

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



Photo by John Musser; provided courtesy of the Washington Department of Fish and Wildlife.

Draft 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: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Regional Director, U.S. Fish and Wildlife Service

Date: _____

DISCLAIMER

Recovery plans delineate actions that are determined to be necessary to recover federally listed species. Plans are published by the U.S. Fish and Wildlife Service, and are often prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Costs indicated for recovery action implementation and/or time for achievement of recovery objectives are only estimates and are subject to change. Recovery plans do not necessarily represent the views, official positions, or approval of any individuals or agencies involved in plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and completion of recovery tasks.

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<http://endangered.fws.gov/recovery/index.html>

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EXECUTIVE SUMMARY

Current Status: The Columbia Basin distinct population segment of the pygmy rabbit (*Brachylagus idahoensis*) was listed as an endangered species by the U.S. Fish and Wildlife Service under an emergency regulation in 2001 (U.S. Fish and Wildlife Service [USFWS] 2001). The species was confirmed listed as endangered in 2003, without designation of critical habitat (USFWS 2003). The recovery priority number for the Columbia Basin pygmy rabbit is 3, on a scale from 1C (highest) to 18 (lowest). The Washington Department of Fish and Wildlife began a captive breeding program for the Columbia Basin pygmy rabbit in 2001 (Washington Department of Fish and Wildlife [WDFW] 2001a). The Columbia Basin pygmy rabbit was considered to be extirpated from the wild in mid-2004. On March 13, 2007, 20 captive-bred animals were reintroduced to habitats historically occupied by the species in the Columbia Basin of central Washington. These captive-bred animals experienced a high level of predation over the first several weeks following their release, and as of May 15, 2007, five of them remained alive. Just prior to the release effort there were 86 individuals included in a captive breeding program, 3 of which were purebred Columbia Basin animals. At least one wild-born, and likely captive-bred kit (approximately 1-month old) has been documented at the release site. The remaining captive-bred female was also seen displaying nesting behavior. The balance of the captive population and those recently released to the wild consist of intercross progeny from controlled matings between Columbia Basin pygmy rabbits and pygmy rabbits of the same taxonomic classification from a discrete population in Idaho. Intercross breeding has helped facilitate genetic restoration of the Columbia Basin pygmy rabbit and is considered essential for recovery efforts (USFWS 2006a). Currently, proposed measures to recover the Columbia Basin pygmy rabbit in the wild include additional releases of captive-bred progeny with at least 75 percent Columbia Basin ancestry.

Habitat Requirements: 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.), upon which they are highly dependent on for food and shelter throughout the year. The pygmy rabbit is one of only two rabbit species in North America that digs its own burrows and, therefore, is most often found in areas that also include relatively deep, loose soils that allow burrowing.

Historical Distribution: 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 Draft Recovery Plan, is believed to have been disjunct from the remainder of the species' range for at least 10,000 years, as suggested by the fossil record, and possibly as long as 40,000 to 115,000 years, as suggested by population 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 1900s, including Douglas, Grant, Lincoln, Adams, Franklin, and Benton.

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 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. To varying degrees, all of these influences have impacted the Columbia Basin pygmy rabbit and, in combination, have led to the population's endangered status. At the time of the U.S. Fish and Wildlife Service's 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.

Recovery Strategy: Due to a number of information gaps and other uncertainties in the available information, a phased approach for recovery planning has been proposed in this Draft Recovery Plan. The three general phases are: 1) removal or abatement of imminent threats to prevent the extinction of the Columbia Basin pygmy rabbit; 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. The identified recovery strategy relies on effective adaptive management and is meant to be a dynamic process. To facilitate such a strategy, specific near-term (i.e., 2007 to

2016) 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 sufficiently abate threats to free-ranging Columbia Basin pygmy rabbits to ensure a high probability of the population's persistence within their 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 endangered Columbia Basin pygmy rabbit so that it may be reclassified as threatened and ultimately removed from the List of Endangered and Threatened Wildlife and Plants pursuant to the Endangered Species Act.

Recovery Criteria

Downlisting Criteria: We will consider downlisting the Columbia Basin pygmy rabbit if any of the following criteria have been met: (1) subpopulations at two recovery emphasis areas each have a five-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 cooperative agreements and is available for initial reintroduction efforts; (2) a subpopulation at one recovery emphasis area has a five-year average N_e of at least of 250 individuals, and subpopulations at two other recovery emphasis areas each have a five-year average N_e of at least 125 individuals; or (3) a single subpopulation with a five-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 cooperative agreements have been reached to include the newly occupied habitats within the recovery emphasis area(s) involved and/or management measures to protect identified dispersal corridors have been implemented.

Delisting Criteria: 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 captive breeding, genetics management, and reintroduction efforts. However, near term recovery objectives have been identified and appropriate recovery actions developed that would help provide this information, including: (1) ongoing surveys for free-ranging individuals or subpopulations; (2) augmenting the captive population with additional purebred Columbia Basin pygmy rabbits as available; (3) monitoring survival and movement of newly released Columbia Basin pygmy rabbits; (4) addressing existing constraints or management needs within recovery emphasis areas and appropriate intervening properties; and (5) annually updating specific methods and techniques in the Captive Breeding and Genetics Management Plan and Reintroduction Plan.

Recovery Actions:

- Action 1:** Manage the captive breeding program for the Columbia Basin pygmy rabbit.
- Action 2:** Manage the genetic characteristics of the Columbia Basin pygmy rabbit.
- Action 3:** Survey for and monitor free-ranging Columbia Basin pygmy rabbits.
- Action 4:** Reestablish free-ranging Columbia Basin pygmy rabbit subpopulations within their historical distribution.
- Action 5:** Protect free-ranging Columbia Basin pygmy rabbits.
- Action 6:** Manage habitats at recovery emphasis areas to support stable, self-sustaining subpopulations of free-ranging Columbia Basin pygmy rabbits.
- Action 7:** Pursue cooperative agreements for conservation of the Columbia Basin pygmy rabbit with landowners and managers within the population's historical distribution.
- Action 8:** Exchange information with stakeholders and the general public to address concerns and increase support for Columbia Basin pygmy rabbit recovery efforts.
- Action 9:** Secure funding for Columbia Basin pygmy rabbit recovery efforts.
- Action 10:** Revise the 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 of this population because it is likely that only a few Columbia Basin pygmy rabbits currently survive in the wild, there are roughly only 100 individuals in captivity, and future reproduction of the captive animals and success of 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 \$2,403,000. It may be assumed that continued, intensive management would be required for at least the following decade at roughly half the cost.

Recovery Plan Time and Costs (\$1000's)

Table 1

Recovery Action	2007	2008	2009	2010	2011	2012 - 2016	TOTAL
1	172	172	172	81	81	250	928
2	9	9	9	7	14	7	55
3	5	10	15	10	10	25	75
4	77	77	77	47	57	210	545
5	10	10	10				30
6	16	31	36	26	61	140	310
7	60	85	59	34	34	80	352
8	5	5	5	5	5	25	50
9	5	5	5	5	5	25	50
10		2	2	2	2		8
TOTAL	359	206	390	217	269	762	\$2,403

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I. Background

A. BRIEF OVERVIEW AND STATUS SUMMARY

The pygmy rabbit (*Brachylagus idahoensis*) is the smallest rabbit species in North America. Historically, pygmy rabbits were found throughout the semiarid sagebrush steppe biome of the Great Basin and adjacent intermountain regions of the western United States, including portions of Oregon, California, Nevada, Utah, Idaho, Montana, Wyoming, and Washington (Figure 1). Pygmy rabbits in Washington represent the only population that occurs within the Columbia Basin ecosystem, an area that extends from north-central Oregon through central Washington (Quigley *et al.* 1997). This population, referred to as the Columbia Basin pygmy rabbit, has been discrete from the remainder of the species' range for tens of thousands of years, and has been determined to be a distinct population segment under the Endangered Species Act of 1973, as amended (16 United States Code 1531 *et. seq.*) (United States Fish and Wildlife Service [USFWS] 2001). This determination is based on its genetic characteristics, which differ markedly from other population segments; its occurrence in the unique ecological setting of the Columbia Basin; and the significant gap in the current and historic range of the taxon that the loss of this population segment would represent (USFWS 2003a).

Museum specimens and reliable sighting records indicate that the Columbia Basin pygmy rabbit probably occurred in portions of six Washington counties during the first half of the 1900s, including Douglas, Grant, Lincoln, Adams, Franklin, and Benton (Figure 2). This range has gradually diminished over the last century, until the few remaining subpopulations suffered a precipitous decline beginning in the late 1990s. Since 2004, no Columbia Basin pygmy rabbits have been found in the wild. The Washington Department of Fish and Wildlife (WDFW) initiated a captive breeding program for the Columbia Basin pygmy rabbit in 2001 (WDFW 2001a). Just prior to release efforts, there were 86 individuals included in the captive breeding program, 3 of which were purebred Columbia Basin animals. The balance of the captive population consists of intercross progeny from controlled matings between Columbia Basin pygmy rabbits and pygmy rabbits of the same taxonomic classification from a discrete population in Idaho.

The Washington Wildlife Commission classified the pygmy rabbit as a State threatened species in 1990 (Washington Administrative Code (WAC) 232-12-011), and reclassified the species as State endangered in 1993 (WAC 232-12-014).

On November 30, 2001, we, the U.S. Fish and Wildlife Service (Service), published an emergency rule to federally list the Columbia Basin pygmy rabbit as endangered (USFWS 2001). On March 5, 2003, we published a final rule listing the Columbia Basin pygmy rabbit as endangered, without critical habitat (USFWS 2003a). Shortly after final listing, we assembled a multi-party Columbia Basin Pygmy Rabbit Recovery Team (Recovery Team) to assist with development of this Draft Recovery Plan, and to otherwise advise us concerning Federal conservation measures for the Columbia Basin pygmy rabbit (see Acknowledgements, page iii, for Recovery Team membership and expertise).

The recovery priority number for the Columbia Basin pygmy rabbit is 3, on a scale of 1C (highest) to 18 (lowest) (USFWS 1983a and 1983b). This ranking is based on a high degree of threat, high potential for recovery, and classification as a distinct population segment under the Endangered Species Act.

Definitions of key terms referenced within this Draft Recovery Plan are provided in the Glossary.

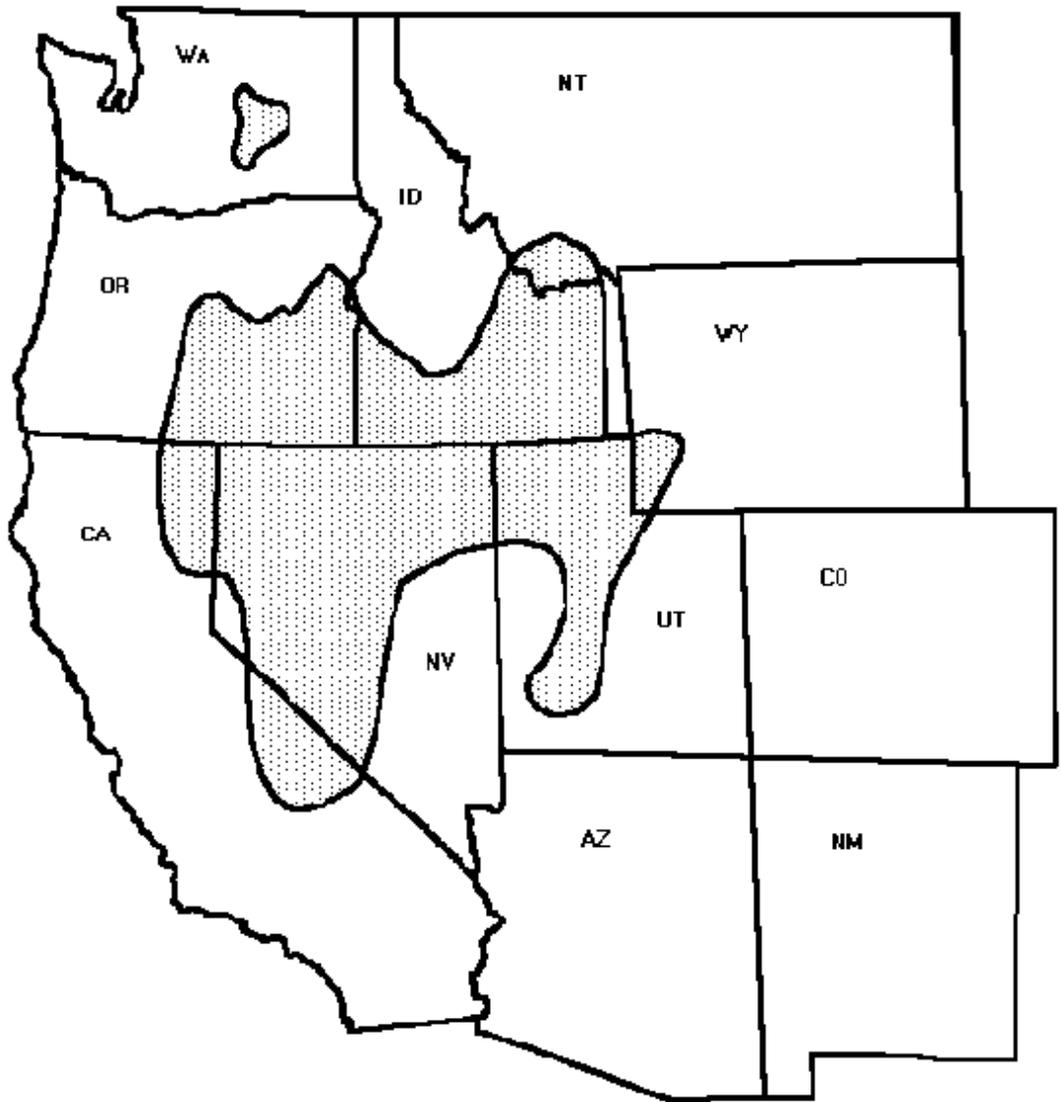


Figure 1. Historic distribution of the pygmy rabbit.

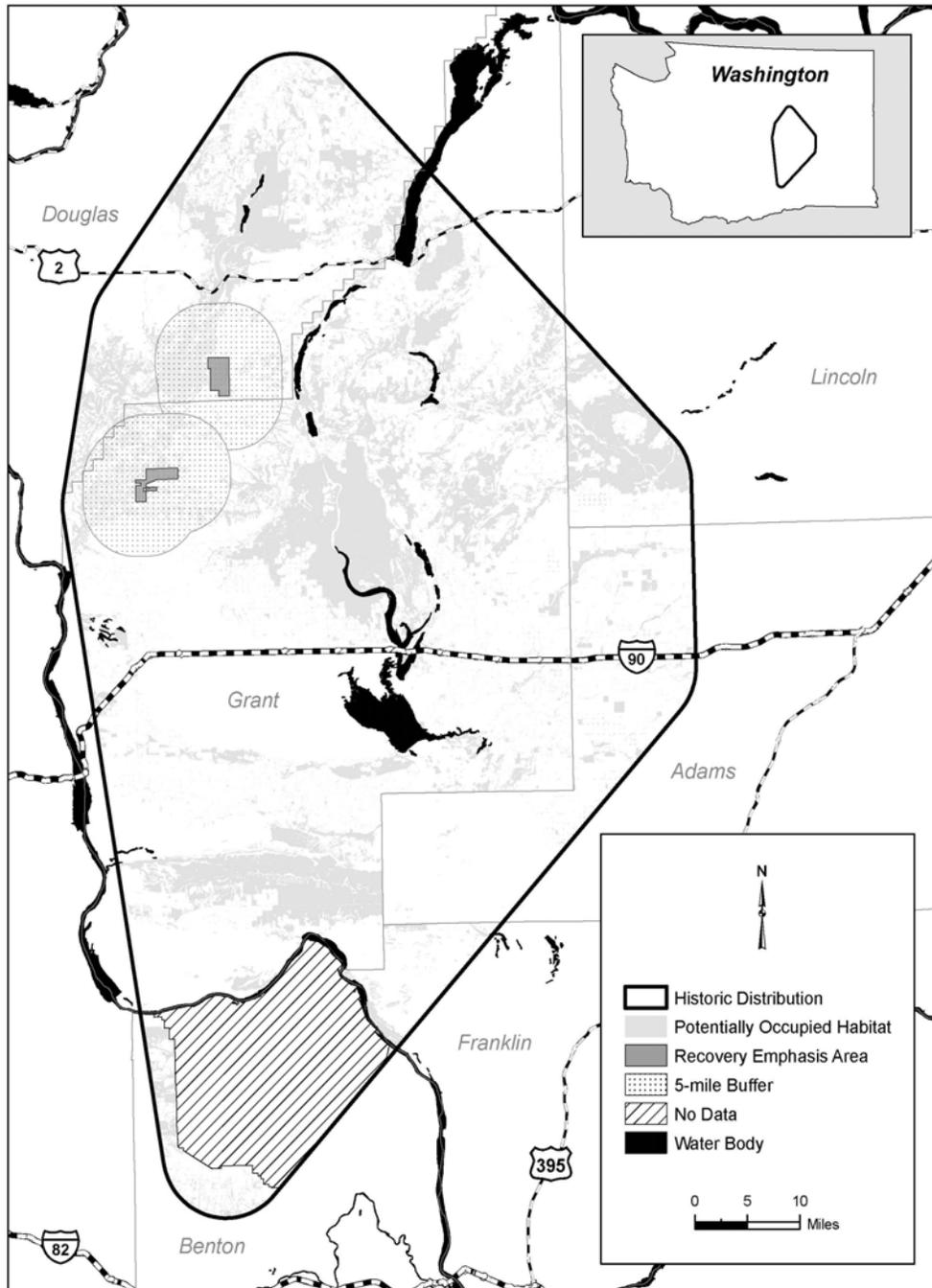


Figure 2. Historic distribution of the Columbia Basin pygmy rabbit, potentially occupied habitat (i.e., appropriate soils and habitat intersect layers), and recovery emphasis areas with 5-mile buffers (see text).

B. STRUCTURE OF THE DRAFT RECOVERY PLAN

There are currently a number of significant information gaps in our knowledge about pygmy rabbits in general and, more specifically, about how the Columbia Basin pygmy rabbit will respond to the ongoing and developing conservation strategies documented in this Draft Recovery Plan. As such, the available information does not currently allow for a long-term recovery plan to be developed or specific criteria to be defined that, when met, could ensure the population's full recovery. Therefore, this Draft Recovery Plan prescribes a phased approach for recovery planning. This phased approach will allow for formulation and implementation of appropriate adaptive management measures as the information base concerning the Columbia Basin pygmy rabbit improves. Recovery of the Columbia Basin pygmy rabbit will require both effective adaptive management to determine optimal means to reestablish free-ranging subpopulations and sustained conservation measures to ensure the population's long-term viability in the wild.

The balance of this section documents the available information on the biology of the species as a whole, provides an overview of the recovery environment as context for this Draft Recovery Plan, and describes the current status of the Columbia Basin population. The remainder of the Draft Recovery Plan is divided into four main sections, as follows:

Recovery Strategy: This section outlines the overall recovery strategy for the Columbia Basin pygmy rabbit.

Recovery Goals, Objectives, and Criteria: This section establishes the general, long-term goal and objective that we anticipate will remain in place throughout the recovery process for the Columbia Basin pygmy rabbit. This section also establishes specific near-term (i.e., 2007 to 2016) recovery objectives. Finally, this section establishes a range of recovery criteria that, when met, could initiate Federal reclassification of the Columbia Basin pygmy rabbit from endangered to threatened status.

Recovery Program: This section defines the detailed, near-term recovery actions that are considered necessary to advance the recovery process for the Columbia Basin pygmy rabbit to the next phase of recovery.

Recovery Implementation: This section documents the planned implementation of near-term recovery actions, including the parties likely responsible for implementing the actions; estimated costs, anticipated timing, and priorities for the actions; and which of the five listing factors will be addressed by the actions. This section also documents the first of what will become a series of near-term Implementation Schedules. We will prepare revised Implementation Schedules, as necessary, to reflect the knowledge gained, accomplishments met, potential future constraints encountered, and consequent refinements to near-term recovery objectives and/or actions as recovery progresses. The Implementation Schedule also provides a means to easily track the progress of the identified recovery actions.

We plan to finalize this Draft Recovery Plan for the Columbia Basin pygmy rabbit following expert peer review, public comment, and incorporation of any necessary changes within 1 year of its publication. The Final Recovery Plan will 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, and specific actions to obtain this information have been identified.

C. SPECIES DESCRIPTION AND LIFE HISTORY

1. 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* (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).

2. Physical Description

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 (cm) (9.3 to 11.6 inches (in)) (Orr 1940; Janson 1946; Wilde 1978; Gahr 1993; WDFW 1995; T. Katzner, Arizona State University, pers. comm. 2002). 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 cm (1.4 to 2.0 in)), rounded, and thickly furred outside. Their tails are small (1.5 to 2.4 cm (0.6 to 0.9 in)), 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.

3. Distribution

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 (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, crop margins, 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). 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), as suggested by the fossil record (Grayson 1987; Lyman 1991; Lyman 2004), and possibly as long as 40,000 to 115,000 years before present, as suggested by population genetic analyses (WDFW 2001a; K. Warheit, WDFW, pers. comm. 2002). The Columbia Basin pygmy rabbit likely had a broader distribution during the mid-Holocene (roughly 7,000 to 3,000 years before present) (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).

Columbia Basin pygmy rabbits were considered rare with local areas of occurrence within the Columbia Basin during the early 1900s (Dalquest 1948), although there is little comprehensive information available regarding their historical distribution and abundance within this region (WDFW 1995). Museum specimens and reliable sighting records indicate that Columbia Basin pygmy rabbits probably occurred in portions of Douglas, Grant, Lincoln, Adams, Franklin, and Benton Counties, Washington, during the first half of the 1900s (Figure 2).

Columbia Basin pygmy rabbits were thought to be extirpated from Washington during the mid-1900s, until a 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-1900s (WDFW 2000).

The number of Columbia Basin pygmy rabbit subpopulations and active burrows in Washington has declined over the past two decades (WDFW 2001a). Four of the 5 subpopulations located in 1987 and 1988 were very small, with fewer than

100 estimated active burrows (WDFW 1995). The largest known subpopulation, located at the Sagebrush Flat site, 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, three of the small subpopulations located in 1987 and 1988 were extirpated during the 1990s, leaving just three known subpopulations in 1999 (WDFW 2001a).

One of the three remaining sites experienced a catastrophic fire in 1999 and declined to three active burrows, while the newly discovered site in Grant County declined for unknown reasons to two active burrows following the winter of 1999-2000. These two subpopulations are now considered to be extirpated (WDFW 2001a). In addition, during the winter of 1997-1998, 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 did not detect any animals in July 2004 (B. Patterson, WDFW, pers. comm. 2006), indicating that the Columbia Basin pygmy rabbit may have been extirpated from the wild.

A captive breeding program for the Columbia Basin pygmy rabbit was initiated by the Washington Department of Fish and Wildlife in 2001 (WDFW 2001a). On March 13, 2007, 20 captive-bred animals were reintroduced to habitats historically occupied by the species in the Columbia Basin of central Washington. These captive-bred animals experienced a high level of predation over the first several weeks following their release, and as of May 15, 2007, five of them remained alive. Just prior to the initial release effort, there were 86 individuals included in the captive breeding program, 3 of which were purebred Columbia Basin animals (USFWS 2007). The balance of the captive population and those recently released to the wild consist of intercross progeny from controlled matings between Columbia Basin pygmy rabbits and pygmy rabbits of the same taxonomic classification from a discrete population in Idaho (see Conservation Measures, p. 26).

4. Habitat and Diet

Pygmy rabbits occur in a variety of semiarid, shrub steppe habitat types that are found throughout their historical distribution. Within these habitat types, pygmy rabbits are typically found in areas that include the tallest (e.g., greater than 91 cm

(36 in)), most dense (e.g., 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, Davila 2004).

The winter diet of pygmy rabbits is comprised of up to 99 percent sagebrush (Wilde 1978), 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 rabbit populations likely change depending on the regions and specific habitat types they occupy (T. Katzner, pers. comm. 2002).

5. **Burrowing Behavior**

The pygmy rabbit is one of only two 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 (e.g., greater than 51 cm (20 in)), loose soils of wind-borne or water-borne origin that allow burrowing (Nelson 1909, Green and Flinders 1980a, WDFW 1995). Pygmy rabbits occasionally make use of natural cavities, holes in volcanic rock, rock piles, artificial structures, or burrows abandoned by other species, such as the yellow-bellied marmot (*Marmota flaviventris*) or badger (*Taxidea taxus*) (Wilde 1978; Green and Flinders 1980a; WDFW 1995). As a result, pygmy rabbits may occur in areas of shallower or more compact 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. During winter, pygmy rabbits make extensive use of snow burrows to access sagebrush forage (Bradfield 1974)

and to provide thermal cover while traveling among their underground burrows (Katzner and Parker 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).

6. **Reproduction**

Pygmy rabbits begin breeding the year following their birth and, in Washington, breeding occurs from February through June (Gahr 1993). Gestation of captive pygmy rabbits is from 22 to 24 days (Elias 2004), and females can produce from one to four litters per year (Green 1978; Wilde 1978; Elias 2004). Kits emerge from their burrows at roughly 2 weeks of age, and average annual litter sizes in captivity ranged from 3.3 to 3.6 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; Fisher 1979).

Recent 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 16.5 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.

7. Home Range and Movements

Pygmy rabbits have relatively small home ranges during winter, remaining within roughly 30 meters (98 feet) of their burrows (Orr 1940; Janson 1946; Gahr 1993; Katzner and Parker 1997), although some snow burrows may extend outward over 100 meters (328 feet) (Bradfield 1974). Pygmy rabbits have larger home ranges during spring and summer (Orr 1940; Janson 1946; Gahr 1993; Katzner and Parker 1997). 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 km (7.5 mi) 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 miles) 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).

8. Mortality

The annual mortality rate 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 (Wilde 1978; 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; Wilde 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).

D. RECOVERY SETTING

1. Geography

Elevations within the historical distribution of the Columbia Basin pygmy rabbit range from 113 meters (370 feet) above sea level at the Columbia River in northern Benton County to over 1,067 meters (3,500 feet) on the Waterville Plateau in Douglas County (Figure 2). The northern portion of this area has been heavily influenced by glacial activity and contains several large and numerous smaller coulees (i.e., ravine networks). Soils are typically thinner here than elsewhere in the area and contain numerous rocky outcrops. The Columbia River and its system of palisades and steep draws bound the western edge of the area. The central portion of the area is dissected by three east-west oriented ridge systems, which are the Beezley Hills to the north, the Frenchman Hills in the central region, and the Saddle Mountains to the south. The area between these ridge systems is generally flat to gently rolling and contains several dune complexes. The eastern portion of the area contains moderately rolling slopes, and several coulees transect the region, draining to the southwest. Finally, in the southern portion, the area is flat to gently rolling along the Columbia River, but rises into the Rattlesnake Hills at its extreme southern extent.

The Columbia Basin ecosystem lies within the rain shadow of the Cascade Range to the west and represents the northern-most extent of the semiarid, shrub steppe biome of the western United States. Precipitation is relatively light, ranging from roughly 18 cm (7 in) in the southwest and lower elevations to over 30 cm (12 in) in the northeast and higher elevations. Approximately 65 percent of the precipitation falls from October through March. Average minimum and maximum daily temperatures are roughly -7° and 2° Celsius (20° and 35° Fahrenheit) in January and 13° and 31° C (55° and 88° F) in July (USFWS 1997).

2. Vegetation

Native vegetation communities within the historical distribution of the Columbia Basin pygmy rabbit include a variety of arid and semiarid shrub steppe habitats, as well as sparsely scattered wetland and riparian habitats. In addition to naturally occurring vegetation, large expanses of irrigated crop fields and considerably more wetland and riparian habitat have been created as a result of the federally-

sponsored Columbia Basin Irrigation Project that draws water from the Columbia River at Grand Coulee Dam (U.S. Bureau of Reclamation (USBR) 1998). Large dryland (i.e., non-irrigated) agricultural fields and smaller fields irrigated by private wells also occur within the population's historical distribution, especially in the northern and eastern portions.

Daubenmire (1988) classified the various native shrub steppe habitat types of the Columbia Basin ecosystem into zonal and edaphic (i.e., soil characteristics) series, as well as other unique types of plant associations including those found on talus slopes, cliffs, and dunes. The zonal habitat types occur on deep loamy soils and represent climatic climax communities. The edaphic habitat types are found within these zonal communities and differentiate at distinct soil type boundaries and/or gradate along geologic and climatic influences. The zonal habitat types and their management are of primary importance with regard to conservation of the Columbia Basin pygmy rabbit.

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. 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 10.16 centimeters (4 inches) in height. Finally, the fourth vegetative layer is made up of a thin, fragile crust, called the cryptogam, 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.

Cheat grass (*Bromus tectorum*), an exotic annual grass from Eurasia, has become very widespread throughout the Columbia Basin ecosystem. In some areas it has replaced the native grass species amid the native shrubs and forbs, and can persist

indefinitely within these habitat types (Cassidy 1997). In other areas, shrubs are completely absent and cheat grass is essentially the only grass species that occurs. Such sites now represent newly formed grassland communities in portions of the population's historical distribution (USFWS 1995). Cheat grass may affect the suitability of habitats used by the Columbia Basin pygmy rabbit (see Threats, p. 18).

Most of the non-irrigated agricultural lands within the population's historical distribution are farmed to produce winter wheat and other small-grain crops, such as barley. A wide variety of crops are grown on the lands receiving irrigation and include wheat, alfalfa, corn, beans, potatoes, mint, apples, and grapes. These agricultural developments and the other broad-scale changes to the vegetation communities within the Columbia Basin have also had significant impacts on the assortment and relative abundance of various upland species. Some of these species are potential predators of the Columbia Basin pygmy rabbit, such as the coyote and common raven, which have done well with the land use changes in the region and their populations have likely increased from historical levels (see Threats, p. 18).

3. Land Ownership and Use

Prior to European settlement and wide-spread development of agricultural fields within the Columbia Basin ecosystem, nearly the entire region consisted of native shrub steppe habitats. Presently, as much as 70 percent of these original native habitats within the population's historical distribution have been converted for various uses, including agricultural, residential, industrial, and urban developments (Dobler 1996). In addition, most of the remaining undeveloped land within the population's historical distribution is subject to a variety of other human influences, including livestock grazing, recreation, altered fire frequencies, and exotic species invasion. Much of the remaining undeveloped land within the population's historical distribution is located on public properties managed by various Federal and State agencies.

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; and the Hanford Site managed by the U.S. Fish and Wildlife Service and U.S. Department of Energy. 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 Washington Department of Fish and Wildlife; and scattered ownership managed by the Washington Department of Natural Resources. 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 the Bureau of Land Management and the Washington Department of Natural Resources, and operating buffer zones for various sensitive Federal facilities, primarily by the U.S. Bureau of Reclamation and the U.S. Department of Energy.

Non-governmental organizations and private land owners currently contributing to Columbia Basin pygmy rabbit recovery efforts (see Conservation Measures, p. 26) include The Nature Conservancy in Douglas and Grant Counties and the Lancaster Family 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 dryland crop production, livestock operations, and urban and rural developments (e.g., housing, commercial / industrial facilities, transportation corridors).

E. THREATS

Threats to the Columbia Basin pygmy rabbit are classified according to the five factors identified in section 4(a)(1) of the Endangered Species Act for consideration in listing, reclassification, and delisting decisions. The available information addressing each of these five factors is summarized below.

Factor A – Present or threatened destruction, modification, or curtailment of habitat or range: Dryland and irrigated crop production has converted and fragmented large portions of the native shrub steppe habitats that were originally present within the Columbia Basin (Daubenmire 1988; Franklin and Dyrness 1988; Dobler 1996; WDFW 1995; USBR 1998). In addition, urban and rural developments permanently remove native shrub steppe habitats. Columbia Basin pygmy rabbits cannot occupy these converted sites and, due to their relatively restricted movements, fragmentation of shrub steppe habitats severely limits the pygmy rabbit's ability to disperse (Green and Flinders 1980b). 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 Draft Recovery Plan.

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 follows:

Sagebrush is easily killed by fire, and when it occurs at increased frequency, fire 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 cheatgrass (*Bromus tectorum*) and knapweed (*Centaurea* spp.), have become well established throughout the Columbia Basin (Daubenmire 1988; Franklin and Dyrness 1988). Areas with dense cover of cheatgrass 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). 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 proposed in this Draft Recovery Plan.

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 blocks, and other factors that may concentrate livestock use. Impacts to pygmy rabbits may include damage to burrow systems and possible direct mortality due to trampling (Rauscher 1997; N. Siegel, Washington State University, pers. comm. 2001; M. Hallet, pers. comm. 2002), 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 2004). It is currently unknown if human-altered densities, distributions, or behaviors of other native or introduced species may 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. Further study to develop appropriate recommendations for livestock grazing that could help avoid or minimize its potential impacts, as well as to monitor for any effects potentially due to management activities for other native or introduced species, were important considerations during development of the recovery actions proposed in this Draft Recovery Plan.

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/or educational management activities, as follows:

Pygmy rabbits are often difficult to distinguish from species of cottontail rabbits (*Sylvilagus* spp.) (Garber 1993; 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. However, due to their typically restricted distribution and preference for dense habitats, combined with relatively few small 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 currently considered to be low (WDFW 1995). 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 proposed in this Draft Recovery Plan.

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). Capture-related mortality rates (including recaptures) reported for pygmy rabbits are roughly 3 percent (Gahr 1993), 5 percent (Wilde 1978), and 13 percent (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 facilities, site security, and husbandry techniques may all affect the level of capture-related mortality incurred.

Currently, the Washington Department of Fish and Wildlife is leading efforts to manage a captive breeding program for the Columbia Basin pygmy rabbit (see Conservation Measures, p. 26). As of December 31, 2006, the estimated annual mortality of all captive pygmy rabbits that may be attributed to the captive breeding program, at least in part, is approximately 4 percent. Since only a few, recently released captive-bred individuals are believed to occur in the wild (see Reintroduction, p. 38), the captive breeding program is still essential to help ensure the long-term survival of the Columbia Basin pygmy rabbit, and the incidental mortality incurred in captivity is considered within acceptable limits with regard to Federal recovery objectives (USFWS 2003b). As we learn more

about this species, captive breeding 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). In addition, some past investigations of pygmy rabbits have entailed 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 (Janson 1946; Bradfield 1974; Green 1978; Wilde 1978; Gahr 1993; Gabler 1997; Rauscher 1997). Human activity in occupied habitats may also attract the attention of predators, livestock, 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. However, due to the projected near-term vulnerability of the population, these sources of potential disturbance and mortality were considered during development of the recovery actions proposed in this Draft Recovery Plan.

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 can not be ruled out as a significant risk factor (D. Biggins, U.S. Geological Survey, pers. comm. 2002).

A number of captive Columbia Basin pygmy rabbits have died as a result of various diseases, especially mycobacteriosis and coccidiosis (WDFW 2005a; Harrenstien *et al.* 2006). 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. Preventive measures that have been taken for mycobacteriosis include regular monitoring of captive

pygmy rabbits to try and detect those that may be subclinically infected, quarantine of infected animals, removal of soil from contaminated pens, careful selection and testing of replacement soils, design changes to holding pens so that soils can be replenished more readily, husbandry and captive breeding of pygmy rabbits in soil-free pens, use of larger holding sites that better mimic density conditions in the wild, dietary changes to improve the overall condition of the captive animals, and development of an appropriate treatment regimen.

Comparisons of immune system function (i.e., lymphocyte stimulation and cytokine assays) among the Columbia Basin and Idaho pygmy rabbits, 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, p. 25) and higher susceptibility to mycobacteriosis has been demonstrated for a number of other endangered species (Harrenstien *et al.* 2006).

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 the coccidia. In addition to the soil treatments discussed above for mycobacteriosis, other preventative measures for coccidiosis include regular monitoring of coccidia levels and the prophylactic treatment of the captive pygmy rabbits, including breeding females, with antibiotics. If elevated coccidia levels are documented in any captive pygmy rabbits, they are further treated with antibiotics. The above measures appear to be effective at decreasing the incidence of coccidiosis in the captive population. Future monitoring for the occurrence and possible control of disease outbreaks in the wild and captive portions of the Columbia Basin pygmy rabbit population were important considerations during development of the recovery actions proposed in this Draft Recovery Plan.

Skeletal abnormalities have been detected in one wild-caught and ten captive-born Columbia Basin pygmy rabbits, as well as one intercross individual (WDFW 2004a). These abnormalities consist of missing or malformed metacarpal and metatarsal bones of the fore and hind feet, respectively. This unusual condition (i.e., brachydactyla) 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 may be persistent within the captive population, or if it may represent any significant concerns for the fitness of affected individuals. A subset of pygmy rabbits remaining alive in the captive breeding program and, as feasible, all dead specimens are 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; Wilde 1978). 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; Wilde 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. Habitat enhancement measures to provide appropriate cover, provision of artificial structures, and/or temporary predator control were important considerations during development of the recovery actions proposed in this Draft Recovery Plan.

Factor D – 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, or to maliciously destroy the nests of pygmy rabbits, 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 the Washington Department of Fish and Wildlife and the Washington Department of Natural Resources. In addition, application of the standards on lands managed by the Washington Department of Natural Resources 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 the U.S. Department of Agriculture. Current 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 (M. Ruud, Farm Service Agency, pers. comm. 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 (US Department of Agriculture [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.

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., irrigated and dryland crops, fruit orchards, vineyards, and livestock ranching) throughout Douglas County, Washington. The plan would include protection measures for a number of important wildlife species, including the Columbia Basin pygmy rabbit, and the management measures it prescribes would complement other, ongoing conservation efforts in central Washington. However, the conservation measures prescribed by the plan have not yet been formally adopted, and would only apply to a portion of the historical distribution of the Columbia Basin pygmy rabbit if finalized.

The establishment, protection, maintenance, and enhancement of recovery emphasis areas for the Columbia Basin pygmy rabbit (see Conservation Measures, p. 26), 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 proposed in this Draft Recovery Plan.

Factor E – Other natural or human-caused 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 and possible extirpation from the wild (USFWS 2003a). 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. These influences represent a significant risk to the population’s potential reestablishment and long-term security in the wild (WDFW 1995). 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.

The captive, purebred Columbia Basin pygmy rabbits have not reproduced well enough to accommodate reintroduction efforts, and only a minimal number of purebred animals have been available for breeding efforts since the program’s first breeding season in 2002. In addition, the captive, purebred portion of the Columbia Basin pygmy rabbit population has experienced a loss of genetic diversity as a result of inbreeding (i.e., loss of genetic heterozygosity) and genetic drift (i.e., loss of alleles) (WDFW 2004a). The successful implementation of a captive breeding program and a comprehensive reintroduction program, both of which include appropriate genetics management planning (see Conservation Measures, p. 26), were important considerations during development of the recovery actions proposed in this Draft Recovery Plan.

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 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. To varying degrees, all of these influences have impacted the Columbia Basin pygmy rabbit and, in combination, have led to the population's endangered status. 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.

F. CONSERVATION MEASURES

As the State agency responsible for managing wildlife species, the Washington Department of Fish and Wildlife has undertaken a variety of conservation measures for pygmy rabbits since 1979. These efforts have included population surveys, habitat inventory, land acquisition, habitat restoration, land management agreements, initial studies on the effects of livestock grazing, and predator control. Despite these efforts, in 2001 they 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. To address this risk, the agency determined that intervention, by way of a captive breeding program and reintroduction efforts, was necessary to prevent the extirpation of pygmy rabbits from the State. They have since contracted with captive breeding facilities at Washington State University, the Oregon Zoo, and Northwest Trek Wildlife Park to assist with captive breeding efforts. Washington Department of Fish and Wildlife also convened a multi-party Science Team comprised of individuals from the captive breeding facilities, the Washington Department of Fish and Wildlife, and the Service to provide technical advice for the pygmy rabbit conservation program. Science Team members provide expertise in a broad range of disciplines, including husbandry, veterinary medicine, genetics, wildlife nutrition, population biology, ecology, and endangered species conservation. As necessary, the Science Team also consults on an *ad hoc* basis with experts from other research institutions.

Following Federal listing of the Columbia Basin pygmy rabbit in 2001, we issued an endangered species recovery permit (TE-050644-3) to the Washington

Department of Fish and Wildlife pursuant to section 10(a)(1)(A) of the Endangered Species Act (USFWS 2003b). The recovery permit exempts incidental take of the Columbia Basin pygmy rabbit, that could occur as a result of the State's captive breeding efforts, which would otherwise be prohibited by section 9 of the Endangered Species Act. The recovery permit includes a requirement for annual reporting of activities conducted under the permit. The Annual reports include, in part, an introduction addressing reasons and objectives for taking the species; a methodology section addressing data collection and analysis procedures; a results section that provides the data collected, including information on any other federally listed species detected while conducting activities pursuant to the permit; and a conclusion section that specifically provides recommendations for recovery of the Columbia Basin pygmy rabbit.

Captive Breeding: During fall 2000, the Washington Department of Fish and Wildlife, in cooperation with the Oregon Zoo, initiated studies of husbandry and captive breeding techniques using seven wild-caught pygmy rabbits (three female, four male) from southeastern Idaho (WDFW 2001a). These studies were undertaken to improve the information base for anticipated captive breeding and reintroduction efforts for the Columbia Basin pygmy rabbit. Due to concerns over limited housing capacity for all of the offspring at the Oregon Zoo, and to further develop pygmy rabbit husbandry expertise, a number of captive Idaho pygmy rabbits were moved to facilities at Washington State University and Northwest Trek Wildlife Park. In 2002, Washington State University also initiated studies to investigate reintroduction techniques using the Idaho pygmy rabbits (see Reintroduction, p. 38). Over three breeding seasons from 2001 through 2003, the 7 wild-caught Idaho pygmy rabbits and their progeny produced roughly 30 litters, totaling approximately 90 offspring (Science Team, 2004).

During spring 2001, the Washington Department of Fish and Wildlife, in cooperation with Washington State University, expedited their captive breeding program for the Columbia Basin pygmy rabbit (WDFW 2001a). The program was expedited due to the sudden extirpation of five of the last six subpopulations and the dramatic decline in the last known subpopulation of Columbia Basin pygmy rabbits during the winter of 2000 to 2001. The immediate goal of the program was to capture up to 20 reproductively active Columbia Basin pygmy rabbits to establish a captive breeding population. The actual number and type (i.e., gender, age) of animals taken from the wild was based partly on information

from the concurrent studies of Idaho pygmy rabbits, partly on preliminary estimates of what was needed to appropriately manage this population's unique genetic profile, and partly on the availability of animals for capture. 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.

Between May 7, 2001, and January 15, 2002, 16 Columbia Basin pygmy rabbits (9 female, 7 male) 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 (two female, three male) 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. In order to reduce the risk of catastrophic loss of the single captive population at Washington State University (e.g., from disease epidemic, predator access, vandalism) and to improve the efficiency of 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. Northwest Trek Wildlife Park was added as a third captive breeding facility for the Columbia Basin pygmy rabbit prior to the 2004 breeding season. These additional facilities provided the needed capacity to house a sufficient number of animals for the captive breeding program, improved the efficiency of captive rearing efforts, and further reduced the risk of losing a large proportion of the captive population at any one facility.

Over 4 breeding seasons from 2002 through 2005, the 18 Columbia Basin pygmy rabbits entering the initial captive breeding season and their progeny have produced roughly 22 purebred litters, totaling approximately 79 offspring. As of December 31, 2006, 92 purebred Columbia Basin pygmy rabbits in the captive breeding program have died from a variety of causes, leaving just 3 purebred animals available for the 2007 breeding season (Table 2).

Various procedures have been implemented at the captive breeding facilities to reduce the risk of mortality to the captive pygmy rabbits, including updated protocols to reduce distress in newly captive animals, design changes to holding and breeding pens, regular replenishment of soils, soil-free rearing, antiseptic washing of water bowls and the use of distilled water, dietary adjustments,

Table 2. Causes of mortality in the Columbia Basin pygmy rabbit captive breeding program by pygmy rabbit cohort, as of December 31, 2006.

Cohort →	Wild-bred	2002 CB	2003 CB	2004 CB	2005* CB	2003 B1+	2004 B1+	2005 B1+	2006 B1+	2004 B2+	2005 B2+	2006 B2+	01-06 Total
Cause of Death ↓	[21]	[19]	[17]	[26]	[12]	[23]	[9]	[24]	[2]	[34]	[90]	[186]	[463]
<u>Disease</u>													
Mycobacteriosis	15	5	3	3	0	4	0	0	0	0	3	4	37
Coccidiosis	0	4	1	0	0	2	1	0	0	3	1	3	15
Other Disease	1	0	1	0	0	0	0	0	0	0	0	0	2
Maternal Neglect	0	0	3	5	5	9	0	0	0	3	10	4	39
Trauma	2	2	1	2	0	3	4	1	0	0	3	2	20
Unknown	3	8	7	14	7	5	3	15	2	21	46	121	252
Total Deaths	21	19	16	24	12	23	8	16	2	27	63	134	365
<i>Remaining Alive</i>	<i>0</i>	<i>0</i>	<i>1</i>	<i>2</i>	<i>0</i>	<i>0</i>	<i>1</i>	<i>8</i>	<i>0</i>	<i>7</i>	<i>27</i>	<i>52</i>	<i>98</i>

CB = Captive-bred Columbia Basin Pygmy Rabbits

B1+ = ≥ 50 percent < 75 percent Columbia Basin Ancestry;

B2+ = ≥ 75 percent Columbia Basin Ancestry.

[n] = Total number in cohort.

* = No purebred progeny were produced in 2006.

research on disease in pygmy rabbits and development of appropriate treatment regimens, and increased scrutiny and outreach to prevent undue disturbance of the captive animals. Prior to 2007, the annual mortality of all captive pygmy rabbits (exclusive of the purebred Idaho animals) that may be at least partially attributed to the captive breeding program (e.g., trauma, escape) is roughly 4 percent (USFWS 2007). This level of incidental mortality is considered within acceptable limits with regard to Federal recovery objectives (USFWS 2003b). As new information becomes available, captive breeding protocols will continue to be refined to further lower the incidental mortality associated with these activities, as feasible.

Since the captive breeding program began, only a minimal number of purebred Columbia Basin pygmy rabbits have been available each breeding season, primarily because the captive animals have not been reproducing as well as expected (Elias 2004; WDFW 2005a). For comparative purposes, 78 percent of all wild-caught Idaho pygmy rabbits contributed to reproduction, versus only 44 percent of all wild-caught Columbia Basin pygmy rabbits (WDFW 2006). In addition, 66 percent of the Idaho pairings resulted in confirmed pregnancies, versus only 20 percent for the Columbia Basin pairings. Behaviorally, Columbia Basin pygmy rabbits also take eight times longer after initial pairing to begin reproductive behaviors, and spend five times longer performing reproductive behaviors once started. Finally, the period of successful breeding was roughly 1.5 months longer for the captive Idaho pygmy rabbits (March to early June) compared to the captive Columbia Basin pygmy rabbits (March to mid-April). As a result, while the size and survival of litters were similar between the two groups, the total number of kits produced relative to the number of females in each captive population was nearly 2.5 times greater for the Idaho females.

There are several lines of evidence from ongoing studies that suggest the Columbia Basin pygmy rabbit is suffering from inbreeding depression, including the poor reproductive performance discussed above, the potential for increased susceptibility to disease compared to Idaho pygmy rabbits and other lagomorph species (WDFW 2005a; Harrenstien *et al.* 2006), the existence of unusual skeletal abnormalities (WDFW 2004a), the documented decline in genetic diversity in the wild, and the continued loss of genetic variability in captivity (see Genetics Management, p. 31). Given the constraints that became apparent during the first

several years of the captive breeding program, reintroduction planning for the Columbia Basin pygmy rabbit was postponed until these constraints could be further investigated and appropriate management measures implemented to address them.

Genetics Management: In 2000, the Washington Department of Fish and Wildlife began population genetic analyses of contemporary pygmy rabbit samples from Washington, Idaho, and Montana, and museum skin samples from Washington, Idaho, and Oregon (WDFW 2001b). Analyses have included both mitochondrial and nuclear DNA markers. Results of the genetic analyses indicate that the Columbia Basin pygmy rabbit is genetically distinct from, and has reduced genetic diversity compared with, the other pygmy rabbit populations. Analyses also indicate that the Columbia Basin pygmy rabbit likely had lower genetic diversity historically compared to the other populations.

Information regarding the genetic characteristics of the Columbia Basin pygmy rabbit within its historical distribution is limited. However, based on comparisons of museum and contemporary samples, the genetic diversity of the Columbia Basin pygmy rabbit in the wild has declined over the past 50 years (WDFW 2001b). In addition, the genetic characteristics of the offspring from the single wild-caught pregnant female demonstrate the probable inbred nature of the last known subpopulation of the Columbia Basin pygmy rabbit. Analyses of these offspring show that their genetic markers were identical, and this single documented genotype in the offspring was nearly identical to that of their mother. This strongly suggests that the wild parents of this litter were closely related. Ongoing genetic analyses of the captive-bred animals, initiated in 2001, indicate that the genetic diversity of purebred Columbia Basin pygmy rabbits has continued to decline in the captive population. As a result, the captive, purebred portion of the Columbia Basin pygmy rabbit population has experienced a loss of genetic diversity as a result of inbreeding and genetic drift (WDFW 2004a).

Due to the poor demographic, behavioral, physiological, and genetic outlook for pure Columbia Basin pygmy rabbit breeding efforts, the Washington Department of Fish and Wildlife undertook initial attempts to intercross Columbia Basin pygmy rabbits with Idaho pygmy rabbits during the 2003 breeding season (WDFW 2003). These initial intercross breeding efforts were proposed on an experimental basis to address several basic issues, including the behavioral and

reproductive compatibility between the two populations and the viability of any resulting intercrossed progeny. 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 initial efforts followed the recommendations of the Science Team, and were closely coordinated with us to ensure consistency with our controlled propagation policy. The policy requires, in part, that captive breeding strategies are only employed when efforts to maintain or improve a listed species' status in the wild have failed, are determined to be likely to fail, are shown to be ineffective in overcoming extant factors limiting recovery, or would be insufficient to achieve full recovery (USFWS 2000). The initial intercross breeding efforts were undertaken to better assess the full range of possible recovery measures that could be pursued for the Columbia Basin pygmy rabbit. Results of these efforts confirmed the potential for genetic restoration of the Columbia Basin pygmy rabbit through careful, controlled efforts to compensate for the lack of genetic variability in the purebred population.

Following further coordination with the Science Team, Service, Recovery Team, and the Washington Department of Fish and Wildlife, the scope of the intercross strategy beginning with the 2004 breeding season was broadened (WDFW 2004a). The 2006 management priorities for the captive breeding program (WDFW 2006) were to: 1) maintain the genetic diversity present within the founding purebred Columbia Basin animals by pairing the most genetically appropriate (e.g., underrepresented, less closely related) animals; 2) produce additional purebred Columbia Basin pygmy rabbits to help ensure the population's continued contribution to the captive breeding program; 3) produce additional 75 percent or greater intercross progeny by pairing purebred Columbia Basin pygmy rabbits and/or later-generation intercross progeny; 4) de-emphasize breeding individuals that are disproportionately related to the founding Idaho pygmy rabbits; and 5) conduct additional experimental breeding efforts to improve the success of the program (e.g., alternate breeding pen configurations, off-soil breeding, artificial insemination). Presently, there are no plans to conduct additional first-generation intercross pairings (i.e., produce additional 50 percent progeny) (WDFW 2006). As of December 31, 2006, the captive breeding program for the Columbia Basin pygmy rabbit consisted of 3 purebred animals and 95 intercross animals, of which 86 have at least 75 percent Columbia Basin ancestry (Table 2).

In general terms, the phenomenon of “genetic rescue” involves an increase in fitness of a genetically compromised population by the infusion of increased genetic variation from immigrants of a donor population. Efforts to affect and/or document genetic rescue have been undertaken for isolated populations of various taxa (Tallmon *et al.* 2004), including the Florida panther (*Puma concolor coryi*) (Hedrick 1995), prairie chicken (*Tympanuchus cupido*) (Westermeier *et al.* 1998), Atlantic salmon (*Salmo salar*) (Waser and Strobeck 1998), adder (*Vipera berus*) (Madsen *et al.* 1999), white campion (*Silene alba*) (Richards 2000a), an Amazonian tree (*Dinizia excelsa*) (Dick 2001), Scandinavian wolf (*Canis lupus*) (Vila *et al.* 2003), and Eurasian otter (*Lutra lutra*) (Arrendal *et al.* 2004). This phenomenon has also been widely documented in a variety of animals and plants under experimental settings and for numerous domesticated animal breeds and plant varieties (Vogt *et al.* 1993; Richards 2000b; Hartwell 2003; Tallmon *et al.* 2004; Northcutt *et al.* 2004; Waite *et al.* 2005; Dalton 2005).

In the classic sense, genetic rescue implies the removal of inbreeding depression from a population (i.e., elimination of the effects from deleterious genetic variants). However, concerns have been expressed regarding this limited interpretation of genetic rescue as a management strategy for imperiled taxa (Hedrick 2005). These concerns have encompassed the potential effects due to outbreeding depression from genetic rescue efforts (i.e., loss or reduction of locally adaptive genetic variants) (Maehr and Lacy 2002; Pimm *et al.* 2006), and the complex nature, management discretion, and potential controversy inherent to many naturally occurring and human-facilitated intercross events (Allendorf *et al.* 2001; Tallmon *et al.* 2004; Cowlshaw *et al.* 2006). Concerns have also been expressed regarding the potential for inappropriate management decisions if genetic factors are not sufficiently identified and addressed during recovery efforts for imperiled species (Frankham 2003). Hedrick (2005) promoted the more comprehensive management strategy of “genetic restoration”, which explicitly addresses 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.

Some of the primary threats to the Columbia Basin pygmy rabbit are likely associated with inbreeding depression, including the population's reduced reproductive success and compromised immune response. Early experimental results indicated that the use of intercross breeding would be beneficial in addressing these conditions. Accordingly, and in close coordination with Washington Department of Fish and Wildlife, the Science Team, and the Recovery Team, we have adopted an intercross breeding strategy as a key component of Federal recovery efforts for the Columbia Basin pygmy rabbit (USFWS 2006a). This approach has been taken because a successful purebred breeding strategy is not possible without a sufficient number of additional wild, reproductively active Columbia Basin pygmy rabbits for the captive breeding program. However, based on the available information, we have determined that it is highly unlikely that adequate numbers of purebred animals remain in the wild.

The ultimate goal of the intercross breeding strategy for the Columbia Basin pygmy rabbit is to affect the population's genetic restoration to help ensure its long-term viability. The three primary aims of the intercross strategy that will assist in the recovery of this critically imperiled population are:

- 1) Conserve all of the remaining unique genetic characteristics of the Columbia Basin pygmy rabbit (i.e., minimize genetic drift). The genetic distinctiveness of the Columbia Basin pygmy rabbit is an important component of the taxon's evolutionary legacy (Moritz 2002; USFWS 2003a), and conserving genetic resources is a primary objective of our implementation of the Endangered Species Act (USFWS 1996). Pairing purebred Columbia Basin pygmy rabbits has been a priority for the captive breeding program since it began in 2001 (WDFW 2005a). However, due to the unavailability of additional purebred animals and the observed symptoms likely due to severe inbreeding depression, intercross breeding currently represents the most practicable approach to ensure that the unique genetic resources still inherent to the Columbia Basin pygmy rabbit are conserved.
- 2) Ensure that the Columbia Basin pygmy rabbit population contains enough genetic diversity to remain viable for the foreseeable future (e.g., minimize inbreeding). Loss of genetic diversity represents a significant threat to small populations due to the increased risks of inbreeding depression (Reed and

Frankham 2003). Increasing the Columbia Basin pygmy rabbit's genetic diversity through intercrossing with Idaho pygmy rabbits could help ameliorate the negative effects potentially due to inbreeding, including the poor reproductive performance, diminished immune response, and skeletal abnormalities that have been documented in the population. The available results of the captive breeding program indicate that this is the case (see below).

- 3) Ensure that the unique genetic characteristics of the Columbia Basin pygmy rabbit do not become attenuated through over-representation of genetic material from foreign pygmy rabbit populations (i.e., minimize the potential for outbreeding depression). The unique genotype of this distinct population segment, 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, maximizing the genetic representation of the Columbia Basin pygmy rabbit within the captive population may hold important implications for the recovery of the species in the region.

The extent to which intercross breeding for the Columbia Basin pygmy rabbit is appropriate will be a balance between the above aims. The available information from the captive breeding program with regard to achieving the above aims follows.

Prior to the 2006 breeding season, the captive breeding program for Columbia Basin pygmy rabbit 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). While there has been an overall loss of genetic diversity from the founding population, this is nonetheless an encouraging result considering the limited reproductive success of the purebred animals, and also demonstrates the expertise and efficiency of personnel managing the captive breeding program. With regard to the available breeding scenarios, the captive breeding program is maximizing aim number 1 above.

Prior to the 2006 breeding season, the pygmy rabbits included in the captive breeding program for the Columbia Basin population (all purebred Columbia Basin animals plus all intercrossed progeny remaining alive) had roughly 42

percent greater gene diversity compared with the founding Columbia Basin animals, and 68 percent greater gene diversity compared to the remaining purebred Columbia Basin animals alone (K. Warheit, pers. comm. 2006). In addition, the expected and observed heterozygosity (based on analysis of microsatellites) of all the captive pygmy rabbits remaining alive in the program prior to the 2006 breeding season (exclusive of the purebred Idaho animals) were 24 percent and 43 percent greater, respectively, than the historical levels (circa 1950) documented for the Columbia Basin population through analyses of museum specimens (K. Warheit, pers. comm. 2006). These results indicate that the captive breeding program has largely achieved aim number 2 above.

Considering the relative contributions of the Columbia Basin and Idaho pygmy rabbits founding the intercross progeny prior to the 2005 breeding season, the Columbia Basin population's input is much greater than that of the Idaho population, and this result is consistent among a number of different founder statistics analyzed (WDFW 2005a). These analyses also demonstrated disproportionate contributions to the intercross progeny among the individual founders. Specific breeding scenarios implemented during the 2005 breeding season were intended to de-emphasize disproportionately represented Idaho founders (aim #3, above), as well as to better balance the relative contributions among the founding Columbia Basin animals (aim number 3, above). Breeding scenarios implemented during the 2006 breeding season further deemphasized the Idaho animals' contributions to the program, and improved the balance among the founding Columbia Basin animals (WDFW 2006). These results indicate that the program has addressed, and made significant progress to achieve, aim number 3 above.

Some encouraging results of the captive breeding program to date indicate that the intercross pygmy rabbits (all ancestry percentages combined) have markedly increased reproductive success compared to the purebred Columbia Basin animals, and possibly even the purebred Idaho animals (WDFW 2005a; R. Sayler, Washington State University, pers. comm. 2006). 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 is succeeding in

reducing or eliminating inbreeding depression in the Columbia Basin pygmy rabbit (i.e., genetic rescue).

With regard to genetic restoration of the Columbia Basin pygmy rabbit, the captive breeding program is at least succeeding in achieving the genetic indicators of increased, potentially adaptive genetic variation and the avoidance or minimization of potential 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 population fitness) of the Columbia Basin pygmy rabbit. The extent to which the more comprehensive objectives of genetic restoration may be achieved will take into account the results of future captive-breeding seasons and the performance of captive-bred pygmy rabbits following their release to the wild.

Proposed measures to recover the Columbia Basin pygmy rabbit in the wild include release of captive-bred progeny with at least 75 percent Columbia Basin ancestry. This desired level of genetic representation is based on the results of the captive breeding program and genetics management investigations to date. Achieving intercross levels greatly exceeding 75 percent appears to be of little added benefit and, given the available breeding scenarios, may be very difficult and time consuming (i.e., require multiple breeding seasons). For example, no purebred Columbia Basin pygmy rabbits have been recruited to the population since the 2004 breeding season (Table 2), even though purebred pairings remained a priority for the program (WDFW 2006). In addition, a large proportion of the purebred Columbia Basin animals entering the 2006 breeding season had clinical signs of disease that may have negatively influenced their breeding success, were over 4 years of age, and/or were already well represented genetically by their intercross progeny (WDFW 2006). Finally, estimates of genetic diversity in the captive population decline dramatically if only the captive purebred animals and those with 87.5 percent Columbia Basin ancestry are considered together, and these estimates are roughly equal to those of the founding purebred animals (Figure 3). However, these estimates increase significantly when the captive animals with 75 percent Columbia Basin ancestry are included, with relatively little further improvements gained by considering the captive animals with less than 75 percent Columbia Basin ancestry.

Several factors may influence future management decisions regarding the specific level of intercrossing considered necessary to ultimately affect genetic restoration of the Columbia Basin pygmy rabbit. These factors include, but are not limited to: 1) additional wild Columbia Basin pygmy rabbits may be located and secured for captive breeding efforts, and/or directly translocated to recovery emphasis areas (see Reintroduction, below); 2) differences in the reproductive success or other population fitness indicators between different intercross generations (i.e., ancestry percentages) in the captive pygmy rabbits may become apparent; and 3) the documented future responses (e.g., survival, reproductive success, habitat use) of free-ranging captive-bred pygmy rabbits and their progeny. Future measures to monitor and adjust intercross levels, as feasible, in both the captive and wild portions of the Columbia Basin pygmy rabbit population were important considerations during development of the recovery actions proposed in this Draft Recovery Plan.

Reintroduction: To test reintroduction techniques for the Columbia Basin pygmy rabbit, 42 captive-bred Idaho pygmy rabbits were used as surrogates and experimentally released into suitable habitats in southeastern Idaho during 4 separate release efforts conducted in August and September 2002, July 2003, and February 2004 (Westra 2004). The Idaho pygmy rabbits were closely monitored following their release, and valuable information was generated for planning Columbia Basin pygmy rabbit reintroduction efforts. Various techniques were investigated during this work, including the use of large pre-release pens to acclimate the release groups and temporary containment fencing, supplemental feeding, and provision of artificial burrows at the release sites. Key results of these studies 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. Successful reproduction in the wild by the captive-bred Idaho pygmy rabbits was also confirmed during the 2003 breeding season.

Ultimately, the goal of the captive breeding program for the Columbia Basin pygmy rabbit is to release captive-bred animals at suitable sites within the population's historical distribution to begin the process of its recovery in the wild. Any such suitable sites, referred to as "recovery emphasis areas", will be evaluated to determine whether the area is considered of sufficient size and habitat quality currently, or potentially through appropriate enhancement measures, to support a viable subpopulation of Columbia Basin pygmy rabbits. Recovery emphasis areas represent

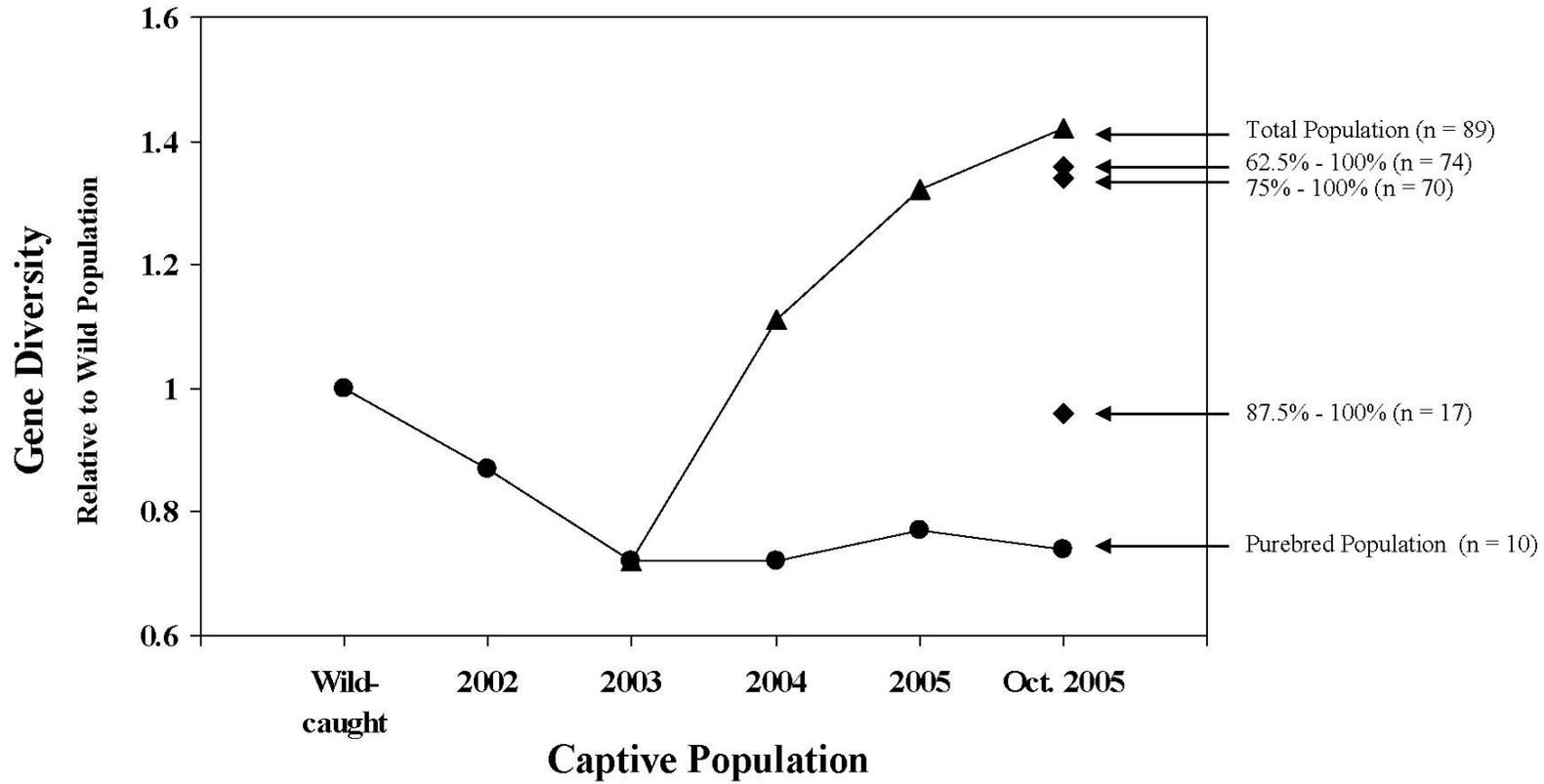


Figure 3. Genetic diversity of the purebred Columbia Basin population (circles) compared to the total captive population (triangles, exclusive of purebred Idaho animals) in the Columbia Basin pygmy rabbit captive breeding program, and genetic diversity of pygmy rabbits with different percentages of Columbia Basin ancestry (diamonds).

sites that will be actively managed to help conserve the Columbia Basin pygmy rabbit in the wild and where long-term recovery objectives (i.e., beyond 10 years) are to be attained (see Recovery Strategy, p. 50).

In 2002, the Washington Department of Fish and Wildlife undertook initial efforts to identify and prioritize possible reintroduction sites throughout the historical distribution of the Columbia Basin pygmy rabbit (Recovery Team 2004). 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 land owner interests. Ten of the candidate sites were further assessed by the Recovery Team through field visits in May, 2004, regarding their potential to help meet long-term recovery objectives for the Columbia Basin pygmy rabbit. Further assessment of the 10 sites considered their existing habitat conditions and land uses, site impacts, management flexibility, necessary protection or enhancement measures, surrounding land uses and ownership patterns, and minimum size estimates. Two of the 10 sites assessed, 1 in the central Moses Coulee area of southern Douglas County and 1 in the Beezley Hills area of northern Grant County, were identified by the Recovery Team as the top priority sites to consider for near-term recovery objectives, including initial reintroduction efforts. These two sites represent the only recovery emphasis areas formally identified to date.

The Washington Department of Fish and Wildlife currently manages the site in southern Douglas county, which totals approximately 1,515 hectares (3,740 acres), to support recovery efforts for the Columbia Basin pygmy rabbit (WDFW 1998 and 2001c). The Nature Conservancy, in cooperation with the Lancaster family, has also acquired or obtained easements on approximately 1,374 ha (3,390 ac) of high quality shrub steppe habitat, which comprise the site in northern Grant County, specifically to support Columbia Basin pygmy rabbit recovery efforts. Other Federal (i.e., Bureau of Land Management) lands and properties managed by The Nature Conservancy within 8 km (5 mi) of the recovery emphasis areas total approximately 2,836 ha (7,000 ac) in the broader Moses Coulee area and approximately 4,862 ha (12,000 ac) 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 Bureau of Land Management and The Nature Conservancy (N. Hedges, BLM, pers. comm. 2006; C. Warner, The Nature Conservancy, pers. comm. 2006). 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 land owners. 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, p. 50).

Researchers at Washington State University, through coordination with us and the Washington Department of Fish and Wildlife, have developed a Reintroduction Plan that identifies specific procedures for release and monitoring of captive-bred Columbia Basin pygmy rabbits (Sayler *et al.* 2007). A draft of the Reintroduction Plan was distributed to the Science Team and Recovery Team for review and the plan was finalized prior to initial release efforts (see below). The Reintroduction Plan was largely based on the investigations of Idaho pygmy rabbits and the results of other ongoing recovery planning efforts for the Columbia Basin pygmy rabbit (e.g., captive breeding, genetics management, evaluation of recovery emphasis areas, population modeling). The Reintroduction Plan generally defines the appropriate makeup for release groups, seasonal timing for initial releases, post-release monitoring actions, and projected timing for subsequent releases, as well as other specific release procedures (e.g., provision of temporary holding pens, artificial burrows, supplemental feeding). The Reintroduction Plan will also be revised annually, as necessary, to accommodate applicable adaptive management measures that have been identified (see Recovery Strategy, p. 50).

An initial release of captive-bred pygmy rabbits took place on March 13, 2007, at the Sagebrush Flat site. The initial release group included 20 animals (8 females, 12 males). Population modeling indicates that the likely success of reintroduction efforts for the Columbia Basin pygmy rabbit is greatly improved by undertaking multiple releases of captive-bred animals over multiple years (Sayler *et al.* 2007). Until a sufficient number of free-ranging animals can be established at one or more of the recovery emphasis areas (see Recovery Strategy, page 34), management emphasis will remain on ensuring that the captive breeding program is secure and can continue to accommodate future reintroduction efforts (WDFW 2007).

Stakeholder Involvement: We developed, with the Washington Department of Fish and Wildlife, a Template Safe Harbor Agreement for the Columbia Basin Pygmy Rabbit (Agreement) (USFWS 2006b). The Agreement provides a process for non-Federal and non-Washington Department of Fish and Wildlife land owners and managers, referred to as Participants, to voluntarily contribute to State and Federal recovery efforts for the Columbia Basin pygmy rabbit without incurring additional regulatory burdens for “incidental take”. In exchange for implementing conservation measures that would be expected to benefit the Columbia Basin pygmy rabbit, Participants are provided with regulatory assurances that they will not be subject to future land-use restrictions or additional management requirements if their voluntary actions result in increased numbers or distribution of Columbia Basin pygmy rabbits on their enrolled property. These assurances allow Participants to develop or make any other lawful use of their enrolled property, even if such activity results in the incidental take of Columbia Basin pygmy rabbits to such an extent that the enrolled property returns to the agreed-upon “baseline” conditions. However, these assurances are contingent on the Participant having maintained the agreed-upon baseline conditions, only engaging in take that is incidental to otherwise lawful activities, and being in full compliance with the Agreement and their associated “Site Plan”. Covered activities may include, but are not limited to, those associated with ranching, farming, recreation, residential upkeep, conservation programs for the covered species, and direct management of shrub steppe habitat, including maintenance, enhancement, restoration, and conversion.

The Agreement clarifies the management responsibilities and expectations of us, the Washington Department of Fish and Wildlife, and prospective Participants, and will serve as the basis for us to issue Federal Enhancement of Survival Permits (Permits) to Participants pursuant to section 10(a)(1)(A) of the Act. To receive a Permit, each prospective Participant would need to complete and submit to us a Federal Fish and Wildlife Permit Application. In addition to submitting a Permit application, each prospective Participant to the Agreement would also need to complete a Site Plan that identifies the specific properties to be enrolled and documents the baseline conditions, existing and, as available, proposed future land-use activities, and agreed-upon conservation measures that would be expected to benefit the Columbia Basin pygmy rabbit on the enrolled properties. Each prospective Participant would need to agree upon and sign the Site Plan

along with us, prior to issuance of the associated Permit. Once issued, Permits would exempt incidental take of Columbia Basin pygmy rabbits, which would otherwise be prohibited by section 9 of the Endangered Species Act, that are above the baseline conditions of the enrolled property.

Conceptually, baseline represents the number of Columbia Basin pygmy rabbits on a given property at the time it is enrolled under the Agreement. However, for most species including pygmy rabbits, it is often difficult or impossible to determine the precise number of individuals in a given occupied area. Therefore, in practice, baseline is typically expressed as “population estimates and distribution” of the covered species or “habitat characteristics and determined area that sustain seasonal or permanent use” by the covered species on enrolled property.

All non-Federal and non-Washington Department of Fish and Wildlife properties within the historical distribution of the Columbia Basin pygmy rabbit that could be voluntarily managed to provide a net conservation benefit to the population are eligible for enrollment under the Agreement, including lands that have been applied for or are currently enrolled under various programs administered by the U.S. Department of Agriculture (e.g., the Conservation Reserve Program). Eligible properties will primarily include those that represent shrub steppe habitat and/or soil conditions that may be capable of supporting the species, either currently or in the foreseeable future. The specific properties being considered for enrollment under the Agreement would be detailed in the Site Plans of prospective Participants. Public lands under the jurisdiction of State agencies other than the Washington Department of Fish and Wildlife may be enrolled under the Agreement.

Non-Federal and non-Washington Department of Fish and Wildlife properties that are eligible for inclusion under the Agreement fall into two main categories. The first category is made up of intervening properties outside of the recovery emphasis areas. While intervening properties are not necessarily actively managed to conserve the Columbia Basin pygmy rabbit, they may nevertheless contribute to recovery efforts (see Recovery Strategy, p. 50). The second category includes those properties that comprise, in whole or in part, the recovery emphasis areas, which will be managed first and foremost to support viable subpopulations of this species. Reflecting this broad approach for recovery

efforts, the process for determining baseline conditions for intervening properties and recovery emphasis areas will vary, as described below.

Determining the number of active burrows present currently represents the most reliable way to estimate pygmy rabbit population abundance and distribution in a given area, and is the most efficient method for documenting the species' overall presence or absence in an area (see Survey and Capture, p. 45). As such, baseline conditions for intervening properties will be established in terms of the number of active Columbia Basin pygmy rabbit burrows present at the time the property is enrolled under the Agreement, or as otherwise determined beforehand through issuance of baseline description letters issued by us.

Key features of recovery emphasis areas are the existing, or potential, habitat conditions they contain that would contribute to supporting long term recovery efforts for the Columbia Basin pygmy rabbit. As such, baseline conditions of eligible properties contributing to recovery emphasis areas will be established in terms of the amount and type(s) of habitat that currently exist on the properties that would contribute to sustaining a viable subpopulation of Columbia Basin pygmy rabbits (see Recovery Strategy, p. 50). Baseline determinations for recovery emphasis areas will require more detailed documentation and/or follow-up field assessments to evaluate existing habitat conditions. Therefore, information needed to establish baseline conditions for these properties will be addressed on a case-by-case basis and documented within each Participant's Site Plan. We will discuss with each prospective Participant the general criteria that will be used for existing habitat documentation or, as necessary, guidance and assistance for conducting follow-up habitat assessments for baseline determinations at recovery emphasis areas. At the discretion of owners and managers of properties contributing to recovery emphasis areas, and with our concurrence and that of the Washington Department of Fish and Wildlife, these baseline conditions may apply whether or not any additional wild Columbia Basin pygmy rabbits are documented during future surveys of these properties.

Measures to pursue and secure cooperative agreements with non-Federal land owners and managers, as well as other stakeholders potentially affected by recovery efforts for the Columbia Basin pygmy rabbit, were important considerations during development of the recovery actions proposed in this Draft Recovery Plan.

Survey and Capture: The Washington Department of Fish and Wildlife has developed 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” 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 can be 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. Evidence searches will also be the primary method used to conduct baseline surveys for intervening properties pursuant to the Agreement (see Stakeholder Involvement, p. 42).

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”, would be 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 would also involve concerted efforts to obtain visual observations of live animals, closely monitoring potentially active burrow systems, collecting pellet samples for genetic testing, and/or revisiting sites on subsequent surveys. Complete area searches are typically applied where relatively few (e.g., less than 10) pygmy rabbits are thought to remain in an area, and/or when there is a need to accurately estimate the number of active burrows that may be present. This survey method was used by Washington Department of Fish and Wildlife at the last known occupied sites, which 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 capture operations that may be conducted pursuant to the Agreement, and for determining

baseline conditions for intervening properties that may harbor Columbia Basin pygmy rabbits.

The final 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 the Washington Department of Fish and Wildlife 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, will be the primary means to monitor the status of any reestablished free-ranging subpopulations over time and their response to future research and/or adaptive management measures. Information that is routinely recorded for each of the three 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 the Washington Department of Fish and Wildlife, and the maintenance and use of these data will be important for the monitoring objectives and other recovery actions recommended in this Draft Recovery Plan.

We along with the Washington Department of Fish and Wildlife, consider it very unlikely that any purebred Columbia Basin pygmy rabbits remain in the wild. However, not all potentially suitable habitats have been surveyed, and it is possible that there are still some free-ranging purebred animals within the population’s historic distribution. Therefore, there are ongoing survey efforts to locate and, as opportunities may arise, capture additional purebred Columbia

Basin pygmy rabbits from the wild so that they can be included in the captive breeding program and/or translocated directly to one or more recovery emphasis areas. All future capture and transportation operations would be conducted pursuant to the Washington Department of Fish and Wildlife's existing recovery permit (USFWS 2003b). Securing additional purebred Columbia Basin animals, and/or confirming their continued existence in the wild, would improve the overall recovery outlook for this population (see Recovery Strategy, p. 50), and were important considerations during development of the recovery actions proposed in this Draft Recovery Plan.

Currently, the number of additional Columbia Basin pygmy rabbits considered appropriate to remove from the wild is 30. This preliminary estimate is based on the original program goal of capturing 20 reproductively active Columbia Basin pygmy rabbits, while only 9 of the 21 wild-bred animals (43 percent) have actually contributed to reproduction (4 of 11 females, 5 of 10 males). Thirty additional wild-caught animals is a minimum estimate for several reasons, including: 1) it is now apparent that the genetic diversity of the Columbia Basin pygmy rabbit in the wild had been declining over the past several decades; 2) the contemporary wild population was likely suffering from inbreeding depression; 3) five of the wild-bred pygmy rabbits in the captive breeding program were siblings, and only the parents of this litter represent founding animals; 4) the captive population has continued to lose genetic diversity; and 5) the reproductive success of the purebred population has declined commensurately. In addition to captive breeding considerations, under certain circumstances it may also be appropriate to translocate wild animals at currently occupied sites directly to one or more recovery emphasis areas. Such instances may include, but are not limited to: 1) too few animals would be left at the site to be considered viable following capture operations; 2) the occupied area is small, surrounded by unsuitable habitat, and immigration from, or emigration to surrounding areas due to natural dispersal would be precluded; and 3) direct translocation may offer a more efficient and effective means to manipulate the demographic make up and/or future intercross levels of the managed subpopulation(s) at recovery emphasis areas. The number of Columbia Basin pygmy rabbits that may be appropriate to remove from the wild and/or translocate between occupied sites will be reassessed as any additional free-ranging purebred animals may be located and secured for the captive breeding program.

Public Outreach: We distributed information packages to a wide range of interested parties following publication of the proposed rule to list the Columbia Basin pygmy rabbit in 2001 (USFWS 2001). The information packages and, as requested, copies of the proposed rule were sent to State and Federal resource agencies, elected officials, the scientific community, industry groups, non-governmental organizations, Native American Tribes, and the general public to request comments or suggestions concerning development of a final listing rule for the Columbia Basin pygmy rabbit. We also held a public meeting to solicit input from interested parties in February, 2002, following publication of the proposed rule. All substantive comments received as a result of these outreach efforts were addressed in the final listing rule for the Columbia Basin pygmy rabbit, published in 2003 (USFWS 2003a). The final listing rule and a Recovery Outline developed by us in November 2004 (USFWS 2004), also specify general conservation measures that we determined to be appropriate to initiate recovery of the Columbia Basin pygmy rabbit. Information packages and, as requested, copies of the final rule and the Recovery Outline were also distributed to interested parties upon their completion.

Since publication of the final listing rule, and through coordination with the Washington Department of Fish and Wildlife 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., Bureau of Land Management, Washington Department of Natural Resources), and concerned citizens. We, the Washington Department of Fish and Wildlife, 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 described in this Draft Recovery Plan.

Predator Control: The Washington Department of Fish and Wildlife implemented a predator control program during the fall-winter periods of 1998 to 1999 and 1999 to 2000 due to confirmed evidence of coyote predation of Columbia Basin pygmy rabbits (WDFW 2000). Numerous coyotes and several long-tailed weasels were removed by shooting or trapping over approximately 52 square kilometers (20 square miles) around and including the last known occupied site at the Sagebrush Flat Wildlife Area. The level of effort to control terrestrial predators varied among years and areas, and the efficacy of this program to protect Columbia Basin pygmy rabbits is unknown. There are also a variety of avian predators that may occur at sites occupied by Columbia Basin pygmy rabbits. In an effort to help control the occurrence of common ravens and other predatory birds, the Washington Department of Fish and Wildlife removed obsolete structures from the last known occupied site that could have been used for perching or nesting by avian predators (WDFW 2003).

To further address the future threat of predation at the recovery emphasis areas, additional measures have been implemented or are being considered, including controlling artificial food sources (e.g., spilled grain, trash, carnivore baits), additional removal of unnecessary structures potentially used as perch sites by avian species (e.g., old fencing), and providing appropriate exclusion fencing (WDFW 2003; C. Warner pers. comm. 2006; R. Sayler pers. comm. 2006). In addition, several measures, such as containment fencing, security and predator monitoring, and provision of artificial burrows, have been taken or are being considered to reduce the risk of predation of captive pygmy rabbits at pre-release sites and at the captive breeding facilities (R. Sayler pers. comm. 2001; L. Shipley, pers. comm. 2001; Westra 2004).

II. Recovery Strategy

We have worked closely with the Washington Department of Fish and Wildlife to address the conservation needs of the Columbia Basin pygmy rabbit since dramatic declines in the population were documented during the late 1990s. One of our main objectives during this period has been to ensure that Federal recovery planning efforts are consistent with and complement existing and developing State conservation measures, as appropriate. We also assembled a multi-party Recovery Team in 2003 (see Acknowledgements, page iii) to assist with development of this Draft Recovery Plan, and to otherwise advise us concerning recovery actions for the Columbia Basin pygmy rabbit. In addition, we have undertaken a number of efforts to involve various stakeholders and other interest groups in recovery planning for the Columbia Basin pygmy rabbit, which has contributed to the development of the following proposed recovery strategy, as well as the recovery objectives, criteria, and actions described below.

Due to a number of information gaps in the available information, including uncertainties regarding how the Columbia Basin population may respond to ongoing and developing conservation measures, the Recovery Team has recommended a phased approach for recovery planning. The three phases reflect our proposed recovery strategy for this population, and include: 1) removal or abatement of imminent threats to the Columbia Basin pygmy rabbit in order to prevent the extinction of the population; 2) reestablishment of an appropriate number and distribution of free-ranging subpopulations to further reduce threats over the near term (10 years); and 3) establishment and protection of a sufficiently resilient, free-ranging population that would be expected to withstand foreseeable long-term threats.

Our recovery strategy for the Columbia Basin pygmy rabbit is meant to be a dynamic process. The phased approach proposed in this Draft Recovery Plan provides for the development and implementation of appropriate adaptive management measures as the information base concerning the Columbia Basin pygmy rabbit improves. Adaptive management is a continual process of investigation, planning, implementation, monitoring, and evaluation of recovery actions so that future adjustments to management practices can be made to fully achieve recovery objectives. The currently identified near-term recovery objectives and criteria are limited by the available information, which is reflected

in the phased approach to recovery. In turn, many of the identified recovery actions address the early stages of adaptive management and are designed primarily toward information gathering and initial assessment needs. In addition, while the three identified recovery phases are logical from a management perspective, they largely represent artificial delineations of a continuous process. As such, the recovery actions developed to address each phase are not necessarily mutually exclusive and may overlap chronologically and/or functionally. The recovery actions are also expected to evolve over time in response to adaptive management.

To facilitate the phased recovery strategy and implementation of adaptive management measures, the current Implementation Schedule (see p. 89) represents the first of what will become a series of near-term implementation plans. We will revise the implementation schedules as appropriate 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.

The original objective of the captive breeding program for the Columbia Basin pygmy rabbit was to achieve necessary population growth by augmenting existing, free-ranging subpopulations with captive-bred animals as soon as possible (WDFW 2001a). At the time, this was determined to be the most efficient, cost-effective strategy. However, this approach is no longer possible due to the sudden extirpation of all known wild subpopulations and the poor reproductive performance of the captive, purebred Columbia Basin pygmy rabbits, which is presumably due mainly to inbreeding depression (see Captive Breeding, p. 27). As a result, the captive, purebred population was ultimately represented by only nine founders, and underwent a loss of genetic diversity (see Genetics Management, p. 31).

It is now considered likely that the last known subpopulation of Columbia Basin pygmy rabbits, which was used to found the captive population, was already experiencing a significant level of inbreeding by the late 1990s, resulting in diminished genetic variability. Securing additional purebred Columbia Basin pygmy rabbits from the wild, if any still exist, remains a high priority for the captive breeding program, as well as for other recovery considerations (see

Conservation Measures, p. 50). However, the available information indicates that substantially increasing the genetic diversity of the captive population through the inclusion of additional purebred animals is very unlikely. Therefore, intercross breeding with Idaho pygmy rabbits of the same taxonomic classification, yet from a different geographic area, was determined to be necessary to facilitate genetic restoration of the Columbia Basin population, and is currently considered essential to meet Federal recovery objectives (USFWS 2006a). Based on results of the captive breeding program and genetics management efforts to date (see Genetics Management, p. 31), proposed measures to recover the Columbia Basin pygmy rabbit in the wild will require release of captive-bred progeny with at least 75 percent Columbia Basin ancestry.

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. Since emergency listing, the captive breeding program, genetics management efforts, habitat acquisition, and identification of appropriate recovery emphasis areas undertaken to date have reduced the immediacy of these threats. Accordingly, objectives established to address the first phase of recovery have largely been accomplished (see below). However, as addressed above, many of the associated actions initiated during the first phase of recovery will be necessary to continue and/or revise in subsequent phases as recovery progresses.

Recovery objectives that have been accomplished to date include:

- Abatement of imminent threats to the Columbia Basin pygmy rabbit population due to inbreeding and small population size through appropriate implementation of captive breeding and genetics management measures.
- Establishment of a captive population of Columbia Basin pygmy rabbits that can ensure maintenance of the population's genetic and demographic status, as appropriate, and which is also considered capable of supporting future reintroduction and augmentation efforts.

- Identification of two recovery emphasis areas capable of supporting reintroduced, free-ranging subpopulations of Columbia Basin pygmy rabbits that would be considered secure over the near-term (10 years).
- Development of a Reintroduction Plan that identifies specific techniques to be undertaken during future release efforts, as well as generally identifying appropriate post-release monitoring measures and future research objectives (Saylor *et al.* 2007).
- Development and implementation of appropriate measures to engage the full range of potential stakeholders and other interested parties in voluntary, proactive conservation efforts for the Columbia Basin pygmy rabbit.

A key objective for the second phase of recovery planning is to release and establish an appropriate number and type (gender, age, ancestry) of captive-bred 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 restoration and initial reintroduction efforts, any free-ranging subpopulations of Columbia Basin pygmy rabbits will face continuing risks from inbreeding and loss of genetic diversity if they remain small and isolated (Lande and Barrowclough 1987). Therefore, it will be important to increase the numbers and distribution of free-ranging Columbia Basin pygmy rabbits as soon as possible to prevent future inbreeding, to retain their increased genetic diversity, and to reduce their vulnerability to stochastic events. As such, two important, near-term considerations for reintroduction efforts 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. Simultaneously, it will be important to maintain a sufficient number and demographic composition of pygmy rabbits in captivity to ensure that the captive breeding program remains secure until appropriate, free-ranging subpopulations can be reestablished.

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 (Soulé 1980; Hunter 1996). 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. Recovery emphasis areas, therefore, 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 supporting a viable subpopulation of Columbia Basin pygmy rabbits over the long-term.

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, p. p. 38) 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 Goals, Objectives, and Criteria, p. 56).

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 (Gahr 1993) suggested even lower densities, 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

lands outside of recovery emphasis areas may contribute to recovery objectives (see below).

Intervening non-Federal and non-Washington Department of Fish and Wildlife 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 Safe Harbor Agreement for the Columbia Basin pygmy rabbit (see Stakeholder Involvement, p. 42). 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. 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 be secured for captive breeding efforts and/or translocated directly 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-Washington Department of Fish and Wildlife properties will be identified and documented as specific properties are enrolled under the Agreement (see Stakeholder Involvement, p. 42). 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). Section 7 requires that Federal agencies, in consultation with us, utilize their authorities to further the purposes of the Endangered Species Act, and carry out programs for the conservation of endangered and threatened species. Section 7 also requires that Federal agencies consult with us to ensure that their proposed actions are not likely to jeopardize the continued existence of any listed species or adversely modify designated critical habitat.

As the near-term (i.e., 2007 to 2016) objectives currently identified for the second phase of recovery are accomplished and met, revised implementation schedules will be developed to identify updated, specific recovery objectives, criteria, and actions considered necessary to advance to the final phase of the overall recovery strategy.

III. Recovery Goals, Objectives, and Criteria

The goal of Federal recovery planning is to recover a listed species to the point that protections under the Endangered Species Act 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. Recovery goals are subdivided into discrete component objectives, which collectively describe the conditions for achieving downlisting or delisting. Recovery objectives are therefore the recovery goal parameters, and the criteria are the values of those parameters. The Endangered Species Act 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, p. 18). Recovery criteria (delisting or downlisting) can be viewed as the targets or values by which progress toward achieving recovery objectives can be 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 Endangered Species Act.

A. GOAL

The ultimate goal of this recovery plan 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, be removed from the Federal List of Endangered and Threatened Wildlife and Plants. In order to achieve this goal, threats to free-ranging Columbia Basin pygmy rabbits will need to be sufficiently abated such that there is a high probability of the population's persistence within their historical distribution over the foreseeable future.

B. OBJECTIVES

1. Near-term (2007 to 2016)

- a. The Reintroduction 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 annually to account for adaptive management measures.
- b. Captive pygmy rabbits available for release to recovery emphasis areas represent at least 75 percent Columbia Basin ancestry, are considered fit for release by veterinary staff, and otherwise satisfy requirements of the most current Captive Breeding and Genetics Management Plan and Reintroduction Plan (e.g., relatedness, age, sex ratios).

- c. Two recovery emphasis areas of at least 1,316 hectares (3,250 acres) each are formally established through completion of one or more appropriate cooperative agreements, and are available for reintroduction and/or augmentation efforts.
- d. Reestablished subpopulations at two recovery emphasis areas each have a 5-year average N_e of at least 125 individuals.
- e. 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).
- f. 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 cooperative agreements.
- g. Appropriate cooperative agreements that lead to proactive, voluntary conservation efforts with land owners, 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 Endangered Species Act.

C. RECOVERY 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 Endangered Species Act are no longer necessary and the species may be delisted. The following discussion summarizes the relationship between the listing factors established by the Endangered Species Act and the recovery actions developed to address the threats to the Columbia Basin pygmy rabbit (see Recovery Program, p. 62).

Listing Factor 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 term and long term considerations for this species, and would be addressed by the recovery actions directed at habitat management efforts.

Listing Factor B: Overutilization for commercial, scientific, or educational purposes: The Columbia Basin pygmy rabbit captive breeding and reintroduction programs are essential to ensuring the long-term survival of this population, although incidental mortality and certain other negative impacts have occurred as a result of activities associated with these efforts. Potential threats to the population due to scientific and educational management activities would be addressed by the recovery actions through implementation of adaptive management measures to refine captive breeding, release, monitoring, and research protocols as we learn more about this species biological requirements.

Listing Factor C: Disease or Predation: A number of Columbia Basin pygmy rabbits have died in captivity as a result of various diseases. Preventative measures to address this threat include, among other things, regular monitoring and quarantine of infected animals, decontaminating holding pen areas when necessary, redesigning holding pens to more closely mimic density conditions in the wild, and prophylactic treatment of captive pygmy rabbits with antibiotics. Predation is thought to be the major cause of mortality among free-ranging pygmy rabbits (Green 1979; Wild 1978), and would be addressed by recovery actions directed at habitat enhancement measures and/or establishing temporary predator control programs.

Listing Factor D: Inadequacy of existing regulatory mechanisms: Although Washington State regulations make it illegal to hunt, possess, maliciously harass or kill, or to maliciously destroy the nests of pygmy rabbits, 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 would be addressed by the recovery actions through the establishment and support of recovery emphasis areas and implementation of a Safe Harbor Agreement that has been established to promote the recovery of the population. In addition, intervening Federal properties outside of recovery emphasis areas will contribute to recovery efforts.

Listing Factor 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 small size and possible extirpation from the wild, since small populations are highly susceptible to random environmental events and demographic and genetic limitations (Shaffer 1981). This threat would be addressed by the recovery actions through successful implementation of the Captive Breeding and Genetics Management Plan and Reintroduction Plan.

1. Reclassification from Endangered to Threatened Status

Because of uncertainties with regard to how recovery of the Columbia Basin pygmy rabbit will progress as recovery actions are implemented, several recovery criteria based on the above threat factors and overall recovery strategy have been identified. In addition, recovery criteria may be met in the near or long term, depending on the overall effectiveness of recovery efforts. We will consider reclassification of the Columbia Basin pygmy rabbit pursuant to the measures prescribed by the Endangered Species Act if any one of the following criteria have been met:

- a. Subpopulations at two 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 cooperative agreements and is available for initial reintroduction efforts.
- b. A subpopulation at one recovery emphasis area has a 5-year average N_e of at least of 250 individuals, and subpopulations at two other recovery emphasis areas each have a five-year average N_e of at least 125 individuals.
- c. 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 cooperative agreements have been reached to include the newly occupied habitats within the recovery emphasis area(s) involved and/or management measures to protect identified dispersal corridors have been implemented.

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 captive breeding, genetics management, and reintroduction efforts.

However, near term recovery objectives have been identified (see Recovery Objectives, p. 57) 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, augmenting the captive population with additional purebred Columbia Basin pygmy rabbits, as available, to maximize their genetic representation within the captive breeding program, monitoring survival and movement of newly released Columbia Basin pygmy rabbits, addressing existing constraints or management needs within recovery emphasis areas and appropriate intervening properties, and annually updating specific methods and techniques in the Captive Breeding and Genetics Management Plan and Reintroduction Plan.

IV. Recovery Program

Based on the best available information and the near-term recovery objectives and criteria established above, we have identified the following recovery actions that are considered necessary to advance Federal recovery of the Columbia Basin pygmy rabbit.

Action 1: Manage the captive breeding program for the Columbia Basin pygmy rabbit.

- 1.1 – Identify and produce an appropriate number and type of pygmy rabbits needed to maintain a viable captive population (also see action 2.1).

The captive breeding facilities currently contributing to recovery efforts include the Oregon Zoo, Washington State University, and Northwest Trek Wildlife Park. WE provide coordination among the facilities along with the Washington Department of Fish and Wildlife. A Captive Breeding and Genetics Management Plan guides the breeding efforts and is updated annually (WDFW 2007). Current estimates indicate a captive population of approximately 70 animals entering the breeding season will maintain its genetic diversity. Further assessment of the captive population will be ongoing and this target number will be refined, as necessary.

- 1.2 – Identify and produce an appropriate number and type of pygmy rabbits needed to support reintroduction and augmentation efforts (also see action 4.3).

The appropriate number and type of captive-bred pygmy rabbits needed for reintroduction and augmentation efforts will be estimated from developing population viability analyses (WDFW 2005b; Saylor *et al.* 2007), studies of captive-bred Idaho pygmy rabbits released in Idaho under experimental conditions, and, ultimately, from monitoring of release efforts in Washington. A Reintroduction Plan has been developed by researchers at Washington State University in cooperation with the Washington Department of Fish and Wildlife (Saylor *et al.* 2007). This plan and the Captive Breeding and Genetics Management Plan help define the appropriate makeup for release groups, seasonal

timing for initial releases, post-release monitoring actions, and projected timing for subsequent releases, as well as other specific release procedures (e.g., provision of temporary holding pens, artificial burrows, supplemental feeding).

1.3 – Identify and maintain appropriate configuration of captive breeding facilities to support actions 1.1 and 1.2.

Captive breeding efforts are currently distributed between three facilities to provide sufficient space and the necessary expertise to support an appropriate captive population, and to reduce the risk of disease transmission or other potential threats at a single facility. Washington State University, as a research facility, will eventually reduce captive breeding efforts over time. As necessary, additional captive breeding facilities will be established to maintain the program until it is no longer needed to ensure recovery.

1.4 – Continue to develop and test new techniques to improve husbandry of captive pygmy rabbits, and implement as appropriate.

This includes a wide variety of investigations, including work to improve the diet, veterinary procedures, and breeding strategies for captive pygmy rabbits. As it often takes a number of years to accumulate large enough sample sizes to determine if one method may have advantages over another, it is expected that continued refinements of husbandry and breeding techniques will be implemented throughout the initial phases of recovery.

1.5 – Improve reproductive success of captive pygmy rabbits.

1.5.1 – Determine whether captive animals can breed in soil-free pens.

The captive breeding facilities are in the preliminary stages of investigating soil-free breeding, and have had small-scale experiments to refine captive breeding of pygmy rabbits in non-soil environments. Off-soil husbandry and breeding could help address disease issues and improve survival and reproductive success of captive pygmy rabbits. Additional investigations will be conducted and, as available, improvements will be implemented over the next several years.

1.5.2 – Determine whether larger breeding pens can: a) allow multiple animals to be successfully held and bred at the same time; and b) increase reproductive performance.

Initial experiments in 2005 and 2006 suggest that two males can be held and bred with one female in a larger pen, but experiments with two females in one large pen were inconclusive. Reproductive performance of captive pygmy rabbits was improved with breeding in larger pens versus smaller pens. However, due to small, initial sample sizes, additional testing will be needed and investigations will continue in future breeding seasons.

1.5.3 – Continue to investigate progesterone monitoring for early pregnancy detection.

Laboratory analyses from 2002 through 2004 showed that progesterone can be detected in pygmy rabbit feces, but progesterone levels vary across the reproductive cycle. Further work to accurately measure a combination of fecal hormones in captive and wild pygmy rabbits may help develop techniques for assessing the reproductive status of free-ranging animals.

1.5.4 – Continue to investigate the use of artificial insemination.

The poor reproductive performance of Columbia Basin pygmy rabbits resulted in several genetically important animals dying without successfully reproducing. The purpose of this research is to develop artificial insemination techniques to help maintain genetic diversity within the captive Columbia Basin pygmy rabbits through direct reproductive intervention. Preliminary investigations in 2004 showed some promise for further developing this technique. As feasible (e.g., considering funding needs, available animals), additional research will be conducted to refine necessary procedures.

1.5.5 – Continue to identify, prioritize, and pursue other reproductive research objectives.

Poor reproduction of purebred Columbia Basin pygmy rabbits in captivity has limited growth of the population and delayed reintroduction efforts. Further work is necessary to examine the cause(s) of the poor reproduction and to develop

adaptive solutions to increase reproductive success of the captive animals. Some of the topics that will be examined include links between reproductive success and nutrition, stress, and social groupings, harvesting and preserving ovaries of genetically important females at death, and further investigations of pygmy rabbit reproductive behaviors.

1.6 – Improve survival of captive pygmy rabbits.

1.6.1 – Develop effective disease prevention and treatment measures for captive pygmy rabbits (also see actions 1.5.1, 2.1.2, and 4.2.2).

Infectious disease (e.g., mycobacteriosis) and intestinal parasitism (e.g., coccidiosis) are two of the major causes of mortality in captive adult and juvenile pygmy rabbits, respectively. Clinical trials over the past several years have led to the development of prevention and treatment methods that have met with some success. Refinement of these methods and continued investigation into additional methods will be necessary to maximize the contributions that genetically valuable adults make to the captive population and to increase the survival of juveniles.

1.6.2 – Continue to investigate mortalities of captive pygmy rabbits and implement available measures to minimize future threats.

In order to manage the health of captive pygmy rabbits, it is necessary to know the causes of morbidity and mortality in the population. This can most effectively be done by routinely screening the health of live pygmy rabbits and by thoroughly investigating all mortalities for which the cause of death is not immediately apparent.

1.7 – Update Captive Breeding and Genetics Management Plan annually (also see action 2).

The Captive Breeding and Genetics Management Plan is a document that identifies the most genetically important individuals and guides priorities for pygmy rabbit pairings each year. Computer software designed for endangered species conservation applications (American Zoological and Aquarium

Association Population Management 2000) is used to help develop the breeding priorities and planned pairings. This software integrates tools for demographic and genetic analysis of pedigrees, and guides users through management decisions for meeting demographic objectives while maintaining genetic diversity in closed populations of rare animals (<http://www.ansci.cornell.edu/cat/completed.html>). Lists of compatible individuals are sent to the captive breeding facilities, which use the lists to manage available pairings throughout the breeding season. As necessary to accommodate important pairings, captive pygmy rabbits may be moved among the facilities. However, movements between facilities are minimized to the extent possible and veterinary screening of any pygmy rabbits involved is undertaken to further reduce the risk of incidental disease transmission.

Action 2: Manage genetic characteristics of the Columbia Basin pygmy rabbit.

2.1 – Optimize genetic diversity of the captive population.

The genetic characteristics of all captive pygmy rabbit offspring are assessed by the Washington Department of Fish and Wildlife following each breeding season (WDFW 2006). Several methods are undertaken to optimize the genetic diversity of the captive Columbia Basin pygmy rabbit population, including: a) attempting to equalize representation among the Columbia Basin founders; b) careful introduction and assessment of non-Columbia Basin pygmy rabbits into the captive breeding program (i.e., intercrossing); and c) refining population genetics modeling, which will facilitate minor changes in breeding scenarios each year to improve the captive population's genetic diversity, and will also lead to better understanding of the long-term implications of captive breeding and genetics management results.

2.1.1 – Maintain unique genetic characteristics of the Columbia Basin pygmy rabbit within the captive population.

Strategies to accomplish this include selecting individuals with the desired genetic makeup to breed with one another, allowing one male to mate with multiple females, and providing larger pens for breeding.

2.1.2 – Implement intercross breeding to ensure that the captive population has sufficient genetic diversity, while minimizing the genetic representation of foreign pygmy rabbit populations.

This is a critical task undertaken by the Washington Department of Fish and Wildlife geneticists, and is addressed and documented in annual updates of the Captive Breeding and Genetics Management Plan (WDFW 2007).

2.1.3 – Augment captive population with additional wild Columbia Basin pygmy rabbits, as available, to maximize their genetic representation within the captive breeding program.

Columbia Basin pygmy rabbits are believed to be extirpated from the wild. However, if additional wild Columbia Basin pygmy rabbits are located during future surveys, they will be secured, as appropriate (see Survey and Capture, p. 45), to help maintain or improve the genetic diversity of the captive population.

2.1.4 – Evaluate and manage the genetic characteristics of the captive population to determine appropriate animals to maintain in captivity each year.

Computer software has been developed by conservation geneticists and population biologists in conjunction with the American Zoological and Aquarium Association for use in endangered species management (Population Management 2000). Use of this software is helpful for both the captive breeding and genetics management aspects of recovery efforts for the Columbia Basin pygmy rabbit.

2.2 – Manage genetic diversity of free-ranging subpopulations.

2.2.1 – Obtain tissue samples of free-ranging animals, as necessary, to assess and/or monitor the genetic characteristics of all known free-ranging subpopulations.

Any remaining and/or reestablished free-ranging subpopulations will be sampled for both genetic and population monitoring purposes. Initially, 50 percent of the estimated population (both re-captures of released animals and new offspring) will be sampled over the first 2 years; the appropriate percentage will be

reevaluated for future efforts. The molecular diversity in the free-ranging population will be evaluated for changes over time to determine if, and to what extent, the free ranging population(s) become differentiated from the captive population.

2.2.2 – Augment free-ranging subpopulations with captive animals and/or translocate pygmy rabbits from other occupied sites, as appropriate (see Survey and Capture, p. 45), to maintain appropriate genetic characteristics in the wild.

In the unlikely event that one or more large, free-ranging subpopulations are located during future surveys, the genetic health of the subpopulation will be evaluated (see action 2.2.1) and appropriate management measures undertaken (e.g., capture, translocation, protection) to maximize the genetic diversity of the Columbia Basin pygmy rabbit and to otherwise accomplish the near-term recovery objectives that have been identified.

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

3.1 – Search for new subpopulations.

If any additional free-ranging, purebred Columbia Basin pygmy rabbits persist, they could provide a significant benefit to conservation of this population. Much of the remaining shrub steppe habitat within the population's historical distribution has been surveyed without locating 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 of 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 land owners and/or

appropriately designated managers (also see Stakeholder Involvement, p. 42; action 7).

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

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

3.1.4 – Consolidate and document updated survey results and cooperative agreement measures annually.

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

Free-ranging pygmy rabbits will be monitored using the Skalski monitoring method, or similar method(s) (see Survey and Capture, p. 45). Initially, free-ranging subpopulations will be monitored annually. The monitoring method used and frequency of monitoring will be continually assessed and, as necessary, updated and included within a revised Reintroduction Plan (see action 4.8).

3.2.1 – Coordinate survey data collection, maintenance, and reporting among affected parties.

3.2.2 – Continue to develop and improve abundance indices of overall and effective population sizes based on counts of active burrows, and to refine appropriate survey and monitoring techniques for free-ranging subpopulations.

Appropriate indices based upon counts of active burrows 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. Updated survey and monitoring techniques are being investigated for pygmy rabbits throughout the species'

range. This work, along with ongoing investigations of newly released Columbia Basin pygmy rabbits, will facilitate continued improvement of these techniques.

3.2.3 – 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.

Action 4: Reestablish free-ranging Columbia Basin pygmy rabbit subpopulations within their historical distribution.

4.1 – Formally establish (i.e., enroll under a cooperative agreement, see action 7) and continue to manage recovery emphasis areas that have been identified.

Two high priority recovery emphasis areas have been identified and are currently being managed to accommodate initial reintroduction efforts for captive-bred Columbia Basin pygmy rabbits (see Reintroduction, p. 38). These areas are comprised of lands under Washington Department of Fish and Wildlife, non-governmental organization, and private ownership or management authority.

4.1.1 – Continue to pursue cooperative agreements with parties interested in having pygmy rabbits released on their properties and/or including their properties within one or more recovery emphasis area(s) (see action 7).

4.1.2 – Through annual review and, as appropriate, revision, ensure that all conservation measures prescribed by existing cooperative agreements are active and adequate to accommodate Federal recovery efforts for the Columbia Basin pygmy rabbit.

- 4.2 – Prepare recovery emphasis areas for reintroduction and/or augmentation of captive-bred Columbia Basin pygmy rabbits (also see action 4.8).

A Reintroduction Plan has been developed that identifies specific procedures for release and monitoring of captive-bred Columbia Basin pygmy rabbits (see Reintroduction, p. 38). Preparation of recovery emphasis areas may also include prior monitoring and, as feasible, control of disease vectors and predator occurrences that may negatively affect newly released Columbia Basin pygmy rabbits.

- 4.2.1 – Monitor predators at release sites and, as feasible (e.g., contingent on Agreement conditions), implement interim predator control measures to minimize loss of novice animals (also see actions 5.1 and 6.3).

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, weasels, badgers, ravens, and various raptor species. It may be feasible and effective to control only one or two key predators, or simply monitor their abundance, during initial release efforts. Various measures have previously been implemented at the identified recovery emphasis areas to address predators (see Predator Control, p. 49). Weasels have been observed in and around pygmy rabbit burrows in the past, and have successfully preyed upon newly released Idaho pygmy rabbits. Coyotes were observed bedding directly adjacent to active Columbia Basin pygmy rabbit burrows at the last known occupied site in southern Douglas County. As feasible, preventive control will be conducted prior to and through the first breeding season. Further evaluation of predation effects by predator species and survival / habitat relationships (e.g., key contributing habitat features) of newly released Columbia Basin pygmy rabbits will be conducted to determine the efficacy of any initial, and possible need for continuing, predator control measures at recovery emphasis areas.

- 4.2.2 – Monitor for disease vectors at release sites and, as feasible, implement measures to reduce the risk of infection and transmission in free-ranging Columbia Basin pygmy rabbits.

Monitoring for diseases at reintroduction sites will be undertaken approximately 6 months prior to release. The presence of significant disease vectors at a release site may preclude immediate release of captive-bred animals to the area. As available, preventive measures (e.g., flea treatments) would be taken prior to release.

4.2.3 – Provide supplemental features at release sites (e.g., pre-release pens, artificial burrows, feeding stations) to improve the survival of novice animals, as necessary.

Pre-release pens and supplemental feeding were used in the experimental releases of Idaho pygmy rabbits, and may be used to acclimate some Columbia Basin pygmy rabbit release groups at release sites. Artificial burrows have been used successfully in the conservation of a number of 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 Idaho pygmy rabbits during experimental releases in Idaho, and they will be provided at recovery emphasis areas for Columbia Basin pygmy rabbit releases.

4.3 – Determine the appropriate captive animals to be released into the wild each year by evaluating the genetic characteristics and demographics of any free-ranging subpopulations and the captive population (also see actions 2 and 4.8).

4.4 – Conduct reintroduction, augmentation, and/or translocation efforts at the highest priority recovery emphasis area(s) (also see action 2.2.2).

Of several potential sites evaluated (see Reintroduction, p. 38), the two currently identified recovery emphasis areas have the highest quality habitat, supported pygmy rabbits in the recent past, and have various other management advantages that would facilitate pygmy rabbit conservation (e.g., controlled recreation, reduced disturbance, exclusion fencing, predator and fire abatement measures, existing road management).

4.5 – Monitor survival and movement of newly released Columbia Basin pygmy rabbits (also see action 4.8).

4.5.1 – As feasible considering equipment and workforce availability, all or an appropriate proportion of Columbia Basin pygmy rabbits released at recovery emphasis areas will be fitted with radio transmitters to monitor their movements, habitat use patterns (see action 6.1.1), and causes of mortality.

Radio-transmitters 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 due to the transmitters is low. Radio-telemetry monitoring is the primary means by which movements, habitat use patterns, and mortality factors of released animals can be assessed.

4.5.2 – Develop and follow protocols to manage Columbia Basin pygmy rabbits that may disperse beyond recovery emphasis areas (also see action 7).

Newly released Columbia Basin pygmy rabbits will likely continue to disperse beyond recovery emphasis areas. Appropriate measures will be implemented to contact and pursue cooperative agreements with land owners and managers of intervening properties. Initially, workloads will be prioritized to address intervening properties within 8 km (5 mi) of the recovery emphasis area(s) used for initial reintroductions, and other as-yet unsurveyed properties that contain “survey habitat” (see Glossary, p. 101) and that have the greatest potential to still harbor free-ranging Columbia Basin pygmy rabbits. As resources and workloads allow, pursuing cooperative agreements for other intervening properties within the historical distribution of the Columbia Basin pygmy rabbit will be addressed.

4.6 – Continue to investigate, identify, and address existing constraints or management needs of recovery emphasis areas and, as feasible (i.e., contingent on cooperative agreement conditions), intervening properties that support additional occupied habitats or identified dispersal corridors of newly released Columbia Basin pygmy rabbits (also see actions 5, 6, and 7).

- 4.7 – 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 Endangered Species Act, and define criteria that would demonstrate that threats to the population are sufficiently ameliorated (also see actions 5, 6, and 7).

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, future effects of diseases and predation, and the habitat use, seasonal movement, and dispersal behaviors of newly released animals. The management direction currently identified emphasizes protection and enhancement of habitat conditions at existing recovery emphasis areas and, as feasible, maintaining habitat conditions and implementing appropriate protection measures on intervening properties. Additional recovery emphasis areas will be identified, prioritized, and formally established, and/or appropriate intervening properties will be protected as the information base concerning the Columbia Basin pygmy rabbit improves, and as feasible through appropriate cooperative agreements, in order to meet the identified near-term recovery objectives and reclassification criteria.

- 4.8 – Update the specific methods and techniques in the Reintroduction Plan annually.

The number of captive-bred Columbia Basin pygmy rabbits required to be released annually will ultimately be based on the survival and reproductive success of previously released animals and the overall status of subpopulations at recovery emphasis areas. There will be an annual reiterative process of refining the number of animals to be released each year, as well as release techniques and post-release monitoring strategies. Other information needs include evaluating potential effects of pre-release pens, supplemental feeding, seasonality and timing of releases, predator control, and differing make-up of release groups. Ongoing

investigations will lead to an increasingly consistent, effective approach to reestablish subpopulations of Columbia Basin pygmy rabbits.

Action 5: Protect free-ranging Columbia Basin pygmy rabbits.

5.1 – Evaluate and address, as feasible, the potential effects of predators on free-ranging Columbia Basin pygmy rabbits (also see action 4.2.1).

If predation appears to be limiting initial reestablishment or growth of Columbia Basin pygmy rabbit subpopulations, control measures will be implemented to maintain and increase existing subpopulations.

5.1.1 – Remove or manage potential predator attractants 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 (see Predator Control, p. 49).

5.1.2 – Continue annual surveys to determine relative abundance of predators at recovery emphasis areas.

5.2 – Identify and minimize effects of human activities on Columbia Basin pygmy rabbits at recovery emphasis areas and, as feasible (i.e., contingent on cooperative 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 conservation objectives.

5.2.1 – Avoid development of new, or expansion of existing roads and trails, and restore habitats on obsolete roads and trails in occupied areas.

5.2.3 – 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).

5.3 – Enforce Federal regulations that protect Columbia Basin pygmy rabbits from unauthorized “take” (e.g., killing, harm, harassment [see Glossary, page 72]).

Action 6: Manage habitats at recovery emphasis areas to support stable, self-sustaining subpopulations of free-ranging Columbia Basin pygmy rabbits.

6.1 – 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 4.8).

Future planned research of 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.

6.1.1 – 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.

6.1.2 – As feasible (i.e., contingent on cooperative agreement conditions), evaluate contributions to recovery emphasis areas from available habitats on intervening properties, including any that are managed pursuant to programs administered by the U.S. Department of Agriculture (e.g., Conservation Reserve Program (CRP)).

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 alternative habitats may function as pygmy rabbit habitat.

6.1.3 – 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.

6.1.4 – Through coordination with the Science Team and Recovery Team, 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.

6.2 – Protect habitats at recovery emphasis areas and, as feasible (i.e., contingent on cooperative agreement conditions) intervening properties (see action 7).

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

A variety of remote sensing techniques have been developed to assess habitat quality. These techniques are being tested 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 cooperative agreements (see action 7).

6.2.2 – Continue to work with local land owners 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 one recovery emphasis area.

6.2.3 – 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.

6.3 – 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 will be implemented, as available, to appropriately manipulate available habitats.

- 6.4 – 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 (also see action 4.8).

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

- 6.5 – As necessary to achieve near-term recovery objectives, continue to identify, assess, and prioritize potential recovery emphasis areas and, as appropriate, formally establish and provide recommendations to address habitat management needs at these sites (also see actions 4.7 and 6.1).

Potential future recovery emphasis areas on public and willing land owner or manager properties 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.

- 6.5.1 – 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, available slopes, presence of weedy species, existing road systems, fire history, and management access.

- 6.5.2 – Review management plans for public lands and, as feasible (e.g., contingent on cooperative 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 7).

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

6.6 – As feasible through cooperative agreements (see action 7), 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, p. 50). 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 cooperative 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 7: Pursue cooperative agreements for the Columbia Basin pygmy rabbit with land owners and managers of intervening properties within the population’s historical distribution.

7.1 – Develop Site Plans under the existing Agreement and issue associated Permits to non-Federal and non-WDFW land owners and managers of eligible properties whose ongoing management may provide a net conservation benefit for recovery efforts, yet whose land use practices may also result in incidental take of free-ranging Columbia Basin pygmy rabbits (see Stakeholder Involvement, p. 42).

7.1.1 – Contact land owners 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.

Land owners 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 Agreement.

7.1.2 – Determine baseline conditions and monitoring protocols, as necessary, for properties of any land owners or managers interested in participating in the Agreement.

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

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

7.3 – Assist interested non-Federal and non-Washington Department of Fish and Wildlife land owners and managers develop new Habitat Conservation Plans, or otherwise assist with participation in existing Habitat Conservation Plans, with regard to management practices that may result in the incidental take of free-ranging Columbia Basin pygmy rabbits.

7.3.1 – 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 Habitat Conservation Plan 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 throughout 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.

7.3.2 – Assist with development of Certificates of Inclusion for land owners and managers interested in participating in new or existing Habitat Conservation Plans.

7.4 – Continue to coordinate recovery efforts with various Federal agencies (e.g., Bureau of Land Management, U.S. Fish and Wildlife Service, Bureau of Reclamation, Department of Energy) pursuant to the requirements of section 7 of the Endangered Species Act and, as opportunities arise, develop and implement cooperative agreements to address Federal conservation initiatives for the Columbia Basin pygmy rabbit.

7.5 – Continue to identify and secure funding sources to assist interested land owners and managers with development of cooperative 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 9).

Action 8: Exchange information with stakeholders and the general public to address concerns and increase support for Columbia Basin pygmy rabbit recovery efforts.

8.1 – 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.

8.1.1 – 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.

8.1.2 – 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.

8.2 – 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 land owners and managers of intervening properties within the vicinity of recovery emphasis areas to discuss recovery planning for the Columbia Basin pygmy rabbit.

8.2.1 – Initiate and respond to communications with stakeholders.

8.2.2 – 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.

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

8.3 – 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 9. Secure funding for Columbia Basin pygmy rabbit recovery efforts.

9.1 – Continue cooperative efforts with a diverse group of stakeholders, other interested parties, and the general public in recovery planning for the Columbia Basin pygmy rabbit, including land owners and

managers of existing and potential future recovery emphasis areas and intervening properties.

Both public and private land owners 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 land owners can obtain funds for conservation of Columbia Basin pygmy rabbits that may be separate from those that support State or Federal conservation efforts.

9.2 – 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.

9.3 – 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 10: Revise the 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.

10.1 – 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 Captive Breeding and Genetics Management Plan (see action 1.7) and the Reintroduction Plan (see action 4.8) will provide key information to assist with preparation of revised Implementation Schedules. In addition, monitoring and reporting measures associated with implementation of cooperative agreements with various stakeholders (see action 7) will also be used to help develop revised Implementation Schedules.

V. Recovery Implementation

The Implementation Schedule that follows lists the actions and estimated costs associated with the recovery program for the Columbia Basin pygmy rabbit. It is a guide for meeting the recovery goals outlined in this 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 willing to participate may benefit by being able to show in their budgets that their funding request is for a recovery action identified in an approved recovery plan and is therefore considered a necessary action for the overall coordinated effort to recover the Columbia Basin pygmy rabbit. Also, section 7(a)(1) of the Endangered Species Act directs all Federal agencies to utilize their authorities in furtherance of the purposes of the Endangered Species Act by carrying out programs for the conservation of endangered and threatened species.

The following Implementation Schedule lists actions from the above Recovery Program that require funding. 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. As such, these actions are not repeated in the Implementation Schedule, but are described in the Recovery Program section. 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 proposed actions, estimates the duration of the actions, and identifies likely responsible parties for implementing the actions.

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, p. 18) 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 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 the population's 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 we have a statutory responsibility to implement this Draft 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 actively involved in recovery implementation. However, the list of possible stakeholders is not limited to those identified below, and others may participate.

Key to Responsible Parties Identified in the Implementation Schedule:

FCCD	Foster Creek Conservation District
NWT	Northwest Trek Wildlife Park
OZ	Oregon Zoo
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WSU	Washington State University

D. ESTIMATED COSTS FOR RECOVERY ACTIONS

The Implementation Schedule provides the estimated annual costs of implementing the identified recovery actions from 2007 to 2011 and, as feasible, an estimated cost for the time period from 2012 to 2016. 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, genetics management,

reintroduction, monitoring, habitat management, stakeholder involvement, public outreach, predator control).

Estimated overall cost by year:

2007: \$359,000	2010: \$217,000
2008: \$406,000	2011: \$269,000
2009: \$390,000	2012 - 2016: \$762,000

The total estimated cost to implement near-term recovery actions is \$2,403,000.

E. Implementation Schedule for the Draft Recovery Plan for the Columbia Basin DPS of Pygmy Rabbit

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
1	1	C, E	Manage captive breeding program for the Columbia Basin pygmy rabbit.	10 years	WDFW, USFWS, Washington State University, OZ, NWT	150	150	150	75	75	250	850	Needs for captive breeding program will be evaluated in 2011.
1	1.6	C, E	Improve survival of captive pygmy rabbits.	5 years	" "	10	10	10	2	2		34	
1	2	C, E	Manage genetic characteristics of the Columbia Basin pygmy rabbit.	10 years	WDFW	7	7	7	7	7	TBD	35	Genetics management needs for captive population will be reassessed in 2011.

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
1	2.1.3	C, E	Augment captive population with additional wild Columbia Basin pygmy rabbits, as available, to maximize their genetic representation within the captive breeding program.	3 years	" "	2	2	2				6	
1	2.2	C, E	Manage genetic diversity of free-ranging subpopulations.	2 years	" "					7	7	14	Costs incurred 1 year in 5.
1	3	C, E	Survey for and monitor free-ranging Columbia Basin pygmy rabbits.	10 years	WDFW, USFWS	*	*	*	*	*	*		*Cost estimates incorporated by subactions. Long-term survey and monitoring needs will be evaluated in 2011.

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
1	3.1	C, E	Search for new subpopulations.	3 years	WDFW	5	5	5				15	
1	4	A, E	Reestablish free-ranging Columbia Basin pygmy rabbit subpopulations within their historical distribution.	10 years	WDFW, USFWS, WSU, Land Owners and Managers of Recovery Emphasis Areas	*	*	*	*	*	*		*Cost estimates incorporated by subactions. Funding needs for reintroduction, augmentation, and monitoring efforts will be evaluated in 2011.
1	4.1	A, E	Formally establish and continue to manage recovery emphasis areas that have been identified.	10 years	" "	15	15	15	5	5	40	95	
1	4.2	A, E	Prepare recovery emphasis areas for reintroduction and/or augmentation of captive-bred Columbia Basin pygmy rabbits.	4 years	" "	10	10	10			10	40	Costs incurred 1 year in 5 from 2012-2016. Funding needs for preparing potential future

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
													recovery emphasis area(s) will be evaluated in 2011.
1	4.4	A, E	Conduct reintroduction, augmentation, and/or translocation efforts at the highest priority recovery emphasis area(s).	10 years	" "	10	10	10	5	5	25	65	
1	4.5	A, E	Monitor survival and movement of newly released rabbits	10 years	" "	30	30	30	30	30	100	250	
1	5	A, B, C	Protect free-ranging Columbia Basin pygmy rabbits.	10 years	USFWS, WDFW, other Federal Agencies, Participants to the Agreement	*	*	*	*	*	*		*Cost estimates incorporated by subactions. Needs for continuing active protection measures will be evaluated

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
													following initial releases.
1	5.1	A, B, C	Evaluate and address, as feasible, the potential effects of predators on free-ranging Columbia Basin pygmy rabbits.	3 years	" "	7	7	7			TBD	21	
1	6.2	A, E	Protect habitats at recovery emphasis areas and, as feasible, intervening properties.	10 years	" "	5	5	5	5	5	25	50	
1	7	A, D, E	Pursue cooperative agreements for the Columbia Basin pygmy rabbit with land owners and managers of intervening properties within the population's historical	10 years	USFWS, WDFW, other Federal Agencies, Prospective Participants to the Agreement	*	*	*	*	*	*		*Cost estimates incorporated by subactions. The need to develop and implement new cooperative agreements will increase through the

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
			distribution.										first full year following initial release, then decline as intervening properties are addressed. Long-term needs will be reevaluated in 2011.
1	7.1	A, D, E	Develop Site Plans under the existing Agreement and issue associated Permits to non-Federal and non-WDFW land owners and managers of eligible properties whose ongoing management may provide a conservation benefit for recovery efforts, yet whose land	10 years	" "	50	75	50	25	25	50	275	

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
			use practices may also result in incidental take of free-ranging Columbia Basin pygmy rabbits.										
1	7.4	A, D, E	Continue to coordinate recovery efforts with various Federal agencies pursuant to the requirements of section 7 of the Act and, as opportunities arise, develop and implement cooperative agreements to address Federal conservation initiatives for the Columbia Basin pygmy rabbit.	10 years	USFWS, other Federal Agencies	5	5	5	5	5	10	35	
1	7.4	A, D, E	Continue to coordinate recovery efforts with various Federal agencies pursuant to the requirements of	10 years	USFWS, other Federal Agencies	5	5	5	5	5	10	35	

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
			section 7 of the Act and, as opportunities arise, develop and implement cooperative agreements to address Federal conservation initiatives for the Columbia Basin pygmy rabbit.										
1	9	A, C, E	Secure funding for Columbia Basin pygmy rabbit recovery efforts.	10 years	USFWS, WDFW, other Federal Agencies, Prospective Participants to the Agreement	5	5	5	5	5	25	50	Continuing efforts to secure long-term funding will be evaluated in 2010.
1	10	A, B, C, D, E	Revise the Federal Recovery Plan to facilitate implementation of adaptive management	10 years	USFWS, WDFW, other Recovery Team Members		2	2	2	2	TBD	8	Continuing needs to revise Recovery Plan will be evaluated in 2010.

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
			measures considered necessary to achieve the phased recovery strategy.		and Stakeholders								
2	1.5	C, E	Improve reproductive success of captive pygmy rabbits.	5 years	" "	10	10	10	2	2		34	
2	1.7	C, E	Update Captive Breeding and Genetics Management Plan annually.	5 years	WDFW	2	2	2	2	2		10	
2.	3.2	C, E	Monitor free-ranging subpopulations and document their status annually.	8 years	WDFW, USFWS		5	10	10	10	25	60	
2	4.6	A, E	Continue to investigate, identify, and address existing constraints or management needs of recovery emphasis areas and, as feasible, intervening properties that support additional	10 years	" "	10	10	10	5	5	25	65	

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
			occupied habitats or identified dispersal corridors of newly released Columbia Basin pygmy rabbits.										
2	4.7	A, E	Continue to assess and identify appropriate sizes, number, distribution, and configuration of free-ranging subpopulations and define criteria that would demonstrate that threats to the population are sufficiently ameliorated.	2 years	USFWS					10	10	20	Costs incurred 1 year in 5.
2	4.8	A, E	Update the specific methods and techniques in the Reintroduction Plan annually.	3 years	WDFW, USFWS, Washington State University	2	2	2	2	2	TBD	10	Continuing needs for updating methods and techniques within the Reintroduction

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
													Plan will be evaluated in 2011.
2	5.2	A, B, C	Identify and minimize effects of human activities on Columbia Basin pygmy rabbits at recovery emphasis areas and, as feasible, intervening properties.	3 years	" "	3	3	3			TBD	9	
2	6	A, E	Manage habitats at recovery emphasis areas to support stable, self-sustaining subpopulations of free-ranging Columbia Basin pygmy rabbits.	10 years	WDFW, USFWS, Land Owners and Managers of Recovery Emphasis Areas	*	*	*	*	*	*		*Cost estimates incorporated by subactions.
2	6.1	A, E	Continue to investigate and refine estimates of the quantity and quality of habitats	10 years	" "	10	20	20	10	10	50	120	The need to continue investigating and refining

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
			needed to support a viable subpopulation of free-ranging Columbia Basin pygmy rabbits.										habitat estimates will be reduced as subpopulations become reestablished. Long-term needs will be reevaluated in 2011.
2	6.2.1	A, E	Monitor changes in habitats through remote sensing, ground surveys, and mapping.	2 years	WDFW, USFWS					10	10	20	Costs incurred 1 year in 5.
2	6.3	A, E	Continue to investigate and, as available, implement enhancement and restoration measures to improve habitat quantity and quality for Columbia Basin pygmy rabbit subpopulations at	10 years	WDFW, USFWS, Land Owners and Managers of Recovery Emphasis Areas		5	10	10	10	25	60	

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
			recovery emphasis areas.										
2	6.4	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, Land Owners and Managers of Recovery Emphasis Areas	1	1	1	1	1	5	10	

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments	
						FY	FY	FY	FY	FY	FY			
						2007	2008	2009	2010	2011	2012 - 2016			
2	6.5	A, E	Continue to identify, assess, and prioritize potential recovery emphasis areas and, as appropriate, formally establish and provide recommendations to address habitat management needs at these sites.	2 years	" "						25	25	50	Costs incurred 1 year in 5. The need for identifying and formally establishing potential future recovery emphasis area(s) will be evaluated in 2011.
2	7.2	A, D, E	Develop and provide guidelines and technical assistance to interested land owners and managers to address management practices that could potentially affect free-ranging Columbia Basin pygmy rabbits.	10 years	" "	5	5	2	2	2	10	26		

Action Priority Number	Action Number	Listing Factor	Action Description	Action Duration	Responsible Parties	Cost Estimates (\$1,000 units)						Totals by Action Number	Comments
						FY	FY	FY	FY	FY	FY		
						2007	2008	2009	2010	2011	2012 - 2016		
2	7.3	A, D, E	Assist non-Federal and non-WDFW land owners and managers with developing 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, FCCD			2	2	2	10	16	
2	8	A, D, E	Exchange information with stakeholders and the general public to address concerns and increase support for Columbia Basin pygmy rabbit recovery efforts.	10 years	USFWS, WDFW	5	5	5	5	5	25	50	Long-term information exchange and outreach needs will be evaluated in 2010.
				Annual Totals		359	406	390	217	269	762	2403	

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.
- Agreement** – Template Safe Harbor Agreement for the Columbia Basin Pygmy Rabbit developed in accordance with section 10(a)(1)(A) of the Endangered Species Act.
- Baseline** – Number of Columbia Basin pygmy rabbits on eligible property at the time it is enrolled under the Agreement, or as otherwise determined beforehand through baseline description letters issued by the U.S. Fish and Wildlife 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** – Includes any intercross pygmy rabbits in captivity that are considered essential for genetics management efforts; and all released, captive-bred, intercross pygmy rabbits, as well as their naturally reproduced progeny, that have some minor level (i.e., less than 25 percent) of non-Columbia Basin pygmy rabbit ancestry.
- 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.
- Cooperative Agreement** – Collective term to refer to any agreement (e.g., Section 6 Cooperative Agreement, Safe Harbor Agreement, Habitat Conservation Plan, Conservation Agreement, Memorandum of Agreement, Memorandum of Understanding) between the U.S. Fish and Wildlife Service and another party developed to address conservation of the Columbia Basin pygmy rabbit.
- Enrolled Property** – Property included under the Agreement through completed (i.e., signed) Site Plans of Participants.

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

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.

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

Participant – Non-Federal and non-Washington Department of Fish and Wildlife land owner or manager of property enrolled under the Agreement.

Permit – A Federal Enhancement of Survival Permit issued to a Participant, in conjunction with the Agreement and their Site Plan, pursuant to section 10(a)(1)(A) of Endangered Species Act.

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 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 Agreement, and reduction of their future management liability for incidental take of Columbia Basin pygmy rabbits on their enrolled properties.

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 Agreement.

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 400 square feet (approximately 0.01 acres) 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 Endangered Species Act, or attempt to engage in any such conduct.

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