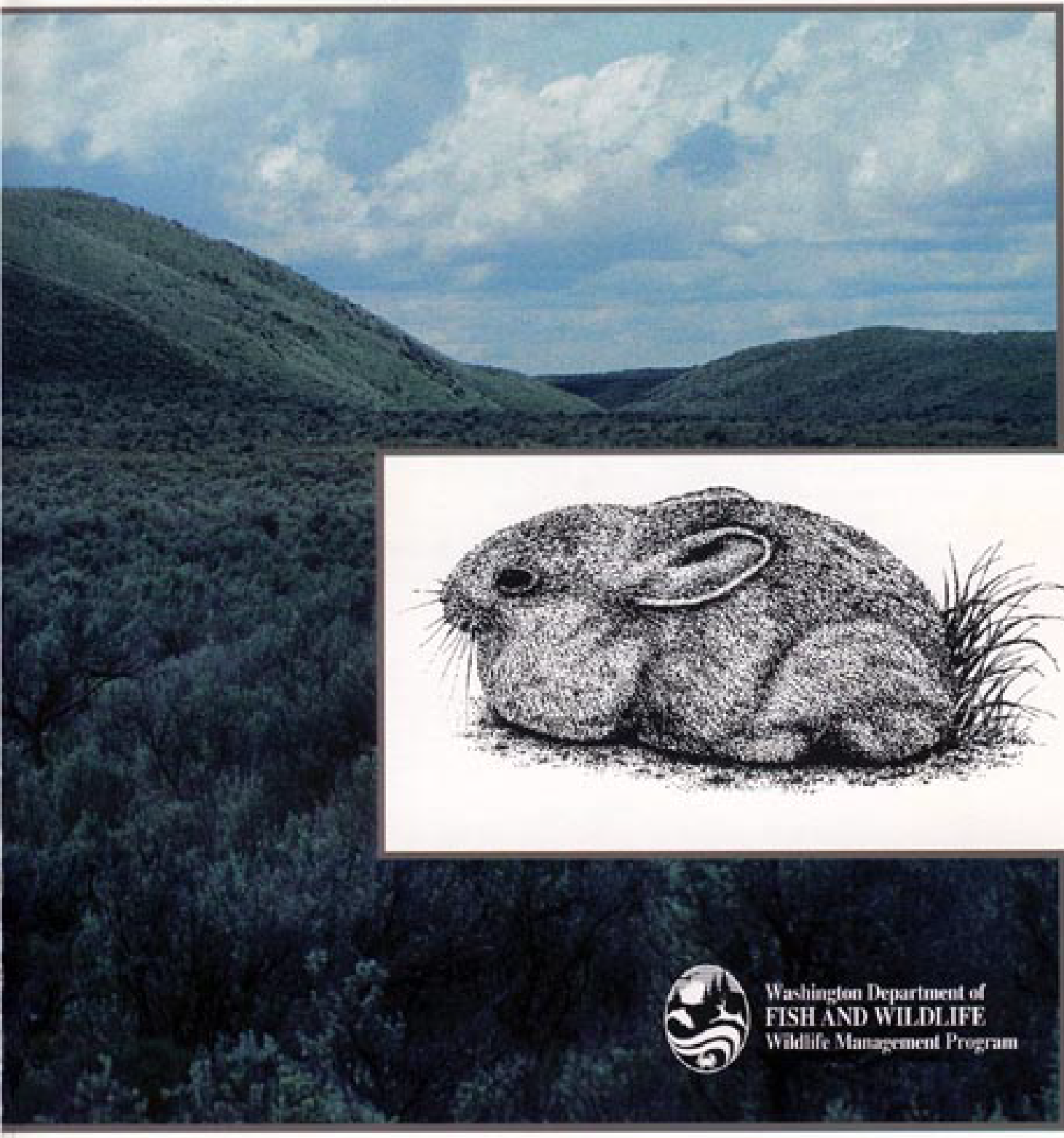
WASHINGTON STATE RECOVERY PLAN FOR THE

July 1995

Pygmy Rabbit



Washington Department of
FISH AND WILDLIFE
Wildlife Management Program

The pygmy rabbit was classified by the Washington Wildlife Commission (now Fish and Wildlife Commission) as a State Threatened species in 1990 (Washington Administrative Code 232-12-011). The species was reclassified to State Endangered status in 1993 (Washington Administrative Code 232-12-014). In 1990, the Commission adopted procedures for listing and delisting species as endangered, threatened, or sensitive and for writing recovery and management plans for listed species (WAC 232-12-297, Appendix A). The procedures, developed by a group of citizens, interest groups, and state and federal agencies, require preparation of recovery plans for species listed as threatened or endangered.

Recovery, as defined by the U.S. Fish and Wildlife Service, is "the process by which the decline of an endangered or threatened species is arrested or reversed, and threats to its survival are neutralized, so that its long-term survival in nature can be ensured."

This document summarizes the historic and current distribution and abundance of the pygmy rabbit in Washington and describes factors affecting the species' populations and habitat. It prescribes strategies to recover the species, which include increasing the extent and quality of available habitat, protecting the population, and initiating research and education programs. Target population objectives and other criteria for reclassification are identified and an implemention schedule is presented.

The draft state recovery plan was reviewed by pygmy rabbit researchers and State and Federal agencies prior to being made available for a 90-day public review. All comments recieved were considered in preparation of this final recovery plan. Additional information on the pygmy rabbit is available from:

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This report should be cited as:

Washington Department of Fish and Wildlife. 1995. Washington state recovery plan for the pygmy rabbit. Wildlife Management Program, Wash. Dep. Fish and Wildl., Olympia. 73pp.

Washington State Recovery Plan

for the

Pygmy Rabbit

Washington Department of Fish and Wildlife
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600 Capitol Way N
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July 1995

Approved:

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Director, Washington Department of Fish and Wildlife ***Date***

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ACKNOWLEDGMENTS

Fred Dobler, Tom Owens, and Harriet Allen all contributed significantly to the writing of part one of this plan. Fred Dobler provided constructive criticism on several drafts of the overall plan. Harriet Allen and Scott Richardson provided guidance in developing format and content. Ron Friesz deserves special mention for his long-time interest in pygmy rabbits and his significant role in the collection of information used here. Harriet Allen, R. Lee Lyman, Jeff S. Green, Scott A. Richardson, Curt Leigh, Ron Fox, and John Pierce made comments on earlier versions which were useful in preparing this plan. Marisa McAllister provided assistance in choosing the cover photograph which was taken by Elizabeth Rodrick. Darrell Pruett and Kirk Lundquist provided graphics support for cover design.

EXECUTIVE SUMMARY

The pygmy rabbit (*Brachylagus idahoensis*) is the smallest rabbit in North America. It is patchily distributed in the sagebrush-dominated areas of the Great Basin. This includes portions of Oregon, California, Nevada, Utah, Idaho, Montana, Wyoming, and Washington. Washington populations are disjunct from the core of the species' range, apparently separated for thousands of years. Paleontological evidence suggests that the species had a broader distribution in Washington thousands of years ago. Today, the known Washington range of the pygmy rabbit is greatly restricted. Museum specimen records and reliable sight records show that pygmy rabbits formerly occupied sagebrush habitat in five Washington counties: Benton, Adams, Grant, Lincoln, and Douglas. Currently, pygmy rabbits are known to survive in five isolated fragments of suitable habitat in Douglas County.

The current Washington population is estimated to be fewer than 250 rabbits. Of the five pygmy rabbit areas known to remain in Washington, the largest may be comprised of fewer than 150 rabbits. The other four populations are significantly smaller.

In 1990, the pygmy rabbit was listed as a threatened species by the Washington Wildlife Commission. The Commission reclassified the species to endangered in 1993. It is listed as a Candidate Category 2 species by the U.S. Fish and Wildlife Service.

The pygmy rabbit is the only rabbit native to North America that digs its own burrows. It is also uniquely dependent upon sagebrush, which comprises up to 99% of its winter diet. Dense sagebrush and relatively deep, loose soil are important characteristics of pygmy rabbit habitat. The primary factor contributing to the decline of the pygmy rabbit in Washington has been loss of habitat due to agricultural conversion.

Because of low numbers and limited distribution, pygmy rabbit populations in Washington are vulnerable to fire, disease, intense predation, and the random variation in birth and death rates, sex ratios, and combinations of demographic parameters that sometimes cause the collapse of small populations. Habitat degradation and loss are likely to continue without active prevention efforts. Before the pygmy rabbit can be considered at low risk of extirpation in Washington, numbers and distribution must be increased. In addition, adequate habitat must be managed for the long-term protection of features that support pygmy rabbits.

The recovery objectives for downlisting from State Endangered status are a minimum population of 1400 adult pygmy rabbits comprised of at least two areas supporting at least 500 adult pygmy rabbits and four additional areas that support at least 100 adult pygmy rabbits. All of the areas must be in secure habitat with long-term management plans in place which conserve pygmy rabbits and their habitat.

The recovery objectives for delisting from State Threatened status are a minimum population of 2800 adult pygmy rabbits comprised of at least four areas supporting at least 500 adult pygmy

rabbits and eight additional areas with at least 100 adult pygmy rabbits. All of these areas must be in secure habitat with long-term management plans in place.

Recovery strategies for this species include protection of existing habitat, identification and management of lands for creation of new habitat, monitoring of the pygmy rabbit population, and research to better understand the effects of management actions. Grazing, if it occurs in pygmy rabbit areas, should be managed to be compatible with pygmy rabbit habitat needs. In all pygmy rabbit areas, steps should be taken to reduce the risk of range fire. To increase the extent of pygmy rabbit habitat, efforts should be directed at identifying lands where soil conditions are suitable for pygmy rabbits. If necessary, lands with appropriate soil conditions should be restored or enhanced to provide pygmy rabbit habitat. Pygmy rabbits should be introduced to selected vacant habitat. Other strategies, including enforcement, data management, cooperative work with landowners and other agencies, research, and public information should all play a role in pygmy rabbit recovery efforts.

PART ONE

BACKGROUND

TAXONOMY

The type specimen of the pygmy rabbit was taxonomically classified as *Lepus idahoensis* (Merriam) in 1891. In 1904 this species was reclassified as *Brachylagus idahoensis* (Lyon). In 1930 Grinnell placed this species in the genus *Sylvilagus*. Examination of 2335 skulls from 9 extant and extinct leporid genera resulted in the conclusion, based on dentition, that the pygmy rabbit is more closely related to the Sumatran hare (*Nesolagus netscheri*) than to either *Lepus* or *Sylvilagus* (Hibbard 1963). Analysis of blood proteins also indicates that the pygmy rabbit is quite different from otherwise similar species of the genus *Sylvilagus* (Johnson 1968). Present information is once again causing a shift in the taxonomic classification of this species, with many zoologists now referring to the pygmy rabbit as *Brachylagus idahoensis* (Ingles 1973; Green and Flinders 1980a).

DESCRIPTION

The pygmy rabbit is the smallest rabbit species in North America. Reported mean weights for adults range from 398-462 g (0.88-1.02 lb) (Orr 1940, Janson 1946, Wilde 1978). Adult females average larger than adult males. In Washington, the mean weight of 20 adult males was 391 g (0.86 lb). The mean weight of 15 adult females was 426 g (0.94 lb) (Gahr 1993). Pygmy rabbits measure 23.5-29.5 cm (9.2-11.6 in) in length (Ingles 1973). The pygmy rabbit's pelage is primarily silky slate gray, tipped with brown; legs, chest and nape are a tawny cinnamon brown; ventral surface is whitish. The ears are distinctly short and rounded, thickly haired both inside and out and 3.5-5.2 cm (1.4-2 in) in length. The tail is small, 1.5-2.4 cm (0.6-0.9 in) (Orr 1940, Janson 1946), and virtually unnoticeable in animals viewed in the wild. In general, the pygmy rabbit is distinguished from the cottontail rabbit by its distinctively smaller size, pale gray pelage, short rounded ears, small legs, and lack of a large white ventral surface on the tail. Also diagnostic is the pale buff along the entire edge of the ear (Dalquest 1948; Burt and Grossenheider 1964; Larrison 1970, 1976; Bradfield 1974).

GEOGRAPHICAL DISTRIBUTION

North America

The pygmy rabbit is found throughout much of the sagebrush area of the Great Basin as well as some of the adjacent intermountain areas (Fig. 1) (Green and Flinders 1980a). The eastern boundary extends to southwestern Montana and western Wyoming (Campbell et al. 1982). The southeastern boundary extends to southwestern Utah (Janson 1946, Pritchett et al. 1987) and includes the only occurrence of the species outside the limits of the Pleistocene Lake Bonneville (Columbia River) drainage. Central Nevada (Nelson 1909) and northeastern California (Orr 1940) form the southern and western limits. The northern boundary of the species' core range

historically reached to the southern foothills of the Blue Mountain Plateau in eastern Oregon (Bailey 1936). However, Washington populations are farther north, extending into Douglas County. Within its range, the pygmy rabbit's distribution is far from continuous. It is patchily distributed, being found only in areas where sagebrush is tall and dense, and the soil is relatively deep.

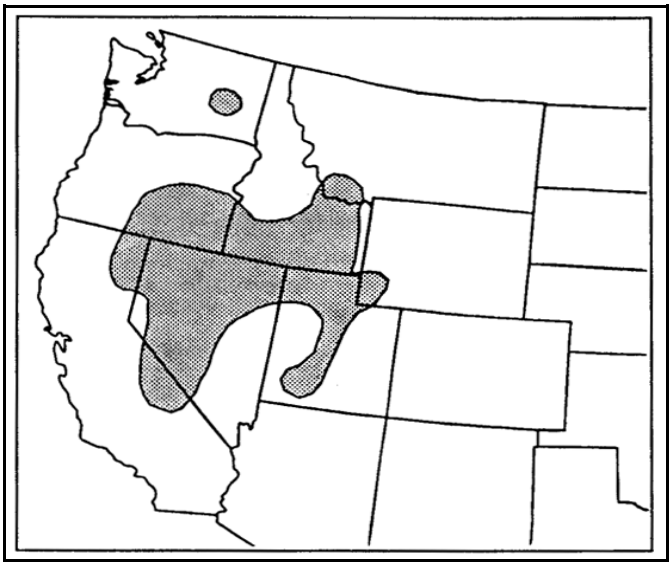

Figure 1. Current range of the pygmy rabbit.

Washington

The pygmy rabbit's Washington range is disjunct from the core range of the species, and likely has been for some time (Lyman 1991, Grayson 1987). The pygmy rabbit's current range is thought to be smaller than during its post-glacial population high, which occurred more than 7,000 years ago (Butler 1972). In the Northwest, a discontinuity developed when the pygmy rabbit's core range shrunk southward toward the central part of eastern Oregon (Weiss and Verts 1984). This discontinuity has left Washington populations isolated in a portion of their prehistoric range (Lyman 1991). The paleontological record verifies pygmy rabbits in Washington over 100,000 years ago. Documented localities of prehistoric occurrence indicate a former range slightly larger than what is documented from historic times. These records do not establish the prehistoric link to populations in either Oregon or Idaho, a link which must have occurred (Lyman 1991). Habitat changes, which reflect climate change over thousands of years, likely account for the isolation of Washington populations.

Table 1 lists reliable historic pygmy rabbit locations in Washington. In most cases voucher specimens are available in museums. The basis for much of our understanding of the pygmy rabbit's historic range in Washington comes from a 1949-50 study of the occurrence of campestral plague in rodents (Dobler, pers. comm.). W. Clanton was the field investigator for this study. One of Clanton's collection localities, Sagebrush Flat, was also a collection site of G. Hudson of the Charles R. Conner museum at Washington State University and M. Johnson, a mammalogist with the University of Puget Sound. The museum records associated with these collections describe the location differently, resulting in the mistaken impression that several localities were involved. Conversations with M. Johnson, examination of Hudson's field notes and Clanton's field maps have resulted in a clear understanding that all specimens were collected at Sagebrush Flat (Dobler, pers. comm.).

Table 1. Historic pygmy rabbit localities in Washington based on museum specimens and reliable reports. Map # refers to Figure 2.

Location	County	Map #	Date(s)	Source[a]
Schrag	Adams	7	1956	WSU 56-45 (Drake)
Lind	"	8	1923	USNM 243294, 243344 (Finley)
Lind	"	8	1924	CSUF #643 (Lane)
Rattlesnake slope Hanford Reservation	Benton	9	1979	R. Fitzner (pers. comm.)
10 km E of Mansfield	Douglas	1	1950	PSM 2300 (Clanton)
Sulphur Canyon	"	2	1979	PSM 25856 (Lloyd)
Sagebrush Flat	"	3	1949	PSM 1992-7 (Clanton)
Sagebrush Flat	"	3	1949	WSU 49-357-362, 49-375 (Hudson)
Sagebrush Flat	"	3	1952	WSU 52-40, UBC 3058 (Hudson)
Sagebrush Flat	"	3	1962	PSM 8955-6 (Johnson)
Sagebrush Flat	"	3	1988	F. Dobler (pers. comm.)
Burton Draw	"	shaded	1987	R. Friesz (pers. comm.)
Coyote Canyon	"	shaded	1988	R. Friesz (pers. comm.)
Whitehall	"	shaded	1988	C. Garber (pers. comm.)
Clay Site	"	shaded	1988	R. Friesz (pers. comm.)
4.8 km NW of Ephrata	Grant	4	1949	PSM 2229 (Clanton)
Warden	"	5	1921	Couch (1923)
13 km W of Odessa	Lincoln	6	1949	PSM 2230 (Clanton)

[a]Museum abbreviations as follows: James R. Slater Museum of Natural History, University of Puget Sound, Tacoma, Washington (PSM); Conner Museum, Washington State University, Pullman, Washington (WSU); University of British Columbia, Vancouver, B.C. (UBC); U.S. National Museum, Washington D.C. (USNM); California State University, Fresno (CSUF). Specimen numbers are followed by collector's name in parentheses.

Written information has contributed to confusion about the pygmy rabbit's former distribution in Washington. Couch (1923) described J. Finley's collection of pygmy rabbits as "near Ritzville" in Adams County. Hall (1981) referenced a record at Lind, also in Adams County. Rather than two separate locales, both of these published sources refer to J. Finley's collection of two pygmy rabbits which is part of the U.S. National Museum collection in Washington D.C. (Table 1).

Booth (1947) reported collecting a pygmy rabbit from Crab Creek in Grant County. Recent examination of the specimen verifies that it is a Nuttall's cottontail (*Sylvilagus nuttallii*). Williams (1975) was likely mistaken in reporting contemporary occurrence of pygmy rabbits in the Juniper Forest of Franklin County. He identified remains found in great horned owl (*Bubo virginianus*) pellets as those of pygmy rabbits and attributed an abundance of tracks observed in the area to pygmy rabbits. He also described pygmy rabbit sub-fossils from wind eroded dunes in

the Juniper Forest. However, while Williams' work was an attempt at characterizing the complete bird and mammal fauna of the Juniper Forest, it did not recognize the presence of Nuttall's cottontails. Since there is considerable evidence that Nuttall's cottontails are the only abundant rabbit at the Juniper Forest (Miller 1977, Dobler pers. comm.), it is likely that Williams misidentified the remains from the owl pellets and the tracks he observed. The skeletal remains recovered from owl pellets could not be found in the University of Idaho's collection so they cannot be examined for verification of species (D. Johnson, pers. comm.).

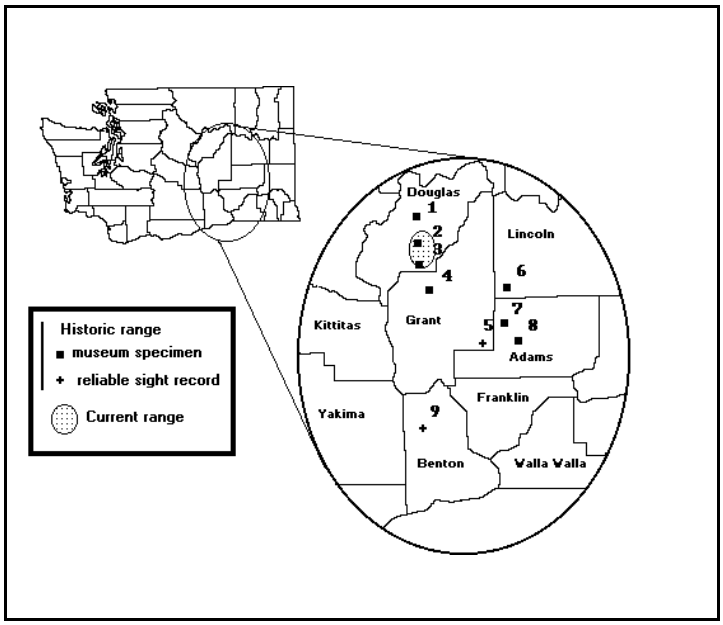

Figure 2. Distribution of the pygmy rabbit in Washington. Numbers refer to entries in Table 1.

Miller (1977) examined bones from erosion sites similar to the sites where Williams recovered sub-fossils. The bones found in these sites, where the wind has scoured away the sand, were left by animals inhabiting the Juniper Forest prior to sand dune formation. Pygmy rabbit bones were not uncommon and their occurrence provided evidence that pygmy rabbits have inhabited the area during the late Holocene (between 3,000 years ago and present). Miller trapped small mammals in the Juniper Forest but did not catch pygmy rabbits. He caught Nuttall's cottontails and considered them locally common. State biologists have surveyed portions of the area and have not found suitable pygmy rabbit habitat in the areas examined (Dobler, pers. comm.).

Recent Department of Fish and Wildlife field inventories verify pygmy rabbits at five sites (all within the shaded area of Figure 2) within Douglas County, including the largest known Washington population at the Sagebrush Flat site where Clanton, Hudson, and Johnson collected. The range of extant populations in Washington is provided in Figure 2.

NATURAL HISTORY

Reproduction

Sexual development in males begins in January, peaks in March and declines in June (Janson 1946, Wilde 1978). Females are fertile from late February through March in Utah (Janson 1946) and from late March through late May in Idaho (Wilde et al. 1976). In Washington, males are reproductively active from January through June, females can be pregnant from February through August, and some females are nursing young from March through September (Gahr 1993). Gestation has been estimated at 39 days (Fisher 1979). Pygmy rabbits are able to breed during their second spring or summer. They do not breed during the year of their birth (Wilde 1978, Fisher 1979).

Bradfield (1974) reports that young are born in the burrows. However, nests are unknown. Excavated burrows do not reveal chambers or nesting material and burrows excavated where lactating females are taken also reveal no young (Janson 1946, Bradfield 1975, Gahr 1993). Wilde (1978) found two small (90 g) juvenile pygmy rabbits underneath separate clumps of sagebrush, far removed from any burrows. He theorized that young are not raised in burrows but are individually hidden at the bases of separate and scattered shrubs.

Litter size ranges from four to eight and averages six (Davis 1939, Wilde et al. 1976, Wilde 1978, Fisher 1979). Females reportedly produce up to three litters per year (Green 1978, Wilde 1978), though Fisher (1979) found no histological evidence of three litters. Two litters had been produced by the five females examined. Based on the observed length of the breeding season and histological determination of conception dates, a maximum of 17 and 29% of the adult female population could have produced three litters in 1975 and 1976, respectively. Wilde (1978) described the existence of a third cohort during 1976 and 1977 in the same study area where Fisher did his work.

In Idaho, Fisher (1979) estimated that 13.0 and 13.7 young were produced per female during 1975 and 1976, respectively. Wilde (1978) reported that the number of young captured per adult female before September 1 was 3.6 in 1976 and 4.9 in 1976. Breeding appears to be highly synchronous within the population and juveniles belong to recognizable cohorts (Wilde 1978, Fisher 1979). In monitoring recaptures of juveniles from 1976 cohorts, Wilde found that 33% the first cohort survived for 20 weeks, reduced to 23% for the second cohort. In the third cohort, none were recaptured after 5 weeks.

Mortality

The chief cause of mortality is predation (Green 1979). Wilde (1978) found that mean annual adult mortality could be as high as 88%. The period of greatest mortality begins in January and extends through March. The survival of juveniles is initially very low, with more than 50%

disappearing within 5 weeks of emergence. Complete loss of a cohort is possible as Wilde reports during a year of his study. Starvation and environmental stress probably account for some loss.

Predators of pygmy rabbits include long-tailed weasel (*Mustela frenata*), coyote (*Canis latrans*), and badger (*Taxidea taxus*), which may enter or dig up pygmy rabbit burrows (Wilde 1978). Other predators, which will take pygmy rabbits encountered above ground, include bobcats (*Felis rufus*), great horned owls (*Bubo virginianus*), long-eared owls (*Asio otus*), ferruginous hawks (*Buteo regalis*), and northern harriers (*Circus cyaneus*) (Gashwiler et al. 1960, Borell and Ellis 1934, Hall 1946, Janson 1946, Ingles 1965, Green 1978, Wilde 1978, Olendorff 1993). In Washington, burrows frequently show signs of being dug out by badgers or coyotes (Dobler and Dixon 1990). Short-eared owls (*Asio flammeus*) and northern harriers frequently hunt over pygmy rabbit colonies (Friesz and Dobler, pers. comm.). Gahr (1993) concluded that at least two cases of pygmy rabbit mortality at Sagebrush Flat were due to predation by raptors. Potential predators seen in the area included great-horned owls, northern harriers, prairie falcons (*Falco mexicanus*), and golden eagles (*Aquila chrysaetos*).

Pygmy rabbits are protected by law and cannot be legally killed. However, discussions with hunters in the Columbia Basin indicate most hunters do not distinguish pygmy from cottontail rabbits. This suggests that pygmy rabbits could be accidentally taken by hunters. However, sites that are currently known to have pygmy rabbits are infrequently visited by hunters.

Disease is probably not a significant mortality factor (Green 1979).

Behavior

Pygmy rabbits have been reported to be crepuscular, most active at dawn or dusk (Davis 1939, Janson 1946). A study in Idaho reports the peak of activity to be during mid-morning, 2 hours after sunrise (Bradfield 1974). On the Idaho Birds of Prey Area, pygmy rabbits are occasionally seen at night during spotlight transects to census black-tailed jack rabbits. They appear to be more easily detected at night than during the day (Doremus, pers. comm.). Gahr (1993) also noted that pygmy rabbits in Washington could be found active during any time, day or night.

Pygmy rabbits have a rather deliberate gait, staying low to the ground. To avoid predators they may depend more on their ability to maneuver through dense sagebrush than on speed (Merriam 1891, Davis 1939, Severaid 1950). Wilde (1978) described a pygmy rabbit with one foot caught in its radio collar. On three legs it eluded researchers trying to chase it down to provide aid. It passed burrows without attempting to enter, making use of its maneuverability through dense sagebrush to escape capture.

Burrowing

The pygmy rabbit is a burrowing species that digs relatively simple burrows in soil and often extensive burrows in snow (Bradfield 1974). Unlike other species of rabbits native to North America, this species usually digs its own burrows (Borell and Ellis 1934, Walker et al. 1964). Burrow systems usually consist of two to seven openings, with the main entrance concealed at the base of a sagebrush plant (Olterman 1972, Green 1979). Gahr (1993) found that Washington burrows contained an average of 2.7 entrances (range 1-10) and entrance diameter averaged 19 cm (8 in) with a range of 10-35 cm (4-14 in) (n=82). A small trench or terrace was present outside burrow entrances and no chambers or enlarged areas were found along the tunnels. Janson (1946) reports that in Utah four or five entrances are typical, but 10 are sometimes observed. In Idaho, two entrances are most often found (Wilde 1978). Tunnels usually extend to no more than 1 m (3 ft) in depth (Green and Flinders 1980a, Kehne 1991, Gahr 1993). Three burrows excavated in Idaho extended below the hardpan and never showed evidence of water (Wilde 1978).

During the winter months the rabbits burrow through the snow to forage. Snow burrows are constructed to lead from one sagebrush plant to another (Bradfield 1974).

Home Range

Pygmy rabbits are generally found within a 30 m (98 ft) radius of their burrows during winter but expand their home range in spring and summer (Janson 1946, Green and Flinders 1979). These estimates imply a home range of 0.30 ha (.7 ac). In Washington, home range and movement data were obtained from 16 radio-equipped pygmy rabbits (seven adult males, seven adult females, and two juvenile females) that were relocated during daylight hours at least 20 times during the breeding season (January-June) (Gahr 1993). Gahr estimated that the core area, or area needed to keep an individual alive, was similar to home ranges implied by Janson (1946) and Green and Flinders (1979). However, infrequent movements away from the core area resulted in estimated average home range sizes up to sixy times greater than previously reported for the species. Estimated average home range size (95% harmonic mean estimation method) was 2.7 ha (6.7 ac) for adult females and 20.2 ha (49.9 ac) for adult males. Males made occasional long distance movements to areas occupied by adult females indicating that larger male home range size was the result of movements associated with breeding.

In Gahr's study, adult males and juveniles both averaged more than one home range center. A home range center is an area with a cluster of relocations at some distance from other clusters of relocations. For males, multiple home range centers corresponded with locations of adult females. For juveniles, home range centers corresponded with the natal area and an area of resettlement after dispersal away from the natal area. Estimated average home range size for juveniles was 7.1 ha (17.5 ac), which, for each of the two juveniles monitored, included a long distance movement during the first few weeks of life.

Gahr (1993) found that, during the breeding season, males seek out different breeding females while females generally remain in one small area. Male movements averaged 155 m (513 ft) while females averaged 33 m (110 ft). Maximum distance between locations was greatest for adult males and ranged up to 1200 m (3960 ft). In the non-breeding season, males still had longer movements than females. However, this difference was not significant, probably due to low sample sizes (*n*#5) (Gahr 1993).

Gahr (1993) partitioned home range data for rabbits in the grazed and not recently grazed portions of her study area. The grazed area had a long history of grazing by both cattle and horses. The area not recently grazed had not been grazed by domestic livestock since at least 1957. Male home range size (95% harmonic mean estimation method) was significantly larger in grazed areas, where it averaged 28.9 ha (71.4 ac), than in areas not recently grazed, where it averaged 13.7 ha (33.8 ac). Adult female home range size did not differ significantly between grazed areas [1.5 ha (3.7 ac)] and areas not recently grazed [3.7 ha (9.1 ac)]. The difference in male home range size between areas grazed and areas not recently grazed was not explained by a difference in the size of the core area. Males in the grazed area traveled longer distances associated with breeding. The average number of home range centers was equal between males in grazed and not recently grazed areas. These data indicate that females were likely more spread out in the grazed areas, resulting in longer distance movements for breeding males in the grazed area. There were no significant differences in comparisons of grazed areas and areas not recently grazed for distances moved between relocations for males or females in the breeding (January-June) or non-breeding season (July-September) (Gahr 1993).

Food

The diet of Idaho pygmy rabbits was studied by analysis of fecal pellets (Green and Flinders 1980b). Sagebrush (*Artemisia* spp.) comprised 99% of the winter diet. During spring and summer, sagebrush continued to be important in the diet (51% relative density), though grasses (39%) and forbs (10%) increased in importance. Preference indices (PI) indicated that pygmy rabbits ate sagebrush in the same proportion as found in their environment (PI=1). The highest preference indices, indicating food items eaten in greater proportion than their occurrence in the habitat, were obtained for wheatgrass (*Agropyron* spp.) (PI=37) and bluegrass (*Poa* spp.) (PI=14).

Fecal pellets were collected adjacent to pygmy rabbit burrows at two sites in Washington (Burton Draw and Coyote Canyon) during November and December 1988 (Dobler pers. comm.). The Washington State University Wildlife Habitat Laboratory completed a diet analysis and provided a report (Davitt pers. comm.). Based on an analysis of plant cell proportions, shrubs were the most important food, comprising a mean 81.5% of the diet. Mean forb content was 13.1% and mean grass content was 4.4%. Big sagebrush was the most important shrub species (67.0% of diet) and rabbitbrush (*Chrysothamnus* spp.) was the next most important shrub, comprising a mean 12.8% of the diet.

At Sagebrush Flat, Gahr (1993) evaluated diet based on visual observations of feeding. Each observation of feeding on an identifiable plant species was given equal importance with an observation of feeding on another plant species. Therefore, the amount eaten was not taken into consideration. Rabbits were observed feeding 82 times and the food item was identified in 53 cases. The rabbits ate shrubs during each month except September, when only one observation of feeding was made. Grasses were the most frequently observed food and were eaten during each month, March through September. Forbs were only observed to be eaten from April through June. There was no difference in feeding activity by plant class between areas grazed and areas not currently grazed (grazed area: shrubs 32%, grasses 45%, forbs 23%; area not currently grazed: shrubs 39%, grasses 45%, forbs 16%).

HABITAT REQUIREMENTS

Vegetative Characteristics

The pygmy rabbit is dependent upon sagebrush, primarily big sagebrush (*Artemisia tridentata*), and is usually found in areas where big sagebrush grows in very dense stands. Tall, dense sagebrush clumps are essential (Orr 1940).

At Sagebrush Flat, Washington, big sagebrush is the dominant shrub species (Gahr 1993). In one pygmy rabbit area in Idaho, bitterbrush (*Purshia tridentata*) and big sagebrush are present in equal amounts (19% coverage of each) (Green and Flinders 1980b). In Oregon, sagebrush species account for 23.7% of the cover at pygmy rabbit sites. Overall shrub cover at pygmy rabbit sites averaged 28.8% with a range of 21.0-36.2%. When 10 habitat variables were submitted to discriminant analysis, shrub cover best distinguished sites occupied by pygmy rabbits from adjacent sites ($r = 0.71$), followed by soil depth ($r = 0.48$) and mean shrub height ($r = 0.46$) (Weiss and Verts 1984).

Several studies have compared shrub cover and height between burrow locations and randomly selected locations (Table 2). While the values reported by these studies are not the same, partly a product of different techniques of measurement, all indicate that sagebrush cover is a major habitat feature selected by pygmy rabbits. Where measured, burrow sites always had greater shrub cover and taller shrubs than random sites.

Historically, conditions suitable for pygmy rabbits were probably uncommon, limited to areas with deep, moisture-retaining soil or areas where disturbance provided opportunities for sagebrush to invade and flourish, relieved from the competition of grasses. Daubenmire (1970) concluded that the pristine condition of the *Artemisia tridentata-Agropyron* association was characterized by 5-26% coverage in big sagebrush. Subsoil conditions probably account for much of the variation. On moist, sandy loams big sagebrush may exceed 2 m in height. Ellison (1960) and Tisdale and Hironaka (1981) indicated that disturbed conditions, grazed or abandoned cultivation, can also contribute to the development of heavy sagebrush cover. Most typically,

heavy grazing increases the density of big sagebrush. Most of Washington's pygmy rabbit sites have a long history of grazing. One pygmy rabbit site in Washington (Burton Draw) has a history of cultivation. When cultivation ended years ago, big sagebrush invaded the fields and provided heavy shrub cover (Dobler and Dixon 1990).

The burrowing and grazing activity of pygmy rabbits may increase sagebrush cover. The area around active pygmy rabbit burrows is heavily grazed by the rabbits (Wilde 1978). In Wilde's words, "growth and reproduction of sagebrush at pygmy rabbit burrows may be increased (Janson 1946, Wilde in prep.). Whether this is due to burrowing activity, per se, or to browsing (Pearson 1965) is unknown." Gahr found that percent cover of bunchgrasses was less at burrow sites (3.2%) than at random sites around burrows (8.9%). The removal of grasses and the disturbance of the soil can create conditions suitable for colonization by sagebrush seedlings. In addition, sagebrush growth may increase with the increase in available moisture which occurs when competing grasses and forbs are removed. The extent to which seedling survival is effected by the browsing of pygmy rabbits is unknown.

Table 2. Comparisons of shrub cover and density between pygmy rabbit burrow sites and non-burrow sites.

Location	Mean shrub cover (%)	Mean shrub height (cm)	Reference
Sagebrush Flat burrow sites	32.7	82	Gahr (1993)
Sagebrush Flat random sites	17	53.4	
Idaho burrow sites	46	56	Green and Flinders (1980b)
Idaho random sites	unknown	25	
Oregon burrow sites	28.8	84	Weiss and Verts (1984)
Oregon random sites	17.7	53	

Burrows

Habitat suitable for pygmy rabbits must allow the animals to burrow. Burrows provide protection during periods of severe weather conditions, safety from predators, and may be used for raising young (Bradfield 1974). Burrows are usually under big sagebrush and only rarely are located in an opening in the vegetation (Green 1978, Wilde 1978). However, pygmy rabbits have been observed using abandoned badger and yellow-bellied marmot (*Marmota flaviventris*) burrows, as well as natural cavities, holes in volcanic rock, rock piles, and around abandoned buildings (Green 1979, 1980; Wilde 1978; Dobler, pers. comm.). These are used in association with typical burrows in deep soil amidst sagebrush. They probably do not represent a habitat alternative capable of totally replacing dense sagebrush and deep soils.

Soil Characteristics

Since pygmy rabbits excavate their own burrows, soil structure is a key habitat feature. Generally, soft, deep soils are required for burrowing. However, three burrows excavated by Wilde (1978) extended below the hardpan. Alluvial fans may provide the soil requirement in some cases (Orr 1940, Green and Flinders 1980b). Oregon burrow sites are located where soils are significantly deeper and looser than adjacent sites (Weiss and Verts 1984). Pygmy rabbits will select sites where wind-borne soil deposits are deeper (Wilde 1978).

A study in Oregon measured habitat variables at sites occupied by pygmy rabbits and adjacent unoccupied sites. When 10 habitat variables were submitted to discriminant analysis, soil depth was the second most important variable distinguishing sites occupied by pygmy rabbits from adjacent sites ($\underline{r} = 0.48$). Shrub cover was the only variable of greater importance ($\underline{r} = 0.71$) (Weiss and Verts 1984).

Kehne (1991) documented soil and other characteristics at 80 active burrow sites at Sagebrush Flat. The soils at Sagebrush Flat are derived from loess, or wind-borne parent materials. Carbonates, which make soils less compact, looser and generally easier to dig, were found at an average of 72 cm (28 in) deep. This depth is shallower than expected in this precipitation zone. Burrows at Sagebrush Flat tend to be in deep soils; 96% are in soils at least 51 cm (20 in) deep. A limiting layer of basalt, duripan, weak pan, or gravel often underlays the soil. A family control characterization of soil types indicates that burrows are found in coarse-silty (46%), fine-loamy (28%), ashy (17%), and coarse-loamy (9%) soils.

Topography

Landform, as well as soil characteristics, plays a part in burrow site selection. The rabbits use the contours of the soil, most often digging into a slope (Wilde 1978; Kehne 1991). At Sagebrush Flat, 77% of 80 active burrows were on mound/intermound or dissected topography (Kehne 1991). Although they do use level sites, even here they often utilize a small rise or change in contour for the burrow entrance. Gahr (1993) found that topography influenced the distribution and abundance of burrow sites at Sagebrush Flat. The study area was divided along 12 and 18 m contour intervals with drainage bottoms defining the base elevation. More burrows were found along four main drainage systems running northeast to southwest. There was almost a four-fold increase in burrow density in the 0-12 m (0-39 ft) interval compared to the $18 m (59 ft) interval. Kehne (1991) observed that the most common similarity between the known pygmy rabbit sites is mound/intermound topography with dissected hillslopes adjacent to narrowly dissected alluvial areas. Soils can be derived from loess, as is the case at Sagebrush Flat, or glacial parent materials.

Cattle Grazing

The influence of cattle grazing on pygmy rabbit habitat is not well understood. There have been no studies specifically designed to determine the influences of grazing or grazing management strategies on pygmy rabbit habitat or population conditions. Green (1978) speculated that the preference of cattle for grasses might result in competition during the spring and summer when pygmy rabbits preferentially select grasses.

In general, grazing is known to affect the characteristics of sagebrush communities. The effects depend on a variety of factors including timing and intensity of grazing, stocking densities, locations of water or salt, and other factors that would concentrate cattle use. In some cases grazing can increase cover of sagebrush (Ellison 1960, Daubenmire 1970, Tisdale and Hironaka 1981, Stevens 1984). Tisdale and Hironaka (1981) found that grazing reduced the more palatable herbaceous species, allowing the shrubs to flourish. This resulted in a dense and vigorous stand of sagebrush with a relatively sparse understory of annuals and unpalatable perennials. Ellison (1960) found that grazing by either cattle or sheep reduced the production of perennial forbs and grasses and increased the volume of sagebrush. Annual grasses also increased. Daubenmire (1970) indicated that sagebrush population density becomes static at only 5-25% coverage when there is good cover of perennial grasses but increases when these grasses are removed. Daubenmire added that sagebrush suffers from breakage when the concentration of cattle or horses is high. Habitat can be rendered unsuitable for pygmy rabbits when broken shrubs result in open canopy conditions.

Pygmy rabbits have evolved in the presence of ungulate grazing. During the 100,000 plus years that pygmy rabbits have inhabited eastern Washington, mule deer, elk, bison, antelope, and bighorn sheep have shared portions of their range. Like the pygmy rabbit, bison and antelope have declined in this region over the past several thousand years (Buechner 1953, Daubenmire 1970). The abundance of grazing ungulates likely never approached the levels found in the grasslands east of the Rocky Mountains and this is evidenced by the lower resilience of eastern Washington plant communities to the effects of heavy grazing (Daubenmire 1970).

Gahr (1993) was able to partition some of the data collected in her study of pygmy rabbits at Sagebrush Flat. The occupied habitat at Sagebrush Flat has been divided by a fence for many years. The approximately 1,133 ha (2,800 ac) area north of the fence has been grazed by cattle and horses at varying intensities and duration for many decades. At the time of Gahr's study, the area was being grazed by cattle for 3 months each fall. The 272 ha (680 ac) area south of the fence has not been grazed since at least 1957 (Guinn 1993). Gahr found no differences in the densities of burrow systems and burrow sites between the grazed and not recently grazed areas at Sagebrush Flat. Both burrow systems and burrow sites were distributed proportional to the area available in each type. However, there are differences in proportions of the areas in different soil conditions. Guinn (1993) reported these differences in terms of "range sites" which have not been characterized for their value to pygmy rabbits. The northern unit of the grazed section was estimated to be about 80% loamy sites, the southern section about 60% loamy and 25% shallow

sites. The area not recently grazed was estimated to be comprised of about one third each shallow and loamy sites.

Gahr also found that the average home range size of adult males in the grazed area was significantly larger than that of adult males in the area not recently grazed. Adult males in the grazed area made more frequent long distance movements to search out females for breeding. This suggested that the density of adult females may have been lower in the grazed area. The ratio of animals trapped in the grazed and not recently grazed areas was lower than expected based on land area. Trapping effort for the two areas was not standardized so this result is not conclusive.

Seasonal

Pygmy rabbit diet changes somewhat with season. Sagebrush is eaten to the virtual exclusion of all other foods during winter. Grasses and forbs become more important in spring and summer (Bradfield 1974, Green 1979, Gahr 1993). Some characteristics of the pygmy rabbit's seasonal diet are summarized under Natural History - Food.

Pygmy rabbits are not known to move seasonally to exploit new or different habitats. During winter, pygmy rabbits excavate extensive snow burrows which are heavily utilized for foraging (Bradfield 1974).

POPULATION DYNAMICS

Detectable population cycles have been documented for some lagomorphs, such as the snowshoe hare (*Lepus americanus*) (Green and Evans 1940). Such predictable cycles are not known for pygmy rabbit populations.

Wilde (1978) concluded that pygmy rabbits have a lower potential for rapid increase in numbers than other lagomorphs. Unlike many lagomorphs, pygmy rabbits do not appear to be able to produce extra litters in response to favorable environmental conditions. It is, perhaps, their dependence upon a long-lived, slow-recovering food source (sagebrush) which has produced this population inertia. There is, however, evidence of marked population fluctuations in some areas. Local population declines have been reported during studies in Idaho, Utah, Oregon, and Wyoming (Janson 1946, Bradfield 1975, Weiss and Verts 1984, Katzner pers. comm.).

POPULATION STATUS

Present

In Washington, five pygmy rabbit populations are known to exist in pockets of suitable habitat in Douglas County. These populations are probably isolated from one another since there is little to no sagebrush landscape connecting them. Gahr (1993) suggested that although maximum movement distances found at Sagebrush Flat may not represent the absolute maximum possible of pygmy rabbits, movement of rabbits between the occupied sites was unlikely.

Three of the populations are extremely small (estimated at fewer than 30 active burrows), and one is estimated to comprise from 70 to 80 active burrows. The Sagebrush Flat population is the largest known population in Washington, with an estimated 588 active burrows (Table 3). Since pygmy rabbits use multiple burrows and share some burrows, the number of rabbits is fewer than the number of active burrows. Gahr (1993) used two techniques to estimate rabbit numbers at Sagebrush Flat. Using data on shared and unshared burrows, she estimated the Sagebrush Flat population to be 78 pygmy rabbits, with a possible range of 55 to 142. Using a second, independent technique based on radio telemetry data, she estimated the population to be 107 pygmy rabbits.

Past

Paleontological investigations suggest shrinkage of the pygmy rabbit's Pacific Northwest range over the past 7,000 years. This shrinkage may be the result of changes in climatic conditions which affect sagebrush plant communities (Butler 1972, Lyman 1991).

Within the past 75 years, available evidence suggests a marked decline in the pygmy rabbit's Washington range, now believed to be restricted to Douglas County. Verified localities (Fig. 2) indicate a past distribution which included portions of five counties. Virtually nothing is known about the abundance of the pygmy rabbit at any of these localities or the extent of area they occupied.

Published information does little to clarify the situation. Taylor and Shaw (1929) reported the pygmy rabbit as fairly common in the coulees and slopes of Adams County. Booth (1947) reported them very scarce, occurring only in small, limited areas in the arid parts of Adams and Grant counties. Dalquest (1948) considered the species rare and of local occurrence, restricted to the central portion of the Columbia Plateau. Buechner (1953), in reviewing the dramatic agricultural changes occurring in eastern Washington, predicted that the pygmy rabbit would disappear entirely in Washington. Maughn and Poelker (1976) indicated that due to its specialized habitat requirements, the pygmy rabbit was suffering a decline in numbers from habitat destruction.

There were no verified pygmy rabbit collections or reports between 1962 and 1979. In 1979, Washington Department of Fish and Wildlife biologists found pygmy rabbits at Sulphur Canyon in Douglas County (Lloyd 1979). Surveys of this area during 1985 found no signs of an extant colony (Poole 1985). It is likely that the Sagebrush Flat population identified in 1949-62 was still existing at this time, but the specific location for the historic records was not known when the surveys were conducted. Because the 1985 searches failed to find pygmy rabbits anywhere in Washington, there was speculation that the species may have been extirpated. In December 1987, Department biologists discovered a colony of pygmy rabbits at Burton Draw in Douglas County (Table 1). Intensive surveys conducted in 1988 found colonies at four additional sites (Sagebrush Flat, Coyote Canyon, Whitehall, and Clay Site).

HABITAT STATUS

Past

Lyman (1991) provided an in depth discussion of evidence of changes in the pygmy rabbit's eastern Washington range over the past 13,000 years. His interpretations of the data indicate that pygmy rabbit range in eastern Washington expanded in response to climate changes affecting big sagebrush. The maximal extent of big sagebrush and pygmy rabbits probably occurred between 8,000 and 4,500 years ago. Over the past 4,000 years, climate changes have caused a decrease in the range of thick stands of big sagebrush and a corresponding shrinkage of the pygmy rabbit's range in eastern Washington.

Within the past 200 years, big sagebrush-dominated plant communities covered much of the landscape within the pygmy rabbit's former range. Prior to European settlement, there was an estimated 4.2 million ha (10.4 million ac) of shrub-steppe landscape in eastern Washington (Dobler 1992). Based on current knowledge of pygmy rabbit habitat requirements, it is likely that pygmy rabbits lived in areas where sagebrush cover was heavy, soils were relatively deep and loose enough to allow digging, and where there was mound-intermound and dissected topography. Pre-settlement big sagebrush cover is estimated at about 10% (Blaisdell 1953), perhaps varying from 5-26% (Daubenmire 1970). Therefore much of the eastern Washington landscape was unsuitable or marginal for pygmy rabbits, which select sagebrush densities of 28-46%. However, localized areas of deep soil and correspondingly high soil moisture were known to support unusually tall, dense sagebrush cover (Daubenmire 1970).

In pre-settlement times, the pygmy rabbit probably inhabited disturbed or unusual sites in the sagebrush landscape, which had an increased density of sagebrush. Pygmy rabbits were probably patchily distributed over a vast area as a result of the scattered distribution of sites with appropriate habitat characteristics. Many areas of sagebrush-dominated landscape without these characteristics probably provided little more than temporary food and cover for animals dispersing out from population centers.

Buechner (1953) discussed some of the historic habitat changes that have affected the biota of Washington. Most areas with deep soils were converted to croplands long ago. Roads and towns also replaced habitat or served to interrupt travel routes. Much of the remaining sagebrush area was used for grazing cattle. Past grazing practices sometimes over-grazed areas to the point that shrub cover was broken down and rendered unsuitable for pygmy rabbits. In addition, over-grazing usually led to invasions of annual species, particularly cheatgrass (*Bromus tectorum*), which brought about pronounced and essentially permanent changes to the shrub-steppe habitats. Sometimes this grazing resulted in dense stands of big sagebrush, which may have provided habitat for pygmy rabbits. In most instances, however, shortened fire cycles and loss of native grasses and forbs eventually rendered over-grazed areas unsuitable. Some pygmy rabbit was created when croplands were abandoned and allowed to return to the heavy sagebrush cover conditions used by pygmy rabbits.

Present

Approximately 40% of the original shrub-steppe now remains in Washington (Dobler 1992). A systematic inventory of sagebrush-dominated landscapes with the deep, loose soils characteristic of pygmy rabbit habitat has not been completed. However, general knowledge of land uses in the pygmy rabbit's range indicates that the appropriate habitat is currently just a small fraction of its former abundance. Much of the landscape within the pygmy rabbit's former range in Washington is now used to grow crops.

Three of the five known pygmy rabbit sites (Sagebrush Flat, Whitehall, and Clay Site) are on state land managed by the Department of Natural Resources and leased for grazing; two (Coyote Canyon and Burton Draw) are on private land (Table 3). In 1993, the Department of Natural Resources, Washington Department of Fish and Wildlife, Soil Conservation Service, and the grazing permittee developed a Coordinated Resource Management Plan to provide for better grazing management and monitoring of vegetation and the pygmy rabbit population at Sagebrush Flat. The completed plan will be evaluated and rewritten during 1995. Sagebrush Flat is also under consideration for Natural Area Preserve status or transfer to the Washington Department of Fish and Wildlife.

Table 3. Currently occupied pygmy rabbit sites in Washington.

Site Name	Landowner	Size (ha)	Est. # of burrows	Est. Population
Sagebrush Flat	Dept. Nat. Resour./Dept. Fish & Wildl.	1272/96	588	<150
Coyote Canyon	Private	184	70-80	?
Burton Draw	Private	128	25	?
Whitehall	Wash. Dept. Nat. Resour.	16	25-30	?
Clay Site	Wash. Dept. Nat. Resour.	<16	7-10	?

CONSERVATION STATUS

Legal Status

During 1990, the pygmy rabbit was classified by the Washington Wildlife Commission as a threatened species under WAC 232-12-011. In 1993, the Wildlife Commission reclassified the species to State Endangered status under WAC 232-12-014. This classification makes it illegal to attempt to kill, injure, capture, harass, possess, or control pygmy rabbits.

The U.S. Fish and Wildlife Service retains the pygmy rabbit in its Candidate Category 2 list of species that may warrant listing under the Endangered Species Act. Therefore, the Service recommends protection of the species and its habitat. However, binding legal protection is not provided by listing as a Candidate Category 2 species.

Management Activities

The Washington Department of Fish and Wildlife has conducted surveys, research, and management activities intended to benefit pygmy rabbits since 1979. The Department conducted a 6-year study of the shrub-steppe ecosystem, including studies of pygmy rabbits. Studies included searches for pygmy rabbit populations, mapping of burrows, radio telemetry, and evaluations of the capability of Landsat technology to identify pygmy rabbit habitat. In 1991 the Department contributed funds to the University of Washington to support a graduate study of pygmy rabbits (Gahr 1993). The study determined burrow habitat and use, population densities, home range sizes, and food habits of pygmy rabbits, and compared parameters on grazed areas and areas not recently grazed.

Because of its endangered status in Washington, the pygmy rabbit is a Priority Species treated by the WDFW Priority Habitats and Species Division. The Priority Habitats and Species Division maintains a Geographic Information Systems database of important habitat areas. These data, along with management recommendations, are provided to landowners, government agencies, and others to enlist their assistance in proper management.

The Department of Fish and Wildlife has acted in other ways to protect known pygmy rabbit sites and to acquire potential habitats. Grazing is the primary economic use for the lands that currently support pygmy rabbits and, in many cases, has been the predominant land use for many years. The effects of different grazing prescriptions on pygmy rabbits and their habitat are largely unknown. However, sagebrush removal to benefit grass production is a common management practice on rangelands and, undoubtedly, renders habitat unsuitable for pygmy rabbits. On the Burton Draw site, pygmy rabbits were first discovered during a WDFW field review of the landowner's proposed sagebrush control project. To avoid the destruction of occupied habitat, arrangements were made to transfer cows to a Department of Fish and Wildlife owned parcel to compensate the landowner for losses due to postponement of sagebrush control. Bonneville Power Administration (BPA) funds later provided for fee title purchase of this property to be managed by WDFW as pygmy rabbit habitat.

A variety of actions have been taken to protect pygmy rabbits and their habitat at the 1368 ha (3380 ac) Sagebrush Flat site. The WDFW purchased grazing sub-leases for a 272 ha (680 ac) portion of the site which has not been grazed since at least 1957. This area made possible research on pygmy rabbit populations in adjacent areas that differ in grazing history (Gahr 1993) and will likely provide for additional future research. The majority of the Sagebrush Flat site, approximately 1000 ha (2471 ac) of shrub-steppe habitat, was the subject of a 1993 agreement between the WDFW, Soil Conservation Service, Department of Natural Resources, and grazing permittee. This agreement, called a Coordinated Resource Management Plan, outlines grazing management prescriptions and monitoring plans designed to improve range condition and track the conditions of the vegetative community and the pygmy rabbit population. An adjacent 96 ha (240 ac) parcel was purchased by WDFW for inclusion in the pygmy rabbit habitat area. This parcel included a 36 ha (90 ac) portion that was cultivated in wheat. During 1994, using funds provided by the BPA, the soil on this former wheat land was back-bladed to create microtopography similar to what pygmy rabbits select for burrow construction. It was then planted to sagebrush, grasses, and forbs (Dobler, pers. comm.).

The BPA may, in the future, provide additional funding to the state for pygmy rabbit recovery actions. These funds are allocated to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries (Ashley 1992, U.S. Dept. Energy 1992a,b, Whalen pers. comm.).

FACTORS AFFECTING CONTINUED EXISTENCE

Present and Threatened Habitat Loss

Most of the former pygmy rabbit habitat in Washington has been altered to the point that it can no longer support pygmy rabbits. Additional losses may occur in the future through conversion of shrub-steppe to cropland, sagebrush removal for cattle grazing, or wildfire. This is especially

likely in areas where pygmy rabbits occur but have not yet been discovered. It is expected that there will be consideration of pygmy rabbit habitat needs in decisions about land uses on the three known sites in public ownership (Table 3). The Department of Natural Resources has been supportive of efforts to maintain habitat conditions suitable for pygmy rabbits and has rejected proposals for sagebrush removal in areas where pygmy rabbits occur. However, portions of the three publicly-owned sites are State Trust lands where there is a legal requirement that they be managed for the benefit of the various Trusts. The DNR is currently considering transferring the Sagebrush Flat site out of Trust status. Options being explored are transfer to WDFW or Natural Area Preserve status. As a Natural Area Preserve, Sagebrush Flat would be managed by the Natural Area Preserves Program within the DNR.

On the Clay site, a mineral lease for the purpose of mining bentonite is being negotiated. WDFW biologists are involved in evaluation of the proposed mining activities and are providing recommendations to minimize effects on pygmy rabbits.

On the sites in private ownership, habitat loss or degradation may be prevented through cooperative agreements. Some opportunities may exist to develop coordinated management agreements to conserve pygmy rabbit habitat conditions. Implementation of sound habitat management prescriptions in the future will be enhanced as knowledge of pygmy rabbit habitat needs and grazing relationships is gained.

Low Population

Even if the five existing pygmy rabbit habitats are maintained in their current condition, populations will remain vulnerable to extirpation. The historic pressures of habitat loss appear to be less important today, mainly due to recognition of the pygmy rabbit's endangered status. However, existing populations are believed to be below the level necessary for long-term viability. Populations comprised of few individuals are vulnerable to extirpation from a variety of factors, often acting in concert. Shaffer (1981) grouped threats to small populations into four categories: demographic stochasticity, environmental stochasticity, natural catastrophies, and genetic stochasticity. Demographic stochasticity is the natural random variation in survival and reproductive success of individuals in a population. Environmental stochasticity is variation in environmental factors such as food sources, disease vectors, predator and parasite populations, climate, and so forth. Natural catastrophes include fire, volcano eruptions, floods, landslides, and other devastating events. Genetic stochasticity results from changes in gene frequencies due to founder effect, random fixation, or inbreeding. Many of these factors vary naturally over time and do not pose a threat to large populations. However, small populations can be extinguished by unfavorable extremes of one or a combination of these factors.

Comparisons of initial population sizes for extant and extinct rabbit populations suggest that populations for this group need to be much larger than those of many other mammals to be secure (Soulé 1987). The wide fluctuations that have been evident in pygmy rabbit populations (Janson 1946, Bradfield 1975, Weiss and Verts 1984, Katzner, pers. comm.) suggest that it is a

species, like other lagomorphs, that needs to be maintained at higher population levels than many other vertebrates to be considered secure.

Habitat Linkages

Green and Flinders (1980b) noted the importance of habitat connectivity and travel corridors. The ability of pygmy rabbits to rebound after periods of unfavorable conditions depends, in part, on landscape features that allow animals to disperse and recolonize suitable habitats. Long-term population maintenance, without human intervention, will likely depend upon establishment of habitat corridors linking the existing small, isolated populations. Such habitat linkages would increase the probability that the habitat which now supports a population would continue to be occupied by pygmy rabbits in the future.

Fire

Range fires can eliminate sagebrush from large areas and are a potential threat to existing pygmy rabbit populations. Sagebrush is slow to re-establish after a range fire. A Benton County pygmy rabbit habitat discovered by R. Fitzner in 1979 was destroyed by fire soon after its discovery. Sagebrush Flat, which contains Washington's largest known pygmy rabbit population, is an area penetrated by open, poor quality roads that are used for night-time parties and other social activities where fires are sometimes built.

Interspecific Relationships

Because existing pygmy rabbit colonies are mostly small in size and found in isolated patches of habitat, predators may be a significant factor in reducing or limiting populations.

Davis (1939) states that pygmy rabbits are infested with endoparasites as well as ectoparasites. Ticks, fleas, and lice may be found on every animal examined (Davis 1939). Fleas are abundant on some specimens. Gahr (1993) observed fleas on pygmy rabbits at Sagebrush Flat year-round, with the greatest infestations occurring from February to May. Ticks were seen on rabbits from March to September with the highest infestation in the spring. Bot fly larvae (*Cuterebra maculata*) were found on two pygmy rabbits in grazed portions of Sagebrush Flat during September. Bot fly larvae were also found on three cottontail rabbits in the grazed area. Although Gahr cautioned that the sample size was too small to draw conclusions, she suggested that cows may act as a vector for spreading the parasites or that the bot flies might be attracted to the grazed area by cow manure. At the Idaho National Engineering Laboratory site, 19% of pygmy rabbits trapped during a 1975-1977 study had bot fly larvae. The study area had been closed to grazing since 1953 (Wilde 1978). Bot fly larvae develop under a rabbit's skin, dropping out through a hole in the skin during late summer or fall. In general, bot fly larvae do not result in serious injury or death (Hall, pers. comm.)

CONCLUSION

The pygmy rabbit's range in Washington has declined significantly. Populations were once established in at least five counties of the shrub-steppe dominated region of eastern Washington. Relatively recent investigations of the pygmy rabbit's habitat requirements have demonstrated the importance of both heavy sagebrush cover and deep, loose soil. In the Columbia Basin of eastern Washington, the majority of lands with deep soils are now cultivated which precludes use by pygmy rabbits.

Biologists working in the shrub-steppe zone have surveyed or looked for indications of pygmy rabbit populations since at least 1979. Despite these efforts, the only known extant populations are in Douglas County. These populations, conceptually treated as five distinct pygmy rabbit sites, are subject to a variety of events that could eliminate pygmy rabbits or their habitat. Each of the relatively small populations is vulnerable to intense predation, disease, and habitat destruction due to fire or other natural phenomena such as drought.

Grazing, if not properly managed and monitored, has the potential to damage pygmy rabbit habitat. Sagebrush removal or conversion of pygmy rabbit habitat to cropland would adversely affect currently suitable habitat. Mining of bentonite may impact pygmy rabbits at one site. The few small pygmy rabbit populations that remain in Washington are vulnerable to extirpation from a wide variety of causes.

PART TWO

RECOVERY

RECOVERY GOALS

The goal of the pygmy rabbit recovery program is to outline strategies which, when implemented, will enhance pygmy rabbit habitat and numbers to a level where there is a high probability of population viability through the foreseeable future.

RECOVERY OBJECTIVES

The pygmy rabbit will be considered for downlisting from State Endangered status when the following criteria have been met:

1. The state supports a minimum 5-year average of at least 1400 adult pygmy rabbits in six populations; two populations with at least 500 adults each and four populations with at least 100 adult rabbits each.

2. Habitat security for the six populations has been established.

The pygmy rabbit will be considered for delisting from State Threatened status when the following criteria have been met:

1. The state supports a minimum 5-year average of at least 2800 adult pygmy rabbits in at least 12 populations; four populations with at least 500 adults each and eight populations with at least 100 adult rabbits each.

2. Habitat security for the 12 populations has been established.

Rationale

Reclassification criteria are based on the following general assumptions about risks of extirpation:

a. The larger a species' population, the lower the risk of extirpation.

b. The more sub-populations a species has, the lower the risk of extirpation.

Pygmy rabbits in Washington are isolated. Viability for this isolated population, barring human intervention, will be dependent upon maintaining adequate numbers and interaction between sub-populations within Washington. A wide range of considerations are useful to establishing population objectives for isolated populations. Many of the concepts used to establish the pygmy rabbit recovery objectives are presented in Salwasser et al. (1984) and briefly summarized below.

The delisting goal, which calls for a minimum of 2800 adult pygmy rabbits, is consistent with current theory concerning minimum population size needed to maintain genetic variability to allow for adaptation to long-term (centuries) environmental change. The objective which calls for geographically separated habitat areas provides greater security from devastating effects of epidemics, fire, and other disasters. However, long-term viability and adaptation to environmental change may depend upon infrequent (perhaps one to a few instances of emigration per decade) genetic exchange between sub-populations. This might be accomplished through the creation of habitat linkages between pygmy rabbit areas or through human intervention to move rabbits.

Relatively small sub-populations of 100 or more adult rabbits are considered large enough to be resilient over the short-term (decades). Resilience refers to the short-term ability of a population to survive in the face of normal, random birth and death events (demographic stochasticity). Populations of this size should also be able to retain sufficient genetic variation to maintain normal fecundity and viability. Including these smaller populations in the recovery objective provides additional security against extirpation and facilitates a realistic strategy for establishing pygmy rabbits over much of their former range in the state. These smaller populations will take advantage of opportunities to establish pygmy rabbits in smaller habitat areas. These populations will be relatively secure in the short term (decades) and provide additional source populations should disease, fire or other factors eliminate other Washington populations.

RECOVERY STRATEGIES AND TASKS

1. Monitor the pygmy rabbit population.

Knowing the distribution and abundance of pygmy rabbits is essential to making informed management decisions. Efforts to determine population trends at existing sites must be continued. In other areas, sighting reports should be evaluated and follow-up surveys conducted to attempt to verify pygmy rabbit presence.

1.1 Determine population trends through fall/winter burrow surveys.

Monitoring of pygmy rabbit populations is needed to provide baseline data from which to discern population trends, changes in distribution, and other population parameters. To avoid trapping and handling pygmy rabbits, trend data should be obtained through survey and classification of burrows. Burrow surveys should be conducted between late fall and early spring, the seasons when pygmy rabbits are most closely associated with burrows. Estimates of active burrows over an entire habitat area are best obtained from randomly selected, circular plots that allow for 100% detection of active burrows. Pins driven into the ground mark plot centers at Sagebrush Flat and these should be used in surveys conducted annually. Burrow activity classification should be based on whether or not passages are open and recent tracks or fecal pellets are present. This technique will provide an indication of population trend.

1.2. Develop techniques for estimating pygmy rabbit numbers.

Techniques suitable for estimating numbers of pygmy rabbits need to be developed. Chosen techniques should minimize mortality. Mark recapture techniques that have been used to estimate rabbit populations should not be used if significant mortality would occur. Marking, in combination with spotlight transects or camera sets are among the techniques that should be considered. Randomly sited circular plots may prove valuable for population estimation, perhaps in combination with counts of active burrows or fecal pellets. These techniques should be considered and, if warranted, refined and tested for their applicability to pygmy rabbits. A population assessment provided by burrow counts will provide needed information in the near term. However, eventually, estimates of pygmy rabbit population sizes should be obtained. A wide variety of techniques should be considered so that one or two of the most promising methods can be tested, refined, and implemented.

1.3. Survey areas of potential pygmy rabbit occurrence.

Areas determined to have good potential to support pygmy rabbits (based on examination of soil type maps, aerial photos, or other sources) should be surveyed on the ground. Similarly, reported pygmy rabbit sightings should be evaluated and, if deemed to be likely, the area of the sighting should be surveyed on the ground.

2. Protect the pygmy rabbit population.

Management actions designed to protect the existing population and increase population size should be initiated. At this time, occupied pygmy rabbit habitat in Douglas County is the highest priority for recovery actions.

2.1. Reduce the potential for destructive fires.

Reducing the risk of devastating fire will involve regulating access, requiring outdoor fire permits, and planning for quick control or suppression of fires that get started.

2.1.1. Limit vehicular access in the vicinity of pygmy rabbit areas.

Reducing accessibility for vehicles can reduce the potential for range fires. Methods for controlling access need to be devised and implemented.

2.1.2. Develop green strips to protect pygmy rabbit habitat areas from fire.

Green strips are comprised of planted perennial grasses that remain green through spring and early summer when lightning-caused fires are most likely to occur. The presence of perennial grasses tends to exclude cheatgrass (a fire risk increaser) and provide a fire resistant strip that will often stop the spread of a range fire. Mowing of the green strip during mid to late summer would provide additional security.

2.1.3. Establish districts surrounding pygmy rabbit areas where outdoor burning permits are used to enforce standards that prevent range fires.

Fire permit requirements should be developed and applied to areas in and adjacent to pygmy rabbit habitat. Local fire districts should be enlisted and contracted, if necessary, to administer permits and enforcement.

2.1.4 Develop strategies and partnerships for fire response readiness.

Equipment and responsible staff need to be identified for response to fires in or adjacent to pygmy rabbit habitat. Local fire districts, State Strike Teams, and others may be incorporated into a fire response plan.

2.2. Keep records on the relative abundance of predators and all evidence of predation. If warranted, take steps to reduce predation.

Mammalian and avian predators may be a threat to pygmy rabbit populations because of the small number of rabbits and the small extent of area they occupy. During pygmy rabbit population monitoring, notes should be taken on predator species observed (including sign) and evidence of predation on pygmy rabbits. If there are indications of regular and widespread predation on pygmy rabbits, steps should be taken to discourage predators from frequenting pygmy rabbit habitat areas. In the long-term it is expected that increasing pygmy rabbit numbers and distribution, as well as maintaining adequate vegetative cover conditions, will make predation unimportant.

2.3. Reduce the potential for mistaken identity killing of pygmy rabbits.

At this time, there is little hunting of any kind in areas known to have pygmy rabbits. If, in the future, pygmy rabbits are found in areas where rabbit hunting occurs, signs should be posted alerting hunters to the presence of protected pygmy rabbits. Areas could also be closed to rabbit hunting if the risks to pygmy rabbits are determined to be significant.

3. Manage habitat to increase pygmy rabbit abundance and distribution.

To establish populations large enough to sustain themselves into the distant future, existing habitat should be enhanced and additional habitat created and managed. The amount of habitat and space required for the achievement of the recovery objective must be determined and sites chosen for management as pygmy rabbit habitat.

3.1. Improve the suitability of existing pygmy rabbit habitat.

Existing pygmy rabbit areas, if enhanced, should be capable of supporting larger numbers of pygmy rabbits. It may be possible to enhance the suitability of existing habitat areas by increasing sagebrush cover or by increasing the availability of favored grasses and forbs. If grazing occurs on a site, it should be managed for compatibility with pygmy rabbits. Grazing management should be responsive to the results of research into the effects of grazing on pygmy rabbits and their habitat. Increasing soil

depth or microtopography may prove to be legitimate enhancements and should be tested. Other enhancements may be developed as an outgrowth of research findings.

3.2. Determine the amount of habitat needed to support a recovered population.

A method for estimating the amount of habitat needed for a recovered population should be developed and applied. The method should reflect the influences of soil types, soil depth, topography, and climate on carrying capacity.

3.3. Identify areas that should be managed as pygmy rabbit habitat.

Using information derived from task 3.2., identify areas that could be managed for pygmy rabbit recovery.

3.3.1. Use Geographic Information Systems technology to identify areas suitable for field survey.

Conduct a broad analysis of landscapes within the historic range of the species in Washington (Douglas, Lincoln, Grant, Kittitas, Yakima, Benton, Franklin, Adams, and Walla Walla counties) to determine the locations of the best areas to be enhanced or restored to a condition attractive to, and capable of supporting, pygmy rabbits. Information on soils, topography, current land uses, ownership, and vegetation should be used to identify areas that could be pursued for inclusion in a management program designed to increase pygmy rabbit numbers and distribution. Initial efforts should be directed toward identification of lands with appropriate soils, topography, and a big sagebrush plant community. Lands in public ownership or those owned by supportive private landowners should be given priority consideration.

3.3.2. Survey identified areas to evaluate their habitat potential.

Conduct surveys designed to characterize habitat conditions and habitat potential. Since pygmy rabbit habitat requirements are fairly well known, measurement of specific characteristics will provide a useful indication of habitat suitability or the potential for developing suitable habitat characteristics.

Priority for surveys should be given to public lands. Private lands should be surveyed when they provide an important link between parcels of public land or when their habitat values are potentially superior to anything available on public land. In some instances croplands with the appropriate

soil and topographic characteristics could benefit pygmy rabbit recovery if returned to a sagebrush-dominated plant community.

After the results of these surveys have been evaluated, potential pygmy rabbit habitat areas should be selected. A discussion of management or enhancement needs and estimated costs should be developed for each habitat area.

3.4. Pursue management of selected areas by natural resource agencies.

Areas selected as candidates for providing pygmy rabbit habitat areas may be best managed by natural resource agencies. However, a variety of options for managing the land to benefit pygmy rabbits should be pursued.

3.4.1. Support or facilitate fee acquisition of existing or potential habitat through purchase, land exchange, or charitable donation.

The Department should facilitate or support acquisition of pygmy rabbit habitat by agencies, persons, or groups that intend to conserve pygmy rabbits and their habitat. Acquisition should be pursued where there are willing sellers and it is determined to be the best means for securing needed habitat for pygmy rabbits.

3.4.2. Support or facilitate the application of less-than-fee mechanisms to provide habitat for pygmy rabbits.

Conservation easements and tax incentives such as open space designation may be used to encourage private landowners to protect pygmy rabbit habitat. Within landscapes of importance to pygmy rabbit recovery, Coordinated Resource Management Plans, access regulation, fire risk reduction, and other management actions should be pursued where fee acquisition is not possible or not warranted.

3.4.3. Develop and apply site-specific management plans.

Site-specific management plans provide guidance for dealing with the needs of a specific pygmy rabbit habitat area. The management considerations or activities required to conserve pygmy rabbit habitat differ from one parcel to another and are influenced by land uses on the parcel as well as land uses on adjacent parcels. A site-specific management plan is important in establishing the habitat and population monitoring and management needs of the site.

Detailed site-specific management plans, agreed to and implemented by WDFW and other involved parties, can be considered the means for achieving habitat security to meet pygmy rabbit recovery objectives.

3.5. Create suitable habitat in areas selected for management as pygmy rabbit habitat.

Develop techniques to create or enhance pygmy rabbit habitat, taking full advantage of expertise in soils, range, and other sciences to attain the desired results. Apply these techniques in areas being managed for pygmy rabbits.

To provide for an increased pygmy rabbit population in Washington, increases in both the suitability of existing habitat and the quantity of habitat overall need to be achieved. The techniques for accomplishing these objectives have not been refined. Vegetative cover and soil characteristics are important to pygmy rabbits and may need to be managed for optimal conditions. This includes control of invading exotics that could degrade habitat conditions. To expand the habitat area available to pygmy rabbits, croplands in some areas should be restored to a predominantly sagebrush cover. These areas will provide an opportunity to experiment with artificially created habitat, such as soil mounds similar to those that are often chosen for burrow construction.

3.5.1. Identify and apply land uses and techniques suitable for enhancing, creating, and sustaining habitat characteristics which benefit pygmy rabbits.

A variety of habitat enhancement techniques should be attempted and evaluated. These could include methods to establish sagebrush, increase sagebrush cover, or create desirable microtopography and soil conditions. For areas currently without a sagebrush plant community, these and other techniques should be tested to learn which techniques produce the best results.

3.6. Monitor habitat conditions in pygmy rabbit habitat areas.

The characteristics of vegetative communities are important to pygmy rabbits. Vegetative cover conditions at sites being managed for pygmy rabbits should be assessed periodically. Descriptive information on the height, density, and species composition of vegetative cover should be collected from sample plots.

4. Establish populations in new areas.

When suitable habitat is secured or created, reintroductions will likely be necessary to restore the species to portions of its former range.

4.1. Investigate techniques for introduction of rabbits to unoccupied habitat.

A wide variety of considerations (e.g., costs, survival advantages, transplant success rates) must be evaluated to determine how to establish new populations in unoccupied habitat. Evaluate and test reintroduction techniques, including use of captive-reared versus wild-caught pygmy rabbits for introduction to unoccupied habitat.

4.2. Conduct genetic comparisons of rabbits from potential transplant source populations.

Genetic comparisons between Washington populations and potential transplant source populations should be conducted and evaluated. This information should be used to help guide decisions about sources of rabbits for transplants.

4.3. Implement introduction of captive-reared or wild-caught juvenile rabbits to unoccupied suitable habitat.

As an outcome of the evaluations described above, a reintroduction method should be selected. Reintroduction should proceed contingent upon adequate habitat provision as described under sections 3.2 and 3.4.

5. Enforce restrictions designed to protect pygmy rabbits.

Under the Wildlife Code of Washington, killing pygmy rabbits is the primary activity prohibited by law and enforcement of this law may be necessary. However, the Department should seek assistance in establishing and enforcing access restrictions, outdoor burning permit requirements, and other rules that serve to protect pygmy rabbits and their habitat.

6. Establish information management and retrieval systems.

Ready access to information gathered during surveys and investigations will be critical for management decision makers. A centralized information system, Wildlife Survey Data Management, exists at the Department of Fish and Wildlife. Summaries of data should be prepared annually and distributed to interested persons and agencies.

6.1. Maintain repository for pygmy rabbit records.

New pygmy rabbit habitat area locations should be submitted to Wildlife Survey Data Management at the earliest opportunity following discovery. Data entry, manual storage, and incorporation into a Geographic Information System should be done as appropriate.

6.2. Produce an annual pygmy rabbit status review.

A report describing the status of the pygmy rabbit population, as well as management activities and their effects, should be prepared and distributed each year. An annual threatened and endangered species status report, combining information for all listed species, is one way to make this information readily available.

7. Coordinate and cooperate with public agencies and other landowners.

Working in concert with other entities will enhance the potential success of WDFW recovery activities.

7.1. Review and recommend revisions to State regulations to protect pygmy rabbit populations and habitat.

State lands are often leased for the purposes of grazing, growing crops, extracting minerals, and other uses. Existing regulations on leasing of state lands may not provide adequate provisions for conserving habitat for endangered species. A comprehensive review of the rules which govern the leasing process needs to be conducted and recommendations developed for improving protection afforded to endangered species.

7.2. Develop management plans which protect pygmy rabbit populations and habitat.

For pygmy rabbit areas on public lands, protection of pygmy rabbits and pygmy rabbit habitat should be a primary goal of Coordinated Resource Management Plans, lease agreements, and other land use plans. For State Trust Lands there may be Trust compensation required. The existing Coordinated Resource Management Plan for Sagebrush Flat should be revised at the earliest opportunity to incorporate additional information on pygmy rabbit monitoring and habitat needs. For pygmy rabbits on private lands, the Department should encourage landowners to follow mutually agreeable land use management plans which protect pygmy rabbits and their habitat. Soil Conservation Service personnel should continue to be involved in management of pygmy rabbits because of their expertise in soils and vegetation and because of their frequent interactions with landowners in the range of the pygmy rabbit.

7.3. Provide management recommendations to landowners.

Pygmy rabbit management recommendations which address grazing management, access control, strategies to reduce the risk of range fires, and other strategies to benefit pygmy rabbits should be developed. Agency staff should provide these recommendations to public and private landowners and encourage implementation of the management recommendations to protect existing populations and enhance or create habitat to allow for new or larger populations. Pygmy rabbit recovery will benefit from landowner cooperation. The Department should initiate discussions with landowners to determine current land use practices and to find ways to improve conditions for pygmy rabbits.

When unoccupied habitats that are suitable for enhancement or restoration are identified, Department staff should work with landowners to encourage them to initiate activities that create or enhance habitat conditions for pygmy rabbits. Adjacent landowners should also be encouraged to implement management recommendations which benefit pygmy rabbits.

7.3.1. Work with public landowners to manage grazing and other activities to the benefit of pygmy rabbits.

On public lands, particularly, leases for grazing and other land uses should be contingent upon compatibility with pygmy rabbits. This necessitates cooperation and communication between wildlife professionals and landowners so that biological information can be used to adjust and refine land use practices to meet pygmy rabbit habitat requirements.

7.3.2. Work with private landowners to manage grazing and other activities to the benefit of pygmy rabbits.

Private landowners should be encouraged to manage grazing and other land uses for compatibility with pygmy rabbits. This necessitates cooperation and communication between wildlife professionals and landowners so that biological information can be used to adjust and refine land use practices to meet pygmy rabbit habitat requirements.

7.4. Secure cooperative funding to support recovery activities.

Pygmy rabbit recovery will not be accomplished without the participation of many organizations and individuals. Additional funds will be necessary. Success at completing the recovery tasks outlined in this plan will be contingent upon securing funding for habitat acquisition and restoration and reintroductions of rabbits.

7.4.1. Pursue funding to implement recovery strategies.

Pursue cost or resource-sharing arrangements, federal challenge grants, private foundation grants, Washington Wildlife Recreation Coalition funds, and other sources of funds to implement recovery strategies.

7.5. Create information exchange network between agencies.

State and federal agencies involved in pygmy rabbit management should exchange information so that the management activities of each can benefit from the other's efforts.

7.5.1. Provide locations of critical pygmy rabbit habitat areas to local governments and other agencies for use in land management decisions.

Subdivisions, commercial development, and conversion to cropland destroy vegetative cover conditions that are needed to support pygmy rabbits. The Department should help local governments conserve habitat for threatened and endangered species by identifying locations of critical habitats. Department biologists should make themselves available to local governments and other agencies to assist with assessing the effects of proposed developments and mitigating measures that might be implemented.

8. Complete scientific investigations that will benefit recovery efforts.

Much remains to be learned in Washington and throughout the range of the pygmy rabbit about the species' reproduction, dispersal, response to habitat change and other processes. Washington biologists should develop survey methods to monitor pygmy rabbit abundance. They should also remain abreast of research and management activities elsewhere in the pygmy rabbit's range.

8.1. Investigate the influence of different grazing strategies on pygmy rabbit population density and health.

Knowledge of the effects of variable intensities and durations of cattle grazing is important to achieving pygmy rabbit recovery goals. The potentially large extent of lands necessary to achieve recovery goals make it necessary that options for continued economic uses of the lands be considered. Research should be directed at understanding the effects of grazing on pygmy rabbits and identifying grazing strategies that have the potential to coexist with a healthy, viable pygmy rabbit population.

8.2. Investigate pygmy rabbit dispersal capabilities and the influence of vegetative cover conditions on dispersal.

Knowledge of pygmy rabbit dispersal capability is important for establishing whether or how quickly the species will be able to colonize vacant or newly created habitat at varying distances from existing populations. It is also a key to understanding the degree of isolation of pygmy rabbits in one area from those in another area. This knowledge is important for genetic considerations and for understanding a population's vulnerability to extirpation.

8.3. Determine population dynamics, including survivorship and recruitment patterns at breeding areas.

Pygmy rabbit population dynamics are not well-known. Population estimation techniques, which minimize handling and mortality, should be developed. The reasons for considerable population fluctuation in pygmy rabbits are not known. This aspect of their population dynamics has a bearing on population vulnerability to extirpation and should be investigated so that recovery objectives can confidently reflect a low risk of extirpation.

9. Develop public information and education programs.

Restoring endangered and threatened species to healthy, self-sustaining populations is a tremendous challenge. Successes in endangered species recovery require public funds and resource protection policies that are established as a result of broad public support. Information and education programs provide the means for the public to gain an understanding of recovery programs and needs. These are vital to both recovery of endangered species and long-term viability of wildlife populations.

9.1. Develop educational materials.

Local support for efforts to recover pygmy rabbit populations may be gained through development of quality educational materials. A fact sheet or poster could be designed to communicate information on the pygmy rabbit's special needs. A video and/or slide show describing the pygmy rabbit, its habitat, and recovery efforts could be produced.

9.2. Promote media contact.

Encourage the production of news releases, public service announcements, and articles in newspapers and magazines.

9.3. Conduct workshops and involve the public in recovery efforts, where possible.

Providing information to people who own or lease pygmy rabbit habitat should be the highest priority because these individuals have the greatest capability to affect pygmy rabbits and their habitat. Solicit and coordinate volunteer participation in habitat restoration and other recovery actions.

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PART THREE

IMPLEMENTATION SCHEDULE

IMPLEMENTATION SCHEDULE

The outline of strategies and tasks on the following pages identifies Washington Department of Fish and Wildlife responsibilities, provides estimates of annual expenditures, and assigns priority to recovery tasks, as follows.

Priority 1 Actions necessary to halt the decline and prevent the extirpation of the species in Washington and to monitor the population.

Priority 2 Actions meant to maintain the benefits of Priority 1 tasks and to enhance recovery efforts by stabilizing and rebuilding the population.

Priority 3 Actions that provide direction for future conservation needs.

Acronyms and symbols used to indicate WDFW responsibilities are:

WLM Wildlife Management
CTRL Problem Wildlife
RES Research
WSDM Wildlife Survey Data Management
HAB Habitat
LAND Land Resources
ENF Enforcement
IMR Information and Media Relations

IMPLEMENTATION SCHEDULE

Step-down Outline and Implementation Schedule for Washington State Recovery Plan for the Pygmy Rabbit, including Objectives, Strategies, and Tasks.

	Priority	Duration	Responsibility	Annual cost in thousands of $ 96	97	98	99	00
Monitor the pygmy rabbit population								
1.1. Determine population trends through fall/winter burrow surveys.	1	continuing	WLM	10	4	4	4	10
1.2. Develop techniques for estimating pygmy rabbit numbers	1	3 years	WLM	-	-	6	6	6
1.3. Survey areas of potential pygmy rabbit occurrence	1	ongoing	WLM	1	1	1	1	1
Totals				**11**	**5**	**11**	**11**	**17**
Protect the pygmy rabbit population								
2.1. Reduce the potential for destructive fires								
2.1.1. Limit vehicular access to pygmy rabbit areas	1	as needed	WLM	5	1	1	5	1
2.1.2. Develop green strips to protect pygmy rabbit from fire	1	ongoing	WLM	3	3	3	3	3
2.1.3. Establish districts around pygmy rabbit sites where outdoor burning is regulated	1	as needed	WLM	3	3	3	3	3
2.1.4. Develop strategies and partnerships for fire response readiness	1	as needed	WLM	2	-	2	-	2
2.2. Keep records on predators and predation in pygmy rabbit areas	2	ongoing	WLM	-	-	-	-	-
2.3. Reduce the potential for mistaken identity killing of pygmy rabbits	3	as needed	WLM/LAND	-	-	-	-	-
Totals				**13**	**7**	**9**	**11**	**9**
Manage habitat to increase pygmy rabbit abundance and distribution								
3.1. Improve the suitability of existing pygmy rabbit habitat	1	as needed	WLM	1	1	1	1	1
3.2. Determine the amount of habitat needed to support a recovered population	1	1 year	WLM	5	-	-	-	-
3.3. Identify areas that should be managed as pygmy rabbit habitat								
3.3.1. Use Geographic Information Systems technology to identify areas for field survey	1	1 year	WLM	6	-	-	-	-
3.3.2. Survey identified areas to evaluate their habitat potential	1	1 year	WLM	-	10	-	-	-
3.4. Pursue management of selected areas by wildlife agencies								
3.4.1. Support/facilitate fee acquisition of existing and potential habitat	1	as needed	LAND					
3.4.2. Support/facilitate less-than-fee mechanisms to provide habitat	1	as needed	WLM	20	20	20	20	20
3.4.3. Develop and apply site-specific management plans	1	ongoing	WLM	6	-	3	-	6
3.5. Create suitable habitat in areas selected for management as pygmy rabbit habitat	1							
3.5.1. Identify and apply land uses and techniques to enhance, create, and sustain habitat	1	ongoing	WLM	3	3	3	3	3
3.6. Monitor habitat conditions in pygmy rabbit habitat areas	1	ongoing	WLM	6	6	6	6	6
Totals				**47**	**40**	**33**	**30**	**36**
Establish populations in new areas								
4.1. Investigate techniques for introduction of rabbits to unoccupied habitat	1	5 years	WLM	5	10	10	-	-

Step-down Outline and Implementation Schedule for Washington State Recovery Plan for the Pygmy Rabbit, including Objectives, Strategies, and Tasks.

Annual cost in thousands of $

		Priority	Duration	Responsibility	96	97	98	99	00
4.2.	Conduct genetic comparisons of rabbits from potential transplant source populations	1	2 years	WLM	20	20	-	-	-
4.3.	Implement introduction of pygmy rabbits to unoccupied habitat.	1	as needed	WLM	-	-	2	6	6
	Totals				**25**	**30**	**12**	**6**	**6**
Enforce restrictions designed to protect pygmy rabbits		2	ongoing	ENF	3	3	3	3	3
	Totals				**3**	**3**	**3**	**3**	**3**
Establish information management and retrieval systems									
6.1.	Maintain repository for pygmy rabbit records.	2	ongoing	WSDM	1	1	1	1	1
6.2.	Produce an annual pygmy rabbit status review.	2	annually	WLM	1	1	1	1	1
	Totals				**2**	**2**	**2**	**2**	**2**
Coordinate and cooperate with public agencies and other landowners									
7.1.	Revise State regulations influencing pygmy rabbits and their habitat.	3	as needed	WLM	1	1	1	1	1
7.2.	Develop cooperative management plans	1	as needed	WLM	6	6	6	6	6
7.3.	Provide management recommendations to landowners.	1	ongoing	WLM	3	3	3	3	3
7.3.1.	Work with public landowners to manage grazing and other activities	1	ongoing	WLM	1	1	1	1	1
7.3.2.	Work with private landowners to manage grazing and other activities	1	ongoing	WLM	1	1	1	1	1
7.4.	Secure funding to support recovery activities	1	ongoing	WLM	2	2	2	2	2
7.4.1.	Pursue funding to implement recovery strategies	1	ongoing	WLM	1	1	1	1	1
7.5.	Create information exchange network between agencies.	2	2 years	WSDM	3	3	-	-	-
7.5.1.	Provide locations of critical pygmy rabbit habitat to local governments	2	as needed	HAB	1	-	-	1	-
	Totals				**19**	**18**	**15**	**16**	**15**
Complete scientific investigations that will benefit recovery efforts									
8.1.	Investigate the influence of grazing on pygmy rabbits	1	5 years	RES	20	20	20	20	20
8.1.	Investigate pygmy rabbit dispersal and the influence of vegetation on dispersal	1	5 years	RES	20	20	20	20	20
8.2.	Determine population dynamics, including survivorship and recruitment patterns.	1	5 years	RES	20	20	20	20	20
	Totals				**60**	**60**	**60**	**60**	**60**
Develop public information and education programs									
9.1.	Develop educational materials.	3	1 year	IMR	-	5	-	5	-
9.2.	Promote media contact.	3	ongoing	IMR	1	1	1	1	1
9.3.	Provide information needed by specific target groups.	3	as needed	WLM/IMR	3	-	1	-	3
	Totals				**4**	**6**	**2**	**6**	**4**
	Grand Total				**184**	**171**	**147**	**145**	**152**

APPENDICES

Appendix A. Washington Administrative Code 232-12-297. Section 11 addresses Recovery Plans.

WAC 232-12-297 Endangered, threatened, and sensitive wildlife species classification.

PURPOSE

1.1 The purpose of this rule is to identify and classify native wildlife species that have need of protection and/or management to ensure their survival as free-ranging populations in Washington and to define the process by which listing, management, recovery, and delisting of a species can be achieved. These rules are established to ensure that consistent procedures and criteria are followed when classifying wildlife as endangered, or the protected wildlife subcategories threatened or sensitive.

DEFINITIONS

For purposes of this rule, the following definitions apply:

2.1 "Classify" and all derivatives means to list or delist wildlife species to or from endangered, or to or from the protected wildlife subcategories threatened or sensitive.

2.2 "List" and all derivatives means to change the classification status of a wildlife species to endangered, threatened, or sensitive.

2.3 "Delist" and its derivatives means to change the classification of endangered, threatened, or sensitive species to a classification other than endangered, threatened, or sensitive.

2.4 "Endangered" means any wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state.

2.5 "Threatened" means any wildlife species native to the state of Washington that is likely to become an endangered species within the forseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats.

2.6 "Sensitive" means any wildlife species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened in a significant portion of its range within the state without cooperative management or removal of threats.

2.7 "Species" means any group of animals classified as a species or subspecies as commonly accepted by the scientific community.

2.8 "Native" means any wildlife species naturally occurring in Washington for purposes of breeding, resting, or foraging, excluding introduced species not found historically in this state.

2.9 "Significant portion of its range" means that portion of a species' range likely to be essential to the long term survival of the population in Washington.

LISTING CRITERIA

3.1 The commission shall list a wildlife species as endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available, except as noted in section 3.4.

3.2 If a species is listed as endangered or threatened under the federal Endangered Species Act, the agency will recommend to the commission that it be listed as endangered or threatened as specified in section 9.1. If listed, the agency will proceed with development of a recovery plan pursuant to section 11.1.

3.3 Species may be listed as endangered, threatened, or sensitive only when populations are in danger of failing, declining, or are vulnerable, due to factors including but not restricted to limited numbers, disease, predation, exploitation, or habitat loss or change, pursuant to section 7.1.

3.4 Where a species of the class Insecta, based on substantial evidence, is determined to present an unreasonable risk to public health, the commission may make the determination that the species need not be listed as endangered, threatened, or sensitive.

DELISTING CRITERIA

4.1 The commission shall delist a wildlife species from endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available.

4.2 A species may be delisted from endangered, threatened, or sensitive only when populations are no longer in danger of failing, declining, are no longer vulnerable, pursuant to section 3.3, or meet recovery plan goals, and when it no longer meets the definitions in sections 2.4, 2.5, or 2.6.

INITIATION OF LISTING PROCESS

5.1 Any one of the following events may initiate the listing process.

5.1.1 The agency determines that a species population may be in danger of failing, declining, or vulnerable, pursuant to section 3.3.

5.1.2 A petition is received at the agency from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the classification process.

5.1.3 An emergency, as defined by the Administrative Procedure Act, chapter 34.05 RCW. The listing of any species previously classified under emergency rule shall be governed by the provisions of this section.

5.1.4 The commission requests the agency review a species of concern.

5.2 Upon initiation of the listing process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department,

announcing the initiation of the classification process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

INITIATION OF DELISTING PROCESS

6.1 Any one of the following events may initiate the delisting process:

6.1.1 The agency determines that a species population may no longer be in danger of failing, declining, or vulnerable, pursuant to section 3.3.

6.1.2 The agency receives a petition from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may no longer be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the delisting process.

6.1.3 The commission requests the agency review a species of concern.

6.2 Upon initiation of the delisting process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the delisting process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

SPECIES STATUS REVIEW AND AGENCY RECOMMENDATIONS

7.1 Except in an emergency under 5.1.3 above, prior to making a classification recommendation to the commission, the agency shall prepare a preliminary species status report. The report will include a review of information relevant to the species' status in Washington and address factors affecting its status, including those given under section 3.3. The status report shall be reviewed by the public and scientific community. The status report will include, but not be limited to an analysis of:

7.1.1 Historic, current, and future species population trends.

7.1.2 Natural history, including ecological relationships (e.g., food habits, home range, habitat selection patterns).

7.1.3 Historic and current habitat trends.

7.1.4 Population demographics (e.g., survival and mortality rates, reproductive success) and their relationship to long term sustainability.

7.1.5 Historic and current species management activities.

7.2 Except in an emergency under 5.1.3 above, the agency shall prepare recommendations for species classification, based upon scientific data contained in the status report. Documents shall be prepared to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act (SEPA).

7.3 For the purpose of delisting, the status report will include a review of recovery plan goals.

PUBLIC REVIEW

8.1 Except in an emergency under 5.1.3 above, prior to making a recommendation to the commission, the agency shall provide an opportunity for interested parties to submit new scientific data relevant to the status report, classification recommendation, and any SEPA findings.

8.1.1 The agency shall allow at least 90 days for public comment.

8.1.2 The agency will hold at least one public meeting in each of its administrative regions during the public review period.

FINAL RECOMMENDATIONS AND COMMISSION ACTION

9.1 After the close of the public comment period, the agency shall complete a final status report and classification recommendation. SEPA documents will be prepared, as necessary, for the final agency recommendation for classification. The classification recommendation will be presented to the commission for action. The final species status report, agency classification recommendation, and SEPA documents will be made available to the public at least 30 days prior to the commission meeting.

9.2 Notice of the proposed commission action will be published at least 30 days prior to the commission meeting.

PERIODIC SPECIES STATUS REVIEW

10.1 The agency shall conduct a review of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing. This review shall include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification.

10.1.1 The agency shall notify any parties who have expressed their interest to the department of the periodic status review. This notice shall occur at least one year prior to end of the five year period required by section 10.1.

10.2 The status of all delisted species shall be reviewed at least once, five years following the date of delisting.

10.3 The department shall evaluate the necessity of changing the classification of the species being reviewed. The agency shall report its findings to the commission at a commission meeting. The agency shall notify the public of its findings at least 30 days prior to presenting the findings to the commission.

10.3.1 If the agency determines that new information suggests that classification of a species should be changed from its present state, the agency shall initiate classification procedures provided for in these rules starting with section 5.1.

10.3.2 If the agency determines that conditions have not changed significantly and that the classification of the species should remain unchanged, the agency shall recommend to the commission that the species being reviewed shall retain its present classification status.

10.4 Nothing in these rules shall be construed to automatically delist a species without formal commission action.

RECOVERY AND MANAGEMENT OF LISTED SPECIES

11.1 The agency shall write a recovery plan for species listed as endangered or threatened. The agency will write a management plan for species listed as sensitive. Recovery and management plans shall address the listing criteria described in sections 3.1 and 3.3, and shall include, but are not limited to:

11.1.1 Target population objectives.

11.1.2 Criteria for reclassification.

11.1.3 An implementation plan for reaching population objectives which will promote cooperative management and be sensitive to landowner needs and property rights. The plan will specify resources needed from and impacts to the department, other agencies (including federal, state, and local), tribes, landowners, and other interest groups. The plan shall consider various approaches to meeting recovery objectives including, but not limited to regulation, mitigation, acquisition, incentive, and compensation mechanisms.

11.1.4 Public education needs.

11.1.5 A species monitoring plan, which requires periodic review to allow the incorporation of new information into the status report.

11.2 Preparation of recovery and management plans will be initiated by the agency within one year after the date of listing.

11.2.1 Recovery and management plans for species listed prior to 1990 or during the five years following the adoption of these rules shall be completed within five years after the date of listing or adoption of these rules, whichever comes later. Development of recovery plans for endangered species will receive higher priority than threatened or sensitive species.

11.2.2 Recovery and management plans for species listed after five years following the adoption of these rules shall be completed within three years after the date of listing.

11.2.3 The agency will publish a notice in the Washington Register and notify any parties who have expressed interest to the department interested parties of the initiation of recovery plan development.

11.2.4 If the deadlines defined in sections 11.2.1 and 11.2.2 are not met the department shall notify the public and report the reasons for missing the deadline and the strategy for completing the plan at a commission meeting. The intent of this section is to recognize current department personnel resources are limiting and that development of recovery plans for some of the species may require significant involvement by interests outside of the department, and therefore take longer to complete.

11.3 The agency shall provide an opportunity for interested public to comment on the recovery plan and any SEPA documents.

CLASSIFICATION PROCEDURES REVIEW

12.1 The agency and an ad hoc public group with members representing a broad spectrum of interests, shall meet as needed to accomplish the following:

12.1.1 Monitor the progress of the development of recovery and management plans and status reviews, highlight problems, and make recommendations to the department and other interested parties to improve the effectiveness of these processes.

12.1.2 Review these classification procedures six years after the adoption of these rules and report its findings to the commission.

AUTHORITY

13.1 The commission has the authority to classify wildlife as endangered under RCW 77.12.020. Species classified as endangered are listed under WAC 232-12-014, as amended.

13.2 Threatened and sensitive species shall be classified as subcategories of protected wildlife. The commission has the authority to classify wildlife as protected under RCW 77.12.020. Species classified as protected are listed under WAC 232-12-011, as amended. [Statutory Authority: RCW 77.12.020. 90-11-066 (Order 442), § 232-12-297, filed 5/15/90, effective 6/15/90.]

Appendix B. Responses to written comments received during Recovery Plan review, organized by plan section.

Section	Comment *Response*
Executive Summary	The Executive Summary of the Plan should state that the pygmy rabbit is still vulnerable to further habitat loss, conversion, and degradation. *A statement to this effect has been added to the Executive Summary.*
Part One: Background	State regulations require that recovery implementation be sensitive to landowner issues, however, the scientific background should not be unduly influenced by these issues. *Agreed.*
Geographical Distribution North America	Verts and Carroway (1984) is not listed in the references. *This citation should have been Weiss and Verts (1984).*
Geographical Distribution Washington	Additional prehistoric remains of pygmy rabbits have been identified that date within the past 3,000 years. Two new sites with pymy rabbit remains are in Lincoln County and one is in Adams County. *This additional support for references to the prehistoric range of the pygmy rabbit in Washington has been added to the plan.*
Natural History Mortality	The generic statement that weasels are predators of pygmy rabbits should include the parenthetical "*Mustela* spp." rather than "*Mustela frenata*." *The statement was changed to refer to the long-tailed weasel (Mustela frenata), since it is the weasel that inhabits pygmy rabbit range in Washington.*
Natural History - Home range	Why was there no mention of female rabbit home ranges in grazed areas and areas not recently grazed? *The difference in home range size for adult female pygmy rabbits was not statistically significant between the grazed area and the area not recently grazed. However, these figures have been included along with the statement that the difference is not statistically significant.*

Natural History - Food

The fact that food consumption by plant class is similar in grazed and not recently grazed areas indicates that pygmy rabbits are specialists with respect to food selection since current grazing is expected to change grass species cover.

There is ample evidence of the pygmy rabbit's food preferences and the preference index values from Green and Flinders (1980b) have been added to illustrate this preference for certain grasses during spring and summer. However, the extent to which current grazing has effected the availability of grasses to pygmy rabbits is unknown.

The importance of green rabbitbrush and other shrubs (besides sagebrush) in the diet of pygmy rabbits is unclear in the discussion of food. Some of the stated facts on this subject seem contradictory.

Few references indicate that green rabbitbrush has significant importance as a food for pygmy rabbits. However, diet data from Washington which indicate some winter feeding on this shrub have been added.

The grass component of the pygmy rabbit's diet has been underemphasized in much of what has been written about Sagebrush Flat. Green and Flinders (1980b) found that bluegrasses and wheatgrass were both eaten preferentially during Spring and Summer.

The importance of grasses in the spring and summer diet of pygmy rabbits has been incorporated in this plan, including the preference indices from Green and Flinders (1980b).

Habitat Requirements - General

Pygmy rabbits inhabit deep, friable soils and shrub cover and shrub height are positively correlated with depth of soil. Sagebrush coverage in stands varies from 5 to 26 percent without the influence of past grazing.

The relationship between soil depth and sagebrush height and cover is well established. Pygmy rabbits do inhabit areas at the upper range of natural sagebrush coverage. During pre-settlement times, areas with heavy sagebrush cover suitable for pygmy rabbits are believed to have been rare. Heavy grazing in the late 1800s and early 1900s reportedly increased sagebrush cover in many areas of eastern Washington.

Habitat Requirements - Vegetative characteristics

Currently, dense stands of sagebrush are widespread, but pygmy rabbits have not expanded out into many of these areas. It is likely that soil depth and structure are the most important habitat characteristics.

Soil depth, microtopography, and sagebrush height and coverage are all important to pygmy rabbits. Weiss and Verts (1984) found that sagebrush cover was the most important of ten variables measured. Nonetheless, all are important. The reasons why pygmy rabbits have not spread into other areas of dense sagebrush may relate to inappropriate soil conditions or to a variety of other factors including, for example, geographic distance and isolation of rabbits from these areas. They are not known to be good dispersers and source populations for colonization have been limited for many decades, perhaps centuries.

Habitat Requirements - Cattle Grazing

In the past, the Nongame Advisory Council considered recommending removing cattle from Sagebrush Flat, but were dissuaded by Department of Wildlife concerns over the effect this would have on managing other sites on private land in Douglas County. Now, the Department of Fish and Wildlife leaves out mention of political concerns and, instead, interprets grazing to be beneficial to pygmy rabbits.

Sagebrush Flat, by itself, will not provide for the recovery of the pygmy rabbit in Washington. Increasing the amount of pygmy rabbit habitat in the Columbia Basin will not be easy and, without local support, will be nearly impossible. Our strategy will be to work together with local citizens to increase the amount of habitat available for pygmy rabbits. Grazing is an economic use of the land that, if carefully managed, may be compatible with pygmy rabbits. This plan outlines a strategy for monitoring, evaluating, and modifying economic uses of the land so that they remain compatible with pygmy rabbits.

Conclusions on beneficial impacts of grazing are made without scientific evidence while evidence of the negative impacts of grazing are not mentioned.

Statements on the potential for both benefit and harm from grazing were included. The scientific evidence for a potential benefit from grazing is not based on research on the effects of grazing on pygmy rabbits. It is based on research on the effects of grazing on the characteristics of shrub-steppe plant communities. Grazing can produce vegetation changes that are detrimental to pygmy rabbit habitat characteristics. However, grazing also can produce heavy sagebrush cover which every pygmy rabbit study acknowledges is important to pygmy rabbits.

The significantly larger male home size in the grazed area indicates that the rabbits are unable to meet their life needs in a normal size area and that grazing may result in lower rabbit densities, possibly due to competition for food.

Gahr (1993) found that the larger home range size of adult males in the grazed area was attributable to longer movements for breeding, suggesting the possibility of a lower density of adult females in this area.

Pygmy rabbits eat considerable amounts of grass in spring and summer. Cattle are directly competing for this food.

Competition for grasses between pygmy rabbits and cattle during spring and summer is possible.

The reported shrub cover percentages would be more valuable if it was indicated whether the study areas were undisturbed or grazed.

Shrub cover percentages in Table 2 come from three studies. Only one of these, Gahr (1993), contained information regarding grazing of the habitat area under study. However, Gahr did not partition shrub cover and height data by grazing history. In all studies, shrub cover and height data at pygmy rabbit burrows and at randomly seclected locations indicated that a range of conditions existed. Information on the grazing histories of each study area would have been useful to a degree. It is, however, important to recognize that the term "grazed" represents a highly variable condition and includes the feeding activities of domestic livestock as well as wildlife. Grazing can involve high densities of grazing animals, year-long duration, species which prefer grasses or species which prefer forbs. Grazing exists as a continuum of variation in all of these categories.

The one study that discriminates between habitats differentially disturbed is limited to "grazed" and "not recently grazed." What is "recent?"

The recovery plan has been amended to include additional detail on the grazing history of the areas studied by Gahr (1993). The area not recently grazed has not been used by livestock since at least 1957.

There is no evidence that pygmy rabbits "select" sites with 28-46% shrub cover in natural situations. Perhaps there were no undisturbed sites available to study.

Perhaps none of the pygmy rabbit study areas was undisturbed. However, the association of pygmy rabbits with heavy sagebrush cover is frequently described by researchers and there is no support for the suggestion that some other condition would be preferred in an undisturbed environment. The data on shrub cover densities included in Table 2 indicate shrub cover at pygmy rabbit burrows compared with shrub cover at randomly selected points. This is a common way to identify features that appear to be selected by an animal.

Sagebrush density and height are the result of deeper soils and, consequently, increased soil moisture available over a longer period of time. Density of sagebrush may further increase because of lack of competition to the sagebrush seedlings from grasses in overgrazed sites. The statement that overgrazing to increase sagebrush density, followed by removal of cattle, benefits pygmy rabbit habitat, lacks scientific evidence. Other factors (i.e. soft, deep, moist soils, topography), and return of grasses upon cessation of overgrazing, are probably more important than increased density of sagebrush alone. If density of sagebrush were the primary limiting factor for this species, it would now be widespread throughout much of the remaining shrub-steppe.

Sagebrush density and height can increase with soil depth. Research on the effects of grazing on sagebrush-dominated plant communities indicates that sagebrush cover increases in response to grazing. It remains to be determined whether grazing-induced increases in sagebrush cover could provide habitat that would be used by pygmy rabbits.

Historically, pygmy rabbits probably inhabited areas at the natural upper range of sagebrush density (20-26%). Higher densities, as a result of grazing, are not necessarily more optimal. Pygmy rabbits survived for thousands of years without the densities of sagebrush that have resulted from livestock grazing in recent times.

Aboriginal landscapes offered a much greater extent of contiguous sagebrush-dominated area. Suitable habitat was likely not common but existed in a quantity and distribution that allowed pygmy rabbits to persist. With the loss of much of this habitat and the isolation of suitable habitat patches by roads, croplands, and other features, there is a greater likelihood that pygmy rabbit populations will not survive in the suitable habitat still available to them. On the isolated patches of shrub-steppe that remain, it is important to consider enhancements, where possible, to maximize pygmy rabbit habitat values. Grazing may be a means to enhance portions of these parcels by increasing sagebrush cover. As stated above, it remains to be determined whether grazing-induced increases in sagebrush cover results in new or improved habitat for pygmy rabbits.

Within areas of dense sagebrush, understory structure is the deciding factor in use by rabbits. Areas where branches have been broken off by cattle foraging for grasses and forbs are not used by rabbits.

This observation may be true. Research of this feature of pygmy rabbit habitat has never been published so it is difficult to evaluate. The effects of cattle on understory structure and the association of pygmy rabbits with different understory structure conditions are good directions for research inquiry. These research tasks are identified in the recovery plan.

There is evidence that grazing can harm pygmy rabbit habitat and no evidence that it can benefit habitat. Sagebrush density is not, as the plan suggests, the primary determinant of suitable habitat and to increase sagebrush density above the ambient level would require a grazing level that would result in heavy competition between cattle and rabbits, destruction of sagebrush understory structure and probable collapse of rabbit burrows.

Persuasive evidence indicating that all forms of grazing are incompatible with pygmy rabbits has not been produced or cited. Most of the pygmy rabbit research conducted to date indicates that sagebrush cover is an important determinant of suitable habitat. Weiss and Verts found that sagebrush cover was the most important of ten variables evaluated. It is not possible, based on existing research, to state that grazing which produces increased sagebrush cover also destroys understory structure and rabbit burrows and results in competition between cattle and pygmy rabbits for grasses.

The range-wide decline of the pygmy rabbit, even where habitat has not been converted to agriculture, suggests that livestock and rabbits are not compatible.

Very little is known about the range-wide decline of the pygmy rabbit. The many land uses which eliminate pygmy rabbit habitat and isolate pygmy rabbit populations are probably sufficient, by themselves, to produce a range-wide decline. Evidence of decline in areas not converted to agriculture is limited to observations of population declines occurring during the course of research on the rabbits. This has occurred repeatedly and the researchers have not offered explanations. It has occurred in areas being grazed as well as on the INEL site in Idaho which was not grazed. The possible explanations for these population declines are numerous and largely speculative.

Two references, Buechner (1953) and Maughn and Poelker (1976), relate pygmy rabbit declines to agriculture and habitat destruction. Did the studies address grazing? Is there information on soil compaction, particularly in moist areas?

Buechner described changes in the Columbia Basin and noted that "truck crops and wheat are completely replacing nearly all of the zerophytic (sic) vegetation." He went on to predict that the pygmy rabbit, sage grouse, sage thrasher, and jack rabbits would disappear entirely in response to a shift in vegetation to "one characterized by cultivated crops, hedgerows and windbreaks, and new relations in weed populations." Maughn and Poelker compiled an annotated list of species in need of special management consideration. Their brief statement on the pygmy rabbit included the statement that "they are declining because of destruction of sagebrush areas."

Grazing could be responsible for the pygmy rabbit's continued existence in Douglas County. Some of the areas with colonies have been grazed for over 100 years.

The long span of time during which pygmy rabbits have co-existed with grazing suggests that grazing is not wholly destructive of pygmy rabbits or their habitat. However, in areas that have been grazed for centuries, there are likely ways to manage grazing so that conditions for pygmy rabbits improve. The development of strategies to manage grazing in consideration of pygmy rabbits is a strong recommendation of this plan.

Any conclusions concerning the effect of grazing on pygmy rabbits based on Gahr (1993) are inappropriate. The "grazed" and "ungrazed" portions of her study area were not comparable in size or other habitat features and the duration of the study was insufficient.

Gahr's research provided a first glimpse of some characteristics of a pygmy rabbit habitat area divided by a fence which has separated a relatively continuously grazed area from an area not grazed since 1957. Comparisons of rabbit density, home range, and habitat use between these areas have been useful. The need for carefully designed research on the effects of grazing on pygmy rabbits is identified as a task in the plan.

The plan is inadequate for failing to identify the detrimental effects of grazing on pygmy rabbit populations.

The plan made use of infomation derived from objective, scientific research. In this body of information, evidence of detrimental, neutral, or beneficial effects of grazing on pygmy rabbits is lacking. The plan addresses this lack of information and recommends research to investigate this relationship.

In the Recovery section of the plan, grazing is mentioned only as a land use that should be kept compatible with pygmy rabbits. Where is the evidence that it is the least bit compatible?

The primary evidence for compatibility is the coexistence of pygmy rabbits with grazing. At Sagebrush Flat, grazing by cattle and horses has occurred at varying intensities for roughly a century. Pygmy rabbits have been known to occur here since 1949. There is a long history of grazing in areas that are currently inhabited by pygmy rabbits. In most cases, grazing in these areas has been managed without any consideration for pygmy rabbit habitat.

The assumption that grazing and pygmy rabbits are compatible because they currently coexist is seriously flawed. The pygmy rabbit populations in these areas are at very low levels.

Pygmy rabbits in Washington exist in what are, essentially, islands of habitat. There are limitations to the number of rabbits each island can support. Within these islands, it is not known whether or not pygmy rabbit densities are unusually low. Comparisons to populations in other parts of the species' range provide limited insight. Washington is at the margin of the species' range and densities may be naturally limited.

Pygmy rabbits evolved without large herbivores like livestock. Where the rabbits are now, sagebrush is already present. Livestock have no beneficial effects and they consume forage that the rabbits need. They break sagebrush stems that provide rabbit cover and they compact soil around sagebrush plants that could damage the roots.

There is ample documentation of the existence of large herbivores throughout the Great Basin range of the pygmy rabbit. At times during the past 10,000 years many species, including bison and antelope, were more abundant than at any time during the past several centuries. Livestock grazing frequently increases sagebrush cover, a key component of pygmy rabbit habitat. Grazing intensity can be controlled to limit damage to shrubs and compaction of soil.

Improper grazing management can damage habitat. A Wyoming study found pygmy rabbits using the densest sagebrush habitat available. Often these dense patches have considerable dead branches and twigs. Such structure is frequently eliminated by heavy cattle use.

Grazing is not compatible with pygmy rabbit habitat requirements when cattle use is intense enough to destroy the density and structure of sagebrush.

The kind of grazing which would favor sagebrush and promote high sagebrush densities is abusive grazing which would drastically reduce grass cover, an important component of the pygmy rabbit's spring and summer diet.

The relationship between grazing intensity and the development of increased sagebrush cover conditions is not well established. Lower intensity grazing may also produce heavy sagebrush cover.

Sagebrush Flat is a disturbed system that supports an apparently viable population of pygmy rabbits. There are no pristine situations left in Washington for the species. The species does not exist here in violation of the ecological parameters that molded it evolutionarily. It finds those ecological requirements present at Sagebrush Flat, but in a situation that has been and continues to be degraded by grazing.

Grazing at Sagebrush Flat has a long history and the plant community at this location is not pristine. However, the range condition is good and there is no evidence that conditions are being degraded. Existing plans call for further improving the range condition.

In view of the lack of a scientific basis for arguing that cattle grazing benefits pygmy rabbits, and given the assessment that cows are causing soil compaction, burrow destruction, reduced density of large perennial grasses, and proliferation of exotic plants, the rabbits would benefit from termination of livestock grazing on Sagebrush Flat.

Benefits to pygmy rabbits from cattle grazing are not easily demonstrated and neither are detrimental effects. The factors mentioned have not been demonstrated to be significant to pygmy rabbits at Sagebrush Flat. It is the recommendation of this plan that grazing should be managed to ensure no impact from the factors mentioned. Grazing management which is responsive to the results of surveys of vegetation and pygmy rabbit population conditions should achieve this goal.

Population Dynamics

Marked population fluctuations can result from factors other than population cycles and, since such cycles have not been shown to exist in pygmy rabbits, it is inappropriate to link them in the same sentence.

This section has been changed.

The mention of population cycles is irrelevent to pygmy rabbits. Wilde (1978) found that pygmy rabbit biology precludes such increase/crash cycles. Changes in pygmy rabbit numbers should be referred to as population fluctuations.

Pygmy rabbit population fluctuations have been noted by many of the researchers studying the rabbits. Animals that exhibit wide population fluctuations are more vulnerable to sudden extinction. This is the point of the discussion. Wide variations in population size in pygmy rabbits may not be true cycles.

A Wyoming study found considerable fluctuations in numbers between 1993 and 1994.

This observation from the Wyoming study has been added to this section.

Habitat Status - Past

The plan reports a pre-settlement sagebrush cover of about 10%. This suggests an even distribution of big sagebrush across the landscape. More likely, there were occasional dense clumps associated with deep, moist soils and this explains the patchy distribution of pygmy rabbits speculated in the recovery plan.

The fact that pre-settlement sagebrush cover averaged 10% does not suggest an even distribution of big sagebrush across the landscape. It does, however, suggest that areas with sagebrush cover consistent with pygmy rabbit habitat requirements were relatively uncommon.

The literature does not support the suggestions in the recovery plan that the pygmy rabbit is an opportunist that inhabited disturbed sites in the sagebrush landscape during aboriginal times.

Unfortunately, the literature on pygmy rabbits contains very little on aboriginal habitat conditions. The statement in the recovery plan that pygmy rabbits are opportunists refers to the most reasonable interpretation of the means by which pygmy rabbits survived in an environment where their preferred habitat occurred only rarely and in a patchy distribution. A dynamic pattern of local extinction and colonization of new habitats is most consistent with current metapopulation theory. This theory applies well to species which inhabit patchily distributed habitats. The role of disturbance in creating new pygmy rabbit habitat due to the invasive and opportunistic capabilities of sagebrush is theory rather than established fact.

Daubenmire (1970) describes the original big sagebrush plant community to have included, especially on moist sandy loams, sagebrush exceeding 2 meters in height and 2 decimeters in diameter. There is no justification for the notion that anthropogenic disturbance was, or is, necessary to the creation or maintenance of habitat.

The fact that deep, moisture retaining soils contribute to the development of large sagebrush shrubs has been noted in this plan. Disturbance is another factor known to contribute to the development of heavy sagebrush cover. Even in aboriginal times, when humans were less important in the development of plant community characteristics, environmental conditions were not static. Disturbances of a variety of types, including those associated with frost heaves and the wallows of ungulates, were no doubt present. To ignore the potential contribution of these disturbances to the dynamics of pygmy rabbit habitat creation and loss would be to misrepresent the environment that existed during the evolution of the pygmy rabbit.

Daubenmire (1970) indicates that the evolution of ecotypes of steppe plants in Washington was not influenced by any significant ungulate pressure. In Washington, a respite from excessive animal use produces no recovery of native grasses. Each period of overuse by domestic animals reduces the density of large perennial grasses to a lower level than the preceding and alien species claim the relinquished territory.

There is no argument on these facts. The vegetation of Washington is not adapted to the kind of relentless grazing pressure that typifies plant communities in the Great Plains. However, Daubenmire also described a period lasting for thousands of years when bison, antelope, and other ungulates were present in the Columbia Basin in good numbers. The grazing pressure exerted on plant communities was probably light relative to cattle grazing over the past century, however, the potential local effects of these grazing ungulates cannot be entirely dismissed. There were thousands of years of pygmy rabbit coexistence with native grazing ungulates in greater abundance than recorded during historic times.

Habitat Status - Present

Indicate that Sagebrush Flat is being considered by the Department of Natural Resources for Natural Area Preserve designation.

This has been added to the plan.

The Department of Fish and Wildlife's 36 ha parcel, formerly in wheat, was seeded with sagebrush/bunchgrass/forb mix during November 1994.

This has been added to the Background section of the plan.

How is Bonneville Power Administration (BPA) money being used for conservation agreements, acquisition, and habitat enhancement for pygmy rabbits? How much money is allocated annually for this?

The level of involvement of BPA in pygmy rabbit recovery activities is still in an evolutionary phase. Thus far, BPA funds have been used to purchase 130 ha (320 ac) of pygmy rabbit habitat and to back blade the soil and plant native vegetation on 36 ha (90 ac) of land that was previously wheat land. It is likely that BPA funds will continue to be important to pygmy rabbit recovery actions. In essence, if funds are available to assist the implementation of this plan, they will be used.

Factors affecting continued existence - habitat loss

Please provide evidence for the statement that habitat loss is not currently affecting known populations.

This statement in the plan was made in reference to the five sites with known populations. On these sites, a variety of cooperative efforts have prevented sagebrush removal, mitigated the effects of mining operations, and influenced other activities that would have otherwise harmed pygmy rabbit habitat. Recognition of the need to avoid destruction of pygmy rabbit habitat has been appreciable and no clear instances of habitat loss affecting known populations has been identified.

Recovery - General

The Plan does not discuss where new pygmy rabbit habitat will be created, the number of acres needed, the distribution of habitat needed, or how habitat can be successfully created. Within the current range of the pygmy rabbit, sites with deep soils that might be suitable for pygmy rabbits are Trust Lands leased for the production of wheat.

The creation of an expanded pygmy rabbit habitat area will require an analysis of soils and topography and substantial interaction with current landowners to determine whether habitat creation or enhancement is possible. This will be a time-consuming process and each new step will be determined, in part, by the results of the last step. Similarly, the number of acres needed to achieve recovery goals cannot be estimated without a better understanding of potential carrying capacity.

There is no presentation of evidence to indicate that areas of deep soil currently devoted to growing wheat can be converted to habitat for pygmy rabbits and be successful.

There is evidence that pygmy rabbit habitat can be created. The Burton Draw pygmy rabbit population is established in a stand of dense sagebrush that invaded a formerly cultivated field.

Recovery Objectives - Rationale

Isolated populations of 100 individuals may not be resilient over decades. In a population of 50 breeding pairs, up to one fourth of genetic variability will be lost within 20-30 generations.

Such generalities are useful to consider, however, it is unlikely that pygmy rabbits are among the species which exhibit such extreme vulnerability to loss of genetic diversity. Their population structure is best represented by metapopulation concepts, a larger population comprised of many small subpopulations that are isolated from one another for varying periods of time. Isolation of relatively small subpopulations for decades is likely part of the pygmy rabbit's natural dynamic.

What population size does Soulè suggest is necessary for viability of rabbit populations?

In the various books and papers for which Michael Soulè is an editor or author, there are no definitive statements about minimum viable population sizes for rabbits. There are data which indicate that some rabbit populations have gone extinct despite initially large population sizes. The population dynamics of some species make them especially vulnerable to extinction. The wide fluctuations in populations of many rabbit species makes them more vulnerable than many other species with more stable populations. This plan establishes a relatively high population objective because of reported tendencies for pygmy rabbit populations to fluctuate widely.

Demographic stochasticity is surely a more significant threat to pygmy rabbits than inbreeding or other effects of the loss of genetic diversity.

Yes, and this threat is summarized under "Threats to Continued Existence - Low population" as well as "Recovery Objectives - Rationale."

Recovery - Monitor the pygmy rabbit population	Provide evidence supporting the use of burrow surveys as an indication of population trend. Burrow numbers could fluctuate due to factors completely independent of population size. *Burrow surveys are being conducted between late fall and early spring, the time period when burrow use is greatest and evidence of burrow use is most easily observed. Burrows are classified according to sign of current or recent use. As a result, burrow survey results provide an indication of animal presence. Certain factors could contribute to making this an imperfect index. Weather or other conditions which make signs of burrow use more or less evident could be a factor. Any change in the mean number of rabbits sharing burrows or variation in the proportion of rabbits that use burrows could affect the accuracy of this index to rabbit numbers. However, at this time, these types of variability are not believed to be great and this is as good a monitoring protocol as exists considering the requirement that our monitoring not put rabbits at risk.* Provide evidence for using burrow counts as an index to population size. Gahr (1993) found no such correlation. *Gahr used an assessment of burrow use to estimate the size of the population at Sagebrush Flat. She determined the average number of shared burrows for use in her population estimate. Therefore, Gahr assumed a direct correlation between number of active burrows and population size.*
Recovery - Protect the pygmy rabbit population	Given the low number of pygmy rabbits and the inability of most hunters to distinguish pygmy rabbits from cottontails, hunting should not be allowed where pygmy rabbits are found. *At this time, there is little hunting of any kind in areas known to be inhabited by pygmy rabbits. The plan recommends that if, in the future, pygmy rabbits are found in areas where rabbit hunting occurs, signs should be posted alerting hunters to the presence of protected pygmy rabbits. Areas could also be closed to rabbit hunting if the risks to pygmy rabbits are determined to be significant. Hunter education and enforcement may be just as effective at preventing pygmy rabbit killings as total hunting closures.* Limiting vehicular access will help reduce fire danger and the spread of noxious weeds. *This is recommended.*

It is easiest to look for pygmy rabbits with snow on the ground. The combination of tracks, pellets, and burrows in the snow provide conclusive evidence of pygmy rabbit presence.

Searches for new populations will be most efficient when timed to coincide with periods of snow cover, Monitoring of existing populations will rely upon complete searches of randomly selected fixed-radius circles marked by pins installed in the ground. These pins are a permanent means to mark a precise location. Surveys of the circles established by these pins are conducted when the ground is snow-free in order to for the pins to be found. However, late fall and early spring survey periods are most desireable because pygmy rabbits are still closely associated with burrows at these times.

Proper grazing management could help alleviate the threat of fire to pygmy rabbit habitat.

Grazing at a level which eliminates dry, flammable grasses, twigs and leaf litter is likely not compatible with pygmy rabbit habitat needs. At levels that are compatible with pygmy rabbits, it is unlikely that grazing will appreciably reduce the threat of fire.

The first step toward recovery should be to protect and eliminate grazing and other threats from the two largest sites.

The recovery plan identifies strategies to protect the known populations. Grazing, as it currently exists at these two sites, has not been demonstrated to be a threat. A management plan has been developed and will continue to be modified to ensure protection of the largest pygmy rabbit population at Sagebrush Flat.

Recovery - Manage habitat to increase pygmy rabbit abundance and distribution

Sagebrush Flat should be recommended as a Natural Area Preserve. At a minimum, grazing should not be increased there.

Sagebrush Flat is under consideration by DNR to be designated as a Natural Area Preserve or to be transferred to WDFW. The recovery plan referred to a Coordinated Resource Management Plan that has been developed to ensure that grazing is compatible. It will be reviewed and updated. There is no plan to increase grazing at Sagebrush Flat.

The Corps of Engineers has a 200 acre parcel in Douglas County, upstream of Chief Joseph dam, that is fenced and ungrazed and available for pygmy rabbit recovery, if desired. The site is currently dominated by big sagebrush and antelope bitterbrush.

Options for use of this area will be considered.

Grazing on pygmy rabbit sites should be deferred until recovery goals are met and research provides evidence of compatibility and safe management levels. Any compromises should be limited to a few sites where research and monitoring guide the activity.

This recommendation assumes an adverse effect from existing levels of grazing which has not been demonstrated. These areas have been grazed during most of this century. There is little basis for recommending dramatic changes in the land uses that have coexisted with pygmy rabbits for decades. This plan recommends managing grazing in an attempt to improve conditions for pygmy rabbits. Also recommended are monitoring and research tasks that will provide a better understanding of how the changes we implement will effect pygmy rabbits and their habitat.

The plan makes reference to implementing recovery on "public lands." State Trust Lands should be treated more like private lands because they must be managed to generate economic support to constitutionally created trusts.

State Trust Lands are public lands with Trust obligations. They are still more similar to other public lands than they are to private lands. Many types of public land have legal or management mandates that must be accommodated and State Trust Lands are simply a special case of this.

Recovery - Establish populations in new areas

Captive-breeding should be among the last techniques considered. Captive-reared animals may not be as fit as wild animals.

Captive-breeding is simply an option, not at this time a preferred option.

Thorough genetic comparisons between Washington pygmy rabbits and pygmy rabbits from other states should be conducted. Washington pygmy rabbits may represent a distinct subspecies. These comparisons are necessary prior to any translocations from out-of-state.

Such genetic comparisons are recommended.

Supplementing Washington's pygmy rabbit populations with rabbits from elsewhere should be avoided until all other options have been exhausted.

Translocations of pygmy rabbits from out-of-state populations is not a preferred approach but may be considered if other options prove unworkable.

If there are insufficient wild animals for use in reintroductions, a semi-captive setting involving predator exclosures in a natural situation should be attempted. Supplemental feeding could be attempted to enhance reproduction and survival.

Suggestion noted.

The first priority should be to protect and enhance existing sites with pygmy rabbits. Reintroduction may fail since 52% of reintroductions into areas on the periphery of a species' range have failed in the past. Translocations to the core of a species' range have been successful 76% of the time.

These points are well taken and, generally, consistent with this plan.

When looking for areas to establish new populations of pygmy rabbits, concentrate on areas of historic sightings.

We will consider areas of historic sightings, though there are only nine such locations and we consider these nine locations to be broad indicators of the pygmy rabbit's former range in Washington. To avoid limiting the search for suitable habitat too tightly, this plan recommends an initial analysis of the entire shrub-steppe region of eastern Washington. Areas of historic sightings will, however, get special scrutiny.

Recovery - Coordinate and cooperate with public agencies and other landowners

Soil Conservation Service personnel should be included in recovery implementation efforts. They have considerable expertise in soils and vegetation and are in regular contact with numerous landowners.

A recommendation to involve Soil Conservation Service personnel has been added to the plan.

The Department has no legal basis for continuing grazing in order to maintain working relationships with eastern Washington grazing interests. The acceptance of grazing, even when described with undefinable qualifications such as "proper management," is a misinterpretation of the biological information base and could lead to extirpation of the pygmy rabbit.

The Department of Natural Resources controls grazing leases on DNR land. The Washington Department of Fish and Wildlife provides recommendations to the DNR regarding management for the protection of vulnerable species. The WDFW addresses grazing in the recovery plan and notes the potential for grazing to be harmful as well as compatible with pygmy rabbit habitat needs. The suggestion that all grazing is incompatible with pygmy rabbits is not supported by an objective evaluation of available information.The Department has not supported eliminating grazing at Sagebrush Flat under the current Coordinated Resource Management Plan because: 1) there is no evidence it is harmful to pygmy rabbits at this site, and 2) if it is possible to retain carefully managed grazing, it will help long term recovery goals for the rabbit. If there were evidence of adverse impacts to pygmy rabbit populations, the Department would not hesitate to recommend cessation of that activity.

Grazing has no place in pygmy rabbit habitat or habitat being managed for eventual occupation by pygmy rabbits. Grazing to increase sagebrush would have undesireable impacts to native perennial grasses which are important to the rabbits in the spring. To achieve a dense sagebrush cover, planting nursery raised seedlings would be preferable.

The converse to this is the suggestion that failure to graze native perennial grasses will result in increased competition for nutrients, moisture, and growing space and produce a gradual thinning of the sagebrush cover until much of the area is rendered unsuitable for pygmy rabbits. In fact, the means to achieve the best balance of perennial grasses and sagebrush cover are not well known. Grazing management is potentially one way to influence this dynamic. Methods, costs, and success rates for establishing stands of tall, dense sagebrush through planting are unknown.

The Department of Fish and Wildlife should encourage cooperation for success. All management plans should take into account private property rights.

A cooperative approach, involving willing citizens, is considered the most likely formula for success in recovering pygmy rabbit populations. This plan will not work without extensive cooperation between government agencies and private citizens. All recovery plans are mandated to "promote cooperative management and be sensitive to landowner needs and property rights." This is provided by WAC 232-12-297 which is Appendix A in this plan.

If grazing is prohibited at pygmy rabbit sites, there will be a loss of local good will and the benefits of positive local management. There will be losses of local assistance with the control of noxious weeds, range fire prevention, and monitoring of trespassing.

This plan includes substantial recognition of the need for a cooperative approach to pygmy rabbit recovery and the continuous involvement and education of landowners, lessees, and local citizens. Throughout this process there will be hard choices. We intend to communicate with interested parties so that local citizens will fully understand the basis for decisions that affect their communities. With local involvement in all of the issues, we expect that hard decisions will not result in a loss of local good will because these decisions will be seen as both necessary and reasonable.

Recovery - Complete scientific investigations that will benefit the recovery effort

If we proceed with burrow surveys without knowing their relationship to population numbers, we should indicate this is the case and proceed with testing the validity of the method.

The need to develop techniques to estimate pygmy rabbit population size is indicated in the plan. In the meantime, it is critical to monitor, as best we know how, the condition of the population. It must be done in a way that does not put animals at risk of injury or death. The association of pygmy rabbits with burrows, particularly during winter, is well-established and it is therefore expected that a statistically designed method to estimate the number of active burrows will be meaningful to an understanding of population trend.

Because an understanding of the relationships between grazing and pygmy rabbit habitat is important to recovery and is equally important to developing a cooperative relationship with landowners and agricultural interests, the plan should outline a strategy of scientific study to gain this understanding.

A study of the relationship between grazing and pygmy rabbits is now identified as needed research. Like all research identified as important to recovery strategies, the details of this study should be developed separate from this plan.

Studies of proper grazing management should be conducted. Sound habitat management prescriptions should be developed as knowledge is gained.

To be useful to pygmy rabbit recovery, a study of the relationships between grazing and pygmy rabbits should consider a variety of grazing intensities and seasonal durations.

The value of corridors needs to be studied before any substantial investment is made in acquiring lands to develop them.

Observations of pygmy rabbits indicate use of long, narrow corridors when there is sagebrush cover present. These observations, by themselves, are sufficient to justify initial corridor development between suitable habitat patches. Recovery activities will include substantial monitoring of lands where habitat enhancements are attempted so there will be opportunities to learn what works and what doesn't and adapt accordingly.

Studies of habitat requirements need to be conducted in concert with the development of reliable monitoring methods. Habitat conditions which will support populations over the long term should be identified.

Habitat conditions in areas inhabited by pygmy rabbits are better studied than many other aspects of the species' biology. Nevertheless, the activities outlined in this plan include substantial tracking of both population and habitat conditions in pygmy rabbit areas.

A thorough understanding of population trends and habitat requirements is needed before you can determine the amount of habitat needed for recovery and before habitat enhancement or restoration can be successfully undertaken.

There is adequate information for beginning habitat restoration activities. The habitat that pygmy rabbits occupy has been studied in areas throughout the range of the species and the habitat is remarkably similar in all areas. In addition, there are sites like Burton Draw where pygmy rabbits are known to have colonized sagebrush regrowth on an old agricultural field. There is little doubt that we can create pygmy rabbit habitat.

The amount of habitat needed for recovery is a matter of considerable uncertainty. Until a reliable means to estimate pygmy rabbit population size is developed, there is little reason to try to estimate this quantity.

Information on population dynamics and habitat requirements is badly needed.

There are subtleties of habitat that need to be investigated but there is considerable information already available on this aspect of pygmy rabbit biology. Population dynamics are poorly known and research on this topic is recommended by this plan.

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