SURVEYING FOR PYGMY RABBITS (Brachylagus idahoensis)
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Introduction

Pygmy rabbits are a BLM Sensitive Species which occur through most of the Great Basin. Although it has been petitioned for listing under the Endangered Species Act, its distribution and population trends are largely unknown. In recent years, biologists in most of the western states have surveyed for and found populations of this rabbit, although there is still much area to inventory. On February 26, 2003, biologists from various federal and state agencies and universities met in Reno to discuss the current state of knowledge and future work needed for pygmy rabbits. Development of a consistent method for surveying for pygmy rabbits across their range was identified as a high priority. A westwide survey subgroup was formed which helped develop this current paper, based largely on a previous effort by the Idaho BLM pygmy rabbit survey committee.

The intended audience for this paper is biologists who will be surveying for pygmy rabbits. Our purpose is to help you find pygmy rabbits, by using a standardized but flexible and realistic approach. The information presented is a collation of field knowledge gained by biologists who have surveyed for pygmy rabbits in Idaho, Nevada, Utah, Wyoming, Washington, Oregon, and California. This paper describes pygmy rabbit habitat, how to recognize and evaluate rabbit sign, an approach for organizing and conducting broad-scale surveys, and how to record data. It also includes discussion of some other survey techniques. It includes photos of habitat and burrows. This is a work in progress and may be modified as we learn more about the variety of habitats used by pygmy rabbits, pygmy rabbit sign, and about surveying for these rabbits.

The goal of the broad scale survey described here is primarily to find populations of the rabbit. However, by conducting surveys and recording data in the manner described, locations and a measure of burrow density and “occupancy status” can be obtained at the same time, which can provide a baseline index for population monitoring, and a way to coarsely compare different areas. These surveys will document not only where the rabbits are
but also where they are not, which is useful information for refining habitat models, and for land managers.

We recommend that biologists surveying or studying pygmy rabbits across the range of the species will use the included form to gather the basic population data identified (burrow locations and status), although they may add or delete other data to suit their specific needs. This way, it will be easier to compare population indices across the west and across the years.

**Field Training**

_A key piece of advice:_ The rabbits themselves are secretive and difficult to see; thus it is being familiar with their habitat and sign that is the key to finding populations. Before surveying, look at pygmy rabbit habitat, burrows and pellets with an experienced person in the field. If possible, also look at badger and ground squirrel diggings, to help you learn to distinguish the differences between their burrows and those of pygmy rabbits. Descriptions and pictures are helpful, but there’s no substitute for seeing it in the field. Biologists from different states with experience in surveying for pygmy rabbits are listed in Appendix A.

**Habitat**

There are two main features of pygmy rabbit habitat: relatively taller and denser big sagebrush _(*Artemisia tridentata*)_ (but see below) and deep soils.

**Sagebrush**

Usually burrows are found in the taller and denser big sagebrush in an area. The height of the sagebrush can vary enormously, from about 1 ½ to 7 feet. Density can also vary, but commonly the sagebrush is so dense right at burrows that it is difficult to walk through. This means > 30% cover. Various subspecies of sagebrush are used, including Wyoming _(*A. t. wyomingensis*)_, mountain _(*A. t. vaseyana*)_, and Great Basin _(*A. t. tridentata*)_. Other shrub species may be present, including bitterbrush _(*Purshia tridentata*)_, rabbitbrush _(*Chrysothamnus* spp.), greasewood _(*Sarcobatus vermiculatus*)_, snowberry _(*Symphoricarpos* spp.), and juniper _(*Juniperus* spp.).

In some habitats used by pygmy rabbit in Oregon and Nevada, rabbitbrush is dominant or co-dominant with sagebrush, and burrows occasionally or commonly occur under large dense rabbitbrush (T. Forbes, OR; E. Sequin, NV, pers. comm.) and greasewood (J. Himes, NV, pers. comm.). The burrows are so hidden under the canopy that they are often only found by lifting the vegetation.

Pygmy rabbits also may occupy habitat that does not appear ideal: with short sagebrush and “bad” soil. In east-central Idaho, pygmy rabbits occupy “mima mounds” (mounds of soil several feet high and approximately 20-30 feet in diameter) with taller and denser sage, which are dotted in a landscape of shorter and thinner sagebrush (Roberts 2001). Katzner and Kozlowski (pers. comm.) both emphasize that it is important to keep an open mind, and not develop set ideas about what comprises pygmy rabbit habitat too early, or you may overlook inhabited areas. In Wyoming, Katzner (pers. comm.) has seen pygmy rabbits in areas that he initially would not have thought were habitat. In Montana, the average sagebrush height in occupied sites was only about 15 inches. There, Rauscher (pers. comm.)
has often found them in areas where the sagebrush is not very dense and only knee-high or less, especially in mountain bowls and where sagebrush has been manipulated. In Utah, pygmy rabbits have been found to occupy 12 to 120-inch tall sagebrush. Regardless of the absolute height of the vegetation, the rabbits will almost always burrow in the tallest and densest sagebrush on the landscape.

Soils
Generally, pygmy rabbits burrow in loamy soils deeper than 20 inches. Soil composition needs to be able to support a burrow system with numerous entrances, but also must be soft enough for digging. A habitat model from the Univ. of Idaho (Rachlow and Svancara 2003) used a clay content of 13 to 30%, but models from Idaho State Univ. (Simons and Laundre 2001) used <13.5 % clay. In central Washington, pygmy rabbits are found only in areas with deep loamy soils. In southwest Idaho, they occur in areas with soils classified as stony sandy loam, and sandy loam over sandy clay and clay loam. In east-central Idaho, soils are gravelly outwash plains with lime-coated rocks. On the lava plains of southeast Idaho, rabbits will often burrow between or under lava boulders. In Nevada, soils are light-colored and friable.

At the Landscape Scale
Pygmy rabbits are found in alluvial fans, swales in a rolling landscape, large flat valleys, at the foot of mountains, along creek and drainage bottoms, in basins in the mountains, or other landscape features where soil may have accumulated to greater depths. They are generally on flatter ground, sometimes on moderate slopes, and not on steep ground.

At the Patch Scale
Look for relatively taller, denser big sagebrush (not low sage) and areas where there appears to be a non-uniform distribution of sage, in other words, where the texture of the sagebrush stand is uneven, or “lumpy”, in both height and density. When scanning across a valley these clumps stand out as taller, or as having a different color. It is fairly effective to go directly to these areas to begin a search. Also look for signs of digging, and for soil surface that is not flat and level. The rabbits tend to mound up the soil where they have been burrowing over the years. Drainage bottoms and sagebrush draws with a relatively uniform coverage of sagebrush are also often used by pygmy rabbits.

Habitat Descriptions by State
Idaho: Areas with mounded topography – ‘mima mounds’ – are prime areas to target for surveys. In the Salmon, Idaho area, alluvial plains where rabbits are found are dotted with mounds about 20-30 ft in diameter, 1-2 ft tall, several hundred feet or yards apart, where the sagebrush is taller than in the surrounding intermound spaces. On 1:24,000 aerial photos, these mounds can be seen as a pattern of darker dots, extending over many miles of landscape (Photo 1 – Rocky Canyon); and from the ground, the mounds appear as lenses of darker and taller sage. The mounds are where the pygmy rabbits burrow. In southwest Idaho, a similar habitat is big sagebrush islands intermingled with low sagebrush (Artemisia arbuscula) (Photo 2 – Hutch Springs, Photo 3 – Mudflat Rd with Lynell). These kinds of areas are also visible on aerial photos).
In the mahogany (*Cercocarpus ledifolius*) savannah in the Owyhees of southwest Idaho, the rabbits are found in swales of taller sagebrush (photo 4 – aerial of mahogany savannah, photo 5 - Dry Cr.) Mounding of the soil is present, but does not form distinctive mima mounds. A dotted pattern is usually not visible on 1:24,000 aerial photographs, although careful examination can show subtle and dim dotting. The soil does end up mounded where the pygmy rabbits have been digging their burrows and maintaining them over time.

Another major habitat in the Bruneau plateau country is the bottoms and lower slopes of small drainages where the sagebrush is denser and taller, indicating deeper soils (Photos 6 –& 7).

**Oregon**: Habitats in Oregon are very similar to those in Idaho. Most habitat is comprised of areas where big sagebrush inclusions are mixed with low sagebrush, rabbit brush, or shorter stature big sagebrush. Mounding similar to ‘mima mounding’ occurs in most of these sites (Photos 8, 9, 10, 11). Sagebrush on the mounds is usually 1-3 feet taller than that of the surrounding area. These mounds or clumps of big sagebrush can be spaced from a few feet to hundreds of feet apart.

The second most common type of habitat in Oregon is small draw bottoms where deeper soils have collected. Most of these sites are vegetated with basin big sagebrush in the drainage bottom, surrounded by Wyoming big sagebrush, low sagebrush, or mountain big sagebrush in the surrounding uplands. Some mounding can occur in these areas, but it is absent or very subtle. Burrows in these areas seem to be restricted to the very bottom of the drainages or the lower inside slopes of the drainage itself. Some areas with rabbits are dominated by rabbitbrush (Photo 12 - rabbitbrush).

**Nevada**: In Nevada pygmy rabbits are found in broad valley floors, drainage bottoms, alluvial fans, and other areas with friable soils. Burrows can be located in mounds (either natural or human caused) when they are available in these types of soils. Pygmy rabbit burrows are easiest to find in light colored, friable soils. These soils are usually found in valley bottoms and can be associated with rabbitbrush / sagebrush vegetation. The understory of grasses and forbs can vary from almost none (as in the Reese River Valley) to dense (as in the Sheldon Range). When there are a lot of rabbits present in a valley they are generally distributed throughout the area. However, when there are only a few individuals, they are generally located in the largest, most dense clumps of vegetation (as in the White River Valley).

**Montana**: Pygmy rabbits are found in habitats similar to those in Idaho and Oregon: large intermountain valley bottoms, alluvial fans, mountain valleys and bowls, drainage bottoms, plateaus, rolling sagebrush plains and isolated patches of sagebrush in grasslands. Preferred habitat in Montana appears to be gently sloping or nearly level floodplains where adequate sagebrush and appropriate soils exist. However, many occupied sites have marginal sagebrush cover and shallower soils. Areas that contain mima-like mounds are good areas to investigate. If pygmy rabbits are found in these areas, they generally occur throughout the continuous sagebrush coverage at varying densities and up into sagebrush drainages.
Wyoming: Pygmy rabbits occur in swales of taller, denser sagebrush in a setting of hillsides with thinly distributed, shorter sage. Although there have been no quantitative studies comparing pygmy rabbit habitats in different areas, the habitat in Wyoming appears different from that in Washington, Oregon, Nevada, and western Idaho (Katzner, pers. comm.). The overall impression from observation is that the sagebrush in Wyoming is denser and often less heavily grazed, with more standing dead sagebrush, and more Great Basin big sage. The general areas used by pygmy rabbits have evenly distributed, taller, and more structurally diverse sagebrush with a dense canopy. Three subspecies of big sagebrush can be present, Great Basin, Wyoming, and mountain. Surrounding unused areas have fewer, shorter, shrubs with less vegetative cover.

Utah: The site characteristics of areas inhabited by pygmy rabbits in Utah vary considerably, because they occupy three different ecoregions (U.S. EPA): Central Basin and Range, Wyoming Basin, and the Wasatch and Uintah Mountain. These regions vary significantly in latitude, elevation, precipitation, and geologic history. Pygmy rabbits are found throughout the western half of the state in habitat ranging from 4800 to 7800 feet in elevation and 0° to 20° slopes. Some evidence suggests that Pleistocene Lake Bonneville has excluded the rabbits from the lowest elevations of the Great Basin. Rabbits occur both in alluvial deposits and in favorable microsites on bench tops. Habitat in Utah’s northern or high elevation sites is characterized by Wyoming, mountain, and Basin big sagebrush, with bitterbrush and snowberry present at the highest elevations. (Photos 13, 14 - Northern Utah habitat). Burrow habitat in southern, low elevation sites is often limited to the bottom of gentle drainages supporting Wyoming sagebrush amid a black sage, shadscale, and gray molly community of minimal height (28 cm). Understory condition is variable: many sites have grasses and forbs in excellent condition, but some of the most numerous pygmy rabbit populations discovered are in chronically grazed areas (sheep and cattle) being targeted for rehabilitation. In all parts of its Utah range, burrowing by the pygmy rabbit appears to be part of a positive feedback system: the rabbits choose the tallest, densest sagebrush, and their burrowing and the mounding it causes appears to help taller, denser sagebrush to grow. Especially in the lowest elevations, raised mounds provide relief from shallow water tables and alkali soil chemistry allowing growth of better cover and forage species.

California: Northeastern California has historical records of pygmy rabbits but has not been surveyed recently. Recent surveys have documented rabbits in the Mono Lake area. Pygmy rabbit habitat in Northeastern California is very similar to adjacent Nevada habitat. Two habitat types occur in the Mono area (photos 15, 16). Near Mono Lake, pygmy rabbits occur in islands of big sagebrush and loamy soils, similar to areas in Nevada, but with sandier soils (Photo). Burrows tend to be in sandy loam soils, which are often surrounded by very sandy soils. The second area, near Bodie, has shorter, more uniform sagebrush, often less than 3 ft tall, with less clumping of the sagebrush. The elevation at this site is 8400 ft, one of the highest known populations.

Pygmy Rabbit Sign

Burrows- (Photos 17-20)
• Burrow entrances range from 4-10 inches across, usually fairly round but may be slightly wider than tall. The size of pygmy rabbit burrows usually surprises biologists the first time they see them because the holes are larger than they would have thought; many would have identified them as badger burrows. The older a burrow, the more the entrance seems to get enlarged, possibly from predators digging.

• Burrows are most often placed right at the base of a sagebrush, or occasionally another shrub species. Sometimes an entrance will be more in the open, but the majority of entrances will be underneath sage.

• At burrows, usually you will find the sagebrush so dense that walking is difficult, and you have to thread your way through it (which means >30% canopy cover). In more open sagebrush where you can walk more freely, you will probably not find burrows.

• The opening of the burrow usually flares out, and there may be a large pile of dirt outside the entrance, 1 to 3 feet in diameter.

• Usually, there will be more than one entrance in a burrow system; 2-4 is most common, with a maximum of up to 12, and occasionally there is only one.

• The burrow can slope down very steeply or moderately, and the burrow often narrows down from the flared entrance to about 4-5 inches in diameter.

• At currently used burrows, there will often be a lot of fresh dirt piled outside the entrances. Key your search on piles of fresh dirt to find burrows.

• Burrow systems will rarely be isolated; there will be a number of them in a habitat area. Isolated burrows without pellets are difficult to identify with certainty.

• A key feature of pygmy rabbit burrow systems is that they show evidence of having been built up and used over many years, unlike ground squirrel or badger diggings, which are generally a one-time affair. Pygmy rabbits remodel in the same spot year after year, creating mounded areas with taller, denser sagebrush growing on the old dirt piles, and evidence of burying the lower stem of nearby sagebrush over time. The undug areas between these mounded areas will have a fairly level ground surface (observation from Dana Quinney, expert on badger and ground squirrel diggings, Idaho Army National Guard).

• Sagebrush grows taller and denser on the mounded dirt. As pygmy rabbits ‘remodel’ over the years, filling in one tunnel and digging new ones within the same burrow system, they create overlapping mounds of varying ages in one area. The resulting complex of mounded area may be 15 to 30 ft in diameter. Thus, pygmy rabbit burrow areas have old mounding with plants and shrubs growing on them in addition to the current fresh dirt piles.

It is common to find many old burrows, with no fresh pellets, while surveying. In general, unoccupied old burrows appear to last some years. However, in Nevada, Sequin (pers. comm.) has observed extensive burrow systems “melt” completely into non-existence over the course of two to four weeks of wet weather in certain soils. All evidence of burrows was erased. Some of these burrows had been associated with very high pygmy rabbit activity just a few weeks prior. Later, the rabbits appear to return and dig burrows again.

**Pellets-(Photos 21-22)**

Rabbit pellets are distinctive: round, without dents or points, different from those of any other group of animals. Pygmy rabbit pellets are the smallest of the rabbit pellets, averaging
4-6 mm in diameter. However, the size can vary. Pregnant females produce bigger pellets, as large as cottontails, and up to 11 mm in diameter! (Dave Hays, pers. comm.). Young cottontails can produce very small pellets. Usually the size of pellets is uniform within a pellet group.

- Pellets are in little groupings near the burrow entrance and under sagebrush nearby. At an active burrow, there will often be a carpet of evenly-sized small pellets. Large quantities of uniformly small pellets around a burrow entrance are diagnostic of pygmy rabbits.
- Mountain cottontail pellets average 6-10 mm, but can be smaller. It appears that younger, smaller cottontails produce smaller pellets. Thus, they can overlap in size with pygmy rabbit pellets, creating potential for confusion. Be cautious: in Washington, genetic testing of pellets thought to be pygmy rabbit revealed they were from cottontails (Dave Hays, pers. comm.).
- Cottontails may use some of the same areas as pygmy rabbits, and may use their burrows. Beware particularly if there are rocky outcrops nearby. This is less of an issue in some places such as the Lemhi Valley, where the two do not commonly coexist. It can be more of a problem in smaller pygmy rabbit habitat patches intermixed with rock outcrops, such as in the Owyhee uplands. However, in Lakeview, Oregon, a telemetry study showed cottontails using the same habitats and some of the same burrows as the pygmy rabbits, though there are no rock outcrops for miles.
- Full-grown whitetail jackrabbit scat is 11-12 mm in diameter; blacktail jackrabbit pellets are about 9-10 mm in diameter.
- Rodents, including ground squirrels, have oblong droppings.
- Recent rabbit pellets are usually a dark to medium brown to greenish or blackish color. Very fresh pellets have sheen or appear somewhat glossy. Older pellets appear somewhat dull and eventually weather to gray. If the rabbits have been eating a lot of dry grass, fresh pellets may be more tan, the color of dry grass, and a little larger. If rabbits have been eating green wet feed in the spring, the pellets can be almost black on the outside, green on the inside, and may be more elongated and have little pinched ends, being softer when they were deposited.
- We don’t know how long pellets last or how long they take to turn grey. Weather conditions affect how fast they turn grey; dry pellets will stay brown, wet pellets will turn grey faster. Pellets under winter snow may stay very fresh looking until uncovered the next spring. In an experiment at 6000 ft in southwest Idaho, pellets gathered fresh in April and placed under a sagebrush were still brown in December. By the next April, they were grey, probably from the wet of winter snows and spring rains followed by exposure to sunlight.
- Some ants collect the pellets, so if you find burrows and no pellets, it may be due to ants. Look for them on the conical ant piles.
- Rabbits sometimes eat their own pellets (coprophagy), apparently mostly during the night (Dave Hays, pers. comm.).

Other Burrows (photos 23-26)
• A key difference between pygmy rabbit and badger or ground squirrel burrows is that badger and ground squirrel burrows generally do not create large complex mounds of overlapping dirt piles.
• Richardson’s ground squirrels make smaller holes the size of the diameter of their bodies (approximately 2-3 inches), and which do not usually have a flared entrance or a sizable pile of dirt. They usually dig holes in the open, overall occupy more open areas, and are often associated with a wet area of some kind. Belding’s ground squirrel burrows are similar, but are in dry areas, and can be found under sagebrush as well as in the open. Pygmy rabbit and ground squirrel burrows may be mingled in the same area. Any ground squirrel may use pygmy rabbit burrows, or may dig their smaller burrows off of pygmy rabbit tunnels (Dana Quinney, Idaho National Guard, pers. comm.).
• Piute (Townsend’s) ground squirrels also have small burrows with little dirt around them, and may be both under bushes or out in the open, but not particularly near water.
• Antelope ground squirrels have many small entrance holes placed in a mound of dirt 5-10 ft across and a foot or so high. Kangaroo rat burrows are similar. Both tend to be in sandier soils than pygmy rabbit burrows.
• Badger diggings are typically bigger than those of pygmy rabbits, 12-18 inches across and very round. Where there are ground squirrels, badger diggings may be numerous. Typically, however, you will see large, badger-dug holes located next to small ground squirrel holes, at least while ground squirrels are active. So instead of several moderate-sized burrow entrances near each other, like a pygmy rabbit burrow system, there will be big and small burrows together. Additionally, badger hunting burrows are one-time affairs, and even their natal burrows are only used briefly during one year.
• Where badgers have dug out pygmy rabbit burrows, which is common in some areas, the entrance will be enlarged to 12 ti 18 inches, and very round, with a large pile of dirt. You probably will find both badger-dug and regular pygmy rabbit burrows in the area.
• Coyote and fox burrows are bigger, and more in the open, not under the sage. There will be only one burrow system in an area, not a number of them.
• Chipmunks, pocket mice, and deer mice all have burrows that are tiny (1 inch in diameter or so) and no or little loose dirt outside.
• Pocket gophers produce a mound of dirt about a foot in diameter, approximately 4-6 inches high, and the entrance hole, approximately 2-3 inches in diameter, is hidden under the mound of dirt. There will be a number of mounds in an area, and they are usually more in the open, between the bushes. In winter, pocket gophers tunnel under snow and fill the tunnels with soil; these will produce ropes of soil after the snow melts. They move through the landscape as they burrow, rather than maintaining a stationary burrow system.

**Deciding whether burrows are pygmy rabbit or not**

It is the combination of all indicators that you need to consider, both of the burrow itself, pellets, and the pattern of burrows on the landscape. No other animal digs burrows with the combination of features of those of the pygmy rabbit: in tall dense sagebrush habitat,
burrow entrance 5-7 inches average diameter, located under sagebrush, a number of burrow systems in an area, and small round pellets. A burrow system with a carpet of small rabbit pellets around it is diagnostic of pygmy rabbits.

- First, you need to find both burrows and pellets together.
- For burrows that appear characteristic of pygmy rabbits but have no pellets, search further in the area, and/or look at another time of year. If you find other burrows with pygmy rabbit pellets in the area, then you can conclude that other, similar burrows without pellets are also from pygmy rabbits. Old burrows may tell us something about changes in population extent or density (although we’re not sure how to interpret it yet!), and are also important to map.
- If you find small rabbit pellets but no burrows in the area, they are probably from mountain cottontails, especially near rocks. Burrows are an essential piece of evidence, because the pygmy rabbit seldom ventures far from them. (However, see the section on seasonal considerations.). There should be a number of burrow systems in an area, within a habitat patch.
- Is it the right habitat – big sagebrush and deep soils?
- Are the burrows placed underneath sage? Are they the right size and shape?
- What other animals are around? Be aware there may be cottontails and perhaps young jackrabbits producing small pellets similar in size to pygmy rabbit pellets, or ground squirrels, badgers, or other burrowers to sort out.
- Cottontails and ground squirrels may use burrows originally dug by pygmy rabbits, and further confuse the issue. However, of the rabbits, only pygmy rabbits actually dig burrows. We are interested in burrows dug originally by pygmy rabbits, even if they are now occupied by another animal.
- Finally, you can use other methods (discussed at the end of this paper) to confirm presence of pygmy rabbits.

**Sign in Snow**

During winter, pygmy rabbit tracks and pellets in the snow can be more obvious than other times of the year. Pygmy rabbit tracks can generally be distinguished from other rabbits by the size of the hind foot (Table 1). During winter, juvenile cottontails are nearly the same size as adults, which should minimize overlap in track size between the species.

**Table 1.** Rabbit track sizes, from information in Forrest 1988, Green and Flinders 1980, and Katzner 1994.

<table>
<thead>
<tr>
<th></th>
<th>Pygmy Rabbit</th>
<th>Cottontail</th>
<th>Jackrabbit</th>
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<tbody>
<tr>
<td><strong>Back foot length</strong></td>
<td>1.8-2.5 in</td>
<td>46-71 mm</td>
<td>3-3.5 in</td>
</tr>
<tr>
<td></td>
<td>mm</td>
<td></td>
<td>77-90 mm</td>
</tr>
<tr>
<td><strong>One track set (4 feet)</strong></td>
<td>6-8 in</td>
<td>6.5-11 in</td>
<td>3.5 -4 in</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>90-103 mm</td>
</tr>
<tr>
<td><strong>Between track sets</strong></td>
<td>6-16 in</td>
<td>8-22 in</td>
<td>10-30 in</td>
</tr>
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</table>

Both Rauscher and Katzner (pers. comm.) have observed that pygmy rabbits traveling in fresh snow will re-use the same tracks, leaping from spot to spot a few inches apart (launching-and-landing sites), and leaving a diagnostic pattern. This keeps the rabbits relatively clear of snow and means that they can move much more easily in new snow than if
they had to break trail every time they moved. As the rabbits use those sites for several days, the launching-and-landing sites get larger and larger and eventually become a continuous trail. Other rabbit species do not create this initial stage of re-used launching-and-landing sites. Over time, in older snow, pygmy rabbits create a complex maze of continuous trails between burrows (Ulmschneider, pers. obs.).

It can be quite effective and efficient to drive two-track roads in sagebrush areas a day or two after a light snow, looking for launching and landing sites, measuring rabbit tracks, and following weasel or other predator tracks to locate pygmy rabbits (Rauscher, Katzner pers. comm.). To find burrows, it can also be useful to look where snow on a sagebrush forms an umbrella with a cave underneath. Rabbits often use these areas and pellets and tracks will be found underneath. (Sequin, pers. comm.). In the snow, active burrows will be obvious with tracks leading into and out from the entrances.

Snow tracking is also an excellent way to obtain detailed habitat use data. In Utah, intensive snow tracking was conducted in 2003-2004 on a high elevation (7400 ft) site that had been thoroughly surveyed during the preceding spring and summer. Six to ten hours after a fresh snow, tracks of pygmy rabbits were followed by an observer with a GPS unit. Burrow clusters were considered the sample unit as it was too difficult to distinguish individuals. When overlaid on 1 m resolution imagery, GPS-mapped snow tracks illuminate social interactions between rabbits from different burrow clusters (gene flow), and maximum travel distances from burrows. Uninterrupted tracks extended for several kilometers, creating meta-burrow complexes. Most importantly, habitat parameters being measured are representative of the rabbits’ foraging and social behaviors, not just their burrow locations. It was generally agreed among participating researchers that radio telemetry could not have provided an equivalent level of resolution without disturbing the rabbit.

Organizing and Conducting Surveys

Targeting Habitat
Pygmy rabbits are not randomly distributed within the sagebrush landscape, they are patchily distributed, because they choose particular soils and sagebrush habitats, and they do not appear to be abundant in many situations. Additionally, we cannot yet accurately predict with models where they might occur. With a patchy distribution, random survey methods that might work well for a more evenly distributed animal would be ineffective and inefficient. It is necessary to first target habitat as best you can, that is, to sort out the most likely habitat. We describe below a several-stage approach to doing this, using aerial photos, soil and vegetation maps, Geographic Information Systems (GIS, if available), field knowledge, and driving and walking in the field as the final step to target where to look for pygmy rabbits.

Landscape Scale: The most basic components to use in a GIS model or other map are sagebrush types overlaid on soils (composition and depth). One kind of area to target for surveys is regions where big and low sagebrush are intermingled. Some models have added slope, aspect, fire history, and elevation, but these would be secondary parameters after first delineating sagebrush types and soils.
Fire history can be relevant but you need to know whether sagebrush has come back in or not. The timescale for this will vary enormously depending on whether its mountain sagebrush (maybe 15 years) or Wyoming sagebrush (maybe 100 years or never). So you must include this difference in a model. Aspect may be relevant if windblown soils are being deposited on the lee sides of hills, as in Gabler’s model for the Idaho National Engineering and Environmental Laboratory, and Himes’ model for east-central Nevada. Slope and elevation may be somewhat useful, after first delineating potential habitat using sagebrush types and soils.

For examples of GIS models from Idaho, see Rachlow and Svancara 2003, or Gabler et al 2000. John Himes (Texas Parks and Wildlife Dept.) has developed one for east-central Nevada, currently in review for publication. Be cautious with GIS models – we don’t have successful ones yet. The Idaho models need refinement. The data used for both models did not distinguish between low sagebrush and big sagebrush. This resulted in the models rating as habitat large homogenous expanses of low sage with very rocky shallow soils, where no pygmy rabbits are found. Areas where pygmy rabbits were subsequently found in southwest Idaho were not targeted, some prime areas with intermingled big and low sagebrush. The lessons from these efforts are that better habitat models are needed, as well as finer-scale, more accurate soil and sagebrush data. Additionally, there is no substitute for knowing what to look for from field experience, and going in the field and looking.

Mid-scale: Examine aerial photos, topographic maps, and use local knowledge to add or delete areas from your initial map. It is usually possible to distinguish dense sagebrush or to see mounds of taller, denser sagebrush as a dotted or mottled pattern on aerial photos. Local knowledge will help to eliminate burned areas that haven’t regrown to sagebrush – e.g. some large old fires in the very southwest corner of Idaho are still vegetated with grass, but are included in the 2003 GIS model because they burned more than 15 years ago (the parameter used in the model). In Oregon, biologists have had success with flying over sagebrush landscapes and identifying dense areas of sagebrush for future ground surveys. You could combine surveys for sage grouse or big game with surveys for pygmy rabbit habitat.

Rank the areas you identified at the large scale, and start surveys in the most likely areas. These would be the largest blocks on the sagebrush and soils map which weren’t eliminated by your refinements, areas surrounding past records, areas where aerial photos show mounds of sagebrush as a dotted pattern (see example photo at end), where big and low sagebrush are interspersed, and where there are swales of deep soils and tall dense sage.

Fine scale: You will probably have to make the final choice of where to walk a survey route while you are in the field, because the available data are not at a fine enough scale to do this from a distance. While you are driving to or in a chosen area, look for dense tall sage, especially with a “lumpy” or uneven texture, as well as for signs of digging. Sometimes, particularly where soils are light-colored or contain white, lime-covered rocks thrown out by digging, the mounds of freshly dug soil or white rocks are visible from the road. However, in darker soils this is not true, and you have to walk to see burrows. When a suitable area is spotted, stop and walk a survey route.
Your sampling scheme will be dictated by your particular circumstances, both by how the potential habitat is distributed and by your “person-power”. Your planned survey intensity for each area will vary with its priority, the size of the area you want to survey, and the people available to do it. Depending on travel time and whether you are finding burrows, (which will slow you down), you might expect to complete about 3 to 7 miles of walking transects in a day. Conduct the greatest amount of sampling in high priority areas, less sampling in lower priority areas. Portion your survey efforts among your highest priorities, with some sampling in lower priority habitat also, as a check on your ability to target habitat.

**In snow:** Areas where pygmy rabbits are concentrated will attract predators: coyote, badger, bobcat, and weasel. You can use their tracks to help guide you to pygmy rabbit areas, and even to burrows.

**Patch scale:** While you are walking a survey route you should target the tallest, densest patches of sage. These patches look like islands that stand out above the rest.

**Survey Routes**
The goal of a survey route is to check enough habitat in an efficient manner to determine whether pygmy rabbits are present or not, and secondarily to get an index of density of burrows. The goal is not to map out the total patch of habitat or to map every burrow within the habitat. Therefore you will not be trying to walk the perimeter of the population to map its extent, or to completely inventory the habitat, because this can be very time-consuming. Mapping a polygon requires a lot of walking to determine, first, whether rabbits are there, and their extent, and then walk the whole perimeter to map it with a GPS unit. It is simpler and faster to walk a meandering line through a habitat patch, targeting the most likely looking places (instead of the edge), and then continue on to the next swale or habitat patch, or loop back the other side of the valley. If you map your route and record results well, especially if you use a GPS unit, your survey route will be repeatable.

There are several advantages of recording burrow system locations with a GPS unit as you walk a survey route, as opposed to just tallying them. If you use the “repeat” feature (which fills out each new feature with the data from the previous one, so you only have to change a few things), it only takes a few seconds to record a burrow system as a point using a GPS unit, and will not appreciably increase your survey time. The advantages to having the data in this electronic form are many. You can directly download the points to a GIS map and see the pattern of distribution and density on the large scale. If you only record your survey route, and not the burrow points, you will not be able to easily see this pattern. Being able to see the points displayed on a GIS map is useful for refining your understanding of small-to-large scale distribution and habitat. Displaying the points on a background of orthophotoquads will help you with interpreting habitat from aerial photos, and will help you draw the extent of habitat patches on a topographic map or aerial photo.

Recording burrow system locations is a more complete record for those who come after you and want to repeat your work to determine changes over time – they will know exactly what you found where. For example, on a 2-mile long survey route, you may have found clusters of burrows in only a couple places. You can create a baseline for long-term monitoring at the
same time as doing an initial survey, because you have a repeatable survey line along with very site-specific results. By recording burrow points along your survey line you can determine the whether the distribution of burrow complexes changes over time, which will help us understand how to interpret old burrow complexes.

If you are alone, walk in a loop or triangle, targeting patches of taller, denser sage, looking for pygmy rabbit burrows and pellets. The goal of a looping or triangular route is to survey during all your walking time, and to avoid walking without actually surveying. You may walk through some unsuitable-looking sagebrush, but these data will be useful for helping distinguish where the rabbits do not occur, and will function as a check on your ability to target habitat. Using a topo map, you should be able to design a route that takes you up one swale and down another, or up and down two sides of a valley. In patchy habitat and where patches are small and follow the contours of the land, following the landforms and targeting the taller sagebrush clumps will be most effective. This means your survey line will be meandering, not straight.

If the habitat is uniform or on extensive flats, as in Nevada, straight transect lines arranged in a triangle, or a spiral pattern may be appropriate. For a spiral transect, walk directly to the center of a large, dense sagebrush patch, and then spiral your way out, gradually increasing the diameter of your circle until the habitat is no longer appropriate. To fully check out a potential site often takes about one hour of survey time (Eveline Sequin, pers. comm.).

Transect length should be dictated by the extent of the habitat patch, road distribution, and the amount of overall habitat you have identified to cover. Surveys in Idaho have shown that you will likely need to walk at least ½ mile to check an area for presence of pygmy rabbits with any degree of confidence, because of the distances between burrow systems, unless you find burrows immediately.

With two people working together, one-way linear transects may work, by “leapfrogging”: one person is dropped off to begin a survey route, the second drives ahead and starts another survey route; the first person ends up at the truck and drives ahead to pick up the second. If two people walk a survey route in tandem, the width each can cover will be determined by the habitat, but may be on the order of 100 ft., or 50 ft to each side. When two people are surveying together, each can simultaneously sample opposite sides of the road when the road bisects suitable habitat.

When you drive through unsuitable looking habitat within a generally potential habitat area, stop occasionally and walk a short survey route, as a check on your judgement of habitat, and record your transect walked. Note why the habitat looks unsuitable. Remember that ‘zeroes’ are as important to record as finding pygmy rabbit sign. These data will be used to refine habitat models, and will let us know where to and where not to focus management for pygmy rabbits.

Dogs and horses may be useful during surveys, if available. Dogs can let you know when a burrow is inhabited (though not what animal it is), and may flush rabbits. Horses can be used to survey more quickly than on foot.
**Area search**

When you find several current burrows and you are inventorying a new area, (or if you have not yet seen a pygmy rabbit in the area) take about a half hour to search the area looking for pygmy rabbits. This will help confirm whether you have pygmy rabbits, and will help you gain confidence in your ability to distinguish pygmy rabbit sign. So far you have had the search image for a burrow, and have been looking down. Now, switch, get the search image for movement and rabbits, and walk slowly, in widening circles around the active sites, looking ahead. Rabbits will often slip quietly into the burrow as you approach, and you have to be alert for the slight movement. Once you learn how to look for the actual animal, you will begin to see them more (Dave Hays, pers com.).

Pygmy rabbits are easy to distinguish from mountain cottontails. When running away, the white of a mountain cottontail tail is usually visible. Pygmy rabbits do not have any white on their tail. Also, pygmy rabbits seldom run as far as mountain cottontails. Pygmy rabbits will scamper a short distance and stop, often under sagebrush plant or near a burrow entrance.

**Seasonal Considerations**

Surveys in Washington, Idaho, Nevada, and Oregon have shown considerable variation in the amount of fresh sign at burrows over the course of a year. During late summer and early fall pellets can be scarce at burrows. Burrow complexes that had lots of sign in winter or spring may appear almost deserted in late summer, with few pellets present, and then appear repopulated later.

Pygmy rabbits may use burrows less in summer and fall. In the fall, in SW Idaho, Ulmschneider found many burrows in big sagebrush islands on a valley bottom, with a mix of old and a few brown pellets. Several hundred yards away, under very dense tall sagebrush and bitterbrush on a rocky side slope, lots of fresh small pellets and a pygmy rabbit were observed, although no burrows were found right there. Rachlow (pers. comm.) found a similar situation in the summer in Montana, where there were lots of small pellets but no burrows in very tall sagebrush, and lots of burrows with few pellets in a nearby area. Apparently pygmy rabbits may abandon their burrows at that time of year in favor of dense cover, perhaps due to parasites. Himes (pers. comm.) also observed pygmy rabbit pellets without burrows in dense sage in Nevada in late summer.

In Nevada, Sequin (pers. comm.) has observed pygmy rabbits using certain areas dominated by rabbitbrush only during the dryer part of the year, late spring through fall. These areas have “loamier” soils that are much wetter in winter. Burrows in these areas often disintegrate during the winter, and there is no evidence of rabbits remaining in the area, by tracks, photo monitoring, or sightings. New burrows are then excavated in this habitat in spring. However, during all seasons, rabbits were still found in the adjacent sagebrush-dominated areas.

Winter may be a better time of year to confirm rabbit presence than the summer and fall. After a fresh light snow, fresh tracks and fresh pellets are obvious. Also, rabbits clean out burrow entrances after a snow, which helps identify occupied burrows. Pygmy tracks can
often be followed to a burrow entrance. Winter logistics can become difficult, though, as snow deepens. Additionally, rabbits begin to burrow under the snow as it deepens, and you may not see much sign on the surface.

When initial surveys are conducted in the summer, and if you find possible or “old” pygmy rabbit sign, plan to return in late fall or winter and check again. For monitoring known populations, the time of the year should be consistent.

In the spring, rabbits appear to be active at their burrows; however, pellets can be more confusing because pregnant females make larger pellets that can be confused with cottontail.

**Recording data**

The basics to record are where and when you surveyed, whether you found burrows and pellets or not, and burrow locations and status. If you did find pygmy rabbit burrows, categorize, count them, and map them and your survey route.

Classify the status of each pygmy rabbit burrow system (not each entrance) according to the following system:

*Used burrow plus fresh pellets (B+FP):* brown pellets near a burrow, at least one entrance open, without cobwebs or debris that shows lack of use, usually shows a trail. In snow, tracks and/or pellets visible.

*Unused burrow plus fresh pellet (UB+FP):* burrow entrances have cobwebs, grass seeds, or other debris in entrance, but with brown pellets. May show transitory use.

*Burrow plus old pellets (B+OP):* only grey pellets at a burrow, entrances may show signs of non-use.

*Burrow, no pellets (B):* burrow entrance is not collapsed but no pellets found. Also use this category for burrows in snow where no tracks or pellets are visible.

*Collapsed burrow (Cal):* No pellets

*Pellets only (P):* No burrows found, but pellets appear right for pygmy rabbit. (Collect and label.)

*Fresh digging at a burrow but no pellets (B+dig):* Digging may have been by a predator such as coyote or badger. If it was a predator, it was most likely digging after prey, and the prey may have been pygmy rabbit.

*Possible PR burrow (Poss):* Burrow seems right for pygmy rabbit, but there are confusing pellets or no pellets, or it is not in association with other pygmy rabbit burrows (identified by pellets or sightings).

There are several options for recording data, depending on the equipment available: electronically with GPS units, paper data forms, topographic maps, and aerial photos. With GPS units, one might think that it would be easy to map a polygon delineating a pygmy rabbit population, instead of walking a transect and mapping burrows. However, in the field one soon finds that mapping polygons is difficult and complicated, unless they are very small, and generally requires much more wandering about than walking a transect through a habitat patch, as you try to determine the extent of an often complicated population, exactly where the burrows stop, and then try to walk the perimeter. Additionally, a transect with
burrow points added up along it will give you an index of burrow density that can be measured in future years (most GPS units are accurate within about 2 meters), which a polygon will not give you. If you try to do both, you will greatly lose efficiency! The simplest way to delineate the habitat is to draw the approximate extent of the habitat on a topographic map or aerial photo, after you finish your transect.

1. **GPS unit with a data dictionary (e.g., GeoExplorer 3):** *note your projection on a data sheet e.g., NAD 27.* (A “data dictionary” is an electronic data form that can be filled out directly into the GPS unit, and later downloaded directly to a computer. It can be created to match the paper data form given at the end of this paper.) With a Geo Explorer 3 or other GPS unit that has capability for a data dictionary:

   - Record your survey route (where you walked) using a line feature. You can interrupt the line where you record a pygmy rabbit point (i.e., a burrow system), and then resume it afterwards.
   - Record each pygmy rabbit burrow system (not individual openings) as a point feature, using a pygmy rabbit data dictionary that includes the essential information on the data form at the end of this paper. Use the “repeat” feature, and when you become skilled, it will only take about 30 seconds to record a burrow. Burrow systems may be about 15 ft across. In areas with dense burrows, it may be difficult to decide when to record a new burrow system. One rule of thumb is to record a new burrow system at least 30 ft apart (however they can be much denser than that; in Montana, Rauscher [1997] found an area with 8 burrow systems within 30 m).
   - Take daily field notes of where you surveyed for the day, habitat, numbers of burrows in each status category, extent of habitat, why you thought they were or weren’t from pygmy rabbits, general findings (no sign, old sign, lots of current sign, other critters), and other notes that would help someone else determine where you looked, what you found, and the validity of what you found. Remember that it is possible to lose GPS data, and that general notes are often extremely useful in interpreting the data! Remember zeroes are important to record and discuss!
   - Map your survey areas on a topographic map or aerial photo, with date, your name, and a key to any symbols used.
   - When finding pygmy rabbit sign in a new area, take samples of droppings and label each container with date, location, and your name (film canisters work well, or plastic zip bags).
   - Take photos of burrows, landscape setting, and any other sign (tracks, trails, bones, pellets). Label your photos with date, location (Township, Range, Section and ¼ sections), your name, and what it shows.
   - Also mark your driving routes on the maps, when you are within a search area and looking for target habitat to do foot surveys.

2. **GPS unit without a data dictionary:**

   - Record your survey route using a line feature and pygmy rabbit burrow systems using a point feature, as above.
   - Use the paper data form to record the necessary information.
   - Collect pellets and take photos as above.
• Mark your survey areas on a topographic map or aerial photos, with date, your name, and general findings.
• Also mark your driving routes on the maps.

3. No GPS unit (or GPS unit with a dead battery!)
• Use aerial photos and/or topographic maps to record locations of any burrow systems found and of your survey route. Label each map and photo with “Pygmy Rabbit Survey,” dates, your name, and a key to burrow classification and survey routes.
• Alternatively, if burrows are too dense or difficult to map separately, map out your survey route and the area where burrows are found.
• Keep a tally of burrow systems in each category as you walk a transect within the area delineated (see data sheet). Also mark your driving routes on the maps.

Other Methods

Traps
Trapping is not effective for general surveys. It may be useful once you know where you have the right burrows for further study or to confirm presence. Even in areas with known dense populations of pygmy rabbits, and putting traps right in the entrances of burrows that show fresh activity, trapping success rates are low (0-4%). Burrows are always there and usually distinctive, and therefore are more useful for general surveys.

Camera with automatic trigger (from Eveline Sequin)
Cameras can be used to determine if pygmy rabbits are currently active in an area. Photographs provide direct and convincing evidence that rabbits are present and provide a permanent record. Once burrows are located, or unconfirmed sightings are reported, cameras can be left at the site with minimal human attention to collect the required data. Cameras are able to visually detect pygmy rabbits at locations where other survey methods do not detect them, and may be especially helpful in the spring when the potential presence of other young rabbits may confuse pellet surveys.

Equipment for an “active” camera set-up consists of a camera connected to an infrared beam unit (sender and receiver) that triggers the camera when the beam is interrupted. These infrared units are sold as burglar alarms for modest prices at electronic stores such as Radio Shack®. “Passive” camera setups are triggered by a motion or heat sensor. Active infrared cameras have proven to be more cost effective than passive cameras because they can easily be set in vegetated areas without being triggered by the surrounding moving vegetation.

First a site inspection should be conducted by walking around the area looking for burrowing activity, animals and fresh pellets. Next, set up one active infrared-triggered camera in a central location (near burrows if they have been located). Cameras can be set either across the entrance of an active burrow, or across an open area nearby. The receiver should be set to trigger the camera if the infrared beam is blocked for 0.5 seconds (1 infrared pulse, or the minimum amount of pulses the unit will allow). To make the camera units even more sensitive, reduce the width of the infrared lens to 1 mm with black electrical tape. This combination of settings is responsive enough to capture full body images of rabbits even when they are surprised by the flash or noise. Set the transmitter about 2-4m from the
receiver and camera allowing plenty of area for rabbits to travel between the two units. The beam should be set at a height of approximately 5 cm. Set a camera delay of 1 or 2 minutes so that one animal will not use up the entire roll of film. Use 100 or 200 ASA film, and set the cameras to be active 24 hours a day. In locations where pygmy rabbits are known to be active, it was shown that cameras were usually able to record their presence over the course of one week. Depending on the site and the season, the roll of film will be used up in a few days or over the span of a week. In winter, snow may trigger the camera and use all film in an hour.

It is possible to distinguish pygmy rabbits from other rabbits (juvenile jackrabbits, cottontails) using this method. Adult pygmy rabbits can be distinguished reliably by their tails, heads, ear shape, and size in relation to camera equipment. Juvenile cottontails and jackrabbits can be distinguished by tails, head and ear shape, and coloration. Individual rabbits are generally photographed multiple times at one camera location. Therefore, even if not every photograph is entirely conclusive, the multiple angles of single individuals allow for conclusive evidence. If for some reason only one questionable photograph is received, the camera can always be set out for another week. Comparison photos of rabbit species by Eveline Sequin may be viewed at www.wildlife.utah.gov/habitat.

**Spotlighting**

It is possible to see pygmy rabbits by spotlighting at night; however, it is not as effective or efficient as looking for burrows. Burrows are permanent and easy to spot once you know what to look for, and you can look for them in the day. Spotlighting may be useful for confirming presence by seeing a rabbit once you find an area with burrows, however, the daytime area searches described above are probably more practical. Rauscher reports, “I attempted to spotlight pygmy rabbits in an area I knew to have a relatively high density of rabbits. I only saw 2 pygmy rabbits. This method is not very effective.”

**Peeper Probe**

This is a flexible cable with an infrared camera on the end, allowing you to look down a burrow. It may be useful, once you have found burrows, in spotting a rabbit or helping to identify what species dug a burrow in questionable cases. You may be able to figure out how to distinguish the underground features of pygmy rabbit burrows versus other burrows. Rauscher in Montana has used these probes in known occupied sites, and was able to see pygmy rabbits; however, he thinks that it is probably not too useful or effective for general surveys. The peeper probe may be useful for some aspects of demographic studies, such as looking into natal dens (J. Rachlow, pers. comm.) Females apparently dig single, simple burrows for giving birth, and fill the entrance with dirt, so these burrows may be hard to find.

**Inquire of Locals; Check Hunting Records**

Ask hunters or ranchers who have bagged or claim to have seen pygmy rabbits. On all state-owned Wildlife Management Areas that permit hunting, hunters are required to fill out and submit a card afterwards that indicates their kill to the respective state wildlife agency, which would be an additional way of determining potential sites to survey for pygmy rabbits

**Track Plots**
To determine presence of pygmy rabbits near a burrow, lay aluminum tracking sheets on the ground or make cleared track plots, and cover them with a thin layer of fine dust to record tracks.
Literature Cited


## Appendix A. Persons Knowledgeable about Pygmy Rabbits

**California**
Pat Lauridson, CA Dept. Fish and Game, Sacramento CA  
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**Nevada**
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John Himes, TX Parks and Wildlife Dept., Tennessee Colony TX  
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**Utah**
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**Washington**
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**Wyoming**
Doug Keinath, Nat. Diversity Database, Laramie WY  
dkeinath@uwyo.edu
Todd Katzner, Imperial College, London, England  
t.katzner@imperial.ac.uk
## PYGMY RABBIT SURVEY FORM

**Observer(s):**

**Address:**

**Affiliation:**

**Phone:**

**Observation Date:**

**Site Name:**

**Co.:**

**State:**

**Site #:**

**Township:**

**Range:**

**Meridian:**

**Section:**

**Quarter/Quarter:**

**of Quarter:**

**Project / Transect ID #:**

**Field Map ID:**

**Survey Method:**

**Search Time:**

**Start:**

**Stop:**

### GPS Data

**Projection:**
- Decimal Degrees
- Decimal Minutes
- Degrees/Minutes/Seconds
- UTM Zone:
  - 10
  - 11

**Datum:**
- NAD27
- NAD83
- WGS84

**Coordinates:**

**Starting point**

**Easting**

**Northing**

**Accuracy:**
- PDOP
- FOM
- +/-

**Elevation**

**Feet**

**Meters**

**Land Ownership:**
- State
- BLM
- USFS
- USFWS
- Private* (state below)
- Tribal
- Military
- Nat. Park
- Other:

*Private landowner / Address / Phone:

### Potential Threats to Area:

- Agriculture
- Fire
- Development
- Grazing
- OHV
- None
- Other:

### Summary of Results for Survey Route

<table>
<thead>
<tr>
<th>Pygmy rabbit observed?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Pygmy Rabbit sign observed?</td>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
<td>Possible burrows</td>
<td>Possible Pel</td>
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<table>
<thead>
<tr>
<th>Summary of numbers of burrows</th>
<th>B+FP</th>
<th>B+OP</th>
<th>B:</th>
<th>UB+FP</th>
<th>Col:</th>
<th>B+dig:</th>
<th>FP alone:</th>
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</thead>
<tbody>
<tr>
<td>Coyote</td>
<td>T</td>
<td>S</td>
<td>V</td>
<td>Fox</td>
<td>T</td>
<td>S</td>
<td>V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Predators (T-tracks, S-scat, V-visual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coyote</td>
</tr>
</tbody>
</table>

**Notes.** Provide directions, describe landscape setting, note other animals, explain why if no pygmy rabbits were found, describe behavior of any pygmy rabbits seen, etc.
## CODES FOR DATA

<table>
<thead>
<tr>
<th>Burrow Status</th>
<th>B+FP – used burrow plus brown, green, or black pellets</th>
<th>B+OP – burrow plus grey pellets</th>
<th>B – open burrow, no pellets</th>
<th>UB +FP Unused burrow, fresh pellets</th>
<th>Col – collapsed burrow</th>
<th>B+dig – burrow, fresh digging, no pellets</th>
<th>FP – fresh pellets alone</th>
<th>Poss Possible PR burrow</th>
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<tr>
<td>Burrow Details</td>
<td>T – Clean trail</td>
<td>O – Open</td>
<td>Col – Collapsed</td>
<td>Deb – Debris filled</td>
<td>Dig – Fresh digging</td>
<td>E – Enlarged by predator</td>
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<td></td>
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<tr>
<td>T8 – tracks in snow</td>
<td>US – Untracked snow</td>
<td>B – At base of bush</td>
<td>R – At base of rock</td>
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<td></td>
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<tr>
<td>Pellet Quantity</td>
<td>H – high, lots, a carpet</td>
<td>M – moderate</td>
<td>F – few</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CanopyCover (20 ft radius)</td>
<td>S – shrubs</td>
<td>F – Forbs</td>
<td>G – grass</td>
<td>B – bare ground</td>
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<tr>
<td>0 – (0 – Trace)</td>
<td>1 – (1-10%)</td>
<td>2 – (11-25%)</td>
<td>3 – (26-50%)</td>
<td>4 – (51-75%)</td>
<td>5 – (76-100%)</td>
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<tr>
<td>Grazing use level</td>
<td>0 – None</td>
<td>1 – slight</td>
<td>2 – light</td>
<td>3 – moderate</td>
<td>4 – heavy</td>
<td>5 – severe</td>
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*Use descriptions from BLM's Landscape Appearance Method*

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<th>Burrow #</th>
<th>UTM Easting</th>
<th>UTM Northing</th>
<th>Status</th>
<th>Burrow Details</th>
<th>Pellets</th>
<th>Soil</th>
<th>Canopy Cover</th>
<th>Grass Use</th>
<th>Pygmyrab</th>
<th># of entrances</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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23
BLM's Landscape Appearance Method for classifying Grazing Use Level:

1. **None** (0-5%). The rangeland shows no evidence of grazing use; or the rangeland has the appearance of negligible grazing.

2. **Slight** (6-20%). The rangeland has the appearance of very light grazing. The key herbaceous forage plants may be topped or slightly used. Current seedstalks and young plants of key herbaceous species are little disturbed.

3. **Light** (21-40%). The rangeland may be topped, skimmed, or grazed in patches. The low value herbaceous plants are ungrazed and 60 to 80% of the number of current seedstalks of key herbaceous plants remain intact. Most ground plants are undamaged.

4. **Moderate** (41-60%). The rangeland appears entirely covered as uniformly as natural features and facilities will allow. Fifteen to 20% of the number of current seedstalks of key herbaceous species remains intact. No more than 10% of the number of low value herbaceous forage plants are utilized. (Moderate use does not imply proper use.)

5. **Heavy** (61-80%). The rangeland has the appearance of complete search. Key herbaceous species are almost completely utilized with less than 10% of the current seedstalks remaining. Shoots of rhizomatous grasses are missing. More than 10% of the number of low value herbaceous forage plants have been utilized.

6. **Severe** (81-100%). The rangeland has a mown appearance and there are indications of repeated coverage. There is no evidence of reproduction or current seedstalks of key herbaceous species. Key herbaceous forage species are completely utilized. The remaining stubble of preferred grasses is grazed to the soil surface.
Pygmy Rabbit Summary Sheet

Burrows

- 5-10 inches in diameter
- Placed under sagebrush
- In relatively tall dense sage

Pellets

<table>
<thead>
<tr>
<th>Pygmy Rabbit</th>
<th>Cottontail</th>
<th>Jackrabbit</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6 mm – in carpets near burrow is diagnostic</td>
<td>6-10 mm</td>
<td>9-12 mm</td>
</tr>
</tbody>
</table>

Tracks – length of hind foot

<table>
<thead>
<tr>
<th>Pygmy Rabbit</th>
<th>Cottontail</th>
<th>Jackrabbit</th>
</tr>
</thead>
<tbody>
<tr>
<td>46-71 mm</td>
<td>77-90 mm</td>
<td>90-103 mm</td>
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</tbody>
</table>

Visual

<table>
<thead>
<tr>
<th>Pygmy Rabbit</th>
<th>Cottontail</th>
<th>Jackrabbit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown tail</td>
<td>White tail, obvious from rear</td>
<td>Black-tipped tail (blacktail) or whitish tail (whitetail)</td>
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<tr>
<td>Ears 2 1/4 – 2 1/2 in, about length of head</td>
<td>Ears 2 1/5 – 2 3/5 in, about length of head</td>
<td>Ears 5-7 in, way longer than head, and black tipped</td>
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<tr>
<td>Won’t run far, zigzags, often stops at sagebrush or burrow</td>
<td>Bolts fast and far</td>
<td>Bolts fast and far</td>
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