Clear/Calm	Wind Blown Ice/Snow	Colleen Ferris
3	2/7/14 9:27	Other/Driving	47.878659	-107.9855788	1	270	Ran Away	E	No	Clear/Calm	Wind Blown Ice/Snow	Thomas Ward
4	2/7/14 17:44	Other/Driving	47.8704479	-107.9070116	1	30	Ran Away	S	No	Clear/Calm	Wind Blown Ice/Snow	Thomas Ward
5	2/8/14 13:28	TT05	47.7503138	-107.7818742	1	70	Stationary	NW	No	Windy	Snow	Rob Pudner
6	2/8/14 17:19	Other/Driving	47.8891878	-107.9855835	1	300	Ran Away	E	No	Clear/Calm	Wind Blown Ice/Snow	Cayley Faurot-Daniels
7	2/10/14 13:44	TT06	47.7919443	-107.7245863	1	109	Ran Away	NW	No	Clear/Calm	Snow	Rob Pudner
8	2/10/14 17:35	Other/Driving	47.8064849	-107.7569113	1	400+	Ran Away	W	No	Clear/Calm	Wind Blown Ice/Snow	Cayley Faurot-Daniels
9	2/12/14 12:43	TT05	47.7519138	-107.7855457	1+	400+	Other	Stationary	No	Clear/Calm	Snow	Amanda Smith
10	2/13/14 9:18	TT04	47.732093	-107.8284233	1	0	Other	Stationary	No	Cloudy	Wind Blown Ice/Snow	Thomas Ward
11	2/13/14 9:29	TT04	47.7333649	-107.8300666	1	400+	Other	Stationary	No	Cloudy	Wind Blown Ice/Snow	Thomas Ward
12	2/13/14 9:40	TT03	47.73482804	-107.8431706	1+	400+	Other	Stationary	No	Clear/Calm	Snow	Amanda Smith
13	2/14/14 15:46	Other/Driving	47.7885404	-107.7898341	1	355	Other	S	No	Clear/Calm	Wind Blown Ice/Snow	Colleen Ferris
14	2/18/14 8:38	Other/Driving	47.78853	-107.7898685	2	400+	Grazing/Feeding	E	No	Windy	Dry	Amanda Smith
15	3/5/14 10:26	TT05	47.789295	-107.7573854	1	15	Ran Away	S	Yes	Cloudy	Snow	Merril Warren

Porcupine:

Observation	Date and Time	Transect No.	Location Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	2/24/14 16:05	Other/Driving	47.7314138	-107.7856886	1	100	Stationary	Stationary	Yes	Clear/Calm	Wind Blown Ice/Snow	Thomas Ward
2	3/9/14 10:14	Other/Driving	47.74795	-107.773133	1	400+	Stationary	Stationary	No	Clear/Calm	Muddy	Ryan Rock
3	3/16/14 11:47	TT05	47.7773923	-107.7558083	1	220	Stationary	Stationary	Yes	Clear/Calm	Dry	Ryan Rock

Desert Cottontail:

Observation	Date and Time	Transect No.	Location Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	2/10/14 13:53	Other/Driving	47.76848	-107.76875	1	10	Stationary	Stationary	Yes	Clear/Calm	Wind Blown Ice/Snow	Amanda Smith
2	2/13/14 11:20	TT03	47.71433257	-107.8594105	0	0	Other	Stationary	Yes	Cloudy	Snow	Tony Mancuso

Black-Tailed Prairie Dog:

Observation	Date and Time	Transect No.	Location Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	2/7/14 16:08	TT07	47.758783	-107.6881761	0	25	Other	Stationary	Yes	Clear/Calm	Wind Blown Ice/Snow	Tony Mancuso
2	2/10/14 9:28	TT06	47.7493625	-107.7263331	0	0	Other	Stationary	Yes	Clear/Calm	Snow	Rob Pudner
3	2/10/14 10:43	Other/Driving	47.76356	-107.74939	3	100	Stationary	Stationary	Yes	Clear/Calm	Snow	Tony Mancuso
4	2/10/14 14:28	TT09	47.7711673	-107.7904183	12	200	Grazing/Feeding	Stationary	Yes	Clear/Calm	Wind Blown Ice/Snow	Thomas Ward
5	2/14/14 15:51	Other/Driving	47.7885419	-107.7898424	1	355	Ran Away	NE	No	Clear/Calm	Dry	Colleen Ferris
6	2/18/14 9:27	Other/Driving	47.7885415	-107.7898599	6	1000	Other	Stationary	No	Windy	Dry	Thomas Ward
7	3/3/14 12:46	TT05	47.7710727	-107.7574841	2	100	Stationary	Stationary	No	Clear/Calm	Snow	Merrill Warren
8	3/5/14 9:25	Other/Driving	47.7338725	-107.7783209	10	50	Stationary	Stationary	Yes	Clear/Calm	Wind Blown Ice/Snow	Colleen Ferris
9	3/5/14 9:35	TT05	47.7671684	-107.7552987	2	20	Stationary	Stationary	No	Cloudy	Snow	Merrill Warren
10	3/9/14 8:21	Other/Driving	47.9856549	-107.977559	1	50	Stationary	Stationary	No	Clear/Calm	Muddy	Merrill Warren
11	3/10/14 11:01	TT02	47.737617	-107.810117	5	100	Stationary	Stationary	Yes	Cloudy	Muddy	Cayley Faurot-Daniels
12	3/10/14 14:59	TT02	47.7626	-107.7912	2	50	Stationary	Stationary	No	Cloudy	Muddy	Cayley Faurot-Daniels

Sharp-Tailed Grouse:

Observation	Date and Time	Transect No.	Location Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	2/10/14 11:12	TT09	47.7557754	-107.7802513	5	42	Ran Away	N	No	Clear/Calm	Wind Blown Ice/Snow	Thomas Ward
2	2/10/14 16:20	TT06	47.7441857	-107.7354065	1	30	Ran Away	E	No	Clear/Calm	Snow	Rob Pudner
3	2/12/14 8:42	Other/Driving	47.794162	-107.758606	1	20	Stationary	Stationary	Yes	Clear/Calm	Snow	Cayley Faurot-Daniels
4	2/12/14 8:53	Other/Driving	47.7727403	-107.767054	13	350	Stationary	Stationary	Yes	Clear/Calm	Snow	Cayley Faurot-Daniels
5	2/12/14 12:36	TT05	47.7517145	-107.7856107	1	60	Stationary	Stationary	Yes	Clear/Calm	Snow	Amanda Smith
6	2/12/14 17:23	Other/Driving	47.7980314	-107.7566134	3	25	Ran Away	W	No	Windy	Muddy	Cayley Faurot-Daniels
7	2/13/14 9:57	TT03	47.73528331	-107.8515577	15	100	Ran Away	SE	No	Snowing	Snow	Tony Mancuso
8	2/13/14 15:22	TT03	47.72691177	-107.8275432	9	40	Ran Away	SE	No	Clear/Calm	Muddy	Tony Mancuso
9	2/17/14 9:53	Other/Driving	47.7336141	-107.7177496	1	35	Ran Away	W	No	Windy	Wind Blown Ice/Snow	Thomas Ward
10	2/18/14 8:56	Other/Driving	47.788538	-107.7898491	6	400+	Grazing/Feeding	N	No	Windy	Dry	Amanda Smith
11	2/19/14 12:58	TT08	47.72679029	-107.6520282	3	230	Ran Away	SE	No	Windy	Muddy	Amanda Smith
12	2/21/14 10:36	TT09	47.7575501	-107.7529937	20	50	Ran Away	N	No	Clear/Calm	Dry	Cayley Faurot-Daniels
13	2/24/14 11:08	TT01	47.7188231	-107.8760837	2	30	Ran Away	N	No	Clear/Calm	Wind Blown Ice/Snow	Tony Mancuso
14	3/3/14 12:32		47.77148848	-107.7656736	10	100	Ran Away	W	No	Clear/Calm	Snow	Merrill Warren
15	3/4/14 11:06	TT07	47.7873968	-107.67155	31	100	Ran Away	SW	No	Clear/Calm	Snow	Colleen Ferris
16	3/5/14 8:45	TT05	47.7471706	-107.7606136	3	2	Ran Away	SE	No	Windy	Wind Blown Ice/Snow	Merrill Warren
17	3/5/14 9:14	TT05	47.75722499	-107.7836111	2	50	Ran Away	NE	No	Clear/Calm	Snow	Tony Mancuso
18	3/6/14 10:56	TT09	47.7636	-107.799583	2	150	Flying	W	No	Cloudy	Snow	Ryan Rock
19	3/10/14 10:02	TT04	47.721389	-107.82	1	20	Flying	E	No	Clear/Calm	Muddy	Tony Mancuso
20	3/10/14 14:41	TT04	47.733611	-107.785556	2	3	Flying	NW	No	Cloudy	Muddy	Merrill Warren
21	3/16/14 12:21	TT05	47.7501796	-107.7574706	2	40	Ran Away	NE	No	Clear/Calm	Dry	Colleen Ferris
22	3/23/14 9:28	Other/Driving	47.73507419	-107.82267	2	25	Ran Away	NW	No	Snowing	Wind Blown Ice/Snow	Colleen Ferris
23	3/25/14 9:17	TT06	47.7628156	-107.7344105	6	25	Flying	N	No	Windy	Dry	Beth Schadd
24	3/26/14 10:59	TT03	47.7181574	-107.8532585	2	13	Flying	E	No	Clear/Calm	Dry	Beth Schadd

Greater Sage-Grouse:

Observation	Date and Time	Transect No.	Location Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	2/7/14 13:15	TT08	47.7536485	-107.695439	1	20	Ran Away	S	No	Cloudy	Wind Blown Ice/Snow	Thomas Ward
2	2/7/14 13:33	TT08	47.7508277	-107.688548	22	50	Ran Away	W	No	Cloudy	Wind Blown Ice/Snow	Thomas Ward
3	2/7/14 13:44	TT08	47.7469683	-107.6903674	60	130	Ran Away	S	No	Clear/Calm	Wind Blown Ice/Snow	Colleen Ferris
4	2/7/14 15:13	TT08	47.7286639	-107.6597577	11	400+	Ran Away	NW	No	Clear/Calm	Wind Blown Ice/Snow	Colleen Ferris
5	2/7/14 16:02	TT08	47.7354569	-107.6602955	1	300	Ran Away	W	No	Cloudy	Wind Blown Ice/Snow	Thomas Ward
6	2/8/14 10:37	Other/Driving	47.7748103	-107.7663923	1	2	Ran Away	S	Yes	Cloudy	Wind Blown Ice/Snow	Thomas Ward
7	2/8/14 13:33	Other/Driving	47.7743587	-107.7665672	2	52	Grazing/Feeding	Stationary	Yes	Clear/Calm	Wind Blown Ice/Snow	Thomas Ward
8	2/13/14 8:40	Other/Driving	47.72584236	-107.8132266	8	20	Ran Away	SW	Yes	Cloudy	Snow	Tony Mancuso
9	3/3/14 13:24	Other/Driving	47.78851044	-107.7575108	11	150	Ran Away	E	No	Clear/Calm	Snow	Merrill Warren
10	3/4/14 8:20	Other/Driving	47.7607943	-107.6604339	4	60	Ran Away	E	No	Clear/Calm	Snow	Cayley Faurot-Daniels
11	3/5/14 8:55	TT05	47.7481353	-107.7561107	8	50	Ran Away	S	No	Windy	Wind Blown Ice/Snow	Merrill Warren
12	3/19/14 10:23	TT07	47.757916	-107.685986	2	40	Flying	NW	No	Clear/Calm	Dry	Ryan Rock
13	3/19/14 10:37	TT07	47.7617856	-107.6890771	1	20	Ran Away	W	No	Windy	Dry	Merrill Warren
14	3/19/14 11:53	TT07	47.7918894	-107.6737817	4	12	Ran Away	S	No	Windy	Dry	Merrill Warren
15	3/23/14 9:17	TT04	47.7323478	-107.834213	3	25	Flying	S	No	Clear/Calm	Snow	Beth Schadd

Ring-Necked Pheasant:

Observation	Date and Time	Transect No.	Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	2/6/14 8:06	Other/Driving	47.9859749	-107.9784481	2	100	Ran Away	SE	No	Clear/Calm	Wind Blown Ice/Snow	Colleen Ferris
2	2/10/14 8:25	Other/Driving	47.8123148	-107.756925	6	25	Grazing/Feeding	W	Yes	Clear/Calm	Dry	Colleen Ferris
3	2/17/14 8:56	Other/Driving	47.79979475	-107.7569373	1	30	Ran Away	E	No	Clear/Calm	Dry	Cayley Faurot-Daniels
4	2/20/14 9:13	Other/Driving	47.77939858	-107.7674028	1	15	Grazing/Feeding	Stationary	Yes	Clear/Calm	Dry	Thomas Ward
5	3/3/14 13:33	Other/Driving	47.78986048	-107.7581459	9	5	Ran Away			Clear/Calm	Snow	
6	3/5/14 10:30	TT05	47.7892711	-107.7573684	2	15	Ran Away	E	No	Cloudy	Snow	Cayley Faurot-Daniels
7	3/16/14 10:01	TT05	47.7340097	-107.7765134	1	10	Ran Away	E	No	Cloudy	Muddy	Merrill Warren
8	3/22/14 9:50	TT01	47.7388406	-107.8761873	4	50	Ran Away	S	No	Cloudy	Snow	Merrill Warren

Burrowing Owl:

Observation	Date and Time	Transect No.	Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	2/19/14 9:55	TT07	47.7559135	-107.6840453	1	30	Ran Away	SW	Yes	Clear/Calm	Wind Blown Ice/Snow	Colleen Ferris

Golden Eagle:

Observation	Date and Time	Transect No.	Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	2/12/14 8:47	Other/Driving	47.7894125	-107.7675961	1	350	Stationary	W	No	Clear/Calm	Snow	Amanda Smith

Dead Animals:

Observation	Date and Time	Transect No.	Latitude (deg)	Longitude (deg)	No. Animals	Distance to Group Center (yds)	Animal Behavior	Direction Of Travel	Photo?	Weather	Ground Conditions	Observer
1	3/16/14 11:48	TT05	47.7827865	-107.7786115	1	0	Dead	Dead	Yes	Clear/Calm	Dry	Cayley Faurot-Daniels
2	2/13/14 12:46	TT04	47.6857483	-107.8249831	1	0	Dead	Dead	Yes	Clear/Calm	Wind Blown Ice/Snow	Colleen Ferris
3	2/12/14 14:33	TT05	47.7790705	107.7742069	1	0	Dead	Dead	Yes	Clear/Calm	Snow	Tony Mancuso