

**Recovery Plan for the
Columbia Basin Distinct Population Segment of the
Pygmy Rabbit (*Brachylagus idahoensis*)**



Region 1
U.S. Fish and Wildlife Service
Portland, Oregon

Approved: 
Regional Director, U.S. Fish and Wildlife Service

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<http://www.fws.gov/endangered/species/recovery-plans.html>

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EXECUTIVE SUMMARY

Current Status:

We listed the Columbia Basin distinct population segment of the pygmy rabbit (*Brachylagus idahoensis*) as an endangered species under an emergency regulation in 2001 (USFWS 2001), and fully listed it as endangered in 2003 (USFWS 2003). The current recovery priority number for the Columbia Basin pygmy rabbit is 6 (USFWS 2010a). The Washington Department of Fish and Wildlife began a captive breeding program for the Columbia Basin pygmy rabbit in 2001 (WDFW 2001a), and developed an intercross breeding strategy in 2003 (WDFW 2003). Intercross breeding was conducted to help facilitate genetic restoration of the Columbia Basin pygmy rabbit due to severe inbreeding depression in the purebred captive animals, and is considered essential for recovery efforts (USFWS 2011b). Intercross breeding was accomplished through carefully controlled matings between the founding purebred Columbia Basin animals and pygmy rabbits of the same taxonomic classification from a discrete population in Idaho. The last known wild subpopulation of pygmy rabbits within the Columbia Basin was extirpated by early 2004, although other wild subpopulations may still exist on lands that have not yet been surveyed. In March of 2007, 20 captive-bred, intercrossed pygmy rabbits were reintroduced to habitats historically occupied by the species in the Columbia Basin of central Washington. These captive-bred animals experienced very high mortality over the first several weeks following their release and none were believed to have survived through the spring of 2008. Following the development and implementation of appropriate adaptive management measures, reintroduction efforts were resumed in the summer of 2011. The new measures that have been implemented include additional releases of the captive-bred intercrossed pygmy rabbits, the capture and translocation of wild pygmy rabbits from populations outside of the Columbia Basin for inclusion in the reintroduction program, initiation of partially controlled field-breeding efforts, and improved protective measures during releases. As these new measures have been implemented, the need for continuing captive breeding efforts has steadily diminished, and captive breeding operations at three cooperating facilities were discontinued by the end of July 2012.

Distribution and Habitat:

The pygmy rabbit has been present within the Columbia Basin ecosystem, a geographic area that extends from northern Oregon through central Washington, for over 100,000 years. This distinct population segment of the pygmy rabbit, which is the subject of this Recovery Plan, is believed to have been separated from the remainder of the species' range for at least 10,000 years, as suggested by the fossil record and genetic analyses. Museum specimens and sighting records indicate that the Columbia Basin pygmy rabbit likely occurred in portions of six Washington counties during the first half of the 20th century, including Douglas, Grant, Lincoln, Adams, Franklin, and Benton.

Pygmy rabbits occur in the semiarid shrub steppe biome of the Great Basin and adjacent intermountain regions of the western United States. Within this broad biome, pygmy rabbits are typically found in habitat types that include tall, dense stands of sagebrush (*Artemisia* spp.), on which they are highly dependent to provide both food and shelter throughout the year. The pygmy rabbit is one of only two native rabbit species in North America that digs its own burrows and, therefore, is most often found in areas with relatively deep, loose soils that allow burrowing.

Threats to Recovery:

Large-scale loss and fragmentation of native shrub steppe habitats, primarily for agricultural development, likely played a primary role in the long-term decline of the Columbia Basin pygmy rabbit. However, it is unlikely that these factors alone directly influenced the eventual extirpation of all known subpopulations from the wild. Once a population declines below a certain threshold, it is at risk of extirpation from a number of influences including chance environmental events (*e.g.*, extreme weather), catastrophic habitat loss or resource failure (*e.g.*, from wildfire or insect infestations), predation, disease, demographic limitations, loss of genetic diversity, and inbreeding. At the time of our emergency listing action in 2001, the Columbia Basin pygmy rabbit was imminently threatened by its small population size, loss of genetic diversity, and inbreeding depression, coupled with a lack of suitable, protected habitats in the wild. To varying degrees, all of the above influences continue to impact the Columbia Basin pygmy rabbit and, in combination, have resulted in the population's endangered status.

Recovery Strategy:

A phased approach for recovery planning has been prescribed by this Recovery Plan. The three general phases are: 1) removal or abatement of imminent threats to the population and the potentially suitable shrub steppe habitats in the Columbia Basin; 2) reestablishment of an appropriate number and distribution of free-ranging subpopulations over the near term; and 3) establishment and protection of a sufficiently resilient, free-ranging population that would be expected to withstand foreseeable long-term threats. This recovery strategy is oriented to dynamic adaptive management of the Columbia Basin pygmy rabbit and its habitat, consistent with the Service's Strategic Habitat Conservation process, which calls for an iterative process of biological planning, conservation design, conservation delivery, and monitoring and research. The biological planning and conservation design set forth in this recovery plan lay out the criteria for recovery and identify localities for implementing actions, while the recovery actions describe a process for implementing conservation on the ground, outcome-based monitoring to assess success, and ongoing assumption-driven research to test biological hypotheses important to management. To facilitate such a strategy, specific near-term (*i.e.*, 2012 – 2021) and more

general long-term objectives and criteria have been established. In addition, revised implementation schedules will be developed, as necessary, to reflect the knowledge gained, accomplishments met, potential future constraints encountered, and consequent refinements to near-term recovery objectives, criteria, and/or actions as recovery progresses.

Recovery Goal and Objective:

The goal of this Federal recovery effort is to reclassify the species as threatened and, ultimately, remove it from the Federal List of Endangered and Threatened Wildlife and Plants. This will require that threats to free-ranging Columbia Basin pygmy rabbits are sufficiently abated to ensure a high probability of the population's persistence within its historical distribution over the foreseeable future. The long-term recovery objective is to increase the number, distribution, and security of free-ranging subpopulations of the pygmy rabbit within the Columbia Basin so that the recovery goal may be met.

Recovery Actions:

Action 1: Manage partially controlled field-breeding for the Columbia Basin pygmy rabbit.

Action 2: Survey for, monitor, and assess free-ranging Columbia Basin pygmy rabbits.

Action 3: Reestablish free-ranging Columbia Basin pygmy rabbit subpopulations within their historical distribution.

Action 4: Protect free-ranging Columbia Basin pygmy rabbits.

Action 5: Manage habitats at recovery emphasis areas to support stable, self-sustaining subpopulations of free-ranging Columbia Basin pygmy rabbits.

Action 6: Pursue conservation agreements for the Columbia Basin pygmy rabbit with landowners and managers of intervening properties within the population's historical distribution.

Action 7: Exchange information with stakeholders and the general public to address concerns and increase support for Columbia Basin pygmy rabbit recovery efforts.

Action 8: Secure funding for Columbia Basin pygmy rabbit recovery efforts.

Action 9: Revise the Federal Recovery Plan to facilitate implementation of adaptive management measures considered necessary to achieve the phased recovery strategy.

Date of Recovery:

It is not currently possible to estimate a date of recovery for this population as relatively few, if any, Columbia Basin pygmy rabbits currently survive in the wild as established populations. Only about 100 intercrossed individuals have been recently reintroduced to habitats historically occupied

by the species within the Columbia Basin, and the success of future translocation, field-breeding, and reintroduction efforts cannot yet be accurately predicted.

Total Estimated Cost of Recovery:

It is not currently possible to estimate the total cost of recovery. The estimated cost to implement all recovery actions described in the Implementation Schedule over the next 10 years is \$1,079,000. It may be assumed that continued, intensive management would be required for at least the following decade, at roughly half the cost.

Table 1. Recovery Action Time and Cost (\$000's)

Recovery Action	2012	2013	2014	2015	2016	2017 - 2021	TOTAL
1	70	20	20	50	20	-	180
2	20	45	49	15	19	25	173
3	65	65	35	35	35	85	324
4	7	42	22	7	7	-	85
5	-	52	62	32	32	20	198
6	5	25	27	12	12	10	91
7	2	2	2	2	2	-	10
8	2	2	2	2	2	-	10
9	-	2	2	2	2	-	8
TOTAL	171	255	221	157	133	142	1,079

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I. BACKGROUND

A. Brief Overview

The pygmy rabbit (*Brachylagus idahoensis*) was classified as a threatened species by Washington State in 1990 and was reclassified as endangered in 1993 (Washington Department of Fish and Wildlife [WDFW] 1995). A State recovery plan for the pygmy rabbit was completed in 1995, with amendments to the plan completed in 2001, 2003, and 2011 (WDFW 1995, 2001, 2003, 2011). All of the amendments to the State recovery plan were closely coordinated with the following Federal recovery efforts.

On November 30, 2001, we, the U.S. Fish and Wildlife Service (Service or USFWS), published an emergency rule to federally list the Columbia Basin distinct population segment (DPS) of the pygmy rabbit, hereafter referred to as the Columbia Basin pygmy rabbit, as endangered pursuant to the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.) (USFWS 2001). The Columbia Basin ecosystem, which extends from northern Oregon through eastern Washington, encompasses the entire Washington State population of the pygmy rabbit, which is the only pygmy rabbit population that occurs within the Columbia Basin. On March 5, 2003, we published a final rule listing the Columbia Basin pygmy rabbit as endangered, without critical habitat (USFWS 2003). Our determination that this population is a DPS is based on its isolation within the unusual ecological setting of the Columbia Basin, the significant gap in the range of the taxon that the loss of this population segment would represent, and the population's markedly different genetic characteristics compared to the remainder of the taxon. In September 2010, we also completed a 5-Year Status Review of the Columbia Basin pygmy rabbit, which reaffirmed that this population is an endangered DPS and concluded that several threats to the population had increased since 2003 (USFWS 2010a).

Shortly after publishing the final listing rule, we convened a multi-party Recovery Team (see Acknowledgements) to assist us with development of a Draft Recovery Plan (Draft) for the Columbia Basin pygmy rabbit, which was completed in August 2007 (USFWS 2007). In order to address available new information, ongoing implementation of adaptive management measures, and prescribed changes to specific actions defined in the Draft, we completed an Amendment to the Draft Recovery Plan (Amendment) in May 2011 (USFWS 2011a). Both the Draft and Amendment underwent public and peer review, and this final Recovery Plan has been updated based on the review comments we received. Additional discussion addressing some of

the review comments that were not wholly incorporated or fully addressed in the body of this final Recovery Plan is provided in the Appendix.

The current recovery priority number for the Columbia Basin pygmy rabbit is 6, on a scale of 1C (highest) to 18 (lowest). Recovery priority numbers represent our process for assigning conservation priorities for listed species. The criteria by which a recovery priority number is based are degree of threat to the listed entity, its recovery potential, its taxonomic distinctiveness, and the presence of an actual or imminent conflict between it and development activities. Our ranking of the Columbia Basin pygmy rabbit is based on our determination that it is subject to a high degree of threat, it has low to moderate potential for recovery, it is classified as a DPS, and that there is relatively little conflict expected between implementation of the identified recovery actions and development or other economic activity.

A number of significant information gaps remain about pygmy rabbits in general and, more specifically, about how the Columbia Basin population will respond to ongoing and developing conservation measures. Recovery of the Columbia Basin pygmy rabbit will require both effective adaptive management through comprehensive monitoring and sustained conservation measures to ensure the population's long-term viability. The Draft and Amendment identified criteria for downlisting the species from endangered to threatened; however, they did not identify specific delisting criteria because of the uncertainties in the biological information and the ultimate effectiveness of ongoing population management actions. For similar reasons, this final Recovery Plan does not identify delisting criteria. Nevertheless, we recognize the need for requisite data to develop more precise and biologically accurate long-term recovery and delisting criteria as a high priority, and we have identified specific actions to obtain this information. As necessary, we will periodically review and update this Recovery Plan as research and management activities progress and as we gain further knowledge about the conservation needs of this species.

B. Description and Taxonomy

The pygmy rabbit is a member of the family Leporidae, which includes hares and rabbits. The species has been placed in several genera since it was first classified in 1891 as *Lepus idahoensis* (Washington Department of Fish and Wildlife [WDFW] 1995). In 1904, it was reclassified and placed in the genus *Brachylagus*, and in 1930, it was again reclassified and placed in the genus *Sylvilagus*. More recent examination of dentition (Hibbard 1963) and analysis of blood proteins (Johnson 1968) suggest that the pygmy rabbit differs significantly

from species within either the *Lepus* or *Sylvilagus* genera. The pygmy rabbit is now generally considered to be within the monotypic genus *Brachylagus*, and is again classified as *B. idahoensis* (Green and Flinders 1980a; WDFW 1995). There are no recognized subspecies of the pygmy rabbit (Dalquest 1948; Green and Flinders 1980a).

The pygmy rabbit is the smallest leporid in North America, with mean adult weights from 375 to about 500 grams (0.83 to 1.1 pounds), and lengths from 23.5 to 29.5 centimeters (9.3 to 11.6 inches) (Orr 1940; Janson 1946; Wilde 1978; Gahr 1993; WDFW 1995). Females tend to be slightly larger than males. Pygmy rabbits undergo an annual molt. Their overall color is slate-gray tipped with brown. Their legs, chest, and nape (back of neck) are tawny cinnamon-brown, their bellies are whitish, and the entire edges of their ears are pale buff. Their ears are short (3.5 to 5.2 centimeters [1.4 to 2.0 inches]), rounded, and thickly furred outside. Their tails are small (1.5 to 2.4 centimeters [0.6 to 0.9 inch]), uniform in color, and nearly unnoticeable in the wild (Orr 1940; Janson 1946; WDFW 1995). The pygmy rabbit is distinguishable from other rabbit species by its small size, short ears, gray color, small hind legs, and lack of white on the tail.

C. Distribution and Habitat Use

The historical distribution of the pygmy rabbit included much of the semiarid shrub steppe biome of the Great Basin and adjacent intermountain regions of the western United States (Green and Flinders 1980a), and included portions of Montana, Idaho, Wyoming, Utah, Nevada, California, Oregon, and Washington. Pygmy rabbits occur in a variety of semiarid shrub steppe habitat types that are found throughout their historical distribution. A recently developed database that documents historical and contemporary rangewide occurrences of the pygmy rabbit (USFWS 2010b), combined with an assessment of potentially suitable shrub steppe vegetation communities throughout the western United States (USFWS 2010a), has allowed us to refine the estimated historical distribution of the pygmy rabbit (Figure 1).

Pygmy rabbits are not currently distributed continuously across their range, nor were they in the past. Rather, they are found in areas within their broader distribution where suitable habitats occur. The local distribution of suitable habitat patches, and thus pygmy rabbits, likely shifts across the landscape in response to various sources of disturbance (*e.g.*, fire, flooding, grazing, crop production) combined with long- and short-term weather patterns. In the past, more dense vegetation along permanent and intermittent stream channels, alluvial fans, and sagebrush plains provided travel corridors and dispersal habitat for pygmy rabbits between

appropriate use areas (Green and Flinders 1980a; Weiss and Verts 1984; WDFW 1995). Since European settlement of the western United States, more dense vegetation associated with human activities (*e.g.*, fence rows, roadway shoulders, abandoned fields) likely also provide avenues for dispersal between local populations of pygmy rabbits (Green and Flinders 1980a; Pritchett et al. 1987).

The pygmy rabbit has been present within the Columbia Basin for over 100,000 years (Lyman 1991; Lyman 2004). Based on the fossil record (Grayson 1987; Lyman 1991; Lyman 2004) and population genetic analyses (WDFW 2001b), this population segment is believed to have been disjunct from the remainder of the species' range since at least the early Holocene (10,000 to 7,000 years before present [BP]). The Columbia Basin pygmy rabbit likely had a broader distribution during the mid-Holocene (roughly 7,000 to 3,000 years BP) (Lyman 1991; Lyman 2004). Gradual climate change affecting the distribution and composition of sagebrush habitat types is thought to have resulted in a reduction of the Columbia Basin pygmy rabbit's range during the late Holocene (3,000 years BP to present) (Grayson 1987; Lyman 1991; Lyman 2004). Museum specimens and reliable sighting records indicate that the Columbia Basin pygmy rabbit probably occurred in portions of Douglas, Grant, Lincoln, Adams, Franklin, and Benton Counties, Washington, during the first half of the 20th century (Figure 2).

Nearly the entire historical distribution of the Columbia Basin pygmy rabbit lies within the big sagebrush (*Artemisia tridentata*) – bluebunch wheatgrass (*Agropyron spicatum*) zonal habitat type (Daubenmire 1988). This habitat type consists of four well-defined vegetation layers. The most prominent layer consists of various shrub species, principally big sagebrush, that are intermixed with a second layer comprised of a variety of tall perennial grasses, principally bluebunch wheatgrass. The third layer consists of low-lying perennial and annual grasses and forbs, which are usually less than 10 centimeters (4 inches) in height. Finally, the fourth vegetative layer is made up of a thin, fragile cryptogamic crust, which occurs directly on the surface of the soil. Various lichen, moss, and liverwort species comprise this layer, which has important influences with regard to erosion susceptibility, moisture retention, and nutrient cycling. A small fraction of the population's historical distribution, in the extreme northern portion, is within the threetip sagebrush (*A. tripartita*) - Idaho fescue (*Festuca idahoensis*) zone. This habitat type differs primarily by the substitution of the dominant shrub and grass species, but otherwise has similar characteristics to that of the big sagebrush – bluebunch wheatgrass zone. Within these habitat types, pygmy rabbits are typically found in areas that include the tallest (greater than 91 centimeters [36 inches]) and most dense (greater than 25 percent cover) stands of sagebrush (*Artemisia* spp.). Pygmy rabbits are highly dependent on sagebrush to provide both food and shelter throughout the year (Bailey 1936; Orr 1940; Green and Flinders

1980a; Weiss and Verts 1984; WDFW 1995).

Major Federal lands within the historical distribution of the Columbia Basin pygmy rabbit include the Hanford Reach National Monument and the Saddle Mountain and Columbia National Wildlife Refuges managed by the Service; scattered ownership within the Jameson Lake, Douglas Creek, and Saddle Mountains Management Areas managed by the U.S. Bureau of Land Management (BLM); scattered ownership associated with the Columbia Basin Irrigation Project managed by the U.S. Bureau of Reclamation (USBR); and the Hanford Site managed by the Service and U.S. Department of Energy (DOE). Major State lands within the historical distribution of the Columbia Basin pygmy rabbit include the Sagebrush Flat, Gloyd Seeps, Potholes, and Crab Creek Wildlife Areas managed by WDFW; and scattered ownership managed by the Washington Department of Natural Resources (WDNR). The Sagebrush Flat Wildlife Area was the last site known to support Columbia Basin pygmy rabbits in the wild. Most of these undeveloped public lands are managed to protect their natural resource values. Other major management objectives for these properties include oversight of livestock grazing leases, primarily by BLM and WDNR, and operating buffer zones for various sensitive Federal facilities, primarily by USBR and DOE.

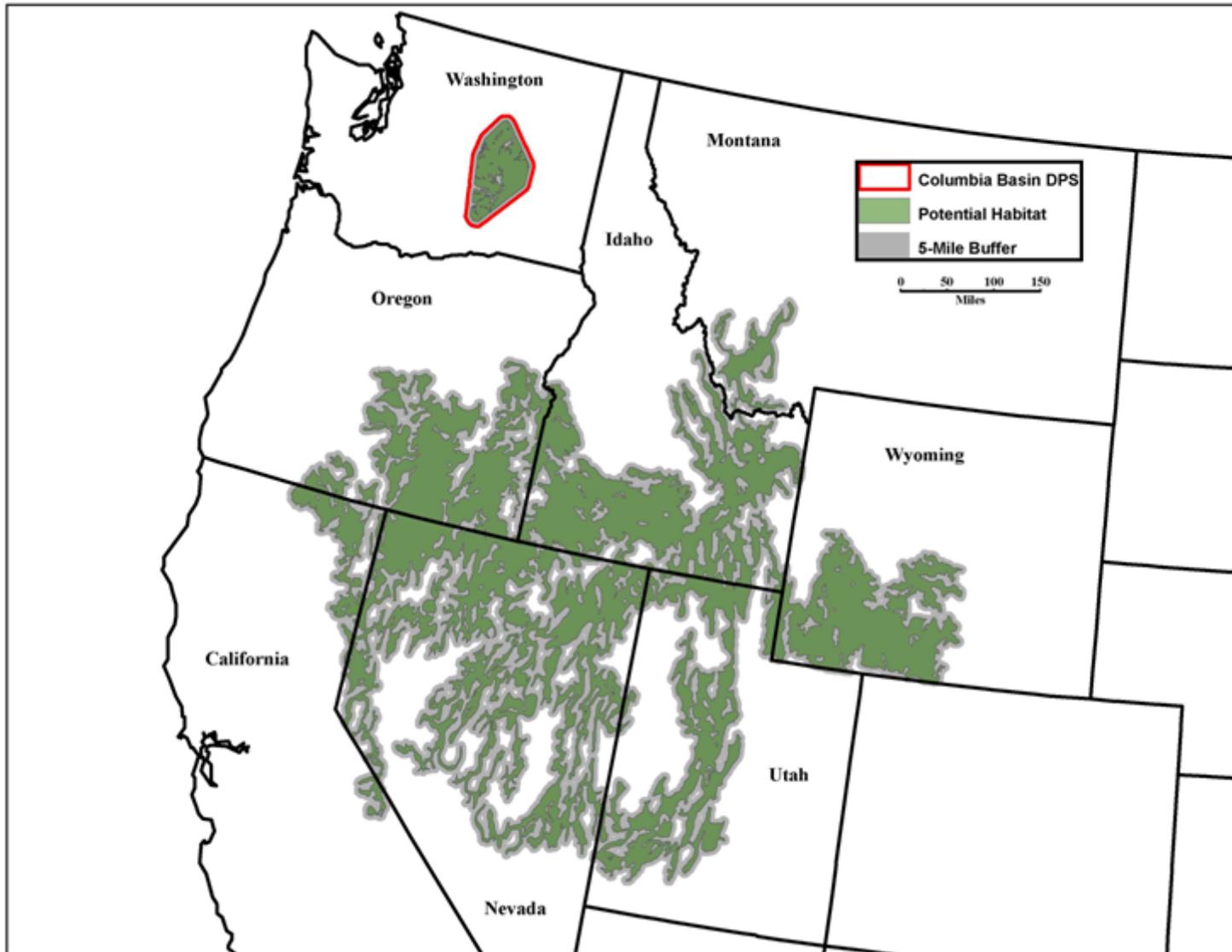


Figure 1. Approximate historical distribution of the pygmy rabbit based on available occurrence data and the distribution of potentially appropriate shrub steppe community types.

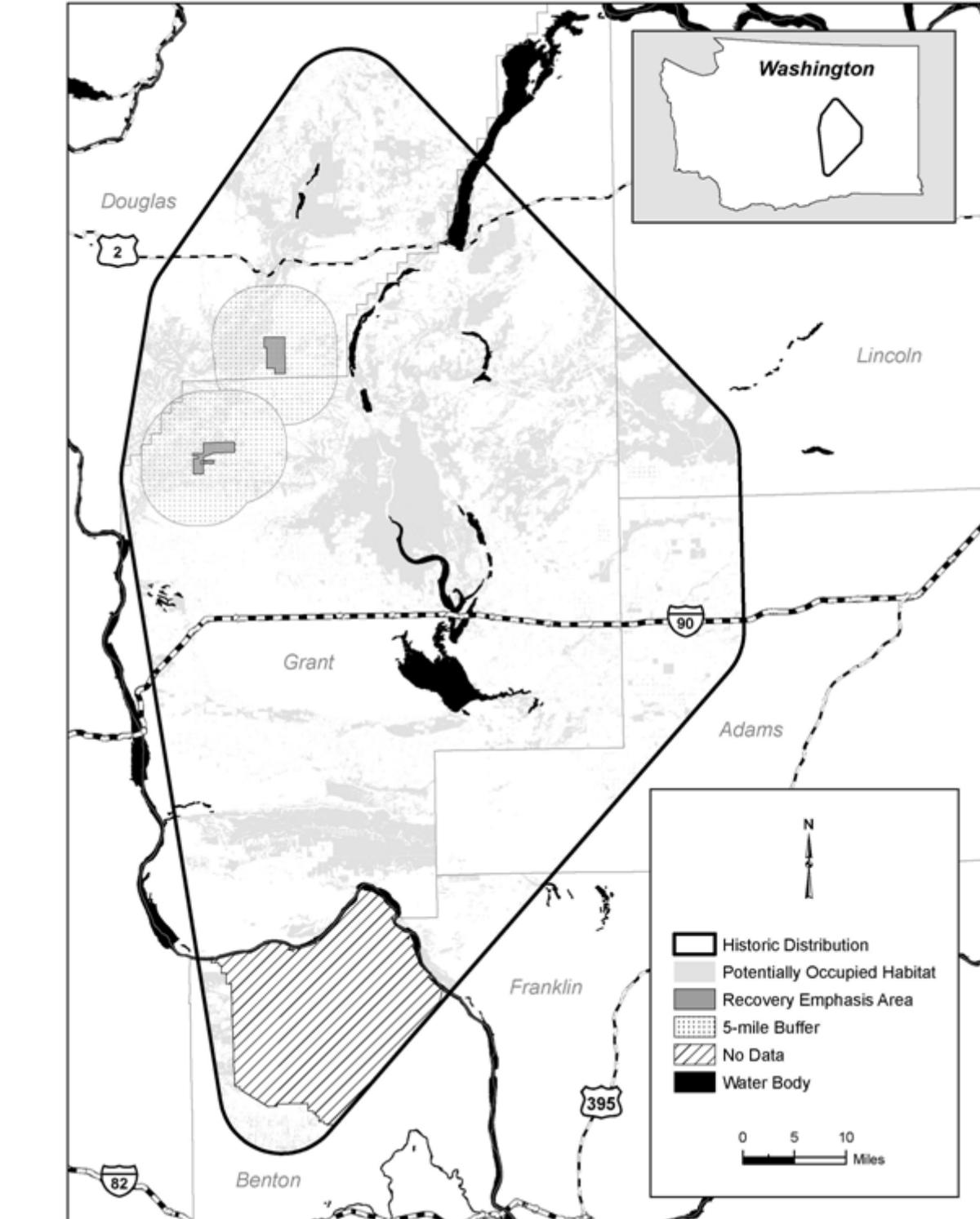


Figure 2. Historical distribution of the Columbia Basin pygmy rabbit, potentially occupied habitat (*i.e.*, appropriate soils and shrub steppe habitat intersect layers), and recovery emphasis areas with 5-mile buffers.

Non-governmental organizations and private land owners currently contributing to Columbia Basin pygmy rabbit recovery efforts (see Conservation Actions Implemented) include The Nature Conservancy in Douglas and Grant Counties and a large private parcel in northern Grant County. Most of the remaining area within the historical distribution of the Columbia Basin pygmy rabbit is in private ownership and managed primarily for irrigated and dry-land crop production, livestock operations, and urban and rural developments (*e.g.*, housing, commercial and industrial facilities, transportation corridors).

D. Life History

Home Range, Dispersal, and Movements: Pygmy rabbits have relatively small home ranges during winter, remaining within roughly 30 meters (100 feet) of their burrows (Orr 1940; Janson 1946; Katzner and Parker 1997), although some snow burrows may extend outward over 100 meters (330 feet) (Bradfield 1974). Pygmy rabbits have larger home ranges during spring and summer (Janson 1946; Gahr 1993). During the breeding season in Washington, females tend to make relatively short movements within a small core area and have home ranges covering roughly 3 hectares (7 acres); while males tend to make longer movements during this period, possibly in response to seeking out estrous females, resulting in home ranges covering roughly 20 hectares (50 acres) (Gahr 1993). These home range estimates in Washington are considerably larger than for pygmy rabbits in other portions of their historical distribution (WDFW 1995; Katzner and Parker 1997).

Recent records from studies in Idaho indicate that juvenile pygmy rabbits often undertake a single, rapid dispersal movement at 6 to 10 weeks of age, and that some juvenile animals may disperse over 10 kilometers (6 miles) during this period (Rachlow and Estes-Zumpf 2005). In addition, adult pygmy rabbits may disperse over 12 kilometers (7.5 miles) between their more restricted, seasonal use sites. While these movements are considerably longer than those documented in previous studies (*e.g.*, Green and Flinders 1979; Katzner and Parker 1998), it should be noted that these are maximum estimates and there appear to be large differences in the propensity of individual pygmy rabbits to disperse, with many animals remaining relatively sedentary. Reflecting this, median recorded dispersal distances in Idaho were 1.1 kilometers (0.7 mile) and 3.0 kilometers (1.9 miles) for males and females, respectively (Rachlow and Estes-Zumpf 2005).

Pygmy rabbits maintain a low stance, have a deliberate gait, and are relatively vulnerable

in more open areas. They can evade predators by maneuvering through the dense shrub cover of their preferred habitats, often along established trails, or by escaping into their burrows (Bailey 1936; Severaid 1950; Bradfield 1974).

Burrowing Behavior: The pygmy rabbit is one of only two native leporids in North America that digs its own burrows (Nelson 1909; Green and Flinders 1980a; WDFW 1995), the other being the volcano rabbit (*Romerolagus diazi*) found in central Mexico (Durrell and Mallinson 1970). As such, pygmy rabbits are most often found in areas that contain relatively deep (greater than 51 centimeters [20 inches]), loose soils of wind-borne or water-borne origin that allow burrowing (WDFW 1995). Pygmy rabbits occasionally make use of natural cavities, holes in volcanic rock, rock piles, sand dunes, artificial structures, or burrows abandoned by other species, such as the yellow-bellied marmot (*Marmota flaviventris*) or badger (*Taxidea taxus*) (Green and Flinders 1980a; WDFW 1995; P. Becker, WDFW, pers. comm. 2012). As a result, pygmy rabbits may occur in areas of shallower, more compact, or sandy soils that support sufficient shrub cover (Bradfield 1974). These atypical burrow sites, which are most often adjacent to areas containing dense sagebrush stands and deep soil conditions, may facilitate dispersal behavior and function as corridors between suitable habitats (Katzner and Parker 1998). During winter, pygmy rabbits make extensive use of snow burrows to access sagebrush forage (Bradfield 1974; Katzner and Parker 1997) and to provide thermal cover (Katzner et al. 1997).

Pygmy rabbits typically dig their burrows into gentle slopes or mound/inter-mound areas of more level or dissected topography (Wilde 1978; U.S. Department of Agriculture [USDA] 1991; Gahr 1993). Burrows frequently have multiple entrances, some of which are concealed at the base of large sagebrush plants (Janson 1946; Wilde 1978; Green 1979; Gahr 1993). Otherwise, individual burrows are relatively simple and shallow, often no more than 2 meters (6.6 feet) in length and usually less than 1 meter (3.3 feet) deep with no distinct chambers (Bradfield 1974; Green and Flinders 1980a; Gahr 1993). The diameter of burrow entrances in Washington averaged 19 centimeters (8 inches) (Gahr 1993). Small, shallow trenches typically found at burrow entrances are referred to as runways.

Pygmy rabbits, especially juveniles, likely use their burrows as protection from predators and inclement weather (Bailey 1936; Bradfield 1974). In general, the number of active burrows in an area increases over the summer as the number of juveniles increases. However, the number of active burrows is not directly related to the number of individuals in a given area because some individual pygmy rabbits appear to maintain multiple burrows, while some individual burrows are used by multiple individuals (Gahr 1993; WDFW 1995).

Diet: The winter diet of pygmy rabbits is comprised of up to 99 percent sagebrush (Green and Flinders), which is unique among leporids (White et al. 1982). During spring and summer in parts of their historical range, their diets consist of up to 51 percent sagebrush, 39 percent grasses (particularly native bunch grasses, such as *Agropyron* spp. and *Poa* spp.), and 10 percent forbs (herbaceous plants) (Green and Flinders 1980b). There is evidence that pygmy rabbits preferentially select native grasses as forage during this period in comparison to other available foods. In addition, total grass cover relative to forbs and shrubs may be reduced within the immediate areas occupied by pygmy rabbits as a result of its use as a food source during spring and summer (Green and Flinders 1980b). The diets of pygmy rabbits likely vary depending on the regions and specific habitat types they occupy (T. Katzner, pers. comm. 2002).

Reproduction: Pygmy rabbits begin breeding the year following their birth and, in Washington, breeding occurs from January through June (Gahr 1993). Gestation in captive pygmy rabbits is from 22 to 24 days (Elias 2004), and females can produce from one to four litters per year (Elias 2004). Kits emerge from their burrows at roughly 2 weeks of age, and average litter sizes in captivity were roughly 3.5 kits per litter at the time of emergence (Elias 2004). Breeding appears to be highly synchronous in a given area, and juveniles are often identifiable to cohorts (Wilde 1978; Becker pers. comm. 2012).

Information on captive and wild pygmy rabbits indicates that females excavate specialized, cryptic “natal” burrows that are disassociated from their resident burrow systems (P. Swenson, Oregon Zoo, pers. comm. 2001; Elias 2004; Rachlow et al. 2005). Recorded lengths of natal burrows from entrance to nest ranged from 15.5 to 35.5 centimeters (7 to 14 inches). In the wild, natal burrows typically consist of a single entrance under a large sagebrush plant (Rachlow et al. 2005). Females begin to dig and supply nesting material (*e.g.*, plucked fur, grass clippings) to these burrows several days prior to giving birth, and may give birth and nurse their young in the runway to the burrow’s entrance. After nursing, the young return to the burrow and the female fills the burrow entrance with loose soil and otherwise disguises the immediate area to avoid detection (Elias 2004; Rachlow et al. 2005). Captive pygmy rabbit females sometimes construct other “dead-end” burrows that appear to be associated with their natal burrows, and female pygmy rabbits may alter their defecation and latrine habits while pregnant or nursing (P. Swenson, pers. comm. 2001). Ongoing work with captive and wild pygmy rabbits should provide additional information concerning details of their reproductive strategy.

Mortality Rates: The annual mortality rates of adult pygmy rabbits may be as high as 88 percent, and over 50 percent of juveniles may die within roughly 5 weeks of their emergence (Wilde 1978; WDFW 1995). However, the mortality rates of adult and juvenile pygmy rabbits

can vary considerably between years, and even between juvenile cohorts within years (Wilde 1978). Starvation and environmental stress likely account for some mortality in wild pygmy rabbits (Wilde 1978), however, predation is generally considered to be the main cause of mortality (Green 1979). Potential predators include fossorial and terrestrial mammals such as badgers, long-tailed weasels (*Mustela frenata*), coyotes (*Canis latrans*), and bobcats (*Felis rufus*), and a variety of avian predators such as great horned owls (*Bubo virginianus*), long-eared owls (*Asio otus*), ferruginous hawks (*Buteo regalis*), northern harriers (*Circus cyaneus*), and common ravens (*Corvus corax*) (Janson 1946; Gashwiler et al. 1960; Green 1978; WDFW 1995; M. Hallet, WDFW, pers. comm. 2002).

Population cycles are not known in pygmy rabbits, although local, rapid population declines have been noted in several states (Bradfield 1974; Weiss and Verts 1984; WDFW 1995). After initial declines, pygmy rabbit populations may not have the same capacity for rapid increases in numbers as other leporids due to their close association with specific components of sagebrush ecosystems, and the relatively limited availability of their preferred habitats (Wilde 1978; Green and Flinders 1980b; WDFW 1995).

E. Abundance and Trends

Columbia Basin pygmy rabbits were considered rare during the early 20th century (Dalquest 1948), although there is little comprehensive information available regarding their historical abundance (WDFW 1995). Columbia Basin pygmy rabbits were thought to be extirpated from Washington during the mid-20th century, until a possible sighting was documented in Benton County in 1979. Intensive surveys in 1987 and 1988 located five small subpopulations in southern Douglas County. Three of the subpopulations were found on State lands and two were found on private lands (WDFW 1995). With the exception of the Benton County record, Columbia Basin pygmy rabbits have only been found in southern Douglas and northern Grant Counties since the mid-20th century (WDFW 2001a).

The number of Columbia Basin pygmy rabbit subpopulations and active burrows in Washington declined following their rediscovery in the late 1980s (WDFW 2001a). Four of the five subpopulations located in 1987 and 1988 were very small, with fewer than 100 estimated active burrows (WDFW 1995). The fifth subpopulation, located at the Sagebrush Flat Wildlife Area in Douglas County, had an estimated 588 active burrows in 1993, when it was considered to support fewer than 150 pygmy rabbits (Gahr 1993). While an additional subpopulation was discovered on private land in northern Grant County in 1997, by 2001 five of the six

subpopulations were extirpated, leaving just one known subpopulation at the Sagebrush Flat site (WDFW 2001a). One of the extirpated sites experienced a catastrophic fire in 1999, while the other sites became extirpated for unknown reasons. In addition, during the winter of 1997 to 1998, the number of active Columbia Basin pygmy rabbit burrows at the Sagebrush Flat site declined by approximately 50 percent, and continued to decline in following years (WDFW 2001a). Surveys of this last known subpopulation have not detected any animals since before July 2004 (B. Patterson, WDFW, pers. comm. 2004), indicating that the Columbia Basin pygmy rabbit may have been extirpated from the wild. However, due to other priorities and limited access to private lands (see Conservation Actions Implemented), only about 7.7 percent, or 46,000 hectares (113,600 acres) of the potentially suitable shrub steppe habitat that remains within the Columbia Basin (totaling roughly 599,000 hectares [1,479,500 acres]) has been surveyed specifically for pygmy rabbit presence since 2001 (USFWS 2010). Therefore, other wild but as yet unknown pygmy rabbit subpopulations may still be present within the Columbia Basin and ongoing survey effort to detect any that may remain has been identified as a key action in this Recovery Plan.

In the fall of 2000, WDFW began developing captive breeding and reintroduction programs for the Columbia Basin pygmy rabbit (see Conservation Actions Implemented). Over the first 10 breeding seasons (beginning in 2002), the average annual growth rate of the captive population (which included intercrossed pygmy rabbits) was roughly 25%, while the number of kits produced each breeding season increased over time, from a low of 19 in 2002 to a high of 275 in 2010. However, the captive breeding program, as originally configured, could not support anticipated reintroduction needs or sufficiently address some of the identified threats to the population and, as of July 31, 2012, only two female pygmy rabbits remained in captivity at the Oregon Zoo (see Captive Breeding).

In 2007, 20 captive-bred adult pygmy rabbits were released into habitat historically occupied by the species in the Columbia Basin (see Reintroduction). These animals experienced very high mortality over the first several weeks following their release, and none were believed to have survived to the spring of 2008. Reintroduction efforts were postponed following this initial release effort.

In 2011, reintroduction efforts for the Columbia Basin pygmy rabbit were resumed. New measures being implemented for these ongoing efforts include capturing wild pygmy rabbits from populations outside of the Columbia Basin to include them in the reintroduction program and holding some of the program animals at the release site in large (up to 4-hectare [10-acre]) enclosures (see Conservation Actions Implemented). During the summer of 2011, 16 captive-

bred adults and 48 captive-bred kits were released into habitat historically occupied by the species in the Columbia Basin. Even with increased protective measures implemented during release efforts, the captive-bred adults again experienced very high mortality and none are believed to have survived. However, several of the captive-bred kits appear to have developed resident burrow systems and successfully over-wintered at the site. Another 34 captive-bred adults and 32 wild-caught adults (from populations in Oregon and Nevada) were placed in the large enclosures at the release site during the fall of 2011. Many of these animals from the captive-bred and wild-caught groups successfully over-wintered in the enclosures. Another 11 captive-bred adults and 44 wild-caught adults (from populations in Nevada and Utah, plus 1 Idaho male captured in 2009) were placed in the enclosures during spring and summer of 2012. Many of the animals in the large enclosures successfully produced over 130 kits during the 2012 breeding season (see Reintroduction). Finally, as of July 31, 2012, another 103 captive-bred and enclosure-bred kits have been released into habitat historically occupied by the species in the Columbia Basin.

Ongoing survey and monitoring efforts will further clarify the abundance and, as possible, population structure and trends of any reintroduced and existing subpopulations of pygmy rabbits within the Columbia Basin (see Conservation Actions Implemented).

F. Threats

The available information indicates that the Columbia Basin pygmy rabbit is endangered (USFWS 2010). Threats to the Columbia Basin pygmy rabbit are classified according to five factors identified in section 4(a)(1) of the ESA for consideration in listing, reclassification, and delisting decisions. The available information addressing each of the five factors, and how these threats were considered in development of recovery actions, is summarized below.

1. Factor A – The present or threatened destruction, modification, or curtailment of its habitat or range

Dry-land and irrigated crop production has converted and fragmented large portions of the native shrub steppe habitats that were present within the Columbia Basin prior to European settlement in the region (Daubenmire 1988; Franklin and Dyrness 1988; Dobler et al. 1996; WDFW 1995). In addition, urban and rural developments permanently remove native shrub steppe habitats. It has been estimated that nearly 60 percent of the native shrub steppe habitats originally within the Columbia Basin have been converted to other uses (Dobler et al. 1996). Columbia Basin pygmy rabbits cannot occupy these converted sites and, due to their relatively

restricted movements, fragmentation of shrub steppe habitats severely limits their ability to disperse (Katzner and Parker 1997).

A number of other, often interacting influences affect the remaining native shrub steppe habitats within the Columbia Basin, including altered fire frequencies, establishment of invasive plant species, recreational activities, and livestock grazing, as described below.

Sagebrush is easily killed by burning, and when fires occur at increased frequency they can remove sagebrush from the vegetation community (Daubenmire 1988; WDFW 1995). Fire frequency has increased over portions of the remaining shrub steppe habitats within the Columbia Basin as a result of various influences, including the establishment of invasive plant species, unimproved road access, and certain recreational activities. Due to their reliance on tall, dense stands of sagebrush and associated shrub steppe vegetation, Columbia Basin pygmy rabbits cannot occupy frequently burned sites. Various nonnative, invasive plant species such as cheat grass and knapweed (*Centaurea* spp.) have become well established throughout the Columbia Basin (Daubenmire 1988; Franklin and Dyrness 1988). Areas with dense cover of cheat grass are apparently avoided by pygmy rabbits in Oregon (Weiss and Verts 1984), and these newly established plant communities often provide fine fuels that can carry fires. Combined with widespread unimproved road access and informal recreational activities that can provide multiple sources of ignition, the establishment of non-native, invasive plant species increases the risk of fire, and reduces the security and suitability of areas that could potentially support the Columbia Basin pygmy rabbit (WDFW 1995).

Under certain circumstances, livestock grazing can negatively impact the Columbia Basin pygmy rabbit. The effects may depend on a variety of factors including livestock type, timing and duration of grazing, stocking densities, locations of water or mineral supplement blocks, and other factors that may concentrate livestock use. Impacts to pygmy rabbits may include damage to burrow systems and possible direct mortality to young due to trampling (Rauscher 1997; N. Siegel, Washington State University [WSU], pers. comm. 2001; P. Becker, pers. comm. 2011), altered movement and behavioral patterns (Gahr 1993; Siegel 2002), fewer available burrows (Siegel 2002), and decreased quantity and nutritional quality of forage species in grazed areas (Siegel-Thines et al. 2004).

It is currently unknown if human-altered densities, distributions, or behaviors of other native or introduced species may also negatively affect pygmy rabbits. For example, range management measures for deer (*Odocoileus* spp.) could concentrate their habitat use patterns, or providing water sources for various game-bird species could indirectly affect predator densities.

Considerations in the Development of Recovery Actions Tied to this Threat:

- The potential for maintenance, enhancement, and connectivity of appropriate shrub steppe habitats was an important near- and long-term consideration during development of the recovery actions prescribed by this Recovery Plan.
- Controlling fire, the establishment of invasive plant species, and inappropriate recreational activities in areas potentially occupied by Columbia Basin pygmy rabbits were important considerations during development of the recovery actions prescribed by this Recovery Plan.
- Recovery actions prescribed by this Recovery Plan will allow for monitoring and addressing any negative effects to pygmy rabbits that may be due to management activities for other native or introduced species.
- Further study to develop appropriate recommendations for livestock grazing that could help avoid or minimize its potential impacts were important considerations during development of the recovery actions prescribed by this Recovery Plan.

2. Factor B – Overutilization for commercial, recreational, scientific, or educational purposes

We are currently unaware of any commercial use of pygmy rabbits; however, there are potential threats to the species due to inappropriate recreational, scientific, and educational management activities, as follows:

Pygmy rabbits are often difficult to distinguish from species of cottontail rabbits (*Sylvilagus* spp.) (WDFW 1995). Because of this, accidental shooting of Columbia Basin pygmy rabbits may occur in association with hunting of other small game species in Washington (WDFW 1979). The use of hunting dogs in areas occupied by Columbia Basin pygmy rabbits may pose additional risks from harassment or direct injury. Areas potentially occupied by the Columbia Basin pygmy rabbit are not necessarily closed to hunters. However, due to their typically restricted distribution and preference for dense habitats, as well as the relatively small number of game hunters in areas potentially occupied by Columbia Basin pygmy rabbits, the risks from accidental shooting by hunters or harassment and harm from hunting dogs is considered to be low (WDFW 1995).

Investigations that require trapping, handling, translocation, and/or captivity of pygmy rabbits can result in mortality from several causes, including exposure (due to excessively high or low temperatures), direct injury from entanglement in traps, trap predation, intra-specific fighting, and capture stress (Bailey 1936; Severaid 1950; Wilde 1978; Gahr 1993; Rauscher 1997; Rachlow and Witham 2004; P. Becker, pers. comm. 2011). Capture-related mortality rates (including recaptures) reported for pygmy rabbits range from roughly 3 to 13 percent (Gahr 1993; Wilde 1978; Rauscher 1997). The mortality rate for one study approached 19 percent when records for recaptured animals were disregarded (11 deaths of 58 individuals), and all of the mortalities in this study occurred in just one portion of the study area (Rauscher 1997). Trapping methods, daily and seasonal timing, study location, holding and transport facilities, site security, and husbandry techniques may all affect the level of capture-related mortality incurred.

Since 2000, WDFW has led captive breeding and reintroduction programs for the Columbia Basin pygmy rabbit (see Conservation Actions Implemented). As of December 31, 2011, the estimated annual mortality of pygmy rabbits that may be attributed to captive breeding activities, at least in part, is approximately 2 percent, while that attributable to reintroduction activities is approximately 3 percent (USFWS 2012). This incidental mortality incurred in the captive breeding and reintroduction programs is considered to be within acceptable limits with regard to Federal recovery objectives (USFWS 2010). As we learn more about reintroducing this species, release protocols will be refined in an effort to further lower the incidental mortality rate associated with these activities.

Some pygmy rabbit burrows are relatively shallow and may collapse when walked on by humans (Wilde 1978; P. Becker, pers. comm. 2011). In addition, some investigations of pygmy rabbits entail the purposeful destruction of individual burrows and/or secondary disturbance to occupied areas while measuring vegetation and other site characteristics in the vicinity of active burrow systems (Orr 1940; Janson 1946; Bradfield 1974; Green 1978; Wilde 1978; Gahr 1993; Gabler 1997; Rauscher 1997; P. Becker, pers. comm. 2011). Human activity in occupied habitats may also attract the attention of predators or other managed wildlife species, which could pose additional risks to Columbia Basin pygmy rabbits in the local area. It is unlikely that these activities have played a significant role in the long-term population decline and range reduction of the Columbia Basin pygmy rabbit.

Considerations in the Development of Recovery Actions Tied to this Threat:

- Near- and long-term measures to monitor and protect Columbia Basin pygmy rabbits

from hunting related impacts were considered during development of the recovery actions prescribed by this Recovery Plan.

- Due to the projected near-term vulnerability of the population, human activity as sources of potential disturbance and mortality were considered during development of the recovery actions prescribed by this Recovery Plan.

3. Factor C – Disease and predation

Pygmy rabbits often harbor a high parasite load (Gahr 1993; WDFW 1995), and some of these parasites, including ticks, fleas, and lice, can be vectors of disease. Episodes of plague and tularemia from these vectors have been reported in populations of other rabbit species and often spread rapidly with high rates of mortality (Quan 1993). Severe disease epidemics have not been reported in pygmy rabbits, and parasites have not been viewed as a significant threat to the species (Green 1979; Gahr 1993). However, epizootics in wild animals are often very difficult to detect and disease cannot be ruled out as a significant risk factor (D. Biggins, U.S. Geological Survey, pers. comm. 2002 and 2012).

A number of captive Columbia Basin pygmy rabbits died as a result of various diseases, especially coccidiosis and mycobacteriosis (WDFW 2010; Harrenstien et al. 2006; Harrenstien et al. 2011). Coccidiosis is caused by a protozoan (likely *Eimeria* spp.) that occurs in soil and feces, and which invades the intestines and other tissues of animals. Coccidiosis may be most detrimental in neonate pygmy rabbits, as both adult and young animals can apparently remain free of the disease while harboring high levels of coccidia. Various preventive measures that were undertaken (see Conservation Actions Implemented) appear to have been effective at decreasing the incidence of coccidiosis in the captive population.

The bacterium that causes mycobacteriosis (*Mycobacterium avium*) commonly exists in soil and water, and can survive for long periods of time in soil. High numbers of the bacterium can also be shed in feces and urine. The incubation period for mycobacteriosis can be weeks to months, and detection of infected individuals is difficult. Comparisons of immune system function (*i.e.*, lymphocyte stimulation and cytokine assays) among pygmy rabbits from the Columbia Basin and populations in Idaho, as well as the riparian brush rabbit (*Sylvilagus bachmani riparius*) and domestic rabbits (*Oryctolagus* spp.), have been undertaken (Harrenstien et al. 2006). In general, Columbia Basin pygmy rabbits had a significantly poorer immune response to mycobacteriosis than pygmy rabbits from Idaho and the other lagomorph species. A

partially-ineffective cell-mediated immune response appears to be the most likely cause of their high mortality resulting from mycobacteriosis. A relationship between diminished genetic diversity (see Factor E) and higher susceptibility to mycobacteriosis has been demonstrated in other endangered species (Harrenstien et al. 2006).

Additional information addressing the assessment, symptoms, impacts, distribution, and treatment of diseases in the captive pygmy rabbits may be found in the original references (WDFW 2010; Harrenstien et al. 2006; Harrenstien et al. 2011). Very little is known about the occurrence, impacts, and possible treatment of diseases in wild pygmy rabbits.

Skeletal abnormalities were detected in one wild-caught Columbia Basin pygmy rabbit and a number of captive purebred and intercross progeny (WDFW 2004a). These abnormalities consist of missing or malformed metacarpal and metatarsal bones of the fore and hind feet, respectively. This unusual condition (brachydactylia) may be a result of inbreeding (Green 1935), and analyses to determine if, and to what extent, there may be a genetic component to the condition are ongoing. Preliminary assessment indicates that this condition is not a simple (*i.e.*, single gene autosomal) recessive genetic trait. It is currently unclear whether the condition has been persistent within the captive animals or the reintroduced population, or if it may represent any significant concerns for the fitness of affected individuals. As feasible, dead specimens collected in the future may be radiographed to further document the occurrence, extent, and possible cause of these abnormalities.

Predation is thought to be the major cause of mortality among pygmy rabbits (Green 1979). However, pygmy rabbits have adapted to the presence of a wide variety of avian and terrestrial predators that occur throughout their historical distribution (Janson 1946; Gashwiler et al. 1960; Green 1978; WDFW 1995). In relatively large, well distributed pygmy rabbit populations, predation is not likely to represent a significant threat to their long-term security. In contrast, due to the extremely small size and localized occurrence of the Columbia Basin pygmy rabbit population, altered predation patterns, or even natural levels of predation, currently represent a significant threat to reestablishment of this population segment in the wild and could impair ongoing conservation efforts.

Considerations in the Development of Recovery Actions Tied to this Threat:

- Measures to identify, assess, monitor, and, as feasible, treat diseases in wild pygmy rabbits were important considerations during development of the recovery actions prescribed by this Recovery Plan.

- Habitat enhancement measures to provide appropriate cover, provision of artificial structures, predator monitoring, and temporary predator control were important considerations during development of the recovery actions prescribed by this Recovery Plan.

4. Factor D – The inadequacy of existing regulatory mechanisms

Washington classification of the pygmy rabbit as a State endangered species makes it illegal to hunt, possess, maliciously harass or kill pygmy rabbits, or to maliciously destroy their nests, unless otherwise authorized by the Washington Wildlife Commission (Revised Code of Washington 77.15.120). However, this State designation does not provide regulatory protection from activities that may incidentally harm the Columbia Basin pygmy rabbit, nor does it provide regulatory mechanisms to protect habitat that may be considered essential to its long-term security. Washington legislation (*i.e.*, House Bill 1309) prescribes ecosystem standards for State-owned agricultural and grazing lands to maintain and restore fish and wildlife habitat by improving overall ecosystem health. However, these standards do not specifically address protection and conservation of the Columbia Basin pygmy rabbit, and are only mandated for lands under the jurisdiction of WDFW and WDNR. In addition, application of the standards on lands managed by WDNR must be consistent with the agency's fiduciary obligations.

Large areas of privately owned land within the historical distribution of the Columbia Basin pygmy rabbit have been withdrawn from crop production and planted to native and non-native cover under the Federal Conservation Reserve Program administered by USDA. Revegetation standards under this program promote the improvement of habitats potentially used by the Columbia Basin pygmy rabbit. The program also restricts livestock grazing on contract lands except under severe drought conditions (USFWS 2001). However, the measures prescribed under this program do not specifically address conservation of the Columbia Basin pygmy rabbit, participation is voluntary, contracts expire after 10 years, and changes to program requirements and management objectives at each renewal period are common (USDA 1998). Presently, it is unclear what effects recent program changes have had, or future changes may have, on recovery efforts for the Columbia Basin pygmy rabbit.

Certain conservation measures developed under the Endangered Species Act, including the template Safe Harbor Agreement and a county-wide Habitat Conservation Plan currently under development, can provide protection and conservation incentives for Columbia Basin

pygmy rabbits (see discussion below under section I.G.6, Stakeholder Involvement). These measures would apply only to willing landowners participating in these programs.

Considerations in the Development of Recovery Actions Tied to this Threat:

- The establishment, protection, maintenance, and enhancement of recovery emphasis areas for the Columbia Basin pygmy rabbit (see Conservation Actions Implemented), as well as other shrub steppe habitats on Federal and non-Federal lands that may help facilitate recovery efforts, were important considerations during development of the recovery actions prescribed by this Recovery Plan.

5. Factor E – Other natural or human-caused factors affecting its continued existence

The most immediate concerns for the Columbia Basin pygmy rabbit are associated with the population's extremely small size and possible extirpation from the wild (USFWS 2010). Small populations are highly susceptible to random environmental events (*e.g.*, severe storms, prolonged drought, extreme cold spells), abrupt changes in cover or food resources (*e.g.*, from wildfire or insect infestations), altered predator or parasite populations, disease outbreaks, and fire. Small populations are also more susceptible to demographic and genetic limitations (Shaffer 1981). These threat factors, which may act in concert, include natural variation in survival and reproductive success of individuals, chance disequilibrium of sex ratios, changes in gene frequencies due to genetic drift, and diminished genetic diversity and associated effects due to inbreeding. These influences continue to represent a significant risk to the potential reestablishment of the Columbia Basin pygmy rabbit and its long-term security in the wild (USFWS 2010).

Only a minimal number of purebred Columbia Basin pygmy rabbits were available for captive breeding during the program's first breeding season in 2002, and these wild animals already expressed limited genetic diversity (see Genetics). In addition, several lines of evidence suggest that the purebred Columbia Basin pygmy rabbits were suffering from inbreeding depression, including their very poor reproductive performance (WDFW 2004a), their potential increased susceptibility to disease compared to Idaho pygmy rabbits and other lagomorph species, their expression of unusual skeletal abnormalities (see Factor C above), a long-term decline in their genetic diversity in the wild (WDFW 2001b), and their continued loss of genetic diversity in captivity (see Genetics). Ultimately, the captive, purebred animals could not produce enough healthy and genetically robust progeny to accommodate reintroduction efforts. This was

the primary reason for initiating an intercross breeding strategy (see Captive Breeding).

We assume that the markedly different genetic characteristics of the purebred Columbia Basin pygmy rabbit population historically conferred an adaptive advantage to the taxon within its native ecological setting (USFWS 2010). Therefore, one of the main objectives of the intercross breeding strategy was to minimize the potential for outbreeding depression (see Glossary). Outbreeding depression can arise from either or both of two mechanisms, which are: (1) dilution or loss of locally adapted genes; and (2) a breakdown of coadapted gene complexes (*i.e.*, groups of genes that function together in an adaptive way). This potential risk was addressed by undertaking measures to conserve, to the extent practical, what remained of the unique genetic characteristics of the purebred Columbia Basin pygmy rabbit population. However, all of the available options for attempting to reestablish a viable population of pygmy rabbits within the Columbia Basin required the input of additional wild animals captured from outside of this ecosystem (USFWS 2010). Any such action would, necessarily, further limit the genetic representation of the historical Columbia Basin population and increase the risk of outbreeding depression. The extent to which this factor may ultimately reduce the likelihood of recovering the Columbia Basin pygmy rabbit is currently unknown, because outbreeding depression in the wild may only manifest itself in subsequent generations of reintroduced animals. Future monitoring of the reintroduced and, to the extent possible, any existing purebred subpopulations will help clarify the extent of this potential risk and possible management measures to address it.

Another objective of the captive breeding program for the Columbia Basin pygmy rabbit was to mimic, to the extent practical, the natural habitat conditions encountered by wild pygmy rabbits to help lessen the extent of domestication (*i.e.*, habituation to captive conditions and associated genetic and behavioral impacts in the founders' progeny) and to better prepare naïve individuals for reintroduction (USFWS 2010). However, even with such remediating measures, domestication can negatively affect various life history traits (*e.g.*, behavior, physiology, genetics) within just a few generations (Frankham 2008; Zeoli et al. 2008). The captive breeding program for the Columbia Basin pygmy rabbit was not intended to be a long-term approach for recovery of the population (USFWS 2007). However, due to unexpectedly low recruitment rates (WDFW 2004a), the anticipated reintroduction efforts were not possible under the original captive breeding scenario and, as a result, the program was extended for multiple generations with only limited input of additional wild animals. Furthermore, the various measures that were taken to help address the negative effects of disease in the captive population (see Factor C) further reduced the ability of the original program to mimic natural habitat conditions and to prepare the captive animals for eventual release. As a result, the captive-bred pygmy rabbits

have been at increased risk of excessive domestication, which could, ultimately and in combination with the genetic limitations described above, lower the potential to successfully reestablish wild subpopulations of the pygmy rabbit within the Columbia Basin (USFWS 2010).

When there is sufficient information available, our analyses conducted pursuant to the ESA include consideration of ongoing and projected changes in climate. The terms “climate” and “climate change” are defined by the Intergovernmental Panel on Climate Change (IPCC). “Climate” refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007). The term “climate change” thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature, precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Currently, there is very limited information available specifically addressing the effects of climate change, or management options that could be considered to address this potential impact, relative to recovery of the Columbia Basin pygmy rabbit (USFWS 2010). As this information base improves, we will include a summary of the available information on the effects of climate change relative to the pygmy rabbit species and, as feasible, prescribe any management measures for the Columbia Basin population in future revisions of this Recovery Plan and/or its implementation schedule(s).

Considerations in the Development of Recovery Actions Tied to this Threat:

- Implementation of a comprehensive reintroduction program, which includes appropriate adaptive management planning to address the various risks associated with small population size discussed above, was an important consideration during development of the recovery actions prescribed by this Recovery Plan.

6. Threats Summary

The large-scale loss and fragmentation of native shrub steppe habitats, primarily for agricultural development, have likely played a primary role in the long-term decline of the Columbia Basin pygmy rabbit. However, it is unlikely that these factors alone directly influenced the eventual extirpation of all known subpopulations from the wild. Once a

population declines below a certain threshold, it is at risk of extirpation from a number of influences including chance environmental events, catastrophic habitat loss or resource failure, predation, disease, demographic limitations, loss of genetic diversity, and inbreeding depression. Certain recovery actions may also increase the risks of disease, domestication, and outbreeding depression. To varying degrees, all of these influences have impacted the Columbia Basin pygmy rabbit and, in combination, continue to endanger this population (USFWS 2010).

G. Conservation Actions Implemented

A variety of conservation actions have been undertaken for pygmy rabbits since 1979. These efforts have included population surveys, habitat inventory, land acquisition, habitat restoration, land management agreements, studies on the effects of livestock grazing, and predator control. Despite these efforts, in 2001 WDFW concluded that attempting to manage the State's remaining pygmy rabbits in the wild would encumber the population with extreme risk due to the array of threats it faced (WDFW 2001a). To address this risk, the agency determined that intervention, by way of captive breeding and reintroduction programs, was necessary to prevent the extirpation of pygmy rabbits from the State. To initiate these recovery efforts, WDFW contracted with captive breeding facilities at WSU, the Oregon Zoo, and Northwest Trek Wildlife Park to assist with captive breeding efforts. WDFW also convened a multi-party Science Advisory Group (SAG) comprised of individuals from the captive breeding facilities, WDFW, and the Service, along with numerous adjunct expert contributors (see Acknowledgements), to provide technical advice on pygmy rabbit recovery efforts. Members of the SAG provide expertise in a broad range of disciplines, including husbandry, veterinary medicine, genetics, wildlife nutrition, population biology, ecology, and endangered species conservation.

Following Federal listing of the Columbia Basin pygmy rabbit in 2001, we issued an endangered species recovery permit (TE-050644-0) to WDFW pursuant to section 10(a)(1)(A) of the ESA (USFWS 2003). The recovery permit exempts incidental take of the Columbia Basin pygmy rabbit that could occur as a result of the State's captive breeding and reintroduction programs, and which would otherwise be prohibited by section 9 of the ESA. The recovery permit, which has been periodically amended since its issuance, includes a requirement for annual reporting of activities conducted under the permit (USFWS 2010). To address requirements of the recovery permit, WDFW developed and annually updated a Captive Breeding and Genetics Management Plan (WDFW 2010). In cooperation with WSU, WDFW also developed a Reintroduction Plan (Sayler et al. 2006) prior to the initial release of captive-

bred animals in 2007 (see Reintroduction). The following discussions document conservation actions that have been undertaken for the Columbia Basin pygmy rabbit by WDFW, the Service, and other stakeholders since it was considered for federally listing.

1. Captive Breeding

During the spring of 2001, WDFW, in cooperation with WSU, began a captive breeding program for the Columbia Basin pygmy rabbit (WDFW 2001a). The program was undertaken due to the sudden extirpation of five of the last six known wild subpopulations and the dramatic decline in the remaining subpopulation of Columbia Basin pygmy rabbits during the winter of 2000 to 2001 (see Abundance).

Between May 7, 2001, and January 15, 2002, 16 Columbia Basin pygmy rabbits were captured and removed from the last known subpopulation as an initial source for captive breeding efforts. Shortly after her capture, one female also gave birth to a litter of five offspring that were conceived in the wild. Three of these 21 animals died prior to the first breeding season, bringing the total number of Columbia Basin pygmy rabbits available for initial captive breeding efforts to 18 (10 females, 8 males). In order to reduce the risk of catastrophic loss of the single captive population at WSU (*e.g.*, from disease epidemic, predator access, vandalism) and to expand the expertise for captive rearing efforts, seven of the wild-caught Columbia Basin pygmy rabbits were placed at the Oregon Zoo facility prior to the 2002 breeding season, and Northwest Trek Wildlife Park was added as a third captive breeding facility prior to the 2004 breeding season. At the time, the Columbia Basin pygmy rabbits that were left in the wild were not considered essential to the captive breeding program, and ongoing efforts to manage them in place were continued.

Due to the poor demographic, behavioral, physiological, and genetic outlook for pure Columbia Basin pygmy rabbit breeding efforts (see Factor E), WDFW undertook initial attempts to intercross the captive Columbia Basin pygmy rabbits with Idaho pygmy rabbits during the 2003 breeding season (WDFW 2003). These initial intercross breeding efforts followed the recommendations of the SAG, and were closely coordinated with the Service to ensure consistency with our controlled propagation policy (USFWS and NMFS 2000). Results from the 2003 breeding season indicated that the reproductive behaviors and physiology of the two populations were compatible and that they could produce viable intercrossed progeny. These results also confirmed the potential for genetic rescue and genetic restoration (see Glossary) of the Columbia Basin pygmy rabbit through carefully controlled intercross breeding to compensate

for the lack of genetic variability in the purebred population (see Genetics). The use of intercross breeding has since become an integral part of State and Federal recovery efforts for the Columbia Basin pygmy rabbit (WDFW 2011; USFWS 2011b).

Various preventive measures were taken at the captive breeding facilities to address some of the specific problems that the program was facing as a result of soil-borne diseases (see Factor C). Soil management measures that were implemented included removal of soil from contaminated pens, careful selection and testing of replacement soils, design changes to holding pens so that soils could be replenished more readily, husbandry and captive breeding of pygmy rabbits in soil-free pens, and use of larger holding sites that better mimicked density conditions in the wild. Other measures undertaken to address the potential for coccidiosis included regular monitoring of coccidia levels and the prophylactic treatment of the captive pygmy rabbits, including breeding females, with antibiotics if elevated coccidia levels were documented. Other measures undertaken to address the potential for mycobacteriosis included regular monitoring of the captive pygmy rabbits to try and detect those that were subclinically infected and quarantine of infected animals. Other general measures that were undertaken included dietary changes to improve the overall condition of the captive animals and development of appropriate treatment regimens.

The captive breeding program for the Columbia Basin pygmy rabbit was effective at maintaining the number of animals in the captive population, as well as managing the population's genetic characteristics (see Genetics). Over the first 10 breeding seasons (beginning in 2002), the average annual growth rate of the captive population was roughly 25 percent, ranging from 98 percent in 2006 to negative 11 percent in 2008 (results exclusive of 20 captive-bred animals released in 2007; see Reintroduction). In addition, the number of kits produced each breeding season increased over time, from a low of 19 in 2002 to a high of 275 in 2010 (2011 excluded due to resumption of release efforts; see Reintroduction). However, on a percentage basis, 2010 had the poorest annual recruitment of kits to the population: only 11 percent ($n = 31$), compared to an average of 30 percent over the first 8 years of the program. Furthermore, the program was not able to significantly reduce the risks to the Columbia Basin pygmy rabbit from domestication or demographic and genetic bottlenecks due to long-term management in captivity with fewer than several hundred individuals (see Threats). Finally, population modeling based on the demographic and genetic parameters documented since captive breeding began indicated that the program, as originally configured, would be only minimally capable of maintaining the captive population (USFWS 2011a) and could not support the anticipated needs for the reintroduction program (see Reintroduction).

As a result of the above circumstances, there was significant uncertainty regarding our ability to reestablish a demographically and genetically viable population of pygmy rabbits within the Columbia Basin without substantial changes to the original approach to recovery (USFWS 2011a). In addition, all available options for attempting to reestablish a viable population of pygmy rabbits within the Columbia Basin would require the input of additional wild animals captured from outside of this ecosystem, which would, necessarily, further limit the genetic representation of the founding purebred Columbia Basin animals. To address this conservation challenge, recent adaptive management measures that have been undertaken include additional releases of the captive-bred intercrossed pygmy rabbits, the capture and translocation of wild pygmy rabbits from populations outside of the Columbia Basin for inclusion in the reintroduction program, construction of large enclosures and initiation of partially controlled field-breeding efforts at the release site, and implementation of improved protective measures during releases (see Reintroduction). As these adaptive management measures have been implemented, the need for continuing captive breeding efforts has steadily diminished. As a result, captive breeding operations at WSU and Northwest Trek Wildlife Park were discontinued following the 2011 breeding season, while operations at the Oregon Zoo were discontinued following the 2012 breeding season (except for ongoing humane care of two animals considered unfit for release due to chronic medical conditions).

2. Genetics

Previous genetic analyses indicated that the purebred Columbia Basin pygmy rabbits were genetically distinct from, and had reduced genetic diversity compared with, other pygmy rabbit populations from throughout the species' historic distribution (WDFW 2001b). Genetic analyses of the captive purebred Columbia Basin pygmy rabbits, initiated in 2001, indicated that this portion of the captive population continued to experience a loss of genetic diversity as a result of inbreeding (*i.e.*, loss of heterozygosity) and genetic drift (*i.e.*, loss of alleles) (WDFW 2004a). The last purebred Columbia Basin pygmy rabbit kits recruited into the captive population were born in 2004, and the last purebred Columbia Basin pygmy rabbit in captivity died in August 2008 (USFWS 2012). Due to concerns over the genetic fitness and demographic limitations of the purebred Columbia Basin pygmy rabbits, WDFW incorporated an intercross breeding strategy beginning in 2003 (see Captive Breeding).

Some of the primary threats to the purebred Columbia Basin pygmy rabbit population at the time of its Federal listing under the ESA were likely associated with inbreeding depression, including the population's reduced reproductive success, compromised immune response, and

possibly skeletal abnormalities. Early experimental results indicated that the use of intercross breeding would be beneficial for addressing these conditions. This approach (i.e., genetic rescue) was taken because a successful purebred breeding strategy was not possible without a sufficient number of additional wild, reproductively active Columbia Basin pygmy rabbits for inclusion in the captive breeding and/or reintroduction programs, and it is highly unlikely that adequate numbers of purebred animals remain in the wild (see Abundance and Trends). Since Federal listing, the ultimate goal of the intercross breeding strategy for the Columbia Basin pygmy rabbit has been to effect the population's genetic restoration to help ensure its long-term viability (WDFW 2011; USFWS 2011b).

By 2006, the captive breeding program had successfully retained roughly 68 percent of the Columbia Basin founder (*i.e.*, wild-caught) genomes in the captive population (K. Warheit, pers. comm. 2006). In addition, the pygmy rabbits included in the captive breeding program expressed much greater gene diversity compared with the founding purebred Columbia Basin animals and, based on analyses of museum specimens (circa 1950), the captive population also had much greater expected heterozygosity (based on analysis of microsatellites) compared to that noted in the historical population (WDFW 2010). Furthermore, considering the relative contributions of the Columbia Basin and Idaho pygmy rabbits founding the intercross progeny (*i.e.*, prior to 2006), the Columbia Basin population's input was much greater than that of the Idaho population, and this result was consistent among a number of founder statistics analyzed (WDFW 2010). These analyses also demonstrated disproportionate contributions to the intercross progeny among the individual founders. Therefore, breeding scenarios implemented during the 2005 and subsequent breeding seasons were intended to de-emphasize disproportionately represented Idaho founders and to better balance the relative contributions among the founding Columbia Basin animals (WDFW 2010).

Some encouraging results of the captive breeding program indicated that the intercross pygmy rabbits have markedly increased reproductive success compared to the purebred Columbia Basin animals (WDFW 2010) and, apparently, a diminished expression of skeletal abnormalities (USFWS 2012). In addition, there are indications that the general immune response of the intercross animals is superior to that of the purebred Columbia Basin pygmy rabbits, and possibly even the purebred Idaho pygmy rabbits (Harrenstien et al. 2006). These results suggest that, at least in the near term, the captive breeding program largely achieved the aims of genetic rescue by reducing or eliminating the effects of inbreeding depression, minimized the likelihood of further genetic drift (*i.e.*, loss of unique genetic characteristics), and made progress to help minimize the potential for outbreeding depression.

With regard to genetic restoration of the Columbia Basin pygmy rabbit, the captive breeding program succeeded in achieving the genetic indicators of increased, potentially adaptive genetic variation and the elimination or minimization of potential inbreeding and outbreeding depression. However, it is currently unknown if the improvements documented thus far in reproductive success and general immune response, among other possible indicators, will ultimately translate into successive generations (*i.e.*, improved fitness) of the reintroduced population of pygmy rabbits within the Columbia Basin. The extent to which the more comprehensive objectives of genetic restoration may be achieved will take into account the success of the reintroduction program, as well as future monitoring efforts and the performance of reintroduced and, as possible, any existing pygmy rabbit subpopulations and their fully wild progeny in the Columbia Basin.

As of July 31, 2012, the intercross pygmy rabbits released to the large enclosures (see Reintroduction) averaged over 73 percent Columbia Basin ancestry (by pedigree), while those fully released (exclusive of enclosure-bred kits) averaged over 69 percent Columbia Basin ancestry (USFWS 2012). For comparison, the intercross pygmy rabbits released in 2007 averaged 76 percent Columbia Basin ancestry. The percentage of Columbia Basin ancestry in the wild has undoubtedly declined, and will continue to decline, as additional wild-caught pygmy rabbits from populations outside of the Columbia Basin are included in the reintroduction program. However, we believe that this new approach to recovery will maximize the likelihood of reestablishing a viable population of pygmy rabbits within the Columbia Basin (see Recovery Strategy).

Several factors may influence future management decisions regarding the specific level of intercrossing considered necessary to ultimately effect genetic restoration of the Columbia Basin pygmy rabbit. These factors include, but are not limited to: (1) the possibility that additional wild Columbia Basin pygmy rabbits may be located and managed in place, secured for partially controlled breeding efforts, and/or directly translocated to recovery emphasis areas; and (2) the documented future responses (*e.g.*, survival, reproductive success, habitat use) of the reintroduced, and any existing, pygmy rabbit subpopulations. Future measures to monitor and adjust intercross levels, as possible, in the wild Columbia Basin pygmy rabbit population were important considerations during development of the recovery actions prescribed by this Recovery Plan.

3. Reintroduction

In 2002, WDFW undertook initial efforts to identify and prioritize possible reintroduction sites throughout the historical distribution of the Columbia Basin pygmy rabbit (USFWS 2007). This site assessment was intended to target priority areas for habitat protection and reintroduction of the Columbia Basin pygmy rabbit, consistent with the conservation design element of our Strategic Habitat Conservation framework (USFWS 2008). These initial efforts considered each candidate site's general habitat conditions, soil types, land ownership, and past records of Columbia Basin pygmy rabbit occurrence. All candidate sites identified were located on properties managed by Federal, State, and/or one or more willing landowner interests. Ten of the candidate sites were further assessed by the Recovery Team through field visits in 2004 regarding their potential to help meet long-term recovery objectives for the Columbia Basin pygmy rabbit. Of the 10 sites assessed, two were identified by the Recovery Team as the top priority sites to consider for near-term recovery objectives, including initial reintroduction efforts. One of these two sites, which are termed "recovery emphasis areas", is located in the central Moses Coulee area of southern Douglas County (*i.e.*, the Sagebrush Flat site) and the other is in the Beezley Hills area of northern Grant County. These two sites are actively managed to help conserve the Columbia Basin pygmy rabbit in the wild and represent areas where long-term recovery objectives (*i.e.*, beyond 10 years) may be attained (see Recovery Strategy). To date, these are the only recovery emphasis areas that have been formally identified.

WDFW manages the site in southern Douglas County, which totals approximately 1,515 hectares (3,740 acres), while The Nature Conservancy, in cooperation with a private landowner, manages the site in northern Grant County, which totals approximately 1,374 hectares (3,390 acres). Other properties managed by The Nature Conservancy and Federal (*i.e.*, BLM) lands within 8 kilometers (5 miles) of the recovery emphasis areas total approximately 2,800 hectares (7,000 acres) in the broader Moses Coulee area and approximately 4,900 hectares (12,000 acres) in the broader Beezley Hills area. Management of these other lands will be consistent with recovery efforts for the Columbia Basin pygmy rabbit to the extent feasible considering overall program objectives of The Nature Conservancy and BLM (C. Warner, The Nature Conservancy, pers. comm. 2006; N. Hedges, BLM, pers. comm. 2007). Portions of the remaining shrub steppe habitat throughout the population's historical distribution are administered by various Federal and State agencies and non-governmental conservation interests, including some private landowners. Conservation measures for the Columbia Basin pygmy rabbit may be considered in future management programs on these lands, including the potential identification of additional recovery emphasis areas (see Recovery Strategy).

In March 2007, WDFW released 20 captive-bred, intercrossed pygmy rabbits directly

(*i.e.*, with provision of only artificial burrows) into habitat historically occupied by the species at the Sagebrush Flat site. These animals experienced very high mortality over the first several weeks following their release, and none were believed to have survived to the spring of 2008. This initial release effort, which used only a minimal number of animals so as not to further constrain the captive population (see Captive Breeding), was largely conducted on an experimental basis to improve the knowledge base for subsequent reintroduction attempts. Key results of this effort, in addition to previous studies of pygmy rabbit reintroduction efforts conducted in Idaho, provided valuable information on the importance of seasonal timing of releases and the movement patterns, vulnerability to predation, habitat use, and over-winter survival of captive-bred pygmy rabbits following their release. Population modeling prior to the 2007 release indicated that the likelihood of success of reintroduction efforts for the Columbia Basin pygmy rabbit would be greatly improved by undertaking multiple releases of relatively large numbers of animals over multiple years (Sayler et al. 2006). This information formed the basis for defining the initial, general targets for the resumption of reintroduction and augmentation planning, which included releasing at least 100 individuals to the wild annually for 3 years (USFWS 2010).

Based on the new information that has been generated and adaptive management planning, WDFW resumed reintroduction efforts for the Columbia Basin pygmy rabbit in 2011. New recovery measures being implemented include capturing and translocating wild pygmy rabbits from populations outside of the Columbia Basin to include them in the reintroduction program, and holding some of the program animals at the release site in large (up to 4-hectare [10-acre]) enclosures constructed in appropriate shrub steppe habitat to facilitate partially controlled field-breeding under more natural conditions. To more fully address and document the new approach for recovery of the Columbia Basin pygmy rabbit (see Recovery Strategy), and to help fulfill reporting requirements pursuant to their Federal recovery permit, WDFW developed a Reintroduction and Genetic Management Plan, which was produced as a formal addendum to the State Recovery Plan for the Columbia Basin pygmy rabbit (WDFW 2011). In part, the plan generally defines the management objectives for partially controlled field breeding at the large enclosures, translocations and the appropriate makeup for release groups, seasonal timing for releases, and post-release survey and monitoring actions, as well as other specific release procedures (*e.g.*, provision of temporary holding pens, artificial burrows, supplemental feeding, temporary predator control). Along with this Federal Recovery Plan, the measures prescribed by the WDFW plan will be periodically revised, as necessary, to accommodate development and implementation of adaptive management actions.

During the summer of 2011, 16 captive-bred adults and 48 captive-bred kits were

released at the Sagebrush Flat site. Even with increased protective measures during release (*e.g.*, provision of small, temporary holding pens and supplemental food), the captive-bred adults again experienced high mortality, however, several of the captive-bred kits appear to have developed resident burrow systems and successfully overwintered at the site. Another 34 captive-bred adults and 32 wild-caught adults (from populations in Oregon and Nevada) were placed in the large enclosures at the release site during fall 2011. Many of these animals from the captive-bred and wild-caught groups successfully overwintered in the enclosures. Another 11 captive-bred adults and 44 wild-caught adults (from populations in Nevada and Utah, plus one Idaho male captured in 2009) were placed in the enclosures during spring and summer of 2012. Many of the animals in the large enclosures contributed to successfully producing over 130 kits during the 2012 breeding season (P. Becker, pers. comm. 2012). Finally, as of July 31, another 103 captive-bred and enclosure-bred kits have been released at the Sagebrush Flat site in 2012. Additional releases of various program animals are planned for the near future (P. Becker, pers. comm. 2012).

Measures to monitor and adjust partially controlled field-breeding, translocation, and release procedures, as well as future survey and monitoring needs for any reintroduced or existing subpopulations of pygmy rabbits within the Columbia Basin, were important considerations during development of the recovery actions prescribed by this Recovery Plan.

4. Predator Control

A number of predators may occur at sites occupied by Columbia Basin pygmy rabbits (see Life History). In an effort to help control the occurrence of predatory birds, obsolete structures potentially used as perch or nesting sites by avian species (*e.g.*, fencing, old buildings) have been removed at the Sagebrush Flat site (WDFW 2003). Additional measures that have been taken include controlling artificial food sources (*e.g.*, spilled grain, trash, carnivore baits), habitat restoration, and providing appropriate exclusion fencing at the recovery emphasis areas (WDFW 2003; C. Warner, pers. comm. 2006). Various other predator control measures have been undertaken prior to and during the resumption of release efforts by WDFW since 2011 (P. Becker, pers. comm. 2011). These measures have included construction of the large enclosures and pre-release pens themselves, which have been effective at excluding large terrestrial predators (*e.g.*, coyotes, badgers); periodic trapping in and around the enclosures to remove other terrestrial predators (primarily weasels); providing artificial burrows within and outside of the enclosures; placing netting over the pre-release pens and key burrows within the enclosures to discourage avian predators; monitoring; and, as necessary, hazing or removal of various avian predators at the release site.

5. Survey and Monitoring

WDFW has used three survey methods for Columbia Basin pygmy rabbits (WDFW 2004b). These methods employ different techniques, require varying levels of effort to perform, and have different applications depending on the information sought. The least intensive of these methods is referred to as evidence searches. Briefly, evidence searches entail qualified personnel walking transects across “survey habitat” (see Glossary) looking for Columbia Basin pygmy rabbits or their sign, such as active burrow systems, tracks, or pellets. As with the other survey methods described below, detailed surveys are not necessary in any areas that do not contain survey habitat, and these sites are documented through cursory visual assessment. Evidence searches are primarily used as an initial approximation to determine the species’ presence or absence in a given area. Since the mid-1980s, evidence searches have been used extensively by biologists to survey large portions of the remaining shrub steppe habitat throughout the population’s historical distribution (see Abundance and Trends).

If evidence searches indicate that Columbia Basin pygmy rabbits might be present in an area, more intensive follow-up surveys, referred to as complete area searches, are conducted. This method is primarily used to confirm the species’ presence in an area, more precisely

document the specific sites occupied, and to estimate the species' relative abundance by locating as many active burrow systems as possible. In addition to walking transects, as described above for evidence searches, complete area searches also involve concerted efforts to obtain visual observations of live animals, closely monitoring potentially active burrow systems, and/or revisiting sites on subsequent surveys. Complete area searches are typically applied when there is a need to accurately estimate the number of active burrows that may be present. This survey method was used by WDFW at the last known occupied sites, and confirmed the extirpation of Columbia Basin pygmy rabbits from the local area. In the event that any additional wild Columbia Basin pygmy rabbits are located in conjunction with evidence searches, this method will also be important for future coordination with various interested parties (see Stakeholder Involvement).

The third survey method is referred to as the "Skalski monitoring method" (Skalski 1996). The main objective of this method is to systematically census active burrow systems at sites known to be occupied by Columbia Basin pygmy rabbits. This repeatable survey method is primarily used as an index to monitor changes in a local subpopulation's abundance and distribution over time. This method may also be used to assess different "treatments" in an occupied area (*e.g.*, habitat condition, land use activity, experimental manipulation) to make inferences about their effects on various pygmy rabbit life history parameters (*e.g.*, density estimates, movement patterns, habitat use). In general, this method involves identifying a stratified random sample of permanently marked plots throughout a specified area. Trained personnel then survey each plot for active burrow systems. The number of active burrow systems documented can be extrapolated to generate an index of pygmy rabbit abundance and relative distribution. Repeated surveys, in turn, can then be used to document trends over time and/or to infer changes in life history parameters attributed to various treatments. This method was used by WDFW at the last known occupied site to monitor the status of the local subpopulation and document its decline. This method, or a similar method based on the same objectives (*e.g.*, Price and Rachlow 2011), will be the primary means to monitor the status of any reestablished or existing free-ranging subpopulations over time and their response to future research and/or adaptive management measures.

In addition to the above survey methods, a non-invasive fecal DNA monitoring method has recently been developed that can distinguish pellet samples among sympatric lagomorph species (Adams et al. 2011). In combination with the above survey methods, this method is being used to survey for and monitor the status of pygmy rabbits within the Columbia Basin and elsewhere (see Recovery Action 3).

Information that is routinely recorded for each of the survey methods described above includes site descriptions, surveyed area, habitat conditions, predator sign, land-use activities, and the presence of other wildlife species. The locations and results of survey efforts are compiled by WDFW, and the maintenance and use of these data will be important for the monitoring objectives and other recovery actions prescribed by this Recovery Plan.

6. Stakeholder Involvement

In October 2006, we and WDFW completed a template Safe Harbor Agreement (SHA) for the Columbia Basin pygmy rabbit (USFWS 2006). In exchange for actions that contribute to pygmy rabbit recovery on non-Federal lands, participating property owners receive formal assurances that if they fulfill the conditions of the SHA, the Service will not require additional management activities by the participants without their consent. To date, we have issued 17 Enhancement of Survival Permits under the SHA, covering management activities on over 49,000 hectares (120,000 acres) of habitat within the population's historical distribution. So far, no incidental take has occurred in association with the SHA. Measures to pursue and secure conservation agreements (see Glossary) with other non-Federal landowners and managers, as well as other stakeholders potentially involved in recovery efforts for the Columbia Basin pygmy rabbit, are ongoing and were important considerations during development of the recovery actions prescribed by this Recovery Plan.

We are currently providing technical assistance to the Foster Creek Conservation District toward development of a county-wide Habitat Conservation Plan (HCP) for private agricultural interests (*i.e.*, dry-land crops, some irrigated crops, and livestock ranching) throughout Douglas County, Washington. The HCP would include protective measures for a number of wildlife species, including the Columbia Basin pygmy rabbit, and the management actions it prescribes would complement other ongoing conservation efforts in central Washington. However, the measures prescribed by the HCP have not yet been formally adopted, and would only apply to willing landowners in a portion of the historical distribution of the Columbia Basin pygmy rabbit if finalized.

7. Public Outreach

Since publication of the final listing rule, and through coordination with WDFW and other Recovery Team members, we have held or otherwise attended a number of meetings with various stakeholders to discuss recovery planning efforts for the Columbia Basin pygmy rabbit.

Stakeholder groups involved in these discussions included the Douglas and Grant County Commissioners, Washington Wheat Growers Association, Washington Cattlemen's Association, Society for Range Management, Foster Creek Conservation District, The Nature Conservancy, various State and Federal resource agencies (*e.g.*, BLM, WDNR), and concerned citizens. The Service, WDFW, and other Recovery Team members have also maintained an effective outreach program with local, State, and national media outlets regarding ongoing conservation efforts for the Columbia Basin pygmy rabbit. Ensuring continued formal and informal public outreach to encourage stakeholder involvement in recovery efforts for the Columbia Basin pygmy rabbit was an important consideration during development of the recovery actions prescribed by this Recovery Plan.

II. RECOVERY STRATEGY

The Draft Recovery Plan defined three phases of the overall recovery strategy for the Columbia Basin pygmy rabbit, which are: (1) removal or abatement of imminent threats in order to prevent the extinction of the Columbia Basin pygmy rabbit; (2) reestablishment of an appropriate number and distribution of free-ranging subpopulations; and (3) establishment and protection of a sufficiently resilient, free-ranging population that would be expected to withstand foreseeable long-term threats. The recovery actions developed to address each phase are not mutually exclusive and may overlap chronologically and/or functionally. Furthermore, the overall recovery strategy that encompasses the different phases is meant to be a dynamic process, and the associated recovery actions are expected to evolve over time in response to adaptive management. Thus the recovery strategy is congruent with our Strategic Habitat Conservation process (USFWS 2008): the biological planning and conservation design set forth in this recovery plan lay out the criteria for recovery and identify localities for implementing actions, while the recovery actions describe a process for implementing conservation on the ground, outcome-based monitoring to assess success, and ongoing assumption-driven research to test biological hypotheses important to management. As such, this Recovery Plan prescribes changes to specific actions defined in the Draft and Amendment based on implementation of adaptive management measures to respond to the available new information.

At the time of our emergency listing action in 2001, the Columbia Basin pygmy rabbit was imminently threatened by its small population size, loss of genetic diversity, and inbreeding depression, coupled with a lack of suitable, protected habitats in the wild (USFWS 2001). Since emergency listing, the captive breeding program, genetics management efforts, habitat acquisition and enhancement actions, stakeholder involvement, and identification of appropriate recovery emphasis areas have reduced the immediacy of these threats. Accordingly, many of the aims of the first phase of recovery have largely been met (USFWS 2007), and most of the measures prescribed by the Draft, Amendment, and this final Recovery Plan emphasize actions considered necessary to accomplish phase 2 of the recovery strategy.

Initially, plans to reestablish free-ranging subpopulations of pygmy rabbits within the Columbia Basin depended entirely on using captive-bred animals. However, the captive breeding program, as originally configured, could not support anticipated reintroduction needs or sufficiently address some of the identified threats to the population. Furthermore, all of the available options for attempting to reestablish a viable population of pygmy rabbits within the Columbia Basin, including expansion of the captive breeding program, would require the input of additional wild animals captured from outside of the ecosystem (USFWS 2010). Trying to

address this management need by expanding the captive breeding program would require a significant commitment of additional resources, yet such action would still be unlikely to ultimately improve the success of reintroduction efforts due to limitations inherent in such a strategy (see Threats). To address this conservation challenge, actions prescribed by this Recovery Plan include additional releases of the captive-bred intercrossed pygmy rabbits, de-emphasis of captive breeding efforts beyond 2012, translocations of wild pygmy rabbits from other populations, implementation of partially controlled field-breeding efforts, and improved release protocols. We believe that this new approach to recovery will maximize the likelihood of reestablishing a viable population of pygmy rabbits within the Columbia Basin by minimizing the potential for disease, domestication, and genetic drift to further affect any captive animals, while minimizing the potential for outbreeding depression and helping to address demographic limitations in the wild.

Several factors may influence future management decisions regarding the number of pygmy rabbits to translocate from other populations outside the Columbia Basin. These factors include, but are not limited to: (1) the potential that surveys may locate additional wild subpopulations of Columbia Basin pygmy rabbits, which could be managed in place, secured for partially controlled field-breeding efforts, and/or translocated to support reintroduction efforts at recovery emphasis areas; (2) possible differences in population fitness parameters (*e.g.*, survival, reproductive success, habitat use) between the captive-bred, enclosure-bred, and translocated wild pygmy rabbits or their progeny, which may become apparent as the reintroduction program continues; and (3) future decisions regarding the level of introgression (see Glossary) considered appropriate. The extent to which the more comprehensive objectives of genetic, demographic, and, potentially, epigenetic (see Glossary) restoration of the Columbia Basin pygmy rabbit may be achieved will depend upon the effectiveness of reintroduction efforts and the performance of any reintroduced or existing subpopulations of pygmy rabbits and their progeny in subsequent generations. Measures to monitor and manage the genetic, demographic, and epigenetic characteristics in wild pygmy rabbits within the Columbia Basin, as feasible, were important considerations during development of the recovery actions prescribed by this Recovery Plan, and will be crucial for advancing to the final phase of recovery for the Columbia Basin pygmy rabbit.

A key objective for the second phase of recovery implementation is to release and establish an appropriate number and type (gender, age, ancestry) of captive-bred, enclosure-bred, and translocated wild pygmy rabbits at one or more recovery emphasis areas to begin the process of recovering the Columbia Basin pygmy rabbit in the wild. However, even with successful genetic rescue and initial reintroduction efforts, any free-ranging subpopulations of pygmy rabbits within the Columbia Basin will face continuing risks from a number of stochastic effects

if they remain small and isolated (Frankham 2003). Therefore, it will be important to increase the number and distribution of free-ranging pygmy rabbits within the Columbia Basin to prevent future inbreeding, to retain their increased genetic diversity, and to reduce their vulnerability to stochastic events. As such, two important, longer-term considerations for the second phase of recovery implementation are the desired number of free-ranging animals to be reestablished at recovery emphasis areas and, in turn, a minimum size estimate for recovery emphasis areas that would be considered necessary to support them. Ensuring long-term protection of these areas is also an important consideration.

In the absence of more species-specific life history data, a common, general approximation of minimum viable population sizes is referred to as the 50/500 rule (Franklin 1980; Soulé 1980). This rule states that an effective population (N_e) of 50 individuals is the minimum size required to avoid imminent risks from inbreeding. N_e represents the number of animals in a population that actually contribute to reproduction, and is often much smaller than the census, or total, number of individuals in the population (N). Furthermore, the rule states that the long-term fitness of a population requires an N_e of at least 500 individuals so that it will not lose its genetic diversity over time and will maintain an enhanced capacity to adapt to changing conditions. Another general principle of conservation biology addresses the concepts of resiliency and redundancy (Shaffer and Stein 2000). Resiliency and redundancy describe the characteristics of a population that would allow it to recover from periodic disturbances and those that would provide it a margin of safety to withstand catastrophic events, respectively. The concepts of resiliency and redundancy are not independent of one another, and some population characteristics contribute to both. Nevertheless, they generally imply that a single population must be large enough, or that it must be comprised of an appropriate configuration of subpopulations, that it would be expected to withstand all sources of periodic and catastrophic disturbances (*e.g.*, local weather events, wildfire, disease outbreaks, changes in cover or food resources, long-term climate patterns), possibly above and beyond that which may be strictly necessary to ensure its genetic and demographic viability (*i.e.*, the 50/500 rule).

Considering the above, recovery emphasis areas for the Columbia Basin pygmy rabbit must be large enough and contain a sufficient quantity and quality of shrub steppe habitat currently, or potentially through appropriate enhancement measures, to be considered capable of at least supporting a genetically and demographically viable subpopulation of the Columbia Basin pygmy rabbit. Furthermore, the overall population should be large enough, or should be comprised of an appropriate configuration of subpopulations, to be considered sufficiently robust to withstand all foreseeable long-term threats. Currently, due to uncertainties in the biological information (*e.g.*, appropriate estimates of N and N_e for pygmy rabbits) and the effectiveness of

ongoing recovery actions, it is not possible to describe what would be expected for a fully recovered population of Columbia Basin pygmy rabbits. However, based on the following information, the near-term (*i.e.*, 2012 to 2021) recovery objectives that have been identified reflect what would be expected over the initial period of the second phase of recovery, while the reclassification criteria that have been identified reflect what would currently be expected at the conclusion of the second phase of recovery.

Rachlow and Witham (2004) calculated density estimates for pygmy rabbits occupying sites under variable habitat conditions. These estimates ranged from 0.38 to 2.72 pygmy rabbits per hectare (0.15 to 1.10 per acre). Considering these density estimates as an initial approximation of the range in area required by pygmy rabbits, a subpopulation of at least 500 individuals would require an area of suitable habitat between roughly 184 and 1,316 hectares (454 and 3,250 acres). The two currently identified recovery emphasis areas (see Reintroduction) total 1,515 hectares (3,740 acres) and 1,374 hectares (3,390 acres). As such, these areas are consistent with the above population density estimates and are considered of an appropriate size necessary to help achieve the recovery objectives and criteria that are currently established for the Columbia Basin pygmy rabbit (see Recovery Goal, Objectives, and Criteria).

A conservative density estimate was considered appropriate for establishing the minimum size of recovery emphasis areas (*i.e.*, 1,316 hectares [3,250 acres]) for several reasons, including: (1) the referenced study involved a discrete population in Idaho occupying a different ecological setting; (2) one study specifically addressing the Columbia Basin pygmy rabbit suggested even lower densities (Gahr 1993), although this study was not specifically designed to evaluate pygmy rabbit population densities and likely occurred during a period of population decline; (3) not all of the existing or potential habitat within the identified recovery emphasis areas may be considered appropriate or currently available for pygmy rabbits; (4) the N_e of free-ranging Columbia Basin pygmy rabbit subpopulations may be substantially less than N ; and (5) it is currently unclear to what extent “intervening properties” (see Glossary) may contribute to recovery objectives, as addressed below.

Intervening non-Federal and non-WDFW properties outside of recovery emphasis areas, while not actively managed to conserve the Columbia Basin pygmy rabbit, may nevertheless contribute to recovery efforts. Any such property that could be voluntarily managed to provide a net conservation benefit to the population will be considered eligible for inclusion under the existing SHA for the Columbia Basin pygmy rabbit (see Stakeholder Involvement). In addition, Federal agencies with management authority over intervening properties outside of recovery emphasis areas must consider the contributions that their Federal authority may provide towards

the survival and recovery of the Columbia Basin pygmy rabbit (see Recovery Implementation). Potential benefits that could be realized on intervening properties include:

- Suitable habitat on intervening properties would be available for use by Columbia Basin pygmy rabbits released to recovery emphasis areas.
- Undeveloped habitats on intervening properties would facilitate dispersal of newly released animals and enhance connectivity of recovery emphasis areas and other potentially occupied sites.
- New subpopulations may form on intervening properties through natural expansion.
- Additional purebred Columbia Basin pygmy rabbits may be located on intervening properties and managed in place, secured for partially controlled breeding efforts, and/or directly translocated to one or more recovery emphasis areas.
- Monitoring and future collection of biological information (*e.g.*, dispersal, survival, productivity, habitat use) would be improved through cooperative management efforts on intervening properties.
- Research and adaptive management measures could be made more comprehensive if implemented at a broader scale through the inclusion of, and facilitated access to, intervening properties.
- The successful implementation of cooperative, proactive management measures on intervening properties would increase public awareness and support for the Columbia Basin pygmy rabbit recovery program.

The voluntary management measures that would be expected to provide one or more of the above conservation benefits on intervening non-Federal and non-WDFW properties will be identified and documented as specific properties are enrolled under the SHA (see Stakeholder Involvement). On intervening properties where Federal management authority exists, measures that could potentially contribute to recovery of the Columbia Basin pygmy rabbit will be evaluated in accordance with our and other Federal agencies' requirements pursuant to section 7 of the Endangered Species Act (*i.e.*, Interagency Cooperation).

The following discussion summarizes the relationship between the major threats to the Columbia Basin pygmy rabbit, organized by the five listing factors established under the ESA (see Threats, above), and the recovery actions developed to address those threats (see Recovery Program).

(A) The present or threatened destruction, modification, or curtailment of the species habitat or range: In order to ensure that the long-term recovery needs of the Columbia Basin pygmy rabbit are met, threats to the population's habitat must be reduced or removed. Maintaining, enhancing, and restoring connectivity of appropriate shrub steppe habitats are important near- and long-term considerations for this species, and will be addressed by the recovery actions directed at protection, management, and monitoring of habitat.

(B) Overutilization for commercial, scientific, or educational purposes: The Columbia Basin pygmy rabbit reintroduction program is essential to ensuring the long-term survival of this population, although incidental mortality and certain other negative impacts have occurred as a result of the activities associated with this program. Potential threats to the population due to scientific and educational management activities will be addressed through implementation of adaptive management measures to refine translocation, partially controlled field-breeding, release, monitoring, and research protocols as we learn more about the biological requirements of this species.

(C) Disease or Predation: The potential for disease (*e.g.*, plague) to impact proposed recovery actions remains a significant concern (D. Biggins, pers. comm. 2012) and predation is thought to be the major cause of mortality among free-ranging pygmy rabbits (Green 1979; Wilde 1978). These threats will be addressed by recovery actions directed at reintroduction, monitoring, and, as feasible, treatment protocols, habitat enhancement measures, and/or establishing temporary predator or disease vector control programs.

(D) Inadequacy of existing regulatory mechanisms: Although Washington State regulations make it illegal to hunt, possess, maliciously harass or kill pygmy rabbits, or to maliciously destroy their nests (Revised Code of Washington 77.15.120), they do not prohibit incidental take of the species nor do they provide regulatory protection of habitats considered essential to the Columbia Basin pygmy rabbit's long-term security. There are also areas of private land within the species' historical distribution enrolled under the Conservation Reserve Program, which incorporates standards to promote the improvement of habitats potentially used by the Columbia Basin pygmy rabbit. However, the prescribed standards do not specifically address conservation of this species, participation is voluntary, and contracts expire after 10

years. This threat will be addressed by the recovery actions through the establishment and support of recovery emphasis areas and implementation of the SHA and, potentially, other long-term agreements that have been established to promote the recovery of the population. In addition, Federal agencies with management authority over intervening properties outside of recovery emphasis areas must consider the contributions that their Federal authority may provide towards the survival and recovery of the Columbia Basin pygmy rabbit (see Recovery Implementation).

(E) Other natural or manmade factors affecting the population's continued existence: The most immediate concerns for the Columbia Basin pygmy rabbit are associated with the population's extremely small size, since small populations are highly susceptible to random environmental events and demographic and genetic limitations (Shaffer 1981). This threat will be addressed by the recovery actions and through the successful development and implementation of the adaptive management measures identified in the Reintroduction and Genetic Management Plan.

The recovery strategy described above, which is meant to be a dynamic process that relies on effective adaptive management, will lead to an increasingly consistent approach to reestablish the pygmy rabbit within the Columbia Basin. As the near-term (2012 to 2021) objectives currently identified for recovery are accomplished, revised implementation schedules will be developed to identify updated recovery objectives, criteria, and actions considered necessary to advance to the final phase of the overall recovery strategy.

III. RECOVERY GOAL, OBJECTIVES, AND CRITERIA

The ultimate goal of Federal recovery planning is to recover a listed species to the point that protections under the ESA are no longer required (*i.e.*, to delist the species), which may include an interim goal of downlisting a species from endangered to threatened status. These recovery goals are subdivided into discrete component objectives, which collectively describe the conditions to achieve downlisting or delisting. Recovery objectives are therefore the recovery goal parameters, and the criteria are the values of those parameters. The ESA states that each recovery plan shall incorporate, to the maximum extent practicable, "...objective, measurable criteria which, when met, would result in a determination...that the species be removed from the list." Accordingly, the recovery criteria represent the standards upon which a decision to reclassify or delist a species is based, in light of the five listing factors (see Threats). Recovery criteria (delisting or downlisting) can be viewed as the targets or values by which progress toward achieving recovery objectives is measured. Based on the best available information and overall recovery strategy identified above, we establish the following recovery goal, objectives, and criteria for recovering the Columbia Basin pygmy rabbit pursuant to the ESA.

A. Goal

The goal of Federal recovery planning is to identify recovery actions that, when implemented, will remove threats to the Columbia Basin pygmy rabbit to the extent that it is no longer in danger of extinction. At that point, the species may be reclassified as threatened, and ultimately may be removed from the Federal List of Endangered and Threatened Wildlife and Plants. In order to achieve this goal, a population of free-ranging Columbia Basin pygmy rabbits will need to be reestablished, and threats to the population will need to be sufficiently abated such that there is a high probability of the population's persistence within its historical distribution over the foreseeable future.

B. Objectives

The period encompassing the near-term recovery objectives identified in the Amendment (*i.e.*, 2011 to 2020) has been adjusted in this Recovery Plan to 2012 to 2021.

1. Near-term (2012 to 2021)

1 – The Reintroduction and Genetic Management Plan, which identifies specific procedures for release efforts and identifies the current monitoring measures and research objectives for free-ranging Columbia Basin pygmy rabbits, is revised, as necessary, to account for the development and implementation of adaptive management measures.

2 – Reintroduced pygmy rabbit subpopulations retain characteristics of Columbia Basin ancestry (see Recovery Action 3.3, below), and all pygmy rabbits to be used for reintroduction efforts are considered fit by veterinary staff and otherwise satisfy the requirements of the most current Reintroduction and Genetic Management Plan.

3 – A sufficient number and demographic composition of pygmy rabbits is retained to support partially controlled field-breeding efforts until at least one free-ranging subpopulation can be initially reestablished (see number 4, below).

4 – Reestablished subpopulations at 2 recovery emphasis areas each have a 5-year average N (population size) of at least 125 individuals. This census estimate for each subpopulation would approximate that of the last known subpopulation that occurred at the Sagebrush Flat site, which (at least in the near-term) was considered relatively secure (see Abundance and Trends). Therefore, until a better estimate of N_e (effective population size) for pygmy rabbits may be established (see number 5, below), the size of each subpopulation would approximate an initial estimate of N that could be expected to address near-term genetic and demographic considerations (*i.e.*, $N_e = 50$, see Recovery Strategy). Establishing two such populations would begin to address longer-term considerations for overall population resiliency and redundancy (see Recovery Strategy).

5 – Future investigations are undertaken to develop appropriate, updated estimators of Columbia Basin pygmy rabbit overall abundance (N), effective population size (N_e), and dispersal corridor habitat and management conditions. These updated estimators, in turn, will make it possible to identify the appropriate size, number, status, and configuration of Columbia Basin pygmy rabbit subpopulations necessary to ensure the population's long-term viability (*i.e.*, establish delisting criteria).

6 – As necessary to meet objective 5 above, additional recovery emphasis areas and/or dispersal corridors are identified, prioritized, and formally established through completion of one or more appropriate conservation agreements.

7 – Appropriate conservation agreements that lead to proactive, voluntary conservation efforts with landowners, managers, and other interested parties within the historical distribution of the Columbia Basin pygmy rabbit are developed and implemented.

2. Long-term

Increase the size, number, distribution, and security of free-ranging subpopulations of the Columbia Basin pygmy rabbit so that the population may be reclassified as threatened and, ultimately, be removed from the List of Endangered and Threatened Wildlife and Plants pursuant to the ESA.

C. Criteria

We establish recovery criteria to serve as objective, measurable guidelines to assist us in determining when an endangered species has recovered to the point that it may be downlisted to threatened, or that the protections afforded by the ESA are no longer necessary and the species may be delisted. Establishing these criteria articulates our conservation objectives for the species under the biological planning element of our Strategic Habitat Conservation framework.

Currently, there are uncertainties with regard to how recovery of the Columbia Basin pygmy rabbit will progress as recovery actions are implemented. Therefore, recovery criteria may be met in the near or long-term, depending on the overall effectiveness of recovery efforts. The following criteria have been coordinated through WDFW and other SAG members.

1. Reclassification from Endangered to Threatened Status

It is not currently possible to describe the total number, size, or connectivity characteristics of reestablished subpopulations, or to define appropriate dispersal corridor habitat conditions that would be expected to maintain a fully recovered population of Columbia Basin pygmy rabbits (see number 2, below). However, any one of the following criteria would demonstrate that significant progress has been made to reestablish a genetically and demographically robust population of pygmy rabbits within the Columbia Basin, and to address the long-term resiliency and redundancy of the population (see Recovery Strategy). Furthermore, each of the following criteria describes conditions that would indicate the

prescribed recovery actions are sufficiently addressing the identified threats to the Columbia Basin pygmy rabbit (see Recovery Strategy). The downlisting criteria specifically address threats related to Factor E (factors related to small population size and the associated vulnerability to genetic threats and demographic or environmental fluctuation) by setting targets for the size of subpopulations. The treatment of recovery emphasis areas and dispersal corridors in the criteria indicates that a sufficient quantity and quality of habitat needs to be established (Factor A) and that appropriate regulatory mechanisms (e.g. completion of conservation agreements) need to be in place to protect these key sites (Factor D). Threats related to Factors B (overutilization) and C (disease or predation) must also be addressed sufficiently, through protection and management of recovery emphasis areas and dispersal corridors, to promote initial recovery of the population and allow subpopulations to become established and expand to a population size that meets the downlisting criteria above (accomplishing Phase 2 of the recovery strategy). Therefore, based on the identified threat factors and overall recovery strategy described above, we will consider reclassification of the Columbia Basin pygmy rabbit from endangered to threatened status pursuant to the measures prescribed by the ESA if any one of the following criteria is met.

1 – Subpopulations at 2 recovery emphasis areas each have a 5-year average N_e of at least 375 individuals, and a third recovery emphasis area has been formally established through completion of one or more appropriate conservation agreements and is available for initial reintroduction efforts; or

2 – A subpopulation at 1 recovery emphasis area has a 5-year average N_e of at least of 250 individuals, and subpopulations at 2 other recovery emphasis areas each have a 5-year average N_e of at least 125 individuals; or

3 – A single subpopulation with a 5-year average N_e of at least of 750 individuals has been reestablished through dispersal and range expansion from one or more recovery emphasis areas, and appropriate conservation agreements have been reached to include the newly occupied habitats within the recovery emphasis area(s) involved and management measures to maintain identified dispersal corridors have been agreed to and implemented.

The above criteria are based on currently available information regarding the Columbia Basin pygmy rabbit. While the initial focus of recovery efforts will be within the two recovery emphasis areas mapped in Figure 2 above, we expect that meeting recovery criteria may eventually require establishing populations in one or more additional or substitute recovery emphasis areas within the historical distribution of the Columbia Basin pygmy rabbit, or

modifying area boundaries to effectively manage expanded populations. If presently unknown wild populations are discovered, they may also contribute to meeting these criteria as appropriate. Management of dispersal corridors is addressed under Criterion 3 for downlisting, and will be further assessed in development of delisting criteria as discussed below.

The effort to meet these criteria will require protection, restoration, and monitoring of sagebrush habitat on recovery emphasis areas and as feasible on intervening lands (Recovery Action 5); adaptively refining procedures for translocation, field-breeding, release, and monitoring to minimize their incidental adverse effects on pygmy rabbits (Recovery Actions 1.1, 1.2, 2.2, 2.3, 2.4, 2.5, 3.2, 3.3, and 3.4); monitoring and effectively controlling predators on recovery emphasis areas (Recovery Action 4.1), and monitoring and treating disease (Recovery Action 4.2). If these management activities have effectively addressed the threats to the species such that the above criteria have been met, we will consider reclassifying the Columbia Basin pygmy rabbit to threatened status.

2. Removal from the List of Endangered and Threatened Wildlife and Plants

We have determined that defining credible delisting criteria is not possible at this time, given the uncertainties associated with the Columbia Basin pygmy rabbit, which include, in part, identifying appropriate density estimates, effective population size(s), dispersal corridor habitat and management conditions, effects of disease and predation, seasonal movement patterns, and the effectiveness of future translocations, field-breeding, genetics management, and reintroduction efforts. However, near-term recovery objectives have been identified (e.g., Objectives 5 and 6, above, will help assess the configuration of subpopulations and dispersal corridors needed for delisting) and appropriate recovery actions developed that would help provide this information. These recovery actions include, in part, ongoing surveys for free-ranging individuals or subpopulations, continuing reintroductions and/or augmentation of the reintroduced subpopulation(s), as necessary, monitoring the survival and movement of newly released or existing pygmy rabbit subpopulations within the Columbia Basin, addressing existing constraints or management needs at recovery emphasis areas and appropriate intervening properties, and periodically updating specific methods and techniques in the Reintroduction and Genetic Management Plan.

IV. RECOVERY PROGRAM

Based on the available new information and changes to the overall recovery strategy to be implemented, various recovery actions from the Draft and Amendment, along with their associated sub-actions, require updating. The original Recovery Action 1 and its associated sub-actions, which addressed management of the captive breeding program, have been updated to address partially controlled field breeding efforts. The original Recovery Action 2 and its associated sub-actions, which addressed the genetic characteristics of a recovering Columbia Basin pygmy rabbit population, were incorporated into Recovery Actions 1, 3, and 4 in the Amendment. Other than appropriately renumbering the recovery actions, updating the cost and duration estimates (see revised Implementation Schedule), and other minor changes to improve clarity, none of the remaining recovery actions from the original Draft (*i.e.*, current Recovery Actions 4 through 9) or their associated sub-actions required updating. Recovery Actions 1, 2, and 3 now address partially controlled field breeding efforts, reestablishing free-ranging subpopulations, and surveying, monitoring, and assessing free-ranging pygmy rabbits within the Columbia Basin, respectively.

The recovery actions described below articulate several elements of our Strategic Habitat Conservation framework: program delivery of conservation actions, outcome-based monitoring to evaluate success, and targeted assumption-driven research to correct uncertainties in the biological foundation for management (USFWS 2008). Because the ongoing management actions for the Columbia Basin pygmy rabbit are critically important to its survival and are inherently based on limited information, it is crucial to effectively use adaptive management to iteratively assess successes and failures and modify management in response.

A. Stepdown Outline of Recovery Actions

Action 1: Manage partially controlled field-breeding for the Columbia Basin pygmy rabbit (CBPR).

- 1.1 – Identify, establish, and maintain enclosures for breeding and reintroduction efforts.
- 1.2 – Optimize the genetic and demographic characteristics of CBPR (see Recovery Action (RA) 2.4).
- 1.3 – Determine feasibility and need for retaining CBPR within one or more of the enclosures for future reintroduction efforts.

Action 2: Reestablish free-ranging CBPR subpopulations within their historical distribution.

- 2.1 – Manage recovery emphasis areas (see RA 4 and 5).
- 2.2 – Provide supplemental features at release sites to improve the survival (see RA 5.3).
- 2.3 – Identify appropriate source populations and translocate CBPR to support reintroduction efforts.
- 2.4 – Identify and release CBPR at the highest priority recovery emphasis area(s) (see RA 1.1, 3.1, and 5.5).
- 2.5 – Update the Reintroduction and Genetic Management Plan as necessary.

Action 3: Survey for, monitor, and assess free-ranging CBPR.

- 3.1 – Search for any remaining wild subpopulations.
- 3.2 – Monitor free-ranging subpopulations and document their status.
- 3.3 – Monitor and manage the diversity of free-ranging subpopulations.
- 3.4 – Continue to develop and refine abundance indices of overall and effective population sizes (see RA 3.2).
- 3.5 – Continue to assess and identify the appropriate population sizes, number, distribution, and configuration necessary to delist the CBPR (see RA 4, 5, and 6).

Action 4: Protect free-ranging CBPR.

- 4.1 – Evaluate and address the effects of predators on CBPR.
- 4.2 – Monitor for diseases and implement measures to treat infection and transmission in free-ranging CBPR.
- 4.3 – Identify and minimize the effects of human activities on CBPR.
- 4.4 – Enforce Federal regulations that protect CBPR from unauthorized “take” (see Glossary).

Action 5: Manage habitats at recovery emphasis areas and intervening properties.

- 5.1 – Investigate and refine estimates of the quantity and quality of habitats needed to support CBPR (see RA 3.5).
- 5.2 – Protect habitats at recovery emphasis areas and intervening properties (see RA 6).
- 5.3 – Investigate and implement enhancement and restoration measures to improve habitat quantity and quality for CBPRs.
- 5.4 – Document methods, treatments, timing, and results of all habitat enhancement, restoration, and protection projects undertaken for CBPR.

- 5.5 –Identify, assess, and prioritize potential recovery emphasis areas; formally establish recovery emphasis area(s) and provide recommendations to address habitat management needs at these sites (see RA 3.5 and 5.1).
- 5.6 –Through conservation agreements (see RA 6), incentives, conservation easements, and/or willing acquisition or exchange, increase the size of recovery emphasis areas.

Action 6: Pursue conservation agreements with landowners and managers of intervening properties within the population’s historical distribution.

- 6.1 – Develop Site Plans under the existing SHA and issue associated Permits (see Stakeholder Involvement).
- 6.2 – Develop and provide guidelines and technical assistance to interested landowners and managers.
- 6.3 – Develop new HCPs.
- 6.4 – Continue to coordinate recovery efforts with various entities.
- 6.5 – Continue to identify and secure funding sources to implementation recovery actions, and/or to otherwise provide incentives for conservation efforts for CBPR (also RA 8).

Action 7: Exchange information with stakeholders and the general public to address concerns and increase support for CBPR recovery efforts.

- 7.1 – Continue to identify stakeholders and address issues of concern.
- 7.2 – Meet or otherwise contact stakeholders and other concerned parties to communicate recovery information and to solicit input.
- 7.3 – Engage local media through news releases and invitations to scheduled events to inform the public concerning recovery efforts for the CBPR.

Action 8: Secure funding for CBPR recovery efforts.

- 8.1 – Continue cooperative efforts with a diverse group of stakeholders in recovery implementation for the CBPR.
- 8.2 – Establish a cooperative framework for matching and cost-sharing Federal and non-Federal funding sources.
- 8.3 – Establish research and management connections between experts in pygmy rabbit biology and the greater shrub steppe ecosystem.

Action 9: Revise this Federal Recovery Plan to facilitate implementation of adaptive management measures considered necessary to achieve the phased recovery strategy.

- 9.1 – Revise Implementation Schedule.

B. Stepdown Narrative

More detailed information regarding the recovery actions for the Columbia Basin pygmy rabbit, including relevant subactions and clarifying discussions are prescribed as follows:

Action 1: Manage partially controlled field-breeding for the Columbia Basin pygmy rabbit.

1.1 – Identify, establish, and maintain an appropriate number and configuration of large enclosures needed to support field-breeding and reintroduction efforts.

Two large enclosures, which are in close proximity to one another, have been constructed at the Sagebrush Flat site; one roughly 2.5 hectares (6 acres) and one roughly 4 hectares (10 acres) in size. In order to reduce the risk of catastrophic loss at the existing enclosures (*e.g.*, from fire, disease epidemic, predator access, vandalism), construction of a third enclosure at another site has been proposed (WDFW 2012). Currently, release efforts are only planned for the Sagebrush Flat site (see Action 2.4).

1.2 – Optimize the genetic and demographic characteristics of pygmy rabbits used for field-breeding efforts within the large enclosures (see Action 2.4).

The genetic characteristics of all pygmy rabbits to be held in the large enclosures and those to be released are periodically assessed by WDFW. Strategies to optimize the genetic and demographic characteristics of pygmy rabbits within the reintroduction program include securing and selecting individuals with the desired genetic makeup to be included in the breeding scenarios and/or to be released. When making these decisions, considerations include the combined objectives of conserving the remaining unique genetic characteristics of the historical Columbia Basin pygmy rabbit population, maximizing the genetic diversity of the reintroduced population, and avoiding breeding scenarios that may pair closely related individuals. Achieving these objectives will help minimize the potential for genetic drift, inbreeding, outbreeding, and demographic limitations to negatively affect reintroduction efforts. Each animal's pedigree and status history will be used to guide these breeding management and release objectives.

1.3 – Following each breeding season, determine the feasibility and need to maintain any captive-bred, enclosure-bred, and/or wild-caught pygmy rabbits within one or

more of the large enclosures to support future reintroduction efforts.

The most recent Reintroduction and Genetic Management Plan will guide future field-breeding and release efforts (see Action 2.5).

Action 2: Reestablish free-ranging Columbia Basin pygmy rabbit subpopulations within their historical distribution.

2.1 – Manage recovery emphasis areas (also see Actions 4 and 5).

To date, two high priority recovery emphasis areas have been established and are currently being managed to accommodate initial reintroduction efforts for the Columbia Basin pygmy rabbit (see Reintroduction). These areas are comprised of lands under WDFW, nongovernmental organization, and private ownership or management authority. Other areas should be added as feasible and considered necessary (see Action 5.5).

2.2 – Provide supplemental features at release sites (*e.g.*, pre-release pens, artificial burrows) to improve the survival of newly released animals, as necessary (also see Action 5.3).

Pre-release pens and supplemental feeding were used in experimental releases of Idaho pygmy rabbits, and have been used successfully to acclimate pygmy rabbit release groups at Columbia Basin sites. Artificial burrows have been used successfully in conservation efforts for a number of other fossorial species, including black-footed ferrets (*Mustela nigripes*), giant kangaroo rats (*Dipodomys ingens*), prairie dogs (*Cynomys* spp.), and burrowing owls (*Athene cunicularia*). Provision of artificial burrows also appeared to increase survival of pygmy rabbits during experimental releases in Idaho, and they have been provided at recovery emphasis areas for releases of pygmy rabbits within the Columbia Basin.

2.3 – Identify appropriate source populations and translocate pygmy rabbits to support reintroduction efforts.

The number of pygmy rabbits available for translocation will vary depending on several factors, including management objectives for the source population(s), trapping and transport logistics, and available resources. Translocated pygmy rabbits

may originate from subpopulations located within or outside of the Columbia Basin ecosystem, as appropriate based on overall program objectives.

2.4 – Identify and release an appropriate number and type of pygmy rabbits needed to support reintroduction and/or augmentation objectives at the highest priority recovery emphasis area(s) (also see Actions 1.1, 3.1, and 5.5).

The appropriate number and type (*i.e.*, sex, age, ancestry) of captive-bred, enclosure-bred, and translocated wild pygmy rabbits needed for reintroduction and/or augmentation efforts will be estimated from ongoing population viability analyses (see Action 3.4), past studies of captive-bred pygmy rabbits released under experimental conditions, availability of animals based on capture and translocation logistics, and, ultimately, from post-release monitoring efforts in the Columbia Basin. The most recent Reintroduction and Genetic Management Plan will guide release efforts (see Action 2.5).

2.5 – Update the Reintroduction and Genetic Management Plan, as necessary, to account for survey and monitoring results, and development and implementation of adaptive management measures.

There will be an iterative planning process of refining the numbers and types of animals to be released each year (see Action 3.3), as well as post-release monitoring strategies. Other information needs for updating the plan include evaluating potential effects of pre-release pens, supplemental feeding, seasonality and timing of releases, predator control, and differing make-up of release groups. During plan revisions, data collection, maintenance, and reporting will be coordinated among affected parties (also see Action 7).

Action 3: Survey for, monitor, and assess free-ranging Columbia Basin pygmy rabbits.

3.1 – Search for any remaining wild subpopulations.

If any additional free-ranging, purebred Columbia Basin pygmy rabbits persist, they may provide a significant benefit to conservation of this population. Surveys of shrub steppe habitat within the population's historical distribution have not located any additional wild pygmy rabbits since 2004. However, the possibility still exists that free-ranging subpopulations may remain in areas that have not yet been surveyed.

3.1.1 – Prioritize and document potential search areas based on likelihood of identifying previously unknown occurrences.

Mapping exercises have been undertaken, using existing databases, to identify areas with appropriate soils and habitat conditions to prioritize areas of public and private lands for ongoing search efforts for the Columbia Basin pygmy rabbit. Private lands are only surveyed with the consent of individual landowners and/or appropriately designated managers (see Action 6).

3.1.2 – Continue to survey public properties within the highest priority area(s).

3.1.3 – Continue to contact landowners and managers within the highest priority area(s) and pursue conservation agreements to undertake surveys and, as appropriate, implement monitoring and management measures for the Columbia Basin pygmy rabbit.

3.2 – Monitor free-ranging subpopulations and document their status.

Updated survey and monitoring techniques are being investigated for pygmy rabbits throughout the species' range. This work, along with ongoing investigations of newly released pygmy rabbits within the Columbia Basin, will facilitate continued improvement of these techniques. Free-ranging pygmy rabbits within the Columbia Basin will be monitored using the most appropriate method(s) (see Survey and Monitoring). The monitoring method used and frequency of monitoring will be continually assessed and, as necessary, updated in a revised Reintroduction and Genetic Management Plan (see Action 2.5).

3.2.1 – Monitor the survival and movements of all captive-bred, enclosure-bred, and translocated wild pygmy rabbits released within the recovery emphasis areas (see Action 2.4).

As feasible considering equipment and workforce availability, all or an appropriate proportion of adult and juvenile pygmy rabbits released within the recovery emphasis areas will be fitted with radio transmitters to monitor their movements, habitat use patterns (see Action 5.1.1), and causes of mortality. Radio-transmitter collars for adults and glue-on transmitters for juveniles have

been used successfully for pygmy rabbit research over a number of years and throughout the range of the species, including the experimental releases in Idaho. Risk of mortality or injury due to the use of transmitters is considered low. Radio-telemetry monitoring is the primary means by which movements, habitat use patterns, and mortality factors of pygmy rabbits within the Columbia Basin can be assessed.

3.2.2 – Track and manage released pygmy rabbits that may disperse beyond recovery emphasis areas (also see Action 6).

Some newly released pygmy rabbits will likely continue to disperse beyond recovery emphasis area boundaries. Appropriate measures will be implemented to contact and pursue conservation agreements with landowners and managers of intervening properties. Initially, workloads will be prioritized to address intervening properties within 8 kilometers (5 miles) of the recovery emphasis area(s) used for initial reintroductions, other as-yet unsurveyed properties that contain “survey habitat” (see Glossary) and that have the greatest potential to harbor free-ranging Columbia Basin pygmy rabbits, and areas that may act as dispersal corridors between occupied sites. As resources and workloads allow, pursuing conservation agreements for other intervening properties within the historical distribution of the Columbia Basin pygmy rabbit will be addressed.

3.3 – Monitor and manage, as feasible, the genetic and epigenetic diversity of free-ranging subpopulations.

3.3.1 – Obtain tissue and/or non-invasive (*e.g.*, fecal pellet) samples of any reestablished and remnant pygmy rabbit subpopulations to assess and monitor their genetic and epigenetic characteristics.

In the event that one or more free-ranging subpopulations are established or a remnant subpopulation is located, the genetic and, as feasible, epigenetic make-up of the subpopulations will be evaluated. Initially, efforts will be made to sample all released and any recaptured animals over the first 4 years after initial releases (*i.e.*, 2011 to 2014). Based on initial results, an appropriate subset of animals may be identified and reevaluated for future efforts. A genetic repository will be developed for all samples collected, which can be used to infer individual

survival, relative movement, reproduction, and ancestry. Information collected will contribute to monitoring the genetic and, possibly, epigenetic characteristics of pygmy rabbit subpopulations within the Columbia Basin over time to determine if, and to what extent, they may become differentiated from the historical, founding captive, and/or founding wild populations, or if any subpopulations may differentiate from one another.

3.3.2 – Implement management measures to adjust genetic and epigenetic characteristics, as appropriate based on overall program objectives.

Ongoing monitoring and implementation of adaptive management measures may help identify the range(s) of desired genetic and/or epigenetic characteristics for free-ranging pygmy rabbit subpopulations within the Columbia Basin (see Actions 1.2, 2.3 and 3.3.1). Appropriate management measures will be undertaken (*e.g.*, translocation, protection) to maximize the overall diversity of the Columbia Basin pygmy rabbit and to otherwise accomplish the near-term recovery objectives that have been identified.

3.4 – Continue to develop and refine abundance indices of overall and effective population sizes based on counts of active burrows or other survey and monitoring techniques, as appropriate (see Action 3.2).

Accurate abundance indices will be needed to evaluate the annual status and trends of free-ranging subpopulations, and/or to infer changes in life history parameters attributed to various experimental treatments or adaptive management measures.

3.5 – Continue to assess and identify the appropriate sizes, number, distribution, and configuration of free-ranging subpopulations necessary to delist the Columbia Basin pygmy rabbit pursuant to the ESA, and define criteria that would demonstrate that threats to the population are sufficiently ameliorated (also see Actions 4, 5, and 6).

Areas that are of sufficient size and that contain appropriate shrub steppe habitat and soil conditions that would be considered capable of supporting a viable subpopulation of Columbia Basin pygmy rabbits are relatively rare. To be consistent with the identified recovery strategy, potential sites would also need to represent willing public or private conservation management authority and flexibility to support long-term conservation efforts for the Columbia Basin pygmy rabbit. Other considerations include current

information gaps, such as appropriate density estimates and other population modeling parameters (see Action 3.4), future effects of diseases and predation, and the habitat use, seasonal movement, and dispersal behaviors of newly released pygmy rabbits. Additional recovery emphasis areas will be identified, prioritized, and formally established and intervening properties will be protected, as feasible through appropriate conservation agreements, in order to meet the identified near-term recovery objectives and reclassification criteria.

Action 4: Protect free-ranging Columbia Basin pygmy rabbits.

4.1 – Evaluate and address, as feasible, the potential effects of predators on free-ranging Columbia Basin pygmy rabbits.

4.1.1– Remove or manage potential predator attractants at occupied sites that could be used as perches, cover, or supplemental food sources (*e.g.*, power poles, old fences, outbuildings, unused equipment, spilled grain, refuse) to reduce the occurrence of local predators, as necessary.

4.1.2 – Monitor predators at release sites and, as feasible (*e.g.*, contingent on conservation agreement conditions), implement interim predator control measures to minimize loss of newly released pygmy rabbits.

Monitoring and, as feasible, implementing appropriate measures to control predators will be one of the biggest challenges of initial release efforts. Principal predators of concern include coyotes (*Canis latrans*), weasels (*Mustela spp.*), badgers (*Taxidea taxus*), ravens (*Corvus corax*), and various raptor species. It may be feasible and effective to control only one or two key predators, or to simply monitor their abundance during initial releases. Various measures have previously been implemented at the recovery emphasis areas to help address predators (see Conservation Actions Implemented). As feasible, preventive control will be emphasized prior to and through the breeding season (roughly March through June). Further evaluation of predation effects by predator species and survival / habitat relationships (*e.g.*, key contributing habitat features) of newly released pygmy rabbits within the Columbia Basin will be conducted to determine the efficacy of, and possible need for continuing, predator control measures.

4.2 – Monitor for diseases and, as feasible, implement measures to treat and/or reduce the risk of infection and transmission in free-ranging Columbia Basin pygmy rabbits.

The presence of disease (*e.g.*, plague) may have significant bearing on the success of reintroduction efforts (D. Biggins, pers. comm. 2012). The potential to implement preventive measures (*e.g.*, flea treatments) will be investigated and undertaken if indicated by monitoring results.

4.3 – Identify and minimize the effects of human activities on Columbia Basin pygmy rabbits at recovery emphasis areas and, as feasible (*i.e.*, contingent on conservation agreement conditions), intervening properties.

A variety of land management activities have the potential to negatively affect pygmy rabbits. Further investigation and adaptive management measures to address potential risks from various land management activities will be undertaken as opportunities arise. For example, additional information will help clarify the compatibility of various recreational activities (*e.g.*, hunting), infrastructure management (*e.g.*, roads, power lines), grazing plans, fire control measures, and research investigations with pygmy rabbit recovery objectives.

4.3.1 – Avoid development of new, or expansion of existing roads and trails, and restore habitats on obsolete roads and trails at occupied sites.

4.3.2 – Protect burrow complexes at occupied sites from disturbances and direct impacts due to existing and proposed land use practices (*e.g.*, grazing management, recreational use, research projects), except under experimental conditions designed to further evaluate the practice(s).

4.4 – Enforce Federal regulations that protect Columbia Basin pygmy rabbits from unauthorized “take” (*e.g.*, killing, harm, harassment [see Glossary]).

Action 5: Manage habitats at recovery emphasis areas and intervening properties (as feasible) to support stable, self-sustaining subpopulations of free-ranging Columbia Basin pygmy rabbits.

5.1 – Continue to investigate and refine estimates of the quantity and quality of habitats needed to support a viable subpopulation of free-ranging Columbia Basin pygmy rabbits (also see Action 3.5).

Future planned research on reestablished, free-ranging Columbia Basin pygmy rabbit subpopulations will improve habitat assessments and population density estimates that, in turn, will facilitate refinements of the Federal recovery objectives, criteria, and actions currently identified for the Columbia Basin pygmy rabbit.

5.1.1 – Document habitat use patterns of free-ranging Columbia Basin pygmy rabbits at recovery emphasis areas (*e.g.*, forage selection, condition, and quality; cover requirements; seasonal movements).

This is an integral part of initial research planning and monitoring needs for free-ranging Columbia Basin pygmy rabbit subpopulations.

5.1.2 – As feasible (*i.e.*, contingent on conservation agreement conditions), evaluate contributions to recovery emphasis areas from available habitats on intervening properties, including any that are managed pursuant to programs administered by USDA (*e.g.*, Conservation Reserve Program).

In the past, Columbia Basin pygmy rabbits have been observed using lands enrolled under the Conservation Reserve Program directly adjacent to shrub steppe habitat. However, it is currently unknown how and to what extent reestablished subpopulations of Columbia Basin pygmy rabbits may use these lands or other altered habitats within or adjacent to recovery emphasis areas, or which components of these sites may function as pygmy rabbit habitat.

5.1.3 – Develop and continue to refine criteria for evaluating and establishing appropriate management and habitat conditions for pygmy rabbit dispersal corridors.

Criteria based upon appropriate management and habitat conditions will be needed to evaluate the potential contributions of intervening properties to facilitate dispersal and/or expansion of free-ranging subpopulations beyond recovery emphasis areas.

5.1.4 – Develop and refine habitat models (*e.g.*, Habitat Suitability Index) for Columbia Basin pygmy rabbits at both local and landscape scales.

Efforts to develop and refine habitat models for Columbia Basin pygmy rabbits will allow for improvements in identified recovery actions and management of available habitats.

5.1.5 – Through coordination with the SAG and other stakeholder parties, solicit expertise (*e.g.*, biological, ecological, management) to identify and prioritize appropriate research objectives and methodologies that will inform continuing development and refinement of habitat and population estimators and modeling exercises.

5.2 – Protect habitats at recovery emphasis areas and, as feasible, intervening properties (see Action 6).

5.2.1 – Monitor changes in habitats through remote sensing, ground surveys, and mapping.

A variety of remote sensing techniques have been developed to assess relative habitat quantity. These techniques are being implemented at several sites in the Columbia Basin. Ground-based sampling to monitor habitat quality was conducted in the past, and will continue to be conducted at various intervals (*e.g.*, 5 to 10 years) unless more effective techniques are developed. Habitat maps will be produced for recovery emphasis areas and other potentially used intervening properties pursuant to any existing conservation agreements.

5.2.2 – Continue to work with local landowners and managers to develop fire management plans and, as appropriate, implement measures to reduce the risk of catastrophic loss of important shrub steppe habitat (*e.g.*, provide firebreaks, monitor and control ignition sources, develop agreements with local fire districts).

A fire management plan has been developed or is in the process of being developed for each of the currently identified recovery emphasis areas. Firebreaks have been constructed and are currently maintained at the Sagebrush Flat Wildlife Area.

5.2.3 – As necessary, provide exclusion fencing at recovery emphasis areas to protect habitats from unauthorized access and potentially negative impacts.

Perimeter fencing has been installed and maintained at key sites on both recovery emphasis areas to help manage unauthorized access.

5.3 – Continue to investigate and, as feasible, implement enhancement and restoration measures to improve habitat quantity and quality for Columbia Basin pygmy rabbit subpopulations at recovery emphasis areas.

As ongoing research improves our understanding of shrub steppe habitat components required by free-ranging Columbia Basin pygmy rabbits, adaptive management measures (*e.g.*, plantings, invasive species removal and control) will be implemented, as available, to appropriately manipulate available habitats.

5.4 – Document methods, treatments, timing, and results of all habitat enhancement, restoration, and protection projects undertaken for free-ranging Columbia Basin pygmy rabbits and maintain those records to facilitate long-term habitat monitoring.

Maintaining adequate records will allow future assessments of what specific management measures contribute to successful shrub steppe habitat manipulation projects.

5.5 – As necessary to achieve near-term recovery objectives, continue to identify, assess, and prioritize potential recovery emphasis areas and, as appropriate, formally establish additional recovery emphasis area(s) and provide recommendations to address habitat management needs at these sites (also see Actions 3.5 and 5.1).

Potential future recovery emphasis areas on properties owned or managed by public agencies and willing private parties will be identified, assessed, and prioritized, as necessary. Key areas that can be formally established will be managed to accommodate future reintroductions and reestablishment of Columbia Basin pygmy rabbit subpopulations. Management recommendations for these sites (*e.g.*, habitat enhancement and/or protection measures, exclusion fencing) will be developed and provided for future planning considerations.

5.5.1 – Continue to collect site-specific habitat information at all potential

recovery emphasis areas.

Habitat information specifically addressing Columbia Basin pygmy rabbit conservation needs (*e.g.*, shrub cover, height, and distribution; soil characteristics) will be collected. Other important considerations for potential future sites include, but are not limited to, their overall size, presence of weedy species, existing road systems, fire history, past occupancy by pygmy rabbits, and management access.

5.5.2 – Review management plans for public lands and, as feasible (*e.g.*, contingent on conservation agreement conditions), other intervening properties affecting potential recovery emphasis areas to determine compatibility of the site(s) with pygmy rabbit conservation measures (also see Action 6).

Provide public land managers and other neighboring landowners and managers information regarding compatibility of near- and long-term management considerations for Columbia Basin pygmy rabbit recovery efforts.

5.6 – As feasible through conservation agreements (see Action 6), incentives, conservation easements, and/or willing acquisition or exchange, increase the size of recovery emphasis areas or otherwise develop and implement habitat protection measures at key occupied sites and/or identified dispersal corridors beyond established recovery emphasis area boundaries.

While intervening properties may not be actively managed to conserve the Columbia Basin pygmy rabbit, they may nevertheless contribute to recovery efforts (see Recovery Strategy). Early identification of future needs and available options for managing additional habitat for reestablished Columbia Basin pygmy rabbit subpopulations will be important for achieving the identified recovery objectives. The successful implementation of conservation agreements and proactive management measures may play an important role in providing sufficient habitats for recovery, and will increase public awareness and support for the Columbia Basin pygmy rabbit recovery program.

Action 6: Pursue conservation agreements for the Columbia Basin pygmy rabbit with landowners and managers of intervening properties within the population's historical distribution.

6.1 – Develop Site Plans under the existing SHA and issue associated Permits to non-Federal and non-WDFW landowners and managers of eligible properties (see Stakeholder Involvement).

6.1.1 – Contact landowners and managers generally within 8 kilometers (5 miles) of recovery emphasis areas to provide information on recovery efforts for the Columbia Basin pygmy rabbit and to address future management options for reintroduced animals that may disperse onto their properties.

Landowners and managers in the vicinity of identified recovery emphasis areas will be contacted and notified of any future releases of Columbia Basin pygmy rabbits, and invited to take part in the SHA.

6.1.2 – Determine baseline (see Glossary) conditions and monitoring protocols, as necessary, for properties of any landowners or managers interested in participating in the SHA.

Baseline conditions will be established through surveys carried out by qualified personnel and at the discretion of the interested landowner or manager.

6.2 – Develop and provide guidelines and technical assistance to interested landowners and managers to address management practices that could potentially affect free-ranging Columbia Basin pygmy rabbits (*e.g.*, grazing regimes, recreational activities, restoration projects).

6.3 – Assist interested non-Federal and non-WDFW landowners and managers with development of new HCPs, or otherwise assist with participation in existing HCPs, with regard to management practices that may result in the incidental take of free-ranging Columbia Basin pygmy rabbits.

6.3.1 – Develop measures to minimize and mitigate incidental take of Columbia Basin pygmy rabbits to the maximum extent practicable.

Appropriate management guidelines will be developed and incorporated into a multi-species HCP that is currently being developed by the Foster Creek Conservation District. If finalized, incorporation of these guidelines will ensure that impacts to the Columbia Basin pygmy rabbit resulting from otherwise lawful activities conducted on private agricultural lands in Douglas County are mitigated to the maximum extent practicable. These guidelines will also assist with management considerations for Columbia Basin pygmy rabbits that may occur on private, agricultural lands throughout the population's historical distribution.

6.3.2 – Assist landowners and managers interested in participating in new or existing HCPs.

6.4 – Continue to coordinate recovery efforts with various Federal agencies (*e.g.*, BLM, Service, USBR, DOE) pursuant to section 7 of the ESA and, as opportunities arise, implement measures to address Federal conservation initiatives for the Columbia Basin pygmy rabbit.

6.5 – Continue to identify and secure funding sources to assist interested landowners and managers with development of conservation agreements, implementation of recovery actions, and/or to otherwise provide incentives for participating in conservation efforts for the Columbia Basin pygmy rabbit (also see Action 8).

Action 7: Exchange information with stakeholders and the general public to address concerns and increase support for Columbia Basin pygmy rabbit recovery efforts.

7.1 – Continue to identify stakeholders and address issues of concern.

By identifying all potential stakeholders, specific outreach efforts can be focused to better communicate significant resource issues concerning the Columbia Basin pygmy rabbit and to respond to stakeholder concerns.

7.1.1 – Review history of comments at meetings, letters to the editor, and news stories to identify primary issues of concern to the general public regarding Columbia Basin pygmy rabbit recovery.

7.1.2 – Continue to develop and maintain lists of interested parties through public

meeting sign-in sheets and submitted comments. Use these lists to develop notices for future meetings and/or targeted information mailings.

7.2 – Meet or otherwise contact stakeholders and other concerned parties to communicate recovery information and to solicit input.

Solicit input from stakeholders, other interested parties, and the general public through public meetings, targeted mailings, and other means. Conduct field trips for landowners and managers of intervening properties within the vicinity of recovery emphasis areas to discuss recovery planning for the Columbia Basin pygmy rabbit.

7.2.1 – Initiate and respond to communications with stakeholders.

7.2.2 – Organize and participate in additional public informational meetings with various stakeholders (*e.g.*, county commissioners, industry groups, conservation organizations) at appropriate benchmarks, such as public comment periods and implementation of significant recovery actions.

7.2.3 – Develop targeted mailings for key stakeholders to communicate as new information warrants and/or to solicit further input.

7.3 – Engage local media through news releases and invitations to scheduled events to inform the public concerning recovery efforts for the Columbia Basin pygmy rabbit.

Action 8: Secure funding for Columbia Basin pygmy rabbit recovery efforts.

8.1 – Continue cooperative efforts with a diverse group of stakeholders, other interested parties, and the general public in recovery implementation for the Columbia Basin pygmy rabbit, including landowners and managers of existing and potential future recovery emphasis areas and intervening properties.

Both public and private landowners and managers may have interests in recovery of the Columbia Basin pygmy rabbit. Efforts to seek active involvement from both the public and private sectors will be ongoing. Private landowners can obtain funds for conservation of Columbia Basin pygmy rabbits that may be separate from those that support State or Federal conservation efforts.

8.2 – Establish a cooperative framework for matching and cost-sharing Federal and non-Federal funding sources.

Various funding sources exist for conservation measures on private, State, and Federal properties. Cooperative projects will be better positioned to receive funds through successful integration of these sources for Columbia Basin pygmy rabbit recovery efforts.

8.3 – Establish research and management connections between experts in pygmy rabbit biology and the greater shrub steppe ecosystem through publications and presentations addressing pygmy rabbits and their associated habitats.

Pygmy rabbits are only one of a number of species of concern in the broader, semiarid shrub steppe biome. Additional funding opportunities are potentially available for research and management that incorporates multiple species. Through publications and presentations, a wider range of concerned managers and researchers will have a better understanding of the conservation needs of pygmy rabbits which, in turn, will make their inclusion in future management and/or research programs more likely.

Action 9: Revise this Federal Recovery Plan to facilitate implementation of adaptive management measures considered necessary to achieve the phased recovery strategy.

This Recovery Plan for the Columbia Basin pygmy rabbit should be reviewed and updated periodically, as necessary, as research and management activities progress and as we gain further knowledge of the ecology and population biology of this species. The need for requisite data necessary to develop more precise and biologically accurate recovery criteria is recognized as a high priority.

9.1 – Revise Implementation Schedule.

Revised Implementation Schedules will be prepared, as necessary, to reflect the knowledge gained, accomplishments met, potential future constraints encountered (*e.g.*, lack of funding, changing management priorities), and consequent refinements to near-term recovery objectives, criteria, and/or actions as recovery progresses. Annual updates of the Reintroduction and Genetic Management Plan (see Action 2.5) will provide key information to assist with preparation of revised Implementation Schedules. In addition,

monitoring and reporting measures associated with implementation of conservation agreements with various stakeholders (see Action 6) will also be used to help develop revised Implementation Schedules.

To the extent appropriate, all of the recovery actions and subactions addressed above that we currently consider necessary to advance Federal recovery of the Columbia Basin pygmy rabbit are included in a revised Implementation Schedule, below.

V. RECOVERY IMPLEMENTATION

The Implementation Schedule that follows lists the actions and estimated annual costs associated with the current recovery program for the Columbia Basin pygmy rabbit, and will be a guide for meeting the recovery goal, objectives, and criteria outlined in this Recovery Plan. Parties with authority, responsibility, or expressed interest to implement a specific recovery action are identified in the Implementation Schedule. The listing of a party in the Implementation Schedule does not require, nor imply a requirement, that the identified party has agreed to implement the action(s) or to secure funding for implementing the action(s). However, parties that are willing to participate may benefit by being able to demonstrate that their management planning efforts and funding requests will contribute to a recovery action identified in a Federal recovery plan, and are therefore considered necessary for the overall coordinated effort to recover the Columbia Basin pygmy rabbit. Also, section 7(a)(1) of the ESA directs all Federal agencies to utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species.

The following Implementation Schedule lists all of the actions from the Recovery Program. In addition to the cost estimates provided, the Implementation Schedule assigns priorities to the identified actions, lists which of the five listing factors will be addressed by the prescribed actions, estimates the duration of the actions, and identifies likely responsible parties for implementing the actions. Various action statements identified in the Recovery Program represent general recovery activities that do not lend themselves to specific funding estimates, rely on future adaptive management measures to refine them, and/or their costs and associated workloads are incorporated into a higher-order action of the same priority. These actions are identified with an asterisk (*) within the Implementation Schedule and, as appropriate, additional notes regarding the status of these actions are provided.

A. Definition of Action Priorities

Recovery actions in the Implementation Schedule have been prioritized, with each action being assigned a “priority number” based on the following definitions. The Implementation Schedule identifies which of the following priorities applies to each recovery action:

Priority 1: Actions that must be taken to prevent the extinction of the species, or to prevent the species from declining irreversibly;

Priority 2: Actions that must be taken to prevent a significant decline in the species’ abundance

or distribution, or some other significant negative impact short of extinction; and
Priority 3: All other actions necessary to provide for full recovery of the species.

B. Listing, Reclassification, and Delisting Factors

We consider the role of five potential factors affecting a species (see Threats) in order to list, delist, or reclassify the species. The Implementation Schedule identifies which of the following factors will be addressed by each recovery action:

Factor A: The present or threatened destruction, modification, or curtailment of its habitat or range;

Factor B: Overutilization for commercial, recreational, scientific, or educational purposes;

Factor C: Disease or predation;

Factor D: The inadequacy of existing regulatory mechanisms; and

Factor E: Other natural or human-caused factors affecting its continued existence.

C. Action Duration and Responsible Parties

Only Federal agencies are mandated to take part in recovery efforts for the Columbia Basin pygmy rabbit, and the Service has a statutory responsibility to implement this Recovery Plan. However, we anticipate that recovery of the Columbia Basin pygmy rabbit will require the involvement and cooperation of Federal, State, local, and private interests. We provide an estimated duration for each recovery action identified in the Implementation Schedule and identify the primary Federal and State agencies having the authority to implement the identified actions, as well as other stakeholder groups and partnerships who are or may be actively involved in recovery implementation. However, the list of possible stakeholders is not limited to those identified in the Implementation Schedule, and others may participate.

D. Estimated Costs of Recovery Actions

The Implementation Schedule that follows outlines actions and estimated annual costs for recovery of the Columbia Basin pygmy rabbit for the first 5 years of the recovery program (2012 to 2016) and a combined estimate for the following 5 years (2017 to 2021). It is a guide for meeting the recovery goal, objectives, and criteria outlined in this plan. This schedule indicates action numbers, action priorities, listing factors addressed, action descriptions,

duration of actions, the primary responsible parties (either funding or carrying out), estimated costs, and supplementary comments. Parties with authority, responsibility, or expressed interest to implement a specific recovery action are identified in the Implementation Schedule. The listing of a party in the Implementation Schedule does not require the identified party to implement the action(s) or to secure funding for implementing the action(s). Estimates for recovery actions are based on average costs of similar actions implemented to date for a variety of recovery activities (*e.g.*, captive breeding, partially controlled field-breeding, genetics management, reintroduction, monitoring, habitat management, stakeholder involvement).

Estimated overall cost by year:

2012: \$171,000; 2013: \$255,000; 2014: \$221,000; 2015: \$157,000; 2016: \$133,000;
2017–2021: \$142,000

Total estimated cost to implement near-term recovery actions (*i.e.*, from 2012 to 2021):
\$1,079,000.

It may be assumed that continued intensive management would be required for at least the following decade, at roughly half the cost.

E. Implementation Schedule for the Columbia Basin Distinct Population Segment of the Pygmy Rabbit

Action Number	Priority Number	Listing Factor(s)	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Comments	
						Total	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016		FY 2017-2021
1	1	C, E	Manage partially controlled field-breeding for the Columbia Basin pygmy rabbit.	5 years	WDFW, USFWS	180	70	20	20	50	20		Feasibility and need for continuing partially controlled field-breeding will be re-evaluated fall 2016.
1.1	*	*	Identify, establish, and maintain an appropriate number and configuration of large enclosures needed to support field-breeding and reintroduction efforts.	*	*	*	*	*	*	*	*		Subactions are incorporated into the entry for Action 1 above.
1.2	*	*	Maximize the genetic and demographic characteristics of pygmy rabbits used for field-breeding efforts within the large enclosures.	*	*	*	*	*	*	*	*		“ ”
1.3	*	*	Following each breeding season, determine the feasibility and need to maintain any captive-bred, enclosure-bred, and/or wild-caught pygmy rabbits within one or more of the large enclosures to support future reintroduction efforts.	*	*	*	*	*	*	*	*		“ ”

Action Number	Priority Number	Listing Factor(s)	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)							Comments
						Total	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017-2021	
2	1	A, E	Reestablish free-ranging Columbia Basin pygmy rabbit subpopulations within their historical distribution.	10 years	WDFW, USFWS, Landowners and Managers of Recovery Emphasis Areas	*	*	*	*	*	*	*	Cost estimates incorporated by sub-actions.
2.1	1	A, E	Manage recovery emphasis areas.	10 years	WDFW, USFWS, Landowners and Managers of Recovery Emphasis Areas	60	5	10	10	5	5	25	
2.2	1	A, E	Provide supplemental features at release sites (e.g., pre-release pens, artificial burrows) to improve the survival of newly released animals, as necessary.	3 years	WDFW, USFWS, Landowners and Managers of Recovery Emphasis Areas	45	5	10	10	10	10		Funding needs for providing supplemental features will be reevaluated fall 2016.
2.3	1	C, E	Identify appropriate source populations and translocate pygmy rabbits to support reintroduction efforts.	3 years	WDFW, USFWS, Cooperating State Agencies	60	10	25	25				Funding needs for translocation efforts will be reevaluated fall 2014.
2.4	*	*	Identify and release an appropriate number and type of pygmy rabbits needed to support reintroduction and/or augmentation objectives at the highest priority recovery emphasis area(s).	*	*	*	*	*	*	*	*	*	This subaction is incorporated into the entries for subactions 2.1 – 2.3. Also, see actions 1.1, 3.1, and 5.5.

Action Number	Priority Number	Listing Factor(s)	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)							Comments
						Total	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017-2021	
3	1	C, E	Survey for, monitor, and assess free-ranging Columbia Basin pygmy rabbits.	10 years	WDFW, USFWS	*	*	*	*	*	*	*	Cost estimates incorporated by sub-actions.
3.1	1	C, E	Search for any remaining wild subpopulations.	5 years	WDFW	50	25	25					Funding needs for future surveys for remaining wild subpopulations will be re-evaluated in 2014.
3.1.1	*	*	Prioritize and document potential search areas based on likelihood of identifying previously unknown occurrences.	*	*	*	*	*					Subactions are incorporated into the entry for Action 3.1 above.
3.1.2	*	*	Continue to survey public properties within the highest priority area(s).	*	*	*	*	*					“ ”
3.1.3	*	*	Continue to contact landowners and managers within the highest priority area(s) and pursue conservation agreements to undertake surveys and, as appropriate, implement monitoring and management measures for the Columbia Basin pygmy rabbit.	*	*	*	*	*					“ ”
3.2	1	C, E	Monitor free-ranging subpopulations and document their status.	7 years	WDFW	150	20	20	20	20	20	50	

Action Number	Priority Number	Listing Factor(s)	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)							Comments
						Total	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017-2021	
3.2.1	*	*	Monitor the survival and movements of all captive-bred, enclosure-bred, and translocated wild pygmy rabbits released within the recovery emphasis areas.	*	*	*	*	*	*	*	*	*	Subactions are incorporated into the entry for Action 3.2 above.
3.2.2	*	*	Track and manage released pygmy rabbits that may disperse beyond recovery emphasis areas .	*	*	*	*	*	*	*	*	*	“ ”
3.3	1	C, E	Monitor and manage, as feasible, the genetic and epigenetic diversity of free-ranging subpopulations.	10 years	WDFW, USFWS, University of Idaho	120	20	20	15	15	15	35	
3.3.1	*	*	Obtain tissue and/or non-invasive (e.g., fecal pellet) samples of any reestablished and remnant pygmy rabbit subpopulations to assess and monitor their genetic and epigenetic characteristics.	*	*	*	*	*	*	*	*	*	Subactions are incorporated into the entry for Action 3.3 above.
3.3.2	*	*	Implement management measures to adjust genetic and epigenetic characteristics, as appropriate based on overall program objectives.	*	*	*	*	*	*	*	*	*	“ ”
4	1	A, B, C	Protect free-ranging Columbia Basin pygmy rabbits.	10 years	WDFW, USFWS, other Federal Agencies, Conservation Agreement Participants	*	*	*	*	*	*	*	Cost estimates incorporated by subactions. Needs for continuing active protection measures will be reevaluated fall 2016.

Action Number	Priority Number	Listing Factor(s)	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Comments	
						Total	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016		FY 2017-2021
4.1	1	A, B, C	Evaluate and address, as feasible, the potential effects of predators on free-ranging Columbia Basin pygmy rabbits.	5 years	WDFW, USFWS, other Federal Agencies, Conservation Agreement Participants	10	2	2	2	2	2		
4.1.1	*	*	Remove or manage potential predator attractants at occupied sites that could be used as perches, cover, or supplemental food sources (e.g., power poles, old fences, outbuildings, unused equipment, spilled grain, refuse) to reduce the occurrence of local predators, as necessary.	*	*	*	*	*	*	*	*		Subactions are incorporated into the entry for Action 4.1 above.
4.1.2	*	*	Monitor predators at release sites and, as feasible (e.g., contingent on conservation agreement conditions), implement interim predator control measures to minimize loss of newly released animals.	*	*	*	*	*	*	*	*		“ ”
4.2	1	A, C	Monitor for diseases and, as feasible, implement measures to treat and/or reduce the risk of infection and transmission in free-ranging Columbia Basin pygmy rabbits.	5 years	WDFW, USFWS, other Federal Agencies, Conservation Agreement Participants	75	5	40	20	5	5		

Action Number	Priority Number	Listing Factor(s)	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)							Comments
						Total	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017-2021	
4.4	1	A, B, C, D, E	Enforce Federal regulations that protect Columbia Basin pygmy rabbits from unauthorized "take" (e.g., killing, harm, harassment [see Glossary]).	10 years	USFWS	*	*	*	*	*	*	*	TBD
5	1	A, C	Manage habitats at recovery emphasis areas and intervening properties (as feasible) to support stable, self-sustaining subpopulations of free-ranging Columbia Basin pygmy rabbits.	10 years	WDFW, USFWS, other Federal Agencies, Conservation Agreement Participants	*	*	*	*	*	*	*	Cost estimates incorporated by sub-actions.
5.2	1	A, E	Protect habitats at recovery emphasis areas and, as feasible, intervening properties.	10 years	WDFW, USFWS, other Federal Agencies, Conservation Agreement Participants	8		2	2	2	2		Long-term needs to protect habitats will be re-evaluated in 2016.
5.2.2	*	*	Continue to work with local landowners and managers to develop fire management plans and, as appropriate, implement measures to reduce the risk of catastrophic loss of important shrub steppe habitat (e.g., provide firebreaks, monitor and control ignition sources, develop agreements with local fire districts).	*	*	*	*	*	*	*	*	*	Subactions are incorporated into the entry for Action 5.2 above (see below for action 5.2.1).

Action Number	Priority Number	Listing Factor(s)	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Comments	
						Total	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016		FY 2017-2021
2.5	2	A, E	Update the Reintroduction and Genetic Management Plan, as necessary, to account for survey and monitoring results, and development and implementation of adaptive management measures.	2 years	WDFW, USFWS	8			4		4		Funding needs for updating Reintroduction and Genetic Management Plan will be reevaluated fall 2016.
3.4	2	C, E	Continue to develop and refine abundance indices of overall and effective population sizes based on counts of active burrows or other survey and monitoring techniques, as appropriate.	10 years	WDFW, USFWS	4					2	2	Costs incurred 1 year in 5.
4.3	2	*	Identify and minimize the effects of human activities on Columbia Basin pygmy rabbits at recovery emphasis areas and, as feasible (i.e., contingent on conservation agreement conditions), intervening properties.	*	*	*	*	*	*	*	*	*	TBD
4.3.1	*	*	Avoid development of new, or expansion of existing roads and trails, and restore habitats on obsolete roads and trails at occupied sites.	*	*	*	*	*	*	*	*	*	Subactions are incorporated into the entry for Action 4.3 above.

Action Number	Priority Number	Listing Factor(s)	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Comments	
						Total	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016		FY 2017-2021
5.1.3	*	*	Develop and continue to refine criteria for evaluating and establishing appropriate management and habitat conditions for pygmy rabbit dispersal corridors.	*	*	*	*	*	*	*	*		“ ”
5.1.4	*	*	Develop and refine habitat models (e.g., Habitat Suitability Index) for Columbia Basin pygmy rabbits at both local and landscape scales.	*	*	*	*	*	*	*	*		“ ”
5.1.5	*	*	Through coordination with the SAG and other stakeholder parties, solicit expertise (e.g., biological, ecological, management) to identify and prioritize appropriate research objectives and methodologies that will inform continuing development and refinement of habitat and population estimators and modeling exercises.	*	*	*	*	*	*	*	*		“ ”
5.2.1	2	A, E	Monitor changes in habitats through remote sensing, ground surveys, and mapping.	2 years	WDFW, USFWS	30					15	15	Costs incurred 1 year in 5.
5.3	2	A, E	Continue to investigate and, as feasible, implement enhancement and restoration measures to improve habitat quantity and quality for Columbia Basin pygmy rabbit subpopulations at recovery emphasis areas.	4 years	WDFW, USFWS, Landowners and Managers of Recovery Emphasis Areas	70		20	30	20			The need to continue investigating and implementing habitat enhancement and restoration measures will be evaluated in 2016.

Action Number	Priority Number	Listing Factor(s)	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Comments	
						Total	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016		FY 2017-2021
5.4	2	A, E	Document methods, treatments, timing, and results of all habitat enhancement, restoration, and protection projects undertaken for free-ranging Columbia Basin pygmy rabbits and maintain those records to facilitate long-term habitat monitoring.	10 years	WDFW, USFWS, other Federal Agencies, Conservation Agreement Participants	10					5	5	Costs incurred 1 year in 5.
5.5	2	A, E	As necessary to achieve near-term recovery objectives, continue to identify, assess, and prioritize potential recovery emphasis areas and, as appropriate, formally establish additional recovery emphasis area(s) and provide recommendations to address habitat management needs at these sites.	2 years	USFWS, WDFW, other Federal Agencies, Prospective Conservation Agreement Participants	40		20	20				The need for identifying and formally establishing potential future recovery emphasis area(s) will be reevaluated in 2016.
5.5.1	*	*	Continue to collect site-specific habitat information at all potential recovery emphasis areas.	*	*	*	*	*	*				Subactions are incorporated into the entry for Action 5.5 above.
5.5.2	*	*	Review management plans for public lands and, as feasible (e.g., contingent on conservation agreement conditions), other intervening properties affecting potential recovery emphasis areas to determine compatibility of the site(s) with pygmy rabbit conservation measures.	*	*	*	*	*	*				“ ”

Action Number	Priority Number	Listing Factor(s)	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Comments	
						Total	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016		FY 2017-2021
6.3	2	A, D, E	Assist interested non-Federal and non-WDFW landowners and managers develop new HCPs, or otherwise assist with participation in existing HCPs, with regard to management practices that may result in incidental take of free-ranging Columbia Basin pygmy rabbits.	10 years	USFWS, WDFW, Foster Creek Conservation District, Prospective HCP Participants	6			2	2	2		
6.3.1	*	*	Develop measures to minimize and mitigate incidental take of Columbia Basin pygmy rabbits to the maximum extent practicable.	*	*	*	*	*	*	*	*		Subactions are incorporated into the entry for Action 6.3 above.
6.3.2	*	*	Assist landowners and managers interested in participating in new or existing HCPs.	*	*	*	*	*	*	*	*		“ ”
6.4	2	A, D, E	Continue to coordinate recovery efforts with various Federal agencies pursuant to section 7 of the ESA and, as opportunities arise, implement measures to address Federal conservation initiatives for the Columbia Basin pygmy rabbit.	10 years	USFWS, other Federal Agencies	35	5	5	5	5	5	10	

Action Number	Priority Number	Listing Factor(s)	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)							Comments
						Total	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017-2021	
5.6	3	*	As feasible through conservation agreements, incentives, conservation easements, and/or willing acquisition or exchange, increase the size of recovery emphasis areas or otherwise develop and implement habitat protection measures at key occupied sites and/or identified dispersal corridors beyond established recovery emphasis area boundaries.	*	*	*	*	*	*	*	*	*	TBD
6.2	3	*	Develop and provide guidelines and technical assistance to interested landowners and managers to address management practices that could potentially affect free-ranging Columbia Basin pygmy rabbits (e.g., grazing regimes, recreational activities, restoration projects).	*	*	*	*	*	*	*	*	*	TBD
Total Costs						1,079	171	255	221	157	133	142	Cost estimates for final 5 years will be re-evaluated 2016.

VI. GLOSSARY

Adaptive Management – Continual process of investigation, planning, implementation, monitoring, and evaluation of recovery actions so that future adjustments can be made to fully achieve recovery objectives.

Baseline – Number of Columbia Basin pygmy rabbits on eligible property at the time it is enrolled under the SHA, or as otherwise determined beforehand through baseline description letters issued by the Service. Baseline is typically expressed as an estimate of population abundance and distribution or amount and type(s) of habitat that sustain the covered species on an enrolled property.

Columbia Basin Pygmy Rabbit – *Brachylagus idahoensis*. Includes any intercross or translocated wild pygmy rabbits, as well as their naturally reproduced progeny, that are considered essential due to demographic, genetic, and/or epigenetic management considerations for recovery planning.

Conservation Measure – Voluntary management commitment of a Participant that is reasonably expected to result in a net conservation benefit to the Columbia Basin pygmy rabbit.

Conservation Agreement – Collective term to refer to any agreement (*e.g.*, Section 6 Cooperative Agreement, Safe Harbor Agreement, Habitat Conservation Plan, Memorandum of Agreement, Memorandum of Understanding) between the Service and another party developed to address conservation of the Columbia Basin pygmy rabbit.

Enrolled Property – Property included under the SHA through completed (*i.e.*, signed) Site Plans of Participants.

Epigenetics – The expression of heritable and nonheritable individual characteristics due to influences of the environment that are not differentially encoded within the genomes of closely related organisms.

ESA – Federal Endangered Species Act of 1973, as amended (16 United States Code 1531 *et. seq.*).

Genetic Rescue – An increase in fitness of a genetically compromised population by the infusion of increased genetic variation from immigrants of a donor population.

Genetic Restoration – Management measures that explicitly address levels of gene flow from donor to recipient populations and the interrelated objectives of eliminating inbreeding depression (genetic rescue), increasing levels of neutral genetic variation, which could

potentially be adaptive or indicative of adaptive variants under future conditions, and avoiding or minimizing the potential effects from outbreeding depression.

HCP – Habitat Conservation Plan developed in accordance with section 10(a)(1)(B) of the ESA.

Incidental Take – Take that is incidental to otherwise lawful activities.

Intercross – Any exchange of genetic material (*e.g.*, through mating, fertilization, or other means) between different species, subspecies, or distinct vertebrate population segments within a taxonomic species.

Intervening Property – Properties outside of recovery emphasis areas that are not actively managed to conserve the Columbia Basin pygmy rabbit, but may nevertheless contribute to recovery efforts.

Introgression – The movement of genetic material (gene flow) from one entity (*e.g.*, taxon, DPS, population) into the gene pool of another by repeated backcrossing.

Net Conservation Benefit – Result of a conservation measure that is reasonably expected to contribute to conservation of the Columbia Basin pygmy rabbit.

Outbreeding Depression – A reduction in fitness that occurs in progeny of matings between genetically divergent individuals.

Participant – Non-Federal landowner or manager of property enrolled under the SHA or other appropriate conservation agreement.

Permit – A Federal Recovery or Enhancement of Survival Permit issued to a Participant pursuant to section 10 of the ESA.

Recovery Emphasis Area – Sites that are actively managed to help conserve the Columbia Basin pygmy rabbit in the wild and where long-term recovery objectives will be attained. Recovery emphasis areas contain habitat characteristics that currently, or potentially through appropriate enhancement measures, would be considered capable of sustaining a viable subpopulation of Columbia Basin pygmy rabbits.

Release Site – Actual site within a recovery emphasis area that is prepared to receive newly released captive-bred, enclosure-bred, and/or translocated pygmy rabbits. Release sites may encompass 20 to 30 hectares (50 to 75 acres) and contain from 25 to 50 artificial burrows, some or all of which may be surrounded by temporary containment fencing.

Regulatory Assurances – Federal regulatory certainty provided to Participants through their Site Plans and the SHA, and reduction of their future management liability for incidental take of Columbia Basin pygmy rabbits on their enrolled properties.

Service – U.S. Fish and Wildlife Service.

SHA – Template Safe Harbor Agreement for the Columbia Basin Pygmy Rabbit developed in accordance with section 10(a)(1)(A) of the ESA. Document finalized October 24, 2006.

Site Plan – Document that formally identifies a Participant’s commitment to implement conservation measures to benefit the Columbia Basin pygmy rabbit, and enrolls the Participant’s property under the SHA.

Survey Habitat – Habitat that may be occupied by Columbia Basin pygmy rabbits. Survey habitat includes: 1) areas that contain greater than or equal to 10 percent sagebrush cover that averages at least 51 centimeters (20 inches) tall by stand type (*i.e.*, relatively continuous, uniform vegetation cover); and 2) thin-soil sites, or other sparsely vegetated areas, that contain habitat patches of at least 37 square meters (400 square feet, or approximately 0.01 acre) that consist of greater than or equal to 20 percent sagebrush cover that averages at least 51 centimeters (20 inches) tall.

Take – To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a species listed as threatened or endangered under the ESA, or attempt to engage in any such conduct.

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APPENDIX. Response To Public and Peer Review Comments

On September 7, 2007, we released the Draft Recovery Plan (Draft) for the Columbia Basin pygmy rabbit for review and comment by Federal agencies, State and local governments, and members of the public, and we announced a 60-day comment period in the Federal Register (72 FR 51461). On June 29, 2011, we released the Amendment to the Draft Recovery Plan (Amendment) for review and comment by Federal agencies, State and local governments, and members of the public, and we announced another 60-day comment period in the Federal Register (76 FR 38203). Over 130 individuals, including elected officials, State and Federal agency personnel, non-governmental organization and industry association contacts, and interested private stakeholders, along with over 20 media outlets were notified of the availability of the Draft and Amendment at the opening of the comment periods.

In accordance with our policy, requests for peer review of the Draft and Amendment were also sent to experts outside of the Service. The following eight peer reviewers provided comments addressing the Draft and/or the Amendment.

Dr. John Litvaitis, Professor, Department of Natural Resources, University of New Hampshire, Durham, New Hampshire (Draft and Amendment)

Dr. Andrew Smith, Parents' Association Professor, School of Life Sciences, Arizona State University, Tempe, Arizona (Draft)

Dr. Todd Katzner, Director, Department of Conservation and Field Research, National Aviary, Allegheny Commons West, Pittsburgh, Pennsylvania (Draft)

Dr. Michael Schroeder, Research Wildlife Biologist, Washington Department of Fish and Wildlife, Bridgeport, Washington (Amendment).

Dr. Lisette Waits, Research Geneticist, Department of Fish and Wildlife Resources University of Idaho, Moscow, Idaho (Amendment)

Dr. Wendy Estes-Zumpf, Research Zoologist, Wyoming Natural Diversity Database, University of Wyoming, Laramie, Wyoming (Amendment)

Dr. Dean Biggins, Fort Collins Science Center, U.S. Geological Survey, Fort Collins, Colorado (Amendment)

Dr. Robin Waples, Senior Scientist, National Marine Fisheries Service, Seattle, Washington (Amendment)

In addition to the comments from the above peer reviewers, we received six comment letters from interested parties addressing the Draft and one addressing the Amendment. Each comment letter we received contained one or more issues, and some letters raised similar issues. Many commenters provided specific advice on wording and clarity or offered suggestions for refining individual recovery tasks. These comments were incorporated, as appropriate, into this final Recovery Plan and are not discussed further here. The following provides our responses to, and additional discussion of the public and peer review comments we received that were not wholly incorporated or fully addressed in the body of this final Recovery Plan. For clarity, comments are paraphrased under appropriate issue headings followed by our responses and, as appropriate, additional discussion.

We carefully considered all of the comments we received in finalizing this Recovery Plan, which was significantly improved as a result, and we thank all of the commenters and peer reviewers for their time and interest in recovery efforts for the Columbia Basin pygmy rabbit.

Disease

Comment: The Amendment did not provide enough information addressing the symptoms, impacts, distribution, and treatment of diseases in captive pygmy rabbits.

Response: More detail addressing the available information has been added to the appropriate sections of this Recovery Plan (see Factor C). Additional information addressing the assessment, symptoms, impacts, distribution, and treatment of diseases in the captive pygmy rabbits may also be found in the original references (WDFW 2010; Harrenstien et al. 2006; Harrenstien et al. 2011).

Comment: Greater effort should be made to identify, assess, and treat diseases, especially plague, in wild pygmy rabbits.

Response: Very little is known about the occurrence, impacts, and possible treatment of diseases in wild pygmy rabbits. Measures to identify, assess, monitor, and, as feasible, treat diseases in wild pygmy rabbits were important considerations during development of the recovery actions prescribed by this Recovery Plan (see Recovery Action 4.2).

Comment: In addition to assessing possible disease transmission among wild subpopulations, the potential for disease transmission from captivity to the wild should be addressed.

Response: All captive pygmy rabbits to be used for reintroduction efforts are examined and must be considered fit by veterinary staff prior to their release, and they must otherwise satisfy the requirements of the most current Reintroduction and Genetic Management Plan (see Near-term Recovery Objective 2). As we learn more about disease in wild pygmy rabbits, adaptive management measures will be developed to address the potential risk(s) of disease to the Columbia Basin population.

Genetics

Comment: The Service places too much emphasis on genetics and possible measures to conserve or adjust genetic characteristics, which could hinder recovery efforts for the population. In addition, there should be a better balance between the various genetic objectives (*e.g.*, demonstrated risks from inbreeding versus possible outbreeding depression). Furthermore, it will not be possible to accomplish all of the objectives simultaneously and tradeoffs between them should be acknowledged. Conversely, the Service places too little importance on conserving the pure Columbia Basin genetic heritage and other recovery actions should be discontinued until all other options (*e.g.*, locating remnant subpopulations) are exhausted. In addition, intercrossing and translocation will further dilute the pure Columbia Basin genetic characteristics, which could lead to litigation and threaten the legal status of this DPS.

Response: Conserving genetic resources is one of our primary objectives in implementation of the ESA (USFWS 1996), and the genetic distinctiveness of the Columbia Basin pygmy rabbit is an important component of the taxon's evolutionary legacy (Moritz 2002; USFWS 2003a). Accordingly, three aims of the intercross breeding strategy are to:

- 1) Conserve the remaining unique genetic characteristics (*e.g.*, mitochondrial haplotypes, nuclear alleles) of the purebred Columbia Basin pygmy rabbits (*i.e.*, minimize genetic drift). Intercross breeding and ongoing reintroduction efforts represent the most practicable approach to conserve these unique genetic resources (see Recovery Strategy).
- 2) Ensure that the Columbia Basin pygmy rabbit population contains enough genetic diversity to remain viable for the foreseeable future (*e.g.*, minimize inbreeding). Increasing and maintaining the genetic diversity of the Columbia Basin pygmy rabbit population through intercrossing with other pygmy rabbit populations has helped ameliorate the negative effects likely due to inbreeding (see Conservation Actions Implemented).

3) Ensure that the unique genetic characteristics of the Columbia Basin pygmy rabbit do not become lost or attenuated through over-representation of genetic material from foreign pygmy rabbit populations (*i.e.*, minimize the potential for outbreeding depression). The unique genetic profile of this DPS, which has evolved in the Columbia Basin ecosystem, may include adaptive advantages for the taxon within this ecological setting (Storfer 1999; Moritz 2002; Manel et al. 2003). To the extent possible, conserving the remaining genetic characteristics from the purebred Columbia Basin pygmy rabbits within the reintroduced population may hold important implications for the recovery of the species in the region (see Recovery Strategy).

We recognize that intercross breeding for the Columbia Basin pygmy rabbit will be a balance between the above aims (see Genetics). Additional discussions addressing the available background information, examples from other species, and reasoning for the genetics strategy that has been undertaken for the Columbia Basin pygmy rabbit may be found in the Draft (USFWS 2007) and the original sources referenced within. The extent to which the more comprehensive objectives of genetic restoration may be achieved will take into account future monitoring and adaptive management efforts, the performance of the reintroduced and, as possible, any existing pygmy rabbit subpopulations and their fully wild progeny, and, ultimately, the success of the reintroduction program.

Even with an emphasis on conserving genetic resources, we also recognize a broad range of objectives for species conservation under the ESA. In addition to its genetic distinctiveness, we recognized the Columbia Basin pygmy rabbit as a DPS due to its occupation of an unusual ecological setting and the significant gap in the range of the taxon that would be created with the loss of this population segment (USFWS 2010). Other possible indicators of distinctiveness (*e.g.*, epigenetics, see following) may also apply to a particular listed entity.

With regard to delaying the identified recovery actions, we have determined that it is highly unlikely that adequate numbers of wild pygmy rabbits remain in the Columbia Basin to effect recovery of a purebred population (see Abundance and Trends), and we have a statutory responsibility to implement recovery actions for the Columbia Basin pygmy rabbit. Furthermore, we must base our actions on the available information, all of which will be considered in any future actions concerning the Federal status of the Columbia Basin pygmy rabbit.

Comment: The discussion of outbreeding depression in the Amendment was confusing and potentially misleading.

Response: The definition of outbreeding depression has been updated and more detail addressing the available information has been added to the appropriate sections of this Recovery Plan (see Factor E and Genetics).

Epigenetics

Comment: The definition of epigenetics used in the Amendment was unfamiliar and another definition was suggested in its place (via Wikipedia: “epigenetics is the study of heritable changes in gene expression or cellular phenotype caused by mechanisms other than changes in the underlying DNA sequence”). In addition, it was unclear in the Amendment what is envisioned regarding references to epigenetic monitoring.

Response: Since Federal listing of the Columbia Basin pygmy rabbit in 2001, the relatively new field of epigenetics has progressed considerably (see Richards 2006; Bird 2007; Goldberg et al. 2007; Chandler 2007; Rando and Verstrepen 2007; Bernstein et al. 2007; Bossdorf et al. 2008; Jablonka and Raz 2009; Choi and Kim 2009; Hansen 2010; Riddihough and Zahn 2010; Chandler 2010; Halfmann and Lindquist 2010; Bossdorf and Zhang 2011; Herrera and Bazaga 2011). This new information indicates that there are numerous pathways by which epigenetic expression may occur (*e.g.*, DNA methylation, chromatin remodeling through histone modification, regulation via small RNA molecules), and various descriptions and definitions of the phenomenon. With regard to recovery of the Columbia Basin pygmy rabbit and this Recovery Plan, epigenetics refers to the expression of heritable and nonheritable individual characteristics due to influences of the environment that are not differentially encoded within the genomes of closely related organisms. This definition is more expansive than the one suggested, with the important distinctions that it is not strictly limited to molecular or cellular inheritance and expression, and it explicitly assumes comparison of more than one group of individuals (*e.g.*, ancestral lines, subpopulations, populations).

Epigenetic systems suggest an efficient mechanism by which populations of species may differentially respond (*i.e.*, adapt) to local environmental conditions. Because epigenetic modifications such as DNA methylation can evolve more rapidly than DNA sequence markers, groups of individuals may rapidly form distinct populations in relation to their epigenetic profiles (in addition to other differentiating characteristics). These rapid changes, which may not be resolvable through current genetic markers, could be an important consideration when identifying recently developed population structure or assessing evolutionary adaptation to specific environments for purposes of conservation. However, as with outbreeding depression, the relative influence of any epigenetic mechanisms would only be apparent through careful

monitoring of source populations used for translocation, reestablished subpopulations, and subsequent generations of pygmy rabbits within the Columbia Basin.

Measures to investigate whether, and the extent to which, the various pygmy rabbits included in the recovery program for the Columbia Basin population may differentiate in their epigenetic profiles were important considerations during development of the recovery actions prescribed in this Recovery Plan. However, neither sampling methodologies nor comprehensive research objectives have yet been developed for epigenetic monitoring of pygmy rabbit populations. A draft study proposal to begin to gather necessary information on gene expression patterns in pygmy rabbits has been developed, but has not yet been finalized and implemented (USFWS 2011c). As this work progresses and available information improves, future revisions of this Recovery Plan and its Implementation Schedule will provide additional clarification of an appropriate epigenetics definition, available monitoring techniques, and general study objectives for the Columbia Basin pygmy rabbit.

Survey and Monitoring

Comment: The plan should clarify why the possible existence of any remnant subpopulations, which could greatly enhance recovery, has not already been resolved. In addition, the plan identifies relatively small funding sums over multiple years for survey efforts to possibly locate existing subpopulations, and seems to imply that these efforts will be conducted ad hoc with other program actions. Rather, the plan should call for concentrated survey effort with sufficient funding for one or two years over key periods. Finally, remnant subpopulations of pygmy rabbits persist in the Columbia Basin, but landowners are unwilling to divulge the information.

Response: While we will continue to enforce our responsibilities under section 9 (Prohibited Acts) of the ESA, it is our policy to engender proactive, cooperative, and flexible conservation efforts with willing partners (USFWS 2006) and to conduct any surveys on private property with the formal consent of the appropriate landowners and managers. Until such agreements can be finalized (see Stakeholder Involvement), these properties may remain unsurveyed, and we must act to conserve the Columbia Basin pygmy rabbit based on the reliability of the available information. In addition, we and our cooperating stakeholders have limited resources and must address a variety of high priority conservation actions for the Columbia Basin pygmy rabbit. To date, most of these efforts have addressed objectives associated with the captive breeding and reintroduction programs, and broad survey effort throughout the population's historic distribution to specifically confirm the presence or absence of any remaining wild subpopulations has not been undertaken. However, we recognize the value of this information,

and the Implementation Schedule in this final Recovery Plan has been updated to reflect a more comprehensive survey effort for any remaining wild subpopulations. As resources, priorities, and opportunities allow, more comprehensive surveys for any remaining wild subpopulations will be conducted.

Comment: The Amendment did not fully address fecal monitoring and the development of a genetic repository that will aid survey and monitoring objectives.

Response: More detail addressing the available information has been added to the appropriate sections of this Recovery Plan (see Survey and Monitoring and Recovery Action 3.3.1).

Comment: Possible problems could become apparent (*e.g.*, disruption of breeding behaviors or care of young) by radio marking all of the released animals, as was proposed in the Amendment. It was suggested that only an appropriate subset of released animals is radio marked until potential risks can be further assessed.

Response: More detail addressing the available information has been added to the appropriate sections of this Recovery Plan (see Recovery Action 3.2.1)

Captive Breeding

Comment: The Amendment did not provide enough detail addressing the captive breeding program, which is crucial to understanding and allowing a rigorous assessment of the proposed actions. In addition, information addressing the captive breeding program should be consolidated into a concise summary section.

Response: More detail addressing the available information has been added to the appropriate sections of this Recovery Plan (see Captive Breeding). Additional information addressing the captive breeding program may also be found in the original references (WDFW 2001a; WDFW 2003; WDFW 2010).

Translocation

Comment: The plan should clarify what criteria are used to identify source populations for translocation and why, and whether there are genetic and legal ramifications that may stem from these choices.

Response: The available information does not indicate that there are any behavioral, physiological, genetic, or other characteristics that may demonstrate an advantage or disadvantage of identifying any one source population over another (see Conservation Actions Implemented). Furthermore, the main objectives of translocation are to include non-domesticated animals in the reintroduction program and to increase the genetic variability of any reestablished subpopulations, and any of the identified source populations would be expected to accomplish these objectives. Finally, the availability of the potential source populations, their status, and their assessed capacity to withstand removal of individuals has been shown to be the most important logistical criteria for identifying the appropriate source populations for translocation (P. Becker, pers. comm. 2011). As the recovery program for the Columbia Basin pygmy rabbit progresses and the available information improves, additional clarification of appropriate criteria for identifying source populations will be provided in future revisions of this Recovery Plan, its Implementation Schedule, and/or WDFW planning measures (see Action 2.4). Additional discussion addressing the potential genetic and legal ramifications from translocation efforts is included above (see comments and responses to Genetics).

Reintroduction

Comment: It is premature to release all captive-bred animals until reintroduction techniques and reliability are improved, and failure of these efforts may impact the genetic integrity and legal status of the Columbia Basin DPS.

Response: We have concluded that little additional conservation benefit may be achieved by continuing the captive breeding program, and that the identified reintroduction efforts will maximize the likelihood of reestablishing a viable population of pygmy rabbits within the Columbia Basin (see Recovery Strategy). Additional discussion regarding the genetic and legal implications for the Columbia Basin pygmy rabbit are provided above (see comments and responses to Genetics).

Comment: Not all pertinent sources of information addressing previous pygmy rabbit reintroductions were referenced in the Amendment, and the plan should further clarify the results of previous investigations (*e.g.*, estimated home range sizes, dispersal behaviors, survival rates).

Response: More detail addressing the available information has been added to the appropriate sections of this Recovery Plan (see Background and Reintroduction). Additional information addressing previous research and pertinent results on reintroductions of pygmy rabbits may also

be found in the original references (Westra 2004; Saylor et al. 2006; Zeoli et al. 2008; WDFW 2011).

Habitat Needs

Comment: Threats to pygmy rabbit habitat (*e.g.*, fragmentation), pygmy rabbit habitat needs, and measures to address potential habitat limitations are underemphasized, and habitat restoration and enhancement actions should occur before efforts to reestablish the population. In addition, patchy habitat distributions for pygmy rabbits, potential population limitations due to poor connectivity (*e.g.*, dispersal, gene flow), and necessary habitat configuration(s) to affect recovery should be discussed in greater detail.

Response: While it is not yet possible to determine the habitat characteristics necessary to effect full recovery of the Columbia Basin pygmy rabbit, currently we believe that existing habitat conditions are conducive to initiate the identified recovery actions. More detail addressing the available information has been added to the appropriate sections of this Recovery Plan (see Recovery Strategy, Objectives, and Action 5).

Comment: Specific measures should be identified to limit potential impacts due to invasive species.

Response: More detail addressing the available information has been added to the appropriate sections of this Recovery Plan (also see Recovery Action 5.3).

Federal Listing and Delisting

Comment: For any future delisting action for the Columbia Basin pygmy rabbit, the Service should consider the joint policy guidance of the Service and National Marine Fisheries Service regarding the assessment of what may constitute the listed entity's "significant portion of its historic range".

Response: We considered all relevant policies during our listing actions and 5-year review of the Columbia Basin pygmy rabbit, and will again do so for any future 5-year review, reclassification, or delisting actions that are conducted.

Comment: The Recovery Plan should include the designation of critical habitat for the Columbia Basin pygmy rabbit.

Response: We do not designate critical habitat through the recovery planning process for threatened and endangered species. Critical habitat is designated through a separate rule-making process, requiring publication of a proposed and final rule in the Federal Register. Designation of critical habitat for the Columbia Basin pygmy rabbit would be done to the maximum extent prudent and determinable, considering available resources, funding, and our other priorities.

Recovery Action Priorities

Comment: Too many Priority 1 recovery actions are identified, which could make it difficult to prioritize management activity.

Response: Recovery priority numbers are assigned based on their importance for preventing extinction and achieving recovery (see Definition of Action Priorities), rather than to define the order in which actions should be implemented for management purposes. Of the actions currently identified in the Implementation Schedule, many meet the definition of highest priority, while relatively few meet the lowest priority. How these actions may be addressed for management activity will depend on a number of factors (*e.g.*, available resources, completion of ongoing actions, willing parties). As recovery of the Columbia Basin pygmy rabbit progresses, other appropriate actions of lesser priority may be identified and/or some of the currently identified high priority actions may be removed or considered of lower priority.

Hunting

Comment: The Draft did not clearly indicate whether potentially occupied areas are opened or closed to sport hunting.

Response: More detail addressing the available information has been added to the appropriate sections of this Recovery Plan (see Factor B and Recovery Action 4.3).

Domestication

Comment: The Amendment did not clearly indicate the distinction between habituation, which is typically understood to occur within the lifetime of an individual organism, and domestication, which implies genetic (and other, such as behavioral and physiological) responses in progeny of the founding captive population.

Response: More detail addressing this distinction has been added to the appropriate sections of this Recovery Plan (see Factor E).

General

Comment: The pygmy rabbit species has no value beyond aesthetics and too much money is being spent on recovery efforts for the Columbia Basin population.

Response: We recognize a broad range of objectives for species conservation under the ESA, and we have a statutory responsibility to implement recovery actions for the Columbia Basin pygmy rabbit.