SURVEY OF PYGMY RABBIT DISTRIBUTION, NUMBERS AND HABITAT USE IN LEMHI AND CUSTER COUNTIES, IDAHO

by
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Abstract. From April to September 1997 and July to August 1998, I conducted a survey for the Bureau of Land Management on the Salmon and Challis Field Office Areas, Idaho, to determine the current distribution, habitat associations and relative densities of pygmy rabbits *(Brachylagus idahoensis)*. The survey area was on mostly public lands in three separate block fault valleys -- Lemhi River/Birch Creek, Pahsimeroi River/Little Lost River and Warm Springs Creek/Big Lost River, totaling approximately 583,600 acres. The survey consisted of reconnaissance from a vehicle and on foot to determine outer limits of the rabbit's occupied range and measurement of density of burrows on belt transects whenever a substantial amount of sign was found. The pygmy rabbit occupies a continuous band of sagebrush habitat from Kaufman Guard Station (on Birch Creek) northwestwards to Hayden Creek (tributary of the Lemhi River) at elevations from 5,600 to 7,300 feet; a continuous band of sagebrush habitat from Summit Creek (tributary of the Little Lost River) northwestwards to the village of May (on the Pahsimeroi River) at elevations from 5,400 to 7,700 feet; and a continuous band of sagebrush habitat from Mackay (on the Big Lost River) northwestwards to Grand View Canyon (on Warm Springs Creek) at elevations from 5,800 to 7,300 feet, except where interrupted by cultivated lands, recent range fires, sagebrush eradication and areas of unproductive soil. Its most preferred habitat was scattered low earth mounds ("Mima mounds") in *Artemisia tridentata* ssp. *Wyomingensis* habitats at elevations between 6,200 and 6,500 feet elevation where sagebrush heights were 24 to 48 inches and crown cover was 40 to 50 percent on the mounds, surrounded by expanses of 12 to 24 inch tall sagebrush and crown cover of 20 to 30 percent between the mounds. Rabbits were also found in adjacent areas but at much lower numbers.

Introduction

The pygmy rabbit *(Brachylagus idahoensis)* is currently a Species of Special Concern (Category C - Undetermined Status Species) on the Idaho State sensitive species list (Conservation Data Center 1994), which means the species may be rare in the state but for which there is little information on their populations, distribution and/or habitat requirements. It is also listed as a Sensitive Species by the Bureau of Land Management (BLM). It is a game species in the State of Idaho with a daily bag limit of 8 during a hunting season that extends from September 1 to February 28.

Merriam (1891) first reported the species in both the Lemhi River and Birch Creek valleys of east-central Idaho. In recent years, studies of the rabbit have been done on the Idaho National Engineering and Environmental Laboratory site (Wilde 1978, Gabler 1997) and the U.S. Sheep Experiment Station (Green and Flinders 1980a. 1980b). A small population is also known to exist on the Snake River Birds of Prey Area of southwest Idaho (John Doremus, pers. comm.) but little is known about the rabbit elsewhere in the state. BLM personnel have reported infrequent observations of pygmy rabbits in the Lemhi River, Birch Creek and Pahsimeroi River valleys. There were no reports from other locations in Lemhi or Custer Counties.

Rauscher (1997) reports that pygmy rabbits are found in Beaverhead, Deerlodge and Madison counties in neighboring southwestern Montana. He states that the rabbit inhabits the majority of suitable habitat in Beaverhead County and that the Horse Prairie region (immediately adjacent to this study area) may be the stronghold for the species in Montana.

Of all the sensitive species of both plants and animals found on the Salmon and Challis Field Office management areas, the pygmy rabbit may be the one with the least available information. To date, there has been no detailed information collected on distribution, numbers or habitat requirements. Major threats to the pygmy rabbit are suspected to be habitat alterations due to cultivation, overgrazing, flooding of burrows, range fires (both prescribed and natural), sagebrush eradication and fragmentation of sagebrush communities. Disease and predation could be taking a toll and hunting may also be a factor. All of these pose a potential threat to pygmy rabbit populations. None of these mortality agents have been evaluated and their cumulative effect on the rabbit is unknown.

All of the pygmy rabbit habitat in the study area is on existing cattle allotments and some managers have thought that cattle grazing might have an effect on this species. There have also been prescribed rangeland fires proposed for several areas in the upper Lemhi Valley to reduce shrub cover and increase grass, which could also directly affect the rabbit.

A better understanding of the habitat distribution and numbers of pygmy rabbits in the local areas as well as in the broader region is needed. The BLM would then be in a better position to evaluate the effects of future management activities such as grazing and prescribed fire on the

rabbit and to examine the effects of past activities. An understanding of this species on the periphery of its range is also integral to understanding the status of the species as a whole. This study was initiated to determine some of this basic information.

The purpose of the study was to map current distribution, describe habitat associations and estimate relative densities and population numbers of the pygmy rabbit in the upper Lemhi River/Birch Creek, Pahsimeroi River/Little Lost River and Warm Springs Creek/Big Lost River valleys of east-central Idaho.

Habitat and Behavioral Characteristics

Pygmy rabbits are the smallest members of the family Leporidae in North America. The adult rabbit is less than a foot long and weighs from 8 1/2 ounces to a pound. They resemble a small cottontail but they lack a white tail. It is the only North American rabbit that digs its own burrows and uses an extensive burrow system.

This rabbit is distributed in the Great Basin of the intermountain west, including Washington, Oregon, California, Nevada, Utah, Montana, Wyoming and Idaho; the BLM Salmon and Challis Field Office management areas are at the northeast corner of the rabbit's reported geographical range (Burt and Grossenheider 1980, Zereloff 1988, Washington Department of Wildlife 1993). They are reported to be limited to sagebrush habitats at elevations ranging from 4,500 to 7,000 feet where there are soils of alluvial origin. Its specific habitat niche is mainly plains and alluvial fans dominated by big sagebrush *(Artemisia tridentata)* where they are found in taller, denser patches of sagebrush. Pygmy rabbits depend on sagebrush for both cover and food. Wilde (1978) reported that sagebrush was the mainstay of the rabbit's diet during the winter and comprised about 35 percent of the diet during the spring and summer on the Idaho National Engineering and Environmental Laboratory site.

Wilde (1978) also found that rabbits are not uniformly distributed over large areas but tend to be restricted or clumped. Clumping appeared to be due to the burrow and sagebrush requirements of the animal. They will live only where the soil is deep enough and of a certain quality for burrowing, and where sagebrush provides adequate shelter and food. He also reported that slope and valley floor sites are preferred over plateaus and flats for burrowing; burrows tended to be located on the lee side of hills and lava flows. Mean height of burrow entrances was 5 inches (range 2 1/4 to 11 inches), and burrow complexes had 1 to 7 entrances with 2 being the most common. Figure 1 shows a typical burrow found on the study area.

Weiss and Verts (1984) stated that pygmy rabbits in Oregon inhabited areas where soils were deeper and looser than at adjacent sites. Soil depth and soil strength, more than soil texture, were physical properties of soil that distinguished sites occupied by pygmy rabbits from adjacent sites and probably were related to excavation of burrows.

Tullis (1995) observed that areas dominated by sagebrush on her study area on the Snake River plains of Idaho had more and taller sagebrush on low earth mounds. Mounds were generally round or oblong with diameters ranging from 8 to 14 meters. Their highest points were usually less than 1/2 meters above the adjacent inter-mound area. Mounds were found on sedimentary deposits such as river terraces, alluvial fans and loess deposits. This micro topography phenomenon is referred to as Mima mounds, named after the Mima Prairie south of Olympia, Washington (Cox 1984). Tullis noted that essentially all mounds in her study area had been occupied by burrowing animals, with no mention of what species were active.

Study Area

The study area (Map 1 and Map 2) is located on large sagebrush plains and alluvial fans of three major northwest - southeast oriented block fault valleys; (1) the upper Lemhi River and upper Birch Creek valleys (448 square miles) head near Gilmore Summit (elevation 7,186 feet) and flow in opposite directions, (2) the upper Pahsimeroi River and upper Little Lost River valleys (245 square miles) head at two unnamed passes (elevation 6,617 and 7,700 feet) and flow in opposite directions, and (3) the upper Warm Springs Creek and upper Big Lost River valleys (220 square miles) head near Willow Creek Summit (elevation 7,161 feet) and flow in opposite directions. The Lemhi River, Pahsimeroi River and Warm Springs Creek flow into the Salmon River drainage and Birch Creek, Little Lost River and Big Lost Rivers flow into the Snake River drainage. The study area ranges in elevation from 5,400 to 7,700 feet and is vegetated with several varieties of big sagebrush -- mainly mountain big sagebrush *(Artemisia tridentata* ssp. *vaseyana)*, Wyoming big sagebrush *(Artemisia tridentata* ssp. *Wyomingensis)* and threetip sagebrush *(Artemisia tripartita),* plus several species of the shorter forms. Green rabbit brush *(Chrysothamnus viscidiflorus)* is another conspicuous shrub species.

Very recognizable sagebrush-covered Mima mounds are dotted in a regular pattern over large portions of the study area (Figure 2). Local BLM personnel and residents observed that pygmy rabbits are closely associated with the mounded sagebrush landscape that dominates a considerable portion of both the upper Lemhi River and Birch Creek drainages and to a lesser extent, other drainages in the study area (Figure 3).

Most of the sagebrush habitat is administered by the BLM Salmon and Challis Field Offices. Idaho state-owned lands are intermixed. The higher slopes are administered by the Salmon, Challis and Targhee National Forests. The lowest elevations are in private ownership where major amounts of sagebrush habitats have been removed and agriculture is currently the predominant land use. Most of the study area is accessible by road.

Methods

Based on the hypothesis that pygmy rabbits on the study area are closely associated with the Mima-type mounds, study efforts were largely confined to the mounded habitats that were stratified out as priority areas to be surveyed. The mounded habitats appear on aerial photos as a dotted pattern and on the ground as raised mounds (usually less than one foot high and approximately 300 to 400 square feet in area). The first cut in the stratification process was aerial photo interpretation, looking for different densities, sizes and patterns of mound distribution. The area was also stratified geographically, trying to sample across the entire study area. On the ground, these broad areas were easily located by the naked eye at close range or by use of binoculars for distant areas. This was followed by a general field reconnaissance by driving slowly along roads that intersected potential sites, searching for any form of soil disturbance that might indicate rabbit activity. Where there were obvious signs of soil disturbance from digging animals, a foot reconnaissance of 200 yards to occasionally several miles was made to determine whether there were rabbits in the area. Wherever currently or recently used isolated mounds or groups of mounds (determined by presence of pellets) were detected, they were mapped on 7.5 minute U.S. Forest Service (USFS) orthophotos or U.S. Geological Survey (USGS) quadrangle topographic maps.

If a substantial amount of sign was found on the foot reconnaissance, the density of rabbit burrows was sampled on a belt transect. Belt transects were 3 chains (198 feet) wide which equates to 24 acres sampled per mile of transect. Transects originated close to an existing road and were in the shape of an equilateral triangle, with sides of 20 chains (1/4 mile) or 40 chains (1/2 mile), depending on the relative size of the block of habitat to be sampled. Transects were run on a line 30 degrees off the general direction of the road. At the end of a transect leg (either 20 or 40 chains), the transect turned at a 120 degree angle for the same distance, then turned again 120 degrees back to the beginning point. At the end of each transect leg, there was an offset of 3 chains before the turn was made to insure there was no overlap in coverage. Data was recorded for transects and also 10 chain long plots, which sampled 3 acre blocks. The triangle shaped transect was used because it allowed efficient use of walking time; there was no "dead heading" back to the truck.

Data collected on each transect and plot included: elevation, slope, aspect, topography, habitat type, sagebrush density both on and off the mounds, sagebrush height both on and off the mounds, and the type and age of rabbit sign found in the immediate vicinity of burrow systems. Age of the sign was categorized as (1) current -- fresh pellets and/or tracks found, (2) recent -- old weathered pellets found, (3) old -- open burrows but no pellets found, and (4) very old -- collapsed burrow entrances. Sagebrush cover were ocular estimates, by visualizing a 10 foot by 10 foot plot on selected mounds and areas closely adjacent to the mound. Sagebrush heights were actual measurements of shortest and tallest plants, excluding seedlings, both on the mounds and closely adjacent to the mounds. Transect locations were recorded on 7.5 minute USFS orthophotos or USGS quadrangle topographic maps and/or aerial photos.

Results

The field survey was conducted on the southern portion of the BLM Salmon Field Office management area between April 2 and September 5, 1997; and on the southern portion of the Challis Field Office management area between July 21 and August 25, 1998. In 1997, I drove approximately 280 miles of roads through potential pygmy rabbit habitat looking for signs of rabbit activity, and walked an additional 50 to 60 miles of reconnaissance wherever rabbit activity, such as fresh digging, was found. In 1998, I drove approximately 385 miles of roads and walked an additional 40 to 50 miles of reconnaissance. During the process, actual rabbit sightings and indications of current and recent use were mapped, which was the basis for establishing the outer limits of current rabbit distribution in the study area. The field maps are on file in the BLM Salmon Field Office, Salmon, Idaho.

Whenever a concentration of sign was found, transects were established to determine burrow density and rabbit use. Sites were selected when it appeared that transects would intersect enough mounds so as to provide measurable data. Early in the survey, several transects were done without prior reconnaissance and produced no positive information. A total of 18 transects, comprised of 159 three acre plots, sampled 477 acres of pygmy rabbit habitat on the BLM Salmon Field Office management area in 1997. No transects were sampled on the BLM Challis Field Office area in 1998 because no concentrations of use were found. These data are the basis for describing three basic habitat classifications and rabbit use on these habitats, as well as for providing a baseline for future comparison.

Current Distribution

Pygmy rabbits were found widely scattered in the Lemhi River/Birch Creek valley in a continuous band (except where interrupted by cultivation, a recent burn or an area of shallow soils) from Kaufman Guard Station (on Birch Creek) northwestwards to Hayden Creek (tributary of the Lemhi River), wherever there was sagebrush cover at elevations ranging from 5,600 feet to 7,300 feet. I determined this limit by traveling from south to north across the study area, searching as I went until no currently or recently used burrows were found. The actual northeastern distributional boundary of the rabbit was determined to be about one mile south of Hayden Creek where there is an abrupt ecotone between sagebrush habitat and irrigated fields. A few hours of effort were also spent driving and walking north of Hayden Creek (Rye Grass and Basin Creeks) with no success.

A band of agricultural lands along Hayden Creek effectively creates a barrier of unsuitable habitat that separates what appears to be suitable habitat north of Hayden Creek from the main continuous block of occupied habitat south of the drainage. A few scattered old burrow systems were found north of Hayden Creek that suggests the area had previously been occupied. Therefore, the area within five mile distance from Hayden Creek in a northerly direction is considered to be hypothetical range where rabbits may possibly be found with a more intensive survey. An area for further study is the dividing ridge between Basin Creek and Bear Valley Creek that appears to have most of the characteristics of the habitat south of Hayden Creek.

In the Pahsimeroi River/Lost River valley, I found a similar band of widely scattered (one mound per 2 to 3 miles traveled) rabbit activity extending from near Summit Creek and Dry Creek (tributaries of the Little Lost River) northwestwards across two unnamed passes adjacent to the Donkey Hills to Tater Creek (tributary of the Pahsimeroi River) near the town of May, Idaho. This also was determined by traveling northwestwards, searching until I found no more currently or recently used mounds. Unlike the Lemhi River Valley, mounds in the Pahsimeroi River Valley were few and far between at the northern end and required considerably more searching. There is no well defined line at the point where occupied habitat ends. Elevations where mounds were found ranged from 5,400 feet at Tater Creek to 7,700 feet near the Donkey Hills (the highest elevation where rabbits were found in the entire study area).

In the Warm Springs Creek/Big Lost River valley, the situation was again very similar. There is a band of widely scattered rabbit activity from near Mackay on the Big Lost River, extending northwestwards across Willow Creek Summit and terminating at Antelope Flat on Warm Springs Creek in the Salmon River watershed. Activity near this northern point was very sparse and active mounds were very difficult to find.[1]

In addition, a tract of currently occupied habitat was found in the head of Railroad Canyon (shown on Map 1 as Canyon Creek along State Route 29), adjacent to Bannock Pass. This appears to be contiguous with habitat found in Horse Prairie Creek, Montana (Rauscher, 1977), just north of Bannock Pass. A small isolated tract of occupied rabbit habitat was also found in Hawley Creek (tributary of the Lemhi River) and in Bradshaw Basin (tributary of the East Fork of the Salmon River). What appeared to be suitable habitat was seen from a distance in Sawmill Canyon on the Little Lost River and along Trail Creek (Big Lost River drainage), both on the Challis National Forest.

The general distribution pattern of the pygmy rabbit on the BLM Salmon and Challis Field Office areas appears as an amoeba-like polygon that originates on the Snake River Plain. The rabbits apparently migrated up the Birch Creek, Big Lost and Little Lost River valleys to the Salmon River/Snake River divide, thence down their counterpart drainages, the Lemhi River, Warm Springs Creek and Pahsimeroi Rivers until they ran out of suitable habitat.

With one exception, no rabbit mounds were found on slopes exceeding 25 percent, as determined by binocular observations. Therefore, the eastern and western limits of these bands of habitat were determined to be the conspicuous topography break where the slope increases to over 25

[1]On December 28, 2000, a small area of occupied habitat (approximately 40 acres) was located by BLM personnel 8 miles north of Challis, Idaho, on the west side of the Salmon River. This location is approximately 18 miles west of occupied habitat in the Pahsimeroi Valley, and 18 miles north of occupied habitat in the Warm Springs Creek watershed.

percent on the lower slopes of the Lemhi, Beaverhead and Lost River Ranges. Most rabbit activity was confined to a band close to (usually within one mile) this slope break on lower mountain slopes and alluvial fans. Very little activity was found on flats in the center of the valley floors.

Habitat Description

Field observations and collected data suggests that at least three different classes of readily recognizable habitat occur on the study area. **High Value** habitat (most preferred) was identified as two small tracts that together contain approximately 2,600 acres (600 of which is private land), all within seven miles of Leadore, Idaho. These areas are located at the mouth of Rocky Canyon and along Texas Creek (between Warm Springs and Cold Springs).

The Rocky Canyon site is located on an alluvial fan and the Cold Springs site is located on a lower mountain slope, both at elevations between 6,200 and 6,500 feet. Each contains numerous very conspicuous oblong-shaped Mima mounds that range in area from 150 to 850 square feet (average = 365) and one foot or less in height. The most noticeable feature of this habitat is the difference in sagebrush height and crown cover from plants growing on the mounds and those growing between the mounds. On the mounds, sagebrush heights ranged from 24 to 48 inches and crown cover ranged from 40 percent to 50 percent. Between the mounds, sagebrush heights ranged from 12 to 24 inches and crown cover ranged from 20 percent to 30 percent. The major shrub species on these locations is Wyoming big sagebrush. A large percentage of the mounds were currently or recently used by rabbits on both sites.

Medium Value (less preferred) comprised the largest block of habitat within the study area, containing a mixture of approximately 366,200 acres of mountain big sagebrush *(Artemisia tridentata* ssp. *vaseyana)* that occurs at the upper elevations and Wyoming big sagebrush *(Artemisia tridentata* ssp. *wyomingensis)* that occurs at lower elevations, often intermixed with threetip sagebrush *(Artemisia tripartita)* and other lower growing sagebrush forms. Over this relatively homogenous block, sagebrush heights range from 18 inches to 36 inches and crown cover ranged from 20 percent to occasionally over 60 percent. Slopes vary from 5 percent to 25 percent, but one group of burrows was found on a 45 percent slope. Mima mounds were not always present. Where they did exist, use of the mounds by rabbits was very light and was usually in a clumped pattern. Lowest elevation where current activity was found was 5600 feet in Hayden Creek; highest was 7,700 feet on the Pahsimeroi River/Little Lost River divide.

At two sites (Transects 14 and 16) in the Moderate Value habitat class, much higher than average numbers of rabbits per square mile were found than in the majority of the block. No visually detectable difference in habitat was noted except for closer spacing of the clumps. These sites are located adjacent to the mouths of Railroad Canyon and Hawley Creek canyon.

Low Value (least preferred or avoided habitat) was identified as areas that have been disturbed by cultivation, recent (< 50 years) range fires and sagebrush eradication. Most of the private land (122,300 acres) in the valley bottoms is currently cultivated and permanently eliminated as pygmy rabbit habitat. A large range fire consumed approximately 2,500 acres of sagebrush cover on the west side of the Birch Creek valley in 1966 that has temporarily eliminated this area as suitable habitat. These lands contain numerous Mima mounds but they are currently dominated by green rabbit brush and short sagebrush of sparse cover. Approximately 31,000 acres sagebrush were eradicated by spraying with the herbicide 2,4 - D or by mechanical means from 1962 to 1987 for increased livestock forage production. A few currently used mounds were found on the sprayed sites, indicating rabbits may be reoccupying these areas.

Non Habitat are areas that are totally unusable because of shallow soil depths and hard pan conditions or droughty soils that are incapable of supporting growth of the taller sagebrush species. BLM soil surveys show approximately 29,000 acres in the Birch Creek valley where soil depths are less than 20 inches with an underlying hard pan that appears to preclude pygmy rabbit use in this area. Soil surveys in the upper Pahsimeroi River valley also show a block of about 12,000 acres of low sagebrush that is incapable of providing cover. No pygmy rabbits were found in either of these situations. Table 1 summarizes the characteristics of the three habitat classes found on the study area. Table 2 summarizes the number of acres in each of the four habitat value classes by watershed.

Estimated Numbers

Rabbit densities from 159 plots on 18 transects on the BLM Salmon Field Office management area are summarized in Table 3, where they have been converted to the number of mounds per square mile in each age class. It shows the number of occupied mounds by four age classes of sign (fresh, recent, old and very old) found on 477 acres of habitat that were sampled. The number of currently occupied mounds varied from 18 to 1,031 per square mile, averaging 202 mounds per square mile in the occupied sample acres. Four transects showed no current or recent activity but there was old and very old sign. This may indicate a reduction in populations in the last decade or so.

Except for Transect 8 (Mill Creek) where no sign was found, all transects were selectively located in areas where a relatively high amount of sign had been seen on reconnaissance. Therefore, the transects represent those areas with relatively high rabbit populations. The average number of occupied mounds per square mile across all the acres mapped would be considerably less than 202. All current and recent use that was found occurred in widely scattered clumps of mounds (usually < 6) or single mounds.

The two areas of High Value habitat had over three times the density of rabbits found on any other transect. These two areas had a marked visually detectable difference in habitat from the other transects - taller, denser sagebrush. Within the Moderate Value habitat class, rabbit

densities ranged from 18 to 249 occupied mounds per square mile. Differences in habitat that may have caused this variation in numbers for the Moderate Value class were not visually apparent. Qualitative assessment of range condition, based on grass presence and vigor, did not appear to correlate with rabbit numbers.

Other Uses of Mounds

During the course of the study, it became quite clear that animals other than pygmy rabbits were also using the mounded sites. Nesting songbirds, particularly sparrows, made a greater amount of use of the taller sagebrush plants on the mounds, apparently for increased visibility over the generally shorter surrounding plants.

In the 1966 burn adjacent to Gilmore Summit, sagebrush has still not regenerated and the mounds are now dominated by green rabbit brush. This shrub apparently does not provide adequate cover or forage for rabbits and the habitat is unoccupied. It appears that Richardson ground squirrels *(Citellus richardsoni)* found a favorable niche and have taken over some of the burrow systems that were most likely created by the pygmy rabbits.

On several sites, mountain cottontail *(Sylvilagus nuttalli)* sign was found closely adjacent to pygmy rabbit burrows suggesting that cottontails might also be using the mounds. At one site, an unidentified mouse was seen disappearing into a pygmy rabbit burrow.

On approximately 10 percent to 20 percent of the mounds, ant hills were present. In several cases, rabbit pellets were found among the heaps of stored vegetative matter. This would indicate the pellets are being used as a food source for ants and may be a reason why pellets are occasionally not found around burrows that otherwise appear to be active.

On one occasion, a very young pronghorn *(Antilocapra americana)* fawn was found bedded at the edge of a Mima mound. In this situation, the fawn was well hidden in the taller shrubs but its location was still visible to its mother who was watching over the short surrounding vegetation.

Conclusions

Results of the study indicate that pygmy rabbits occur in widespread but thinly scattered clumps, occupying most of the undisturbed sagebrush habitat on the southern portions of the BLM Salmon and Challis Field Office Areas. Two pockets of high abundance were found near Leadore, Idaho at elevations between 6,200 and 6,500 feet, where rabbit numbers were significantly higher than the surrounding areas. The overall appearance of these areas was one of denser and taller sagebrush on the mounded islands, surrounded by an expanse of shorter sagebrush. These key areas should definitely be protected to maintain the species on the BLM Salmon Field Office management area.

Pygmy rabbits were also found in the more homogenous sagebrush areas but at far lower numbers. It did however become clear that any agent that removed sagebrush was definitely detrimental to the welfare of the pygmy rabbit. This agrees with most researchers who feel that the primary cause for reduction in range of the pygmy rabbit is habitat loss. Locally, the major causative agents are cultivation, range fires, and sagebrush eradication projects. Of the 583,600 gross acres of habitat (including private lands) originally found on the BLM Salmon and Challis Field Office management areas, 122,300 acres have been permanently removed by agriculture, a loss of 21.0 percent. An additional 2,500 acres have been temporarily removed by recent range fires, a loss of 0.4 percent; and 49,600 acres have been temporarily lost due to sagebrush eradication programs, a loss of 8.5 percent. In addition, 41,000 acres appear to be avoided by rabbits because of shallow soil and hard pan that apparently restricts their digging activities, and on droughty sites where sagebrush growth is restricted, 7.0 percent of study area. A total of 367,200 acres is still considered to be potentially suitable habitat, 62.9 percent of the original acreage.

Sagebrush eradication (spraying and plowing) has been phased out and is no longer considered a threat to pygmy rabbits. Fire now appears to be the greatest threat to the rabbit as evidenced by the fact that no rabbits were found in the large burned acreage in the head of Birch Creek. It is still not known how long it will take for these sites to be reoccupied by sagebrush and rabbits.

Even though range conditions varied markedly from allotment to allotment, this extensive study produced no clear-cut evidence that suggests livestock use is detrimental to pygmy rabbits. Several transect sites showed a large number of burrow systems had been abandoned but it is unclear whether this is related to livestock use. More intensive study will be required to determine if there is a real problem.

Of the many theories advanced for the creation of Mima mounds, it is still unclear as to why the mounds exist on this study area. It has been interpreted by numerous experts from various fields but Tullis (1995) says, "Although the morphology of mounds can be superficially similar from region to region, there is no universally accepted theory for their origin." More than 30 theories have been offered as to how Mima-type mounds are formed. Tullis (1995) concludes that the five main theories are categorized as (1) frost action, (2) burrowing animals, (3) depositional processes (wind, ice or flowing water), (4) erosion processes (ice, water or wind) and (5) seismic shaking.

Tullis (1995) on her study area, approximately 50 miles south of this study area, found that her "data suggests that the mounds were formed by differential heaving of near-surface, silty sediments caused by the growth of ice lenses during a climatic period of intense seasonal freezing." She goes on to say that "fossorial rodents then inhabited the mounds significantly disturbing buried and surface soils. Mammal activities contribute significantly to mound maintenance by encouraging stronger vegetation growth and thus deposition of eolian sediment."

Another of the more generally accepted theories is that fossorial animals are the causative agents. Cox (1984) states, "Fossorial rodents are the builders of Mima mounds, the largest, most widespread landscape features produced by any mammal other than man." Ross, Tester and Breckenridge (1968) go on to say, "Because all of the most important features of the mounds are influenced by animals, it seems very likely that the animals are the primary causes for the mound's origin." Scheffer (1958) claims the pocket gopher is responsible for creating Mima mounds, but other mammals may also be responsible.

Due to the close proximity of this study area and that of Tullis (1995), I feel that her theory could logically be extrapolated to explain the formation of the Mima mounds in the Birch Creek and Lemhi River valleys, and to a lesser extent in the other two valleys. It appears to better explain the local scenario than the fossorial mammal theory proposed by Cox (1984), Ross, Tester and Breckenridge (1968) and Scheffer (1958) because the majority of the mounds in the Birch Creek and Lemhi River valleys, especially those above 7,000 feet, don't give the appearance of any prior mammal activity. Tullis' theory also agrees with the findings of this study in that pygmy rabbits definitely serve to maintain the integrity of the mounded micro-habitats where they are used. This was especially true at lower elevations where most of the rabbit activity was found.

While the study answered in a general way the questions stated in its purpose, it may have raised more questions than it answered. Some of the more important questions still to be answered are:

- What are population trends of pygmy rabbits and those factors influencing trends?
- Is there a possibility of livestock/rabbit competition?
- What is the length of time for disturbed habitats to recover to the point they will support pygmy rabbits?
- What are the importance of the Mima mounds to species other than pygmy rabbits?

This report should be used as a starting point and baseline for further study in answering these questions.

Management Recommendations

(1) Consider the needs of the pygmy rabbit in the planning process for any vegetation altering process, (i.e., prescribed burns and Allotment Management Plans) on the BLM Salmon and Challis Field Office management areas.

(2) Establish the two tracts of key habitat (2,000 acres) as Areas of Critical Environmental Concern and utilize the areas for baseline studies and monitoring of pygmy rabbit habitat use. Maintain these areas in government ownership and protect them from both natural and prescribed fires.

(3) Give high priority to acquisition of high value pygmy rabbit habitat adjacent to BLM land through trade, purchase or conservation easement -- 600 acre tract near Cold Springs in Sections 21, 28 and 33, T. 15 N., R. 26 E.

(4) Maintain habitat integrity for the pygmy rabbit by preventing additional large scale fragmentation of sagebrush habitat types.

(5) Alert BLM and Forest Service personnel to the existence of pygmy rabbits on their specific management areas, and request that they keep records of their sightings, especially those that would extend its range beyond what is reported in this document.

(6) Monitor old burns to determine the length of time required for pygmy rabbits to reoccupy their previously occupied habitats.

(7) Initiate ecological studies to determine the overall use of Mima mounds by all vertebrate species.

(8) Initiate intensive studies to determine if livestock are competing with pygmy rabbits.

(9) Recommend to the Idaho Fish and Game Commission that pygmy rabbits be protected until such time as their overall state-wide status is accurately determined.

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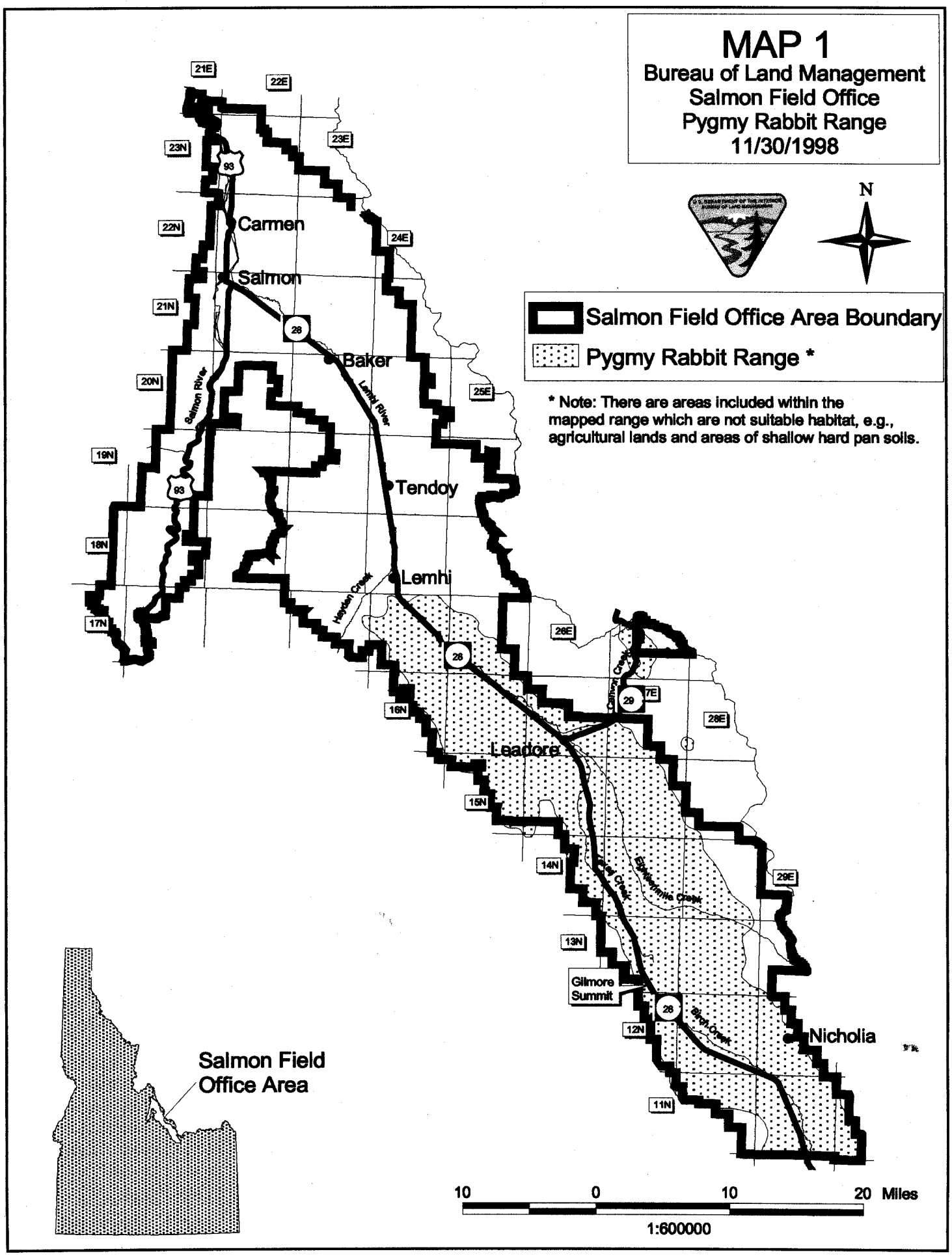
Figure 1. Pygmy rabbit burrow. Entrance is approximately 5 inches in diameter.

Figure 2. Mounded topography typical of study area near Leadore, Lemhi County, Idaho.

Figure 3. Portion of study area in the upper Big Lost River watershed, Custer County, Idaho.


MAP 1
Bureau of Land Management
Salmon Field Office
Pygmy Rabbit Range
11/30/1998
N
Salmon Field Office Area Boundary
Pygmy Rabbit Range *
* Note: There are areas included within the mapped range which are not suitable habitat, e.g., agricultural lands and areas of shallow hard pan soils.
Carmen
Salmon
Baker
Tendoy
Lemhi
Leadore
Gilmore Summit
Nicholia
Salmon River
Lemhi River
Hayden Creek
Eightmile Creek
Birch Creek
21E
22E
23E
24E
25E
26E
27E
28E
29E
23N
22N
21N
20N
19N
18N
17N
16N
15N
14N
13N
12N
11N
93
28
29
Salmon Field Office Area
10
0
10
20 Miles
1:600000

Challis Field Office Area Boundary

Pygmy Rabbit Range *

* Note: There are areas included within the mapped range which are not suitable habitat, e.g., agricultural lands and areas of shallow hard pan soils.

MAP 2

Bureau of Land Management
Challis Field Office
Pygmy Rabbit Range
11/30/1998

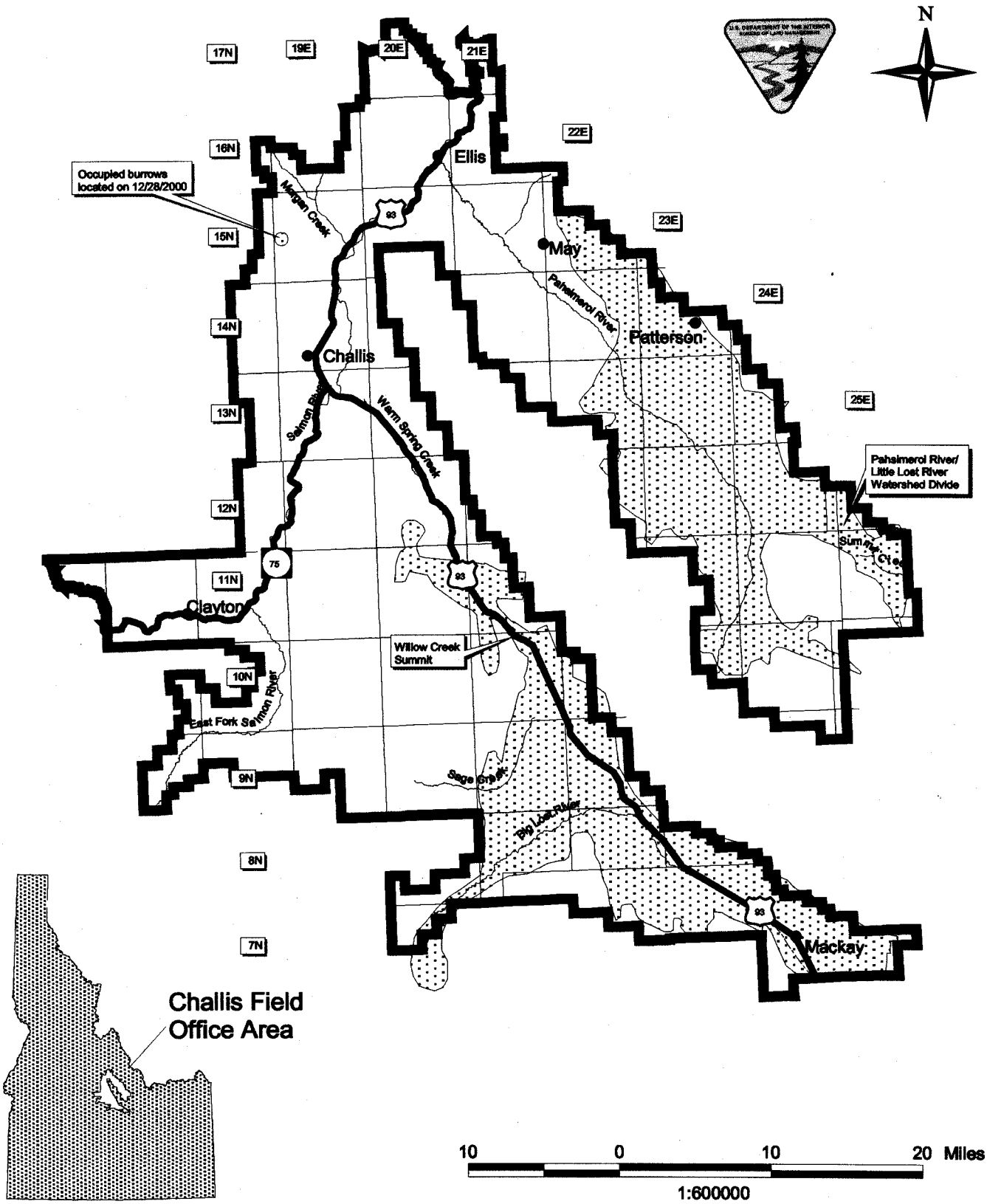


Table 1. General description of pygmy rabbit habitat value classes in the study area.

	HIGH VALUE	MEDIUM VALUE	LOW VALUE
Habitat Use Potential	Most preferred.	Less preferred.	Undesirable, or avoided.
Mounds	Always present.	Often present.	Absent, or present but disturbed.
Rabbit Density	> 700 active mounds per square mile.	< 250 active mounds per square mile.	None.
Sagebrush Height	24" to 48" on mounds. 12" to 24" between mounds.	18" to 36" on mounds. < 12" between mounds.	< 12"
Sagebrush Density	40% to 50% on mounds. 20% to 30% between mounds.	20% to 60% on mounds. < 20% between mounds.	< 20% or > 60%
Slope	5% to 20%	5% to 25%	<5% or >25%
Slope Position	Alluvial fans and lower mountain slopes.	Alluvial fans and lower mountain slopes.	Flat benches.
Habitat Type	*Artemisia tridentata* ssp. *wyomingensis*	*Artemisia tridentata* ssp. *vaseyana* at higher elevations; *Artemisia tridentata* ssp. *wyomingensis* at lower elevations.	Burns or sprayed areas where sagebrush has not recolonized; large amounts of *Chrysothamnus viscidiflorus* are present.
Elevation	6,200 feet to 6,500 feet.	5,600 feet to 7,700 feet.	5,600 feet to 7,300 feet.

Table 2. Tabulation of pygmy rabbit habitat value classes found on the study area, by watershed.

Value	Problem	Lemhi	Birch	Pahsimeroi	Little Lost	Warm	Big Lost	SubTotal	Grand
High	---	---	2,000	---	0	---	0	---	**2,000**
Medium	---	---	164,000	---	117,600	---	83,600	---	**365,200**
	Recent Burn	2,500	---	0	---	0	---	2,500	---
	Sage Erad.	31,000	---	5,400	---	13,200	---	49,600	---
	Cultivated	57,500	---	20,800	---	44,000	---	122,300	---
Low	---	---	91,000	---	27,200	---	57,200	---	**175,400**
Non Hab	Soils	---	29,000	---	12,000	---	0	---	**41,000**
Acres	---	---	**286,000**	---	**156,800**	---	**140,800**	---	**583,600**

ERRATA: UPDATED TABLE (PAGE 16) TO TECHNICAL BULLETIN 01-11 (SURVEY OF PYGMY RABBIT DISTRIBUTION, NUMBERS AND HABITAT USE IN LEMHI AND CUSTER COUNTIES, IDAHO) BY HADLEY B. ROBERTS

Table 3. Number of burrow systems on 18 transects in the upper Birch Creek and Lemhi River Valleys. Burrows are classified by age of sign as fresh, recent, old or very old.

			Fresh				Recent		Old		Very Old	
Transect Number	Transect Location	No. of Plots	No. of Mounds	Mounds Per Plot	Std. Dev.	Per Sq. Mile	No. of Mounds	Per Sq. Mile	No. of Mounds	Per Sq. Mile	No. of Mounds	Per Sq. Mile
17	Warm Springs	6	29	4.8	3.7	1031	11	391	12	427	2	71
15	Rocky Canyon	6	22	3.7	1.2	782	9	320	11	391	11	391
16	Tenmile Creek	6	7	1.2	1.1	249	3	107	14	498	5	178
14	Hawley Creek	6	7	1.2	1.5	249	0	0	1	36	3	107
2	Cold Springs	16	17	1.1	1.2	227	7	93	8	107	14	187
10	Clear Creek	6	4	0.7	1.1	142	0	0	3	107	3	107
4	Cedar Gulch	6	3	0.5	1.1	107	0	0	3	107	2	71
3	Railroad	11	5	0.5	0.5	97	2	39	2	39	9	175
5	Thompson	12	5	0.4	0.6	89	3	53	0	0	6	107
6	Peterson Creek	8	3	0.4	0.7	80	0	0	1	27	2	53
18	Cliff Canyon	6	2	0.3	0.5	71	3	107	7	249	2	71
11	Negro Green	12	2	0.2	0.4	36	1	18	5	89	2	36
9	Middle Ridge	12	1	0.1	0.3	18	1	18	4	71	2	36
7	Buckhorn Mine	6	0	0	0	0	1	36	4	192	3	107
12	Gilmore Summit	6	0	0	0	0	0	0	4	142	21	747
1	Lee Creek Road	24	0	0	0	0	0	0	4	36	23	204
13	McGinty Creek	6	0	0	0	0	0	0	2	71	3	107
8	Mill Creek	4	0	0	0	0	0	0	0	0	0	0