U.S. Fish & Wildlife Service

Recovery Plan for the Northern Idaho Ground Squirrel

(Spermophilus brunneus brunneus)

RECOVERY PLAN

FOR THE

NORTHERN IDAHO GROUND SQUIRREL

(Spermophilus brunneus brunneus)

Region 1

U.S. Fish and Wildlife Service

Portland, Oregon

Approved: Acting Carolyn A. Bohan

Regional Director, Region 1, U.S. Fish and Wildlife Service

Date: JUL 28 2003

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EXECUTIVE SUMMARY

Current Species Status: The northern Idaho ground squirrel *(Spermophilus brunneus brunneus)* was federally listed as a threatened species on April 5, 2000 (U.S. Fish and Wildlife Service 2000a). This subspecies is known to exist only in Adams and Valley Counties of western Idaho. The entire range of the subspecies is about 32 by 108 kilometers (20 by 61 miles), and as of 2002, 34 of 40 known population sites were extant. The subspecies declined from an estimated 5,000 individuals in 1985, to less than 1,000 by 1998, when it was proposed for listing under the Endangered Species Act of 1973, as amended. The 1985 estimate was made for populations judged to be in decline. By the year 2000, preliminary surveys indicated that only about 350 individuals remained at known population sites. Based on more extensive census data collected in the spring of 2002, the population was estimated to be 450 to 500 animals. This revised estimate was the result of more intensive monitoring, habitat enhancement measures, and discovery of new populations.

Habitat Requirements and Limiting Factors: The northern Idaho ground squirrel is known to occur in shallow, dry rocky meadows usually associated with deeper, well-drained soils and surrounded by ponderosa pine and Douglas-fir forests at elevations of about 915 to 1,650 meters (3,000 to 5,400 feet). Similar habitat occurs up to at least 1,830 meters (6,000 feet). Consequently, ponderosa pine/shrub-steppe habitat association with south-facing slopes less than 30 percent at elevations below 1,830 meters (6,000 feet) is considered to be potentially suitable habitat. The northern Idaho ground squirrel is primarily threatened by habitat loss due to forest encroachment into former suitable meadow habitats. Forest encroachment results in habitat fragmentation, eliminates dispersal corridors, and confines the northern Idaho ground squirrel populations into small isolated habitat islands. The subspecies is also threatened by land use changes, recreational shooting, poisoning, genetic isolation and genetic drift, random naturally occurring events, and competition from the larger Columbian ground squirrel (*S. columbianus*).

Recovery Objective: The ultimate goal of this recovery plan is to increase the population size and establish a sufficient number of viable metapopulations[1] of the northern Idaho ground squirrel so the subspecies can be delisted. It would be eligible for delisting consideration when populations are self-sustaining, secure, and meet the criteria listed in Section II of this Plan.

Recovery Priority Number: The recovery priority number for the northern Idaho ground squirrel is 3C on a scale of 1 to 18 (1 equals highest priority), indicating that it is: 1) taxonomically a subspecies; 2) facing a high degree of threat; 3) rated high in terms of recovery potential; and 4) may be in conflict with construction and recreational development projects or other forms of economic activity.

Recovery Criteria: Due to the restricted geographic range and low numbers, the populations must be increased and stabilized. The only historical population level recorded was approximately 5,000 individuals (Yensen 1985). The 1985 estimate was made for populations judged to be in decline. Hence, the recovery target needs to be higher than this historical estimate. The recovery target should be based on an effective population size (*Ne*)[2] greater than 5,000 individuals.

Delisting may be considered when the following recovery criteria have been met:

1. Of the 17 potential metapopulations that have been identified within the *probable historical distribution*, there must be at least 10 metapopulations, each maintaining an average effective population size of greater than 500 individuals for 5 consecutive years.

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[1]Metapopulation- a network of semi-isolated populations with some level of regular or intermittent migration and gene flow among them, in which individual populations may go extinct but then be re-colonized from other populations (Meffe and Carroll 1994). A metapopulation implies that genetic exchange between population subsites (demes) is occurring through dispersal or linkage corridors. Populations must be within reasonable dispersal distance from one another. In the case of northern Idaho ground squirrel, this means less than 1 kilometer (0.6 mile).

[2]Effective population size (*Ne*) - the average size of a population expressed in terms of individuals assumed to contribute genes to the next generation; generally smaller than the actual size of the population, depending on variation in reproductive success among individuals (Ricklefs 1990). Thus, *Ne* must be greater than 5,000 individuals. The exact number remains be to calculated.

2. The area occupied by a minimum of 10 potential metapopulations must be protected. In order for an area to be deemed protected, it must be: (1) owned or managed by a government agency with appropriate management standards in place; (2) managed by a conservation organization that identifies maintenance of the subspecies as the primary objective for the area; or, (3) on private lands with a long-term conservation easement or covenant that commits present and future landowners to the perpetuation of the subspecies.

3. Plans have been completed for the continued ecological management of habitats for a minimum of 10 potential metapopulation sites.

4. A post-delisting monitoring plan covering a minimum of 10 potential metapopulation sites has been completed and is ready for implementation.

Actions Needed:

1. Protect and increase all extant potential metapopulation sites.
2. Establish additional metapopulations and dispersal corridors.
3. Develop and execute a population and habitat management plan for each potential metapopulation site.
4. Accelerate and complete habitat enhancement projects on the Payette National Forest.
5. Develop and implement a transplantation effort to increase genetic diversity in each metapopulation.
6. Fully implement a long-term intensive and extensive metapopulation and habitat monitoring plan to evaluate success of recovery efforts.
7. Continue surveying efforts to locate new populations.
8. Conduct research to fill data gaps to ensure recovery.
9. Establish a captive propagation program as a hedge against extinction while wild populations are being reestablished, to provide an additional source for increasing genetic diversity of wild populations, provide a source for establishing new populations, provide research opportunities, and contribute to public education.

10. Increase efforts to enhance the outreach program for conservation of the northern Idaho ground squirrel.
11. Develop and maintain a comprehensive database to be used for monitoring the success of recovery.
12. Establish and maintain an interagency recovery coordinator and technical working group to coordinate recovery efforts.

Date of Recovery: Because of the high probability of genetic change in existing populations (Gavin *et al.* 1999), and because ground squirrels can respond rapidly to environmental changes either positively or negatively (Runge 1999), it is imperative that recovery implementation be initiated without delay. The Runge (1999) population viability model predicts that the subspecies may go extinct within 7 years under the 1999 demographic trends prior to the subspecies being listed under the Endangered Species Act of 1973, as amended. However, recovery can also be rapid if recovery actions are implemented. If recovery actions produce positive responses at each potential metapopulation site, the delisting could be initiated by 2010.

Estimated Cost of Recovery: The estimated cost of recovering the northern Idaho ground squirrel averages $304,600 per year starting in 2003 ($1,523,000 for 2003 through 2007, see Implementation Schedule, p. 43). We estimate the total cost of delisting to be approximately $2.44 million ($304,600 per year, 2003 through 2010).

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I. INTRODUCTION

A. Overview

We, the U.S. Fish and Wildlife Service (Service), listed the northern Idaho ground squirrel (*Spermophilus brunneus brunneus*) under the Endangered Species Act of 1973, as amended, as a threatened species on April 5, 2000 (U.S. Fish and Wildlife Service 2000a). The recovery priority number for the subspecies is 3C on a scale of 1 to 18, indicating that it is: 1) taxonomically, a subspecies; 2) facing a high degree of threat; 3) rated high in terms of recovery potential; and 4) may be in conflict with construction and recreational development projects or other forms of economic activity.

The northern Idaho ground squirrel is a relatively small member of the genus *Spermophilus;* the mean lengths of the male and female are 23.4 centimeters (9.2 inches) and 22.6 centimeters (8.9 inches), respectively (Yensen and Sherman 1997). The pelage (fur) of northern Idaho ground squirrels on the dorsal area appears dark reddish-gray as the result of a mixture of black unbanded and yellowish-red banded guard hairs. The subspecies' eye ring is buffy-white (Figure 1). The northern Idaho ground squirrel has the most restricted geographical range of any *Spermophilus* species, and one of the smallest ranges of any North American mammal (Gill and Yensen 1992). The first specimens were collected in 1913 by L.E. Wyman, and described by A.H. Howell as a subspecies *(Citellus townsendii brunneus)* of the present-day Washington ground squirrel (*Spermophilus washingtoni*) (then confused with the Townsend's ground squirrel, *C. townsendii*) (Howell 1938). Subsequently, Howell (1938) reclassified the Idaho ground squirrel as a full species, *Citellus brunneus*. Hershkovitz (1949) demonstrated that *Spermophilus* is the correct name for the genus. The systematics of *Spermophilus brunneus* were further investigated by Nadler *et.al.* (1973) with chromosomal descriptions. Yensen (1991) determined that *Spermophilus brunneus* consisted of two subspecies (the northern Idaho ground squirrel, *Spermophilus brunneus brunneus,* and the southern Idaho ground squirrel, *Spermophilus brunneus endemicus*) based on cranial morphology, pelage, life history differences, and other characteristics.

U.S. Fish and Wildlife Service

Figure 1. The northern Idaho ground squirrel.

B. Status and Distribution

The distribution of the northern Idaho ground squirrel has become fragmented into what are now very small, isolated populations in Adams and Valley Counties of west-central Idaho (Figures 2 and 3). Between about 1980 and 1997, seven populations were known to have become extirpated (Yensen and Sherman 1997). For example, the Mill Creek population located on Payette National Forest lands was extirpated in 1997, and the Lick Creek population on private land apparently went extinct in 1999 (Sherman, pers. comm.). The Summit Gulch population was down to one individual when it was supplemented in 1997.

Thirty-four of 40 population sites are extant (Tables 1 and 2), 8 of which have now been extirpated. The occupancy or habitat suitability of 6 sites is unknown, because they have not been surveyed in recent history. Of the 34 extant sites, 16 are on National Forest lands (Council and New Meadows Ranger Districts), 13 are on private lands, 1 is on municipal property (in the town of Bear), and 4 are on a combination of State of Idaho, National Forest, or private lands. For several years, population sites with the largest numbers of northern Idaho ground squirrels have been most closely monitored by researchers. These occur within the Payette National Forest and the privately-owned OX Ranch. Two population sites on the OX Ranch, Squirrel Manor and Squirrel Valley, have been monitored for the longest period of time. Sherman and Gavin (1997, 1999) and Sherman and Runge (2002) documented the decline of the Squirrel Valley population from 120 individuals in 1987, to 10 in 1999, and Squirrel Manor had a population decline from 250 individuals in 1996, to fewer than 50 individuals in 1999. Moreover, each of four other population sites censussed between 1998 and 1999 declined markedly. The declines in 1999 may have been largely due to cold, spring conditions (Sherman and Gavin 1999), whereas the longer-term declines may be related to declining habitat conditions. In general, long-term habitat fragmentation and population declines have resulted in small, isolated ground squirrel populations that appear to be prone to extinction due to naturally occurring factors. In 1985, the total northern Idaho ground squirrel population at 18 known population sites was approximately 5,000 squirrels (Yensen 1985, U.S. Fish and Wildlife Service 1985). A 2002 estimate, based on surveys, indicates there are approximately 450 to 500 northern Idaho ground squirrels at 29 population sites (Haak 2003).

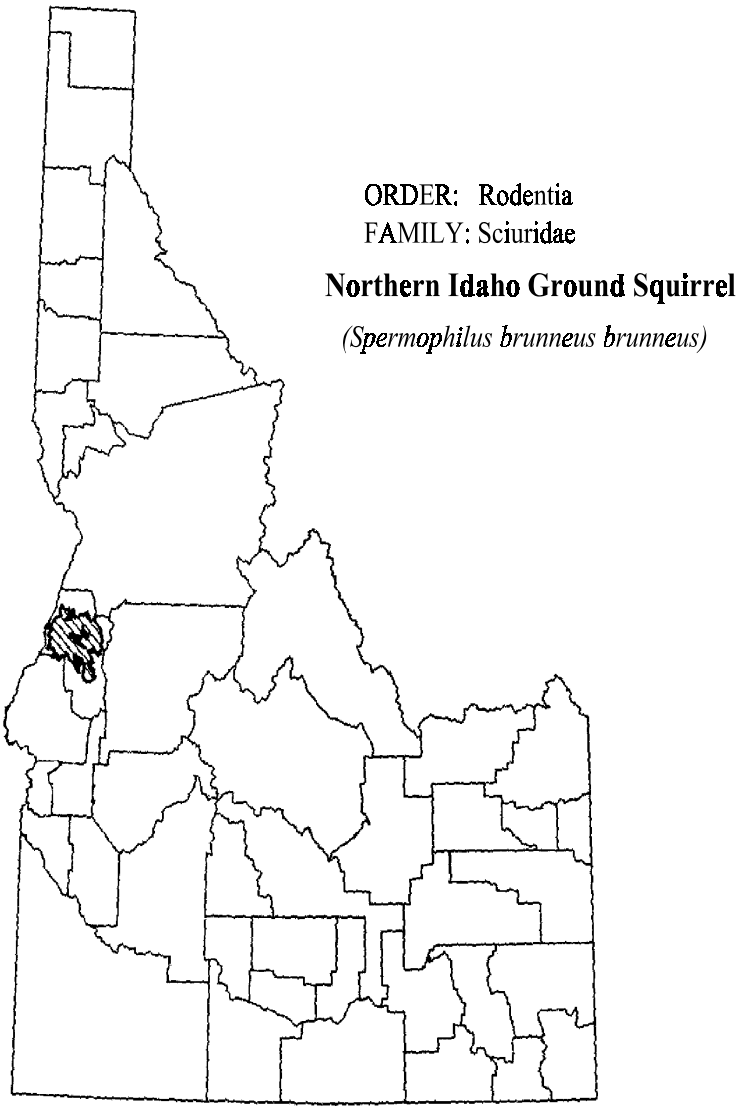

Figure 2. Range of the northern Idaho ground squirrel.
(Idaho Department of Fish and Game 1997)

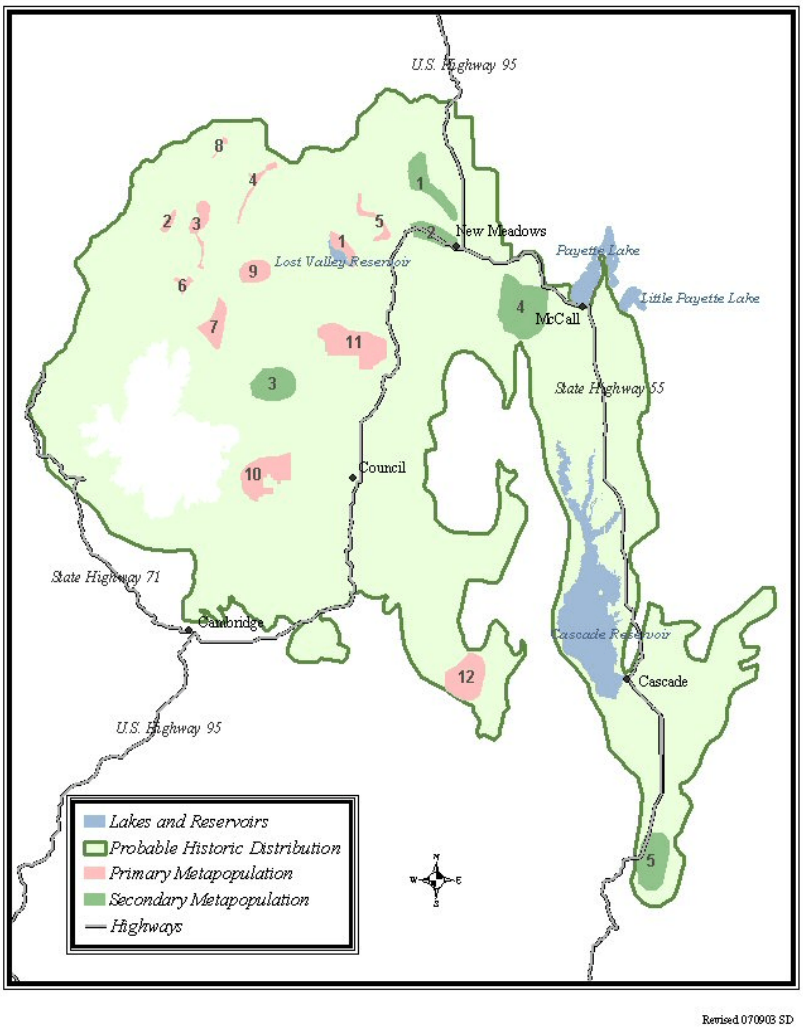

Figure 3 Northern Idaho ground squirrel probable historical distribution map and primary and secondary metapopulation sites (see also Table 3) (U.S. Forest Service 2003).

Table 1. Northern Idaho ground squirrel population sites in the Council Ranger District, Payette National Forest. Key population estimates are based on trapping and marking of adults and yearlings at intensive* monitoring sites from 1999 to 2001, and are based on extensive* monitoring on an annual basis at other sites. Where 1999 to 2001 data is not available, most recent population estimates (year of estimate) are provided.

Population Site	Population Complex	Population Estimate	Land Ownership[1]
Tree Farm	Summit Gulch	64+ (2002)	F
Calf Pen	Summit Gulch	8+	F
Summit Gulch	Summit Gulch	33+ (2002)	F
Cottonwood Corral	Cottonwood	1 (2002)	F
Cottonwood II	Cottonwood	0[2]	F
Cottonwood III	Cottonwood	0[2]	F
Mill Creek	Cottonwood	extirpated	F
Chipmunk Springs	Cottonwood	10+ (2002)	F
Halfway	Cottonwood	6+ (1998)	P
Rocky Comfort Flat	Paradise Flat	3+ (2001)	P
Riley Ranch	Paradise Flat	2+ (1996)	P/F
Squirrel Manor	Bear Creek	18+ (2002)	P
Bear Cemetery	Bear Creek	9 (1996)	M
Squirrel Valley	Bear Creek	6+ (2001)	P
Lick Creek	Bear Creek	extirpated	P
Huckleberry	Bear Creek	5	P/F
Cold Springs	Lick Creek Canyon	26+ (2002)	F
Cold Springs East	Lick Creek Canyon	5+	F
Cold Springs West	Lick Creek Canyon	14+	F
Hoo Hoo Gulch	Lick Creek Canyon	10+	F
Fawn Creek	Lick Creek Canyon	4+	F
Roadside	Lick Creek Canyon	unknown	F
Greenwood	Hornet Creek	unknown	P
Greenwood II	Hornet Creek	unknown	P

[1]F is Federal, P is private, M is municipal, and S is State of Idaho.

[2]Adjacent to, and likely to be recolonized by, Cottonwood Corral.

*See Glossary.

Table 2. Northern Idaho ground squirrel population sites found in the New Meadows Ranger District, Payette National Forest. Key population estimates are based on trapping and marking of adults and yearlings at intensive* monitoring sites from 1999 to 2001, and are based on extensive* monitoring on an annual basis at other sites.

Population Site	Population Complex	Population Estimate	Land Ownership[1]
Slaughter Gulch Campground	Lost Valley	200+ (2002)	F/S
Lost Lake	Lost Valley	3+	F
Lower Mud Creek	Mud Creek	extirpated	P
New Meadow	Mud Creek	3+	P
Ridgetop	Mud Creek	3+	P
Upper Mud Creek	Mud Creek	unknown	P
Price Valley - Mack	Price Valley	32+ (2002)	P/S
Price Valley Guard Station	Price Valley	4+	F
Long Meadow	Price Valley	unknown	P
Price Valley Road	Price Valley	extirpated	P
New Meadows	Little Salmon	9+ (2002)	P
Van Wyck	Long Valley	extirpated	F
Cascade	Long Valley	extirpated	P
Herrick Corral	Round Valley	unknown	P
Sixty Lane	Round Valley	extirpated	P
Wood's Corral	Round Valley	extirpated	P

[1]F is Federal, P is private, M is municipal, and S is State of Idaho.

*See Glossary.

C. Habitat

Nearly all of the meadow habitats utilized by northern Idaho ground squirrel are bordered by coniferous forests of ponderosa pine *(Pinus ponderosa)* and/or Douglas fir *(Pseudotsuga menziesii).* This ground squirrel is not abundant in meadows that contain high densities of small trees (Sherman and Yensen 1994). The northern Idaho ground squirrel consumes at least 45 to 50 plant species (Dyni and Yensen 1996). Seeds of forbs, lupines, and composites are important, while roots, bulbs, leaf stems, and flower heads are a minor component of their diet. Grasses and seeds are especially important, and it ingests large amounts of bluegrass (*Poa* sp.) and other grass seeds to store energy for the winter (Dyni and Yensen 1996). It often inhabits areas with shorter, sparser vegetation than the Columbian ground squirrel. Such areas likely contain less abundant food resources than habitats occupied by Columbian ground squirrels (Dyni and Yensen 1996).

Between 1997 to 1999, there was an attempt to translocate squirrels into areas where they had been recently extirpated (Gavin et al. 1998). The Summit Gulch site (Figures 4 and 5) was intentionally burned, and squirrels were introduced the following spring. During this first translocation attempt, none of the squirrels survived. However, in the second year after the prescribed burn, squirrels were again translocated and during subsequent monitoring of the site, they appeared to survive and reproduce (Haak 2000). This translocation attempt helped to establish the need for reintroducing fire as a means to restore and enhance habitat, and to determine how soon after a treatment squirrels can be translocated while still assuring survival.

D. Life History and Ecology

The northern Idaho ground squirrel emerges in late March or early April and remains active above ground until July or early August (Yensen 1991). Emergence during this period begins with adult males, followed by adult females, and then yearlings. The northern Idaho ground squirrel becomes reproductively active within the first 2 weeks of emergence (Yensen 1991). Females and males

Figure 4. Summit Gulch population site after a controlled burn in 1999 (U.S. Fish and Wildlife Service 1999).

Figure 5. Summit Gulch population site 2 years after the controlled burn (U.S. Fish and Wildlife Service 2001).

are sexually mature the first spring after birth. They produce one litter per year of between two and seven pups, depending on the fitness of the female. Females that survive the first winter live, on average, nearly twice as long as males (3.2 years for females and 1.7 years for males). Individual females have lived for as long as 8 years. Males normally die at a younger age due to behavior associated with reproductive activity. During the mating period, males move considerable distances in search of receptive females and often fight with other males for copulations, thereby exposing themselves to predation by raptors, such as prairie falcons (*Falco mexicanus*), goshawks (*Accipiter gentilis*), and red-tailed hawks (*Buteo jamaicensis*). Significantly more males die or disappear during the 2-week mating period than during the rest of the 12- to 14-week period of above-ground activity (Sherman and Yensen 1994). Seasonal torpor or hibernation generally occurs in early to mid-July for males and females, and late July to early August for juveniles (Yensen and Sherman 1997).

The northern Idaho ground squirrel often digs burrows under logs, rocks, or other objects. Nesting burrows are found in soil pockets that are greater than 1 meter (3.28 feet) deep (Yensen *et al.* 1991, Yensen and Sherman 1997), but dry vegetation sites with shallow soils of less than 50 centimeters (19.5 inches) depth above bedrock are used for auxiliary burrow systems (Yensen *et al.* 1991). Although Columbian ground squirrels *(Spermophilus columbianus)* overlap in distribution with the northern Idaho ground squirrel (Yensen and Sherman, unpublished data, Dyni and Yensen 1996), Columbian ground squirrels prefer moister areas with deeper soils. Sherman and Yensen (1994) reported that the segregation of the two species is due to competitive exclusion as opposed to differing habitat requirements.

E. Population Dynamics

As a result of the factors described in the Life History and Ecology section, and due to the small sizes of the remaining population sites, the northern Idaho ground squirrel may have little resilience to naturally occurring events. Small populations are often vulnerable to climatic fluctuations and catastrophic events (Mangel and Tier 1994). In 1993, Gavin ran a computer population viability simulation program using recruitment and death values recorded over 8

years from an intensively studied northern Idaho ground squirrel population site (Gavin *et al.* 1999; Sherman and Yensen 1994). Variables in the model included no natural immigration, and began the population viability analysis using 50 individuals, a figure that was 30 individuals lower than the actual population size of 80 individuals (Sherman and Yensen 1994). The model calculated that all but 1 of 100 population sites would become extinct in less than 20 years. We contracted with Michael Runge, U.S. Geological Survey-Patuxent Wildlife Research Center, to develop a population model for the northern Idaho ground squirrel (1999). The program is designed to allow the user to develop population projections for a population site or population complex using data collected about the demographic structure over 3 or more years. Using the assumptions of a closed population and overwintering survival of the female and pups, this model predicts population extinction within 7 years using current demographic trends if no conservation measures are taken.

F. Reasons for Decline

1. Present or threatened destruction, modification, or curtailment of habitat or range. The fragmented distribution of the northern Idaho ground squirrel is a remnant of what may once have been a more continuous distribution from Round Valley, Valley County, north to New Meadows, west to Bear, and south to Indian Valley in Adams County, Idaho (E. Yensen, unpublished data). All remaining habitat sites for this ground squirrel are small in relation to those of other species of ground squirrels, ranging from >1 to 44 hectares (>1 to 110 acres), and are threatened primarily by forest encroachment into grassland meadows. Other threats may include residential construction, development of recreational facilities such as golf courses, road construction and maintenance, recreational shooting, and domestic cats.

The primary threat to the northern Idaho ground squirrel is meadow invasion by conifers (Yensen and Sherman 1997). Fire exclusion and the dense regrowth of conifers resulting from past logging activities have significantly reduced meadow habitats suitable for these ground squirrels over the past 40 years (Burns and Zbrorowski 1996). As the amount of suitable meadow habitat on public and private lands has been reduced (Truska and Yensen 1990), northern

Idaho ground squirrel dispersal corridors have been reduced or eliminated, further constricting the subspecies into smaller isolated areas (Yensen and Sherman 1997). Fire suppression has allowed conifers to invade once suitable meadow habitats, thereby shrinking the size of forb/grass meadows or closing grassy dispersal/migration corridors to nearby meadow sites. These changes have isolated the dry meadows with suitable shallow soils and preferred forage and burrow habitat where the northern Idaho ground squirrel finds refuge from the Columbian ground squirrel. Habitat fragmentation and reduced opportunities for dispersal among habitats prevents gene flow and results in considerable population differences (Yensen and Sherman 1997, Sherman and Runge 2002).

The loss of dispersal corridors has caused some isolated population sites to become extirpated in recent years (Sherman and Yensen 1994; U.S. Fish and Wildlife Service 1996). Additionally, small populations at several remaining sites are likely to become extirpated (Sherman and Yensen 1994; Mangel and Tier 1994).

For the past 70 years, agricultural conversion and rural housing developments near the communities of Round Valley, New Meadows, and Council, Idaho, have fragmented some suitable habitat formerly occupied by the northern Idaho ground squirrel. During this time, extensive use of pesticides may have reduced the range and population of northern Idaho ground squirrels (Stoddard 2001). Various other types of developments continue to threaten remaining occupied sites in Adams and Valley Counties. Following completion of a golf course and associated housing development, ground squirrels were eradicated due to their impacts to the fairways and golf greens (Yensen 1985).

A 51.6 kilometer (32 mile) gravel road from Council to Cuprum, Idaho, is being paved in 2003 (U.S. Department of Transportation 1998). Approximately 6.5 kilometers (4 miles) of this project runs through historic and currently occupied habitat of the northern Idaho ground squirrel. The project will also extend seasonal vehicle access to four occupied population sites, which may subject northern Idaho ground squirrels to increased mortality risk from higher speeds of vehicular traffic. Recreational shooting from the road may be another threat. A mitigation plan has been developed for the Council to Cuprum Road

paving project, with cooperation from the Federal Highways Administration (U.S. Forest Service 1997). The plan identifies mitigation actions to attract northern Idaho ground squirrels away from the paved highway and toward adjacent but suitable habitat. Funding for this plan allows for monitoring mitigation measures for a 3-year period after the road improvements have been made. It is uncertain whether proposed mitigation measures are satisfactory for protecting remaining populations in the vicinity of the road improvement project.

Currently, there is local interest in enlarging the dam and pool size of the Lost Valley Reservoir from 1,233.5 hectare/meters to 3,700.5 hectare/meters (10,000 acre/feet to 30,000 acre/feet) for irrigation. If this expansion occurs, it would likely flood key habitat currently occupied by northern Idaho ground squirrels at Slaughter Gulch, the largest known population site. This action would require section 7 consultation because Federal land managed by the Payette National Forest would be flooded, necessitating the acquisition of a special use permit.

Some activities or lack of management practices on private property appear to pose a threat to northern Idaho ground squirrels. Of the 34 extant population sites, 13 are entirely on private property , 2 are on both private and Federal property, and 1 is on both private and State property. Implementing management or survey activities for northern Idaho ground squirrels requires cooperation from private landowners. Controlled burning and reseeding are factors crucial to the continued survival and recovery of northern Idaho ground squirrels, but are often difficult to implement on private lands. Liability concerns develop if a controlled fire burned beyond its intended limits. Reseeding with suitable native forbs and grasses is important to establish appropriate food sources for ground squirrels and other animals. Access to private lands is often denied to agency biologists and researchers, which curtails population site monitoring and habitat restoration activities. The exception to this issue has been the OX Ranch owners and manager, and another private landowner, Bob Mack, who have worked cooperatively with us by allowing access to their lands for researchers and agency biologists to monitor populations and examine habitat conditions.

2. Overutilization for commercial, recreational, scientific, or educational purposes. Recreational shooting has contributed to the decline of northern Idaho ground squirrels at more than four sites (Yensen, pers. comm.). Sites adjacent to roads in particular are subject to a high rate of recreational shootings, and several incidents of shooting northern Idaho ground squirrels have been documented (Yensen, pers. comm.). Scientific collection of ground squirrels potentially could adversely impact this subspecies; however, less than 30 were taken during the past 20 years for museum collections. More recently, no known mortality of northern Idaho ground squirrels has occurred through live-trapping and relocation studies by research scientists handling, weighing, or temporarily marking over 1,100 squirrels (Sherman and Yensen 1994; Haak 2000).

3. Disease and predation. Disease is not thought to be a major factor affecting the northern Idaho ground squirrel. The parasitic nematode *(Pelodera strongyloides)* infects the eyes of the northern Idaho ground squirrel (Sherman and Yensen 1994), but is not currently known to be a cause of mortality in existing populations (Yensen *et al.* 1996). Plague *(Yersina pestis),* a contagious bacterial disease in rodents, has not yet been found in northern Idaho ground squirrel populations (Yensen *et al.* 1996). The disease, once established, could potentially decimate squirrel populations. Blood analysis to determine whether diseases are present has not been done on the northern Idaho ground squirrel.

The primary predators of the northern Idaho ground squirrel include badger *(Taxidea taxus),* northern goshawk *(Accipiter gentilis),* prairie falcon *(Falco mexicanus) ,*and occasionally red-tailed hawks *(Buteo jamaicensis).* Predators may threaten many of the smaller, more isolated population sites of this ground squirrel. Badger activity has been noted at several of these sites (Sherman and Gavin 1997; Haak 2000; Haak 2001; Bangerter, pers. comm.). Badgers are efficient predators and could potentially eliminate a small population in just a few days. Domestic cats have contributed to the decline of the northern Idaho ground squirrel at some sites (Yensen, pers. comm.). Male ground squirrels, due to their above-ground behavior patterns, are particularly vulnerable to predation during the mating season. Juveniles are subject to a high degree of predation during their first year (Sherman and Yensen 1994).

4. Inadequacy of existing regulatory mechanisms. The State of Idaho recognizes the northern Idaho ground squirrel as a Species of Special Concern (Idaho Department of Fish and Game 1992). Because of this status, the northern Idaho ground squirrel is protected from taking (*i.e.*, shooting, trapping, and poisoning) or possession by State law. In 1997, the Idaho Department of Fish and Game classified the northern Idaho ground squirrel as a Protected Nongame Species, making it illegal to collect, harm, or otherwise remove from its natural habitat (Idaho Department of Fish and Game 1997). Historically, protection from recreational shooting has not been adequately enforced (Yensen, pers. comm.). The Idaho Department of Fish and Game has begun to address this issue and has recently produced signs prohibiting shooting of northern Idaho ground squirrels.

Local land use ordinances and other regulations are inadequate for the protection of this subspecies. For example, in four of the existing population sites in Adams County, land use regulations allow for single and multiple housing development under a permit system. There is no consideration under the permit system for impacts to northern Idaho ground squirrels from housing or recreation developments in or adjacent to their habitat. With no limitations on development, it is anticipated that future human population growth and development will eliminate some existing ground squirrel population sites.

5. Other natural or manmade factors affecting continued existence. Land ownership patterns, prelisting activities, and existing conservation efforts on private and public lands affect the conservation of this subspecies. Competitive exclusion for forage and behavioral displacement by Columbian ground squirrels are known to cause local population declines of the northern Idaho ground squirrel (Yensen, pers. comm.; Dyni and Yensen 1996). The northern Idaho ground squirrel may have been forced into areas of shallower soils due to competition from Columbian ground squirrels (Yensen, pers. comm.; Sherman and Yensen 1994). The Columbian ground squirrel is larger and prefers areas with deeper soils that provide better over-winter protection and higher nutrients. Typically their burrow systems are associated with well-drained soils and higher productivity.

Winter mortality may contribute to northern Idaho ground squirrel decline, especially when juvenile squirrels enter hibernation without sufficient fat reserves. Soils also tend to freeze to greater depths where snow levels are insufficient. When this occurs, northern Idaho ground squirrels are unable to thermoregulate or maintain sufficient fat reserves. Although the relationship between ground squirrels and weather is complex (Yensen *et al.* 1992), population sites may have been adversely affected by drought and over-winter mortality in the early 1990's. Winter mortality is of special concern since many remaining sites contain few individuals. High winter mortality combined with loss of suitable vegetation conditions can result in the permanent loss of isolated populations.

G. Conservation Measures

1. Federal Programs. Section 7(a) of the Endangered Species Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if designated. Federal agencies are required to ensure that any activity they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible agency must enter into formal consultation with us. Extant populations of northern Idaho ground squirrels found on Federal land are managed by the Payette National Forest. In addition, sections 2(c)(1) and 7(a)(1) of the Endangered Species Act require Federal agencies to utilize their authorities in furtherance of the purposes of the Endangered Species Act to carry out conservation programs for endangered and threatened species.

All other extant populations of northern Idaho ground squirrels are located on lands owned by the State of Idaho, a municipality, or by private landowners. However, projects authorized or funded by various Federal agencies, or requiring Federal permits could affect the subspecies and are subject to section 7 consultation. Such federally funded projects, including road construction or maintenance and habitat enhancement projects for northern Idaho ground squirrels and other rare species, are subject to section 7 review.

A cooperative agreement between us and U.S. Department of Agriculture, Wildlife Services was signed on June 29, 2001, to provide predator control relief to key populations of northern Idaho ground squirrels. This short-term agreement expired on September 31, 2001. We may develop a long-term agreement with U.S.D.A. Wildlife Services, Idaho Department of Fish and Game, and the Payette National Forest to provide for predator control at essential population sites and complexes.

A conservation agreement between us and the Payette National Forest was finalized in July 1996, establishing the Northern Idaho Ground Squirrel Conservation Committee. The agreement was set for a duration of 5 years (U.S. Fish and Wildlife Service 1996). It was renewed in 2001, and identified conservation and land management actions that provide habitat favorable to the northern Idaho ground squirrel. In 2003, we created a Technical Working Group to further assist with recovery planning and implementation efforts for the squirrel. These actions, some already in the implementation phase, include controlled burning of selected meadows to reduce overstory and to improve forage preferred by the northern Idaho ground squirrel, timber harvest in selected areas to open meadows where active population sites are found, and timber harvest to provide dispersal corridors to improve connectivity between active populations (U.S. Forest Service 2000). For example, 3.3 million board feet of timber is proposed for harvest in Lick Creek drainage during the next 5 years. The sale is designed to reconnect an active population site with other nearby population sites. It will also expand the size of 12 unoccupied meadow habitats on Federal lands that are suitable for recolonization by the northern Idaho ground squirrel.

In 2000, we funded a 3-year study to determine the protein and lipid content of northern Idaho ground squirrel key forage plants. Additionally, a supplemental feeding program was initiated at four sites in 2001, to determine the feasibility of increasing the weight of northern Idaho ground squirrels prior to hibernation.

A comprehensive population monitoring program was started by the Idaho Department of Fish and Game in 1999, and has continued through 2002. The

Idaho Department of Fish and Game, through Endangered Species Act section 6 funding, has monitored key population sites and conducted surveys for additional population sites on an annual basis. Long-term monitoring efforts are expected to continue for the duration of recovery efforts. Annual monitoring reports are published. As a result of these and other surveys, nine new population sites have been found in the past 5 years.

A Safe Harbor Agreement, authorized under section 10 of the Endangered Species Act, was finalized in 2000, and covers 1.67 of 4.68 hectares (5 of 14 acres) of one private land parcel (U.S. Fish and Wildlife Service 2000c). This has allowed us to apply various conservation actions to maintain ground squirrels at the Price Valley-Mack population site. The agreement remains in effect for 20 years and expires on September 17, 2020.

A 5-year Habitat Management Plan is being implemented by the Payette National Forest to improve habitat at population sites, which will provide higher quality forage and burrows. Habitat restoration by the Payette National Forest has had a positive effect on northern Idaho ground squirrel populations. For example, thinning and burning at Summit Gulch, in 1996, significantly increased the amount of suitable habitat, and the population of northern Idaho ground squirrel has increased to 33. At Tree Farm, thinning and burning initiated in 2000, has increased the population from 14 to 64 individuals (Haak 2003). There are other examples of habitat improvement due to these efforts by the Forest Service.

Critical habitat has not been designated for this subspecies because it was determined that it would not benefit the species.

2. Non-Federal Programs. Through access and cooperation of the OX Ranch owners and manager, researchers have intensively studied the demography of the northern Idaho ground squirrels since 1987, at four population sites: Squirrel Manor, Bear Cemetery, Squirrel Valley and Lick Creek (Sherman and Runge 2002). In 2001, the OX Ranch manager conducted a controlled burn of about 50 hectares (200 acres) in the area of the Squirrel Valley population site. Idaho Department of Fish and Game biologists are monitoring squirrel

populations on the OX Ranch in 2003. Other observations and insights about northern Idaho ground squirrel behavior and population numbers have been provided to researchers and biologists by the OX Ranch Assistant Manager. A reintroduction plan, developed by scientists from Cornell University in Ithaca, New York, and Albertson College of Idaho in Caldwell, Idaho, was initiated in the spring of 1997, and continued in 1998. A total of 76 northern Idaho ground squirrels were transplanted to 2 sites that had been treated through burning and timber harvest (Sherman and Gavin 1997; Gavin *et al.* 1998). Both treated sites are on lands managed by the U.S. Forest Service and were selected because they had recently supported northern Idaho ground squirrels. Results at the Summit Gulch population site were positive and this population increased to 33 individuals. However, relocation of northern Idaho ground squirrels was not successful at the Cottonwood Corrals population site, probably due to predators and improper habitat restoration. Long-term benefits from these relocations will not be known for several years.

II. RECOVERY

A. Recovery Plan Objective

The ultimate goal of this recovery plan is to improve the status of the northern Idaho ground squirrel so the subspecies can be delisted. It would be eligible for delisting consideration when populations are self-sustaining, secure, and meet the criteria listed below.

B. Recovery Criteria

Due to the restricted geographic range and low numbers, the populations must be increased and stabilized. The only historical population level recorded was approximately 5,000 individuals (Yensen 1985). This 1985 estimate was made for populations judged to be in decline based on existing habitat reductions due to fire suppression and meadow encroachment. After restoration treatments of burning, for example, ground squirrels quickly populated sites, indicating that habitat loss had resulted in their decline. Hence, the recovery target needs to be higher than the conservative historical estimate 5,000 individuals, and is based on an effective population size (*Ne*) of greater than 5,000 individuals.

Metapopulation sites, encompassing networks of population sites, were mapped by biologists conducting on-the-ground surveys to delineate elevation, slope, soil type, and other factors contributing to habitat that could be utilized by northern Idaho ground squirrels (see Figure 3 and Table 3). All of the known population sites (Tables 1 and 2) fall within the metapopulation sites identified. Metapopulation sites were divided into two categories reflecting the timing, but not necessarily the priority, of our ability to conduct recovery activities on them (Table 3). The 12 primary sites are predominantly on lands administered by the U.S. Forest Service, are currently available for restoration and monitoring activities, and are managed under the Northwest Forest Plan which makes recovery of the northern Idaho ground squirrel a high priority. The five secondary sites are predominantly on private lands where easements, safe harbor agreements, or other negotiations will need to occur before recovery activities can begin.

Table 3. Northern Idaho ground squirrel primary and secondary potential metapopulation sites[1] and land ownership (the exact limits of these sites will be determined and are expected to change as new information becomes available). (See also Figure 3.)

Primary Metapopulation Sites	Ownership(s)
1. Lost Valley - Slaughter Gulch	Federal, State, Private
2. Tree Farm - Calf Pen - Summit	Federal
3. Bear Meadows Complex - Rocky Comfort Flat	Federal, Private
4. Lick Creek Canyon (Fawn Creek to upper Lick Creek)	Federal
5. Price Valley	Federal, State, Private
6. Paradise Flat - Ditch Creek Road	Federal, Private
7. Cottonwood - Halfway - Mill Creek	Federal, Private
8. Huckleberry - Mesa	Federal, Private
9. Chipmunk Springs	Federal
10. Johnson Creek - Pole Creek	Federal
11. Warm Springs - Fruitvale	Federal
12. West Mountain	Federal
Secondary Metapopulation Sites	**Ownership(s)**
1. Mud Creek	Private
2. New Meadows	Private
3. North Hornet area	Private
4. Ecks Flat - Rock Flat - Big Creek	Federal, Private
5. Round Valley	Private

[1] Primary metapopulation sites are predominantly on lands administered by the Forest Service, but there are some State and private lands included. Secondary metapopulation sites are predominantly on private lands that could be useful in the recovery of the subspecies if landowners are willing to participate in this conservation effort.

Recovery will be accomplished by protecting and enhancing sufficient habitat on private and public lands to maintain at least 10 functioning metapopulations of *Ne* > 500 each throughout the probable presettlement distribution in Adams and Valley Counties, Idaho (Figure 3, Table 3). At least 10 metapopulations will allow enough genetic diversity to sustain the subspecies. While the *Ne* for each metapopulation may vary depending on carrying capacity, an *Ne* of at least 500 at each would total greater than 5,000, and ensure stability for the subspeces.

Delisting may be considered when all of the following conditions have been met:

1. Of the 17 potential metapopulations that have been identified within the probable historic distribution, there must be at least 10 metapopulations (Table 3, Figure 3), each maintaining an average effective population size of greater than 500 for 5 consecutive years.

2. The area occupied by a minimum of 10 potential metapopulation sites must be protected. In order for an area to be deemed protected, it must be: (1) owned or managed by a government agency with appropriate management standards in place; (2) managed by a conservation organization that identifies maintenance of the subspecies as the primary objective for the area; or, (3) on private lands with a long-term conservation easement or covenant that commits present and future landowners to the perpetuation of the subspecies.

3. Plans have been completed for the continued ecological management of habitats for a minimum of 10 potential metapopulation sites.

4. A post-delisting monitoring plan covering a minimum of 10 potential metapopulation sites has been completed and is ready for implementation.

C. Recovery Strategy

1. Restore and Maintain Habitat

Thinning, burning, reseeding, livestock grazing, and other measures are necessary management tools for habitat restoration and maintenance. Site-specific habitat management plans for primary metapopulation sites will need to be completed within 2 years of this Recovery Plan, and as stipulated by the Payette National Forest in their Land and Resource Management Plan. The following management tools and sociological considerations should be used to create the habitat at appropriate stages of ecological succession:

Development of site-specific management plans for primary metapopulation sites

- Consider compatible human uses;
- Assess potential forestry practices;
- Conduct plant community composition analysis.

Restoration of habitat

- Thinning and burning;
- Reseeding with native grass and forb species;
- Livestock management.

Maintenance of appropriate habitat

- Prescribed burning at site-specific intervals;
- Vegetation management (*e.g.,* noxious weed control);
- Grazing regimes appropriate to each site.

Implementation of actions to protect known population sites on State of Idaho, municipal, and private lands

- Seek the cooperation of State of Idaho, private, and municipal landowners to protect known northern Idaho ground squirrel population sites;
- Monitor the success of the Safe Harbor Agreement on private lands.

2. Conduct Northern Idaho Ground Squirrel Population Actions

The following actions should be implemented in coordination with the technical working group to further the recovery of the subspecies:

Translocation into existing populations

Translocation will almost certainly be necessary to increase genetic diversity (Gavin *et al.* 1999). Improved release techniques are needed to ensure higher survival rates after translocation. Because of the high loss involved in translocations, a translocation program should be combined with captive breeding. A translocation program will necessitate a monitoring program to evaluate methods and success.

Reintroduction (within the probable historic distribution)

Establishing new populations within formerly occupied habitats will be important to some of the metapopulations.

Captive propagation

Captive breeding may be necessary to curtail extinction of the subspecies due to catastrophic events. Captive breeding programs should utilize nationally established zoological standards, require American Association of Zoos and Aquariums certification, and be based on research recommendations. This would ensure a varied gene pool, as well as additional opportunities for research, education, and public relations.

Research studies

More information is needed on the following topics to guide recovery:

Habitat

- Nutrient cycling and availability during early succession (post-fire succession);
- Fire regime at each site;
- Effects of livestock grazing.

Ground squirrel ecology

- Diet and nutrition;
- Overwinter survival (weather, supplemental feeding, etc.);
- Diseases, especially plague;
- Contaminants (*e.g.,* pesticides).

Population genetics

- Genetics and dispersal in small, isolated populations;
- Estimation of effective population sizes;
- Captive breeding for population augmentation;
- Evaluation of translocation techniques.

Law enforcement

- Assess threats from recreational shooting;
- Conduct gopher poisoning;
- Encourage enforcement of existing Payette National Forest regulations.

Predator management

- Identify site-specific predators;
- Assess seasonal impact of predators on known northern Idaho ground squirrel populations;
- Implement predator management actions.

Competitor management

- Assess impacts of competitors;
- Implement competitor management actions.

3. Monitor Habitat and Populations

Ground squirrel habitat monitoring

Monitoring of ecological succession and the outcome of habitat restoration actions will be necessary to assess the implementation, effectiveness, and validation of recovery efforts. At a minimum, the following actions will be needed:

- Establish vegetation plots and transects;
- Monitor outcome of vegetative treatments (*e.g.,* thinning, burns, and reseeding efforts).

Ground squirrel population monitoring

Monitoring the implementation, effectiveness, and validation of recovery efforts will be necessary to assess the outcome of population recovery actions. At a minimum, the following actions will be needed:

- Refine standardized protocols for metapopulation monitoring (must be both intensive and extensive);
- Monitor annual population size and trajectory;
- Monitor prehibernation and emergence weight;
- Monitor overwintering survival for each age class and sex;
- Determine sex ratios and age structure;
- Monitor reproduction.

Ground squirrel surveys

Continued surveys will be useful to the recovery effort because additional populations provide more management options. Surveying will be done within the probable historical distribution of the subspecies. Methodologies to survey for squirrels need to be standardized to ensure information collected can be used for multiple purposes. The following protocols need to be established:

- Survey timing (seasonality);
- Survey intensity for detectability;
- Reporting format.

4. Coordinate the Northern Idaho Ground Squirrel Recovery Program

Establishment of an Interagency Program Coordinator

A coordinator will help to integrate ongoing programs, seek funding, develop grant proposals, promote research and education opportunities, and manage the database. The coordinator is an ex-officio member of the technical working group, and helps with implementing recommendations of the group.

Maintainance of a Technical Working Group

A technical working group is needed to implement the science-based species recovery plan. This group should be comprised of scientists from each of the participating agencies and academia, and should include a range of technical expertise and resources (*e.g.,* grazing, timber, wildlife, and research).

Development and evaluation of a public outreach program

- Develop posters for distribution that identify the northern Idaho ground squirrel, its distribution, and threats;
- Create audio-visual programs that tell the northern Idaho ground squirrel recovery story;
- Make media contacts for promoting northern Idaho ground squirrel protection.

Development and maintainance of a central database

Habitat, management (burning, thinning, etc.), monitoring, and Geographic Information System data are currently being maintained by the U.S. Forest Service. The Idaho Department of Fish and Game is maintaining northern Idaho ground squirrel population data. Collecting and maintaining all data in a consistent format will help ensure productive management of the subspecies.

Assessment of recovery plan implementation and revision if necessary

Establishment of northern Idaho ground squirrel as a Payette National Forest Management Indicator Species for grassland communities

D. Date of Recovery

Because of the high probability of genetic change in existing populations (Gavin *et al.* 1999), and because ground squirrels can respond rapidly to environmental changes, either positively or negatively (Runge 1999), it is imperative that recovery implementation be initiated without delay. The Runge (1999) population viability model predicted that the subspecies could go extinct within 7 years under the 1999 demographic trends (prior to the subspecies being listed under the Endangered Species Act of 1973) if no conservation measures are taken. However, recovery can also be rapid if recovery actions are implemented. If recovery actions produce positive responses at each metapopulation site, the delisting could be initiated by 2010.

III. RECOVERY ACTION NARRATIVE

1. Restore and maintain habitat. Numerous actions related to habitat improvement for northern Idaho ground squirrel are taking place that appear to be beneficial to the subspecies. The majority of the actions identified here will be focused on the 12 primary metapopulation sites.

1.1 Restore and maintain habitat on Federal lands. The majority of extant squirrel populations currently exist on public land. The Forest Service should utilize their authorities to further the conservation of the subspecies.

1.1.1 Restore Habitat. Utilize a variety of tools to restore potential, but currently unoccupied, habitats within the probable historical distribution of the subspecies.

1.1.1.1 Thinning and burning. Utilize low-intensity prescribed broadcast burns to enhance/rejuvenate the grass/forb component. Fires aid in nutrient release, as well as help in reducing tree and brush densities, and lower vegetation height, which is important to ground squirrels. Mechanical thinning of trees and brush will also be used in conjunction with prescribed burns.

1.1.1.2 Reseeding. It will be necessary to utilize native (locally collected) grass and forb species to expedite restoration.

1.1.1.3 Livestock management. Grazing may be used as a management tool, where appropriate, to help in the restoration of optimal habitat, pending the results of research (see Action 2.4.1.3). Grazing management may potentially include strategies such as short-term and early-season intense grazing, fencing recently thinned and burned areas, or other measures as appropriate.

1.1.2 Maintain appropriate habitat. Habitat that is currently occupied by squirrels must be maintained in early seral stages appropriate for the subspecies. This can be accomplished via the following actions:

1.1.2.1 Prescribed burning. As with the restoration of habitat, prescribed low-intensity burns will be utilized to ensure the appropriate grass/forb component is maintained at ground squirrel sites and the corridors connecting them.

1.1.2.2 Vegetation management. An aggressive noxious weed control effort may be necessary after thinning and burning.

1.1.2.3 Grazing regimes. Grazing may be used as a management tool, where appropriate, to help in the restoration of optimal habitat, pending the results of research (see Action 2.4.1.3). Grazing management may potentially include strategies such as short-term and early-season intense grazing, fencing recently thinned and burned areas, or other measures as appropriate.

1.1.3 Review and renew our Memorandum of Understanding with the Payette National Forest. A conservation agreement (now a Memorandum of Understanding) between the Payette National Forest and us was signed in 1996, and renewed in 2001. The success of this agreement should be reviewed and updated every 5 years.

1.2 Implement actions to protect known northern Idaho ground squirrel population sites on State of Idaho, municipal, and private lands. Several northern Idaho ground squirrel population sites occur on non-Federal lands. Efforts should focus on cooperative actions to protect and enhance existing population sites on these lands**.**

1.2.1 Seek the cooperation of State of Idaho, private, and municipal landowners to protect known northern Idaho ground squirrel population sites. Efforts should be made to seek the cooperation of State, municipal, and private landowners where known population sites area located. Cooperation should include conserving habitat and allowing experimental habitat manipulation for study and monitoring (see actions below for monitoring). Various means to protect northern Idaho ground squirrel habitat can be utilized, including seeking conservation easements, developing management plans and habitat conservation plans, revising land use regulations to protect habitats, and other voluntary or permitted conservation actions. It may be desirable to establish metapopulations on private land, if agreeable landowners can be enlisted.

1.2.2 Monitor the success of the Safe Harbor Agreement on private lands. A Safe Harbor Agreement, authorized under section 10 of the Endangered Species Act, was finalized in 2000, and covers 1.67 of 4.68 hectares (5 of 14 acres) of one private land parcel (U.S. Fish and Wildlife Service 2000c). This has allowed us to apply various conservation actions to maintain ground squirrels at the Price Valley-Mack population site. The agreement remains in effect for 20 years and expires on September 17, 2020. Monitoring of these types of agreements should be part of an overall monitoring effort on private lands**.**

1.2.3 Develop additional Safe Harbor Agreements on private lands as appropriate.

1.3 Develop site-specific management plans for each metapopulation. Each metapopulation should have a management plan that outlines needed enhancement and maintenance of habitat for the subspecies.

2. Conduct northern Idaho ground squirrel recovery actions. A number of recovery actions have been identified by the technical working group to ensure the survival and recovery of the subspecies, and to maintain genetic diversity within and between metapopulations.

2.1 Develop a translocation plan - population genetics management. Develop and implement a plan for translocation of squirrels into restored sites, and supplementation of small populations to ensure genetic diversity. The plan will involve developing a genetics library, cataloging the genetic history of each pup released, and maintaining a genetics "map" of each population site. Translocations, supplementations, and reintroductions should be done within the 12 primary metapopulation sites. These actions are also encouraged on a willing landowner basis for the five secondary metapopulation sites.

2.1.1 Supplement existing populations. Squirrels will be translocated into existing populations to augment those populations and increase genetic diversity.

2.1.2 Translocate into restored sites. Following habitat restoration, squirrels will be translocated into historical sites. Boundaries of metapopulation sites may be redrawn as they prove successful over the long term.

2.2 Reintroduce ground squirrels (within the probable historic distribution). In addition to supplementing active population sites with squirrels, there may also be the need for developing and implementing a plan for reintroducing the subspecies into restored (unoccupied) habitats within the probable historic distribution to further improve the metapopulation viability.

2.2.1 Develop a reintroduction plan. Plans to ensure a low mortality rate among transplanted squirrels will be necessary (see Action 2.4.3.4).

2.2.2 Implement reintroductions.

2.3 Captive propagation. Captive breeding may be necessary as a hedge against the total extinction of the subspecies due to catastrophic events, to ensure a varied gene pool, to provide additional opportunities for research, and to help the public better understand the importance of northern Idaho ground squirrel recovery.

2.3.1 Coordinate and assist Zoo Boise and other accredited zoos in captive breeding and exhibition of northern Idaho ground squirrel.

2.4 Conduct Research Studies. Because of limited existing data on the subspecies, more information will be needed on the following topics to help guide the recovery effort:

2.4.1 Habitat related studies. These include the following:

2.4.1.1 Nutrient cycling and availability during early succession (post-fire succession). It is important to know if the plants at a site have sufficient nutritional quality and productivity, and how nutrient availability in plants changes over time during post-fire succession.

2.4.1.2 Fire regime at each site. It is important to understand the fire regime at each site in order to develop and implement site-specific management plans for maintaining appropriate seral stages and plant community composition.

2.4.1.3 Effects of livestock grazing. Specific studies are needed to assist habitat restoration and maintenance efforts (see Action 1.1 and 1.2 above).

2.4.2 Ground squirrel ecology studies. In order to better manage the subspecies, more information is needed on aspects of northern Idaho ground squirrel life history and ecology. At a minimum, the following studies need to be conducted:

2.4.2.1 Diet and nutrition. We need to understand which species of plants are important in northern Idaho ground squirrel diets, if these species are present in adequate amounts on the study sites, and if these species have adequate nutrients (*e.g.,* nitrogen, phosphorus, and essential fatty acids required for hibernation).

2.4.2.2 Overwinter survival (weather, supplemental feeding, hibernaculum, etc.). Studies indicate that highest mortality occurs during winter because many northern Idaho ground squirrels do not survive hibernation. We need to determine the minimum weights needed by the squirrels before entering hibernation, and if there is a correlation between snowpack depth and duration, soil depths, hibernaculum characteristics, and the survival of northern Idaho ground squirrels.

2.4.2.3 Diseases, especially plague. Because certain epizootics such as plague are known to extirpate entire populations of rodents, there is a need to understand the vulnerability of northern Idaho ground squirrels to potential ground squirrel diseases.

2.4.2.4 Contaminants (pesticides, rodenticides, herbicides, fungicides, gopher control) on private and public lands. Rodenticides and other pesticides are still being used on both public and private lands. Although they have not been identified as a threat to the ground squirrel, there is a need to study and monitor the effects of these pesticides within and adjacent to northern Idaho ground squirrel populations sites.

2.4.2.5 Dispersal. The rate, timing, and age of dispersal of northern Idaho ground squirrels from their natal sites is unknown. However, in order to establish successfully functioning metapopulations, it is important to know how far northern Idaho ground squirrels disperse under a variety of conditions. Timing and age of dispersal is important for planning successful translocation, supplementation, and reintroduction programs. It may be possible to utilize information from surrogate ground squirrel species being studied (*e.g.,* southern Idaho ground squirrels, Pauite ground squirrel, etc.).

2.4.3 Northern Idaho ground squirrel population genetics. Northern Idaho ground squirrel populations are known to be impacted by genetic drift (Gavin *et al.* 1999). It is imperative to monitor and prevent genetic deterioration of the populations. The following are needed:

2.4.3.1 Genetics and dispersal in small, isolated populations. A radio-tracking study could help us determine ages, rates, timing, and distances of dispersal from natal sites.

2.4.3.2 Estimation of effective population sizes.

2.4.3.3 Captive breeding for population augmentation. Captive breeding populations should be established in certified facilities. Studbooks and other record-keeping efforts will help track genetics of the captive individuals. This will enable reintroduced individuals to contribute maximally to the genetic diversity of wild populations upon their release.

2.4.3.4 Evaluation of translocation techniques. Released animals must be monitored to ensure that efforts are successful and to prevent waste of resources and individual squirrels. Release techniques should be evaluated and improved. Information needs include soft release techniques, movements of released individuals, genetic contribution of released individuals, and long-term success.

2.5 Continue law enforcement. Current regulation and laws will need to be aggressively enforced in order to prevent loss of the few remaining individual Northern Idaho ground squirrels. Law enforcement must go hand-in-hand with a well-executed public outreach effort.

2.5.1 Enforcement of existing Payette National Forest regulations. Payette National Forest regulations currently control off-road travel, dispersed recreation, firearms, etc. which give the northern Idaho ground squirrel adequate protection. The Payette National Forest should continue to enforce existing regulations.

2.5.2 Recreational Shooting. Recreational shooting should be discouraged through public outreach, and aggressive law enforcement if outreach efforts fail.

2.6 Manage predators. A badger can severely reduce or eliminate a small ground squirrel population. Live-trapping and relocation, or predator control as a conservation tool, may need to be invoked at specific

sites on an as-needed basis. Control and management of other potential predators (*i.e.,* raptors, domestic cats, etc.) is probably unnecessary or impractical.

2.7 Manage competitors. Columbian ground squirrels compete with northern Idaho ground squirrels. Once habitat restoration occurs, Columbian ground squirrels could move in. A site-specific plan detailing management of both species is necessary to recover northern Idaho ground squirrels, and maintain Columbian ground squirrels at reasonable levels. Occasional capture, translocation, or disposal of Columbian ground squirrels may be needed at some sites.

3. Monitor habitat and populations. It will be necessary to monitor the effectiveness of efforts to improve habitat and the population response to the management for successful recovery.

3.1 Habitat Monitoring. In order to monitor habitat changes after restoration treatments, the following need to be completed:

3.1.1 Establish vegetation plots and transects. Permanent long-term plots and transects should be established in occupied and unoccupied habitats to measure habitat change over time. These plots and transects will be established as part of the site-specific management plan for each of the metapopulations developed.

3.1.2 Monitor the outcome of vegetative treatments (*e.g.,* thinning, burning, and reseeding). The established plots and transects should be monitored to determine vegetation changes in each of the habitats. The results of this monitoring will guide future management actions (*i.e.,* thinning and burning, reintroduction, livestock grazing, etc.).

3.2 Ground Squirrel Population Monitoring. Monitoring of succession and the outcome of habitat restoration actions will be necessary to assess the implementation, effectiveness, and validation of recovery efforts. At a

minimum, the following should be implemented and presented in the annual monitoring report:

3.2.1 Refine standardized protocols for metapopulation monitoring.

3.2.2 Monitor annual population size and trajectory.

3.2.3 Monitor pre-hibernation and emergence weight.

3.2.4 Monitor overwintering survival for each age class and sex.

3.2.5 Determine sex ratios and age structure.

3.2.6 Monitor reproduction.

3.3 Ground Squirrel Surveys. Continued surveys are necessary to identify additional populations, and may provide information that could improve subspecies management. Surveying should be conducted within the probable historical distribution of the subspecies. Methodologies for surveying ground squirrels need to be standardized to ensure information collected can be used for multiple purposes. The following need to be considered:

3.3.1 Establish protocols. The protocols should be developed by the technical working group with input from other specialists.

3.3.1.1 Conduct surveys.

3.3.2 Standardized reporting format. A standardized reporting format will allow data to be collected in a consistent manner.

4. Coordinate the northern Idaho ground squirrel recovery program. Restoration, recovery, and monitoring activities would benefit from a program

coordinator and a technical working group. The technical group needs representation of a variety of technical experts (*e.g.,* for grazing, timber, wildlife, and research). The coordinator helps implement the recommendations of the technical team.

4.1 Establish an Interagency Program Coordinator. A program coordinator was hired in 2003, to integrate ongoing programs, seek funding and develop grant proposals, and promote research and outreach. The coordinator is also the manager for the database, and an ex-officio member of the technical working group**.**

4.2 Maintain Technical Working Group Guidance. In order to implement a science-based species recovery plan, there is a need for a technical working group to help with northern Idaho ground squirrel recovery program coordination. This group should be comprised of scientists from each of the participating agencies and academia, and should be formalized in order to facilitate implementation of the recovery effort.

4.3 Develop, evaluate, and update a public outreach program and materials for northern Idaho ground squirrel recovery. Recovery of the northen Idaho ground squirrel will be promoted by working with others to conserve and protect the subspecies. An informed public should be more interested in the recovery of the subspecies. The general public and all interested parties (such as elected officials; local, county, State, Federal agencies; private landowners; livestock industry; non-governmental organizations; and conservation organizations) should have access to all information regarding the northern Idaho ground squirrel. The public information and outreach program should provide opportunities for the public to hear about northern Idaho ground squirrel biology, its importance in the ecosystem, threats, conservation measures/protection, and recovery success stories. A multi-faceted program should be developed, possibly including:

a) Print materials (timely news releases, news articles, posters, flyers, a ground squirrel guide, game regulation write-ups, and technical posters for symposia);
b) Audio-visual programs (video and radio Public Service Announcements, and PowerPoint presentations);
c) Educational presentations (school visits, outdoor recreation symposia, Zoo Boise tours, and higher education activities);
d) Media (print/TV/radio).

This program will be designed, implemented, and evaluated in cooperation with recovery team members from various agencies and private landowner groups, including information and public affairs specialists.

4.4 Develop and maintain a central database for northern Idaho ground squirrel information. A central database should be established that contains information regarding the location of existing populations, and any new population sites discovered. Past records of northern Idaho ground squirrels should be collected and organized. Records should be entered on quadrangle and geographic information system maps, and keyed to supporting narrative data. Narrative data should include as much information as possible concerning field conditions, observers, dates, times, numbers and gender of squirrels, pertinent biological correlates, and the type of observation. These records and the geographic information system habitat maps should be updated regularly. An effort should be made to conduct a sensitivity analysis using the data collected. Data will be more easily shared among appropriate individuals.

4.5 Assess implementation of the recovery plan and revise as necessary. This recovery plan should be reviewed and revised as necessary or as new information becomes available. Establishing a recovery implementation team may be necessary to coordinate recovery actions.

4.6 Establish northern Idaho ground squirrel as a Payette National Forest Management Indicator Species for grassland communities.

The northern Idaho ground squirrel is associated with grassland/shrub communities within the Payette National Forest. By officially establishing the northern Idaho ground squirrel as a management indicator species, and by monitoring its populations, the condition and vigor of associated animal and plant species can be determined.

Table 4. Cross-reference of recovery actions and listing factors for the northern Idaho ground squirrel**.**

Listing Factor	Threat	Still A Threat?	Recovery Actions	Recovery Criteria
A	Forest encroachment into grassland meadows/fire suppression	Yes	1.1.1, 1.1.2, 1.1.3, 1.3, 2.1, 2.3, 2.5.1.1, 2.5.1.2, 2.5.1.3, 3.1,4.0, 4.6	1,2,3,4
A	Conversion of meadows to agriculture	Yes	1.1.1, 1.1.2, 1.2.1, 1.3, 2.5.1, 2.4.3.1, 2.4.3.2, 2.5.2, 3.1, 3.3, 4.3, 4.4, 4.6	1,3,4
A	Grazing practices	Unknown/ Needs Evaluation	1.1.1.3, 1.1.2.2, 1.1.2.3, 2.5.1.3, 2.5.2.1, 2.5.2.2, 2.5.2.4, 2.5.2, 2.8, 3.1.1, 4.6	1,2,3,4
A	Residential construction	Yes	1.1.1, 1.1.2, 1.3, 2.5, 2.5.2.4, 2.4.3, 2.6.1, 2.7, 4.0, 4.3, 4.3,	1,2
A	Development of recreational facilities, *e.g.,* golf courses	Yes	1.1.1, 1.1.2, 1.3, 2.5, 2.5.2.4, 2.4.3, 2.6.1, 2.7, 4.0, 4.3, 4.3,	1,2
A	Dam expansion for irrigation	Yes	1.1.1, 1.1.2, 1.3, 2.5, 2.5.2.4, 2.4.3, 2.6.1, 2.7, 4.0, 4.3, 4.3,	1,2
A	Road construction and maintenance	Yes	1.1.1, 1.1.2, 1.3, 2.5, 2.5.2.4, 2.4.3, 2.6.1, 2.7, 4.0, 4.3, 4.3,	1,2
B	Recreational shooting	Yes	2.6, 2.6.1, 2.6.2	2,3,4
C	Predation, primarily by badgers	Yes	2.7, 2.8	3
C	Disease, plague	Potential Only	2.4.2.3	3
D	Inadequate local land use ordinances relating to housing developments	Yes	1.2, 1.3, 4.0	1,2,3
E	Land ownership patterns	Yes	1.2, 1.2.1, 1.2.2, 1.3, 2.6, 2.7, 2.8, 4.0	2,3
E	Winter mortality	Yes	1.1.1, 1.1.2, 1.3, 2.0, 2.5, 2.5.2, 2.5.3, 3.2, 4.0	1,2,3

IV. IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and costs for the recovery program. It is a guide for meeting the objectives elaborated in Part II of this plan. This schedule indicates the general category for implementation, recovery actions, corresponding outline numbers, action priorities, duration of actions, responsible agencies, and estimated costs for actions. These actions, when accomplished, should bring about the recovery of the northern Idaho ground squirrel and the protection of its habitat.

Recovery Action Priorities

Priority 1: Actions necessary to prevent extinction or to prevent the subspecies from declining irreversibly in the foreseeable future.

Priority 2: Actions necessary to prevent a significant decline in subspecies population or habitat quality, or other significant negative impact short of extinction.

Priority 3: All other actions necessary to provide full recovery of the subspecies.

Acronym Definitions

IDFG	Idaho Department of Fish and Game
PNF	Payette National Forest
USFWS	U.S. Fish and Wildlife Service
FHA	Federal Highways Administration
BLM	Bureau of Land Management
PWRC	U.S. Geological Survey, Patuxent Wildlife Research Center
WS	Wildlife Services
MOU	Memorandum of Agreement
HCP	Habitat Conservation Plan

Definition of Action Durations

Continual - An action that will be implemented on a routine basis, once begun, until recovery.

Ongoing - An action that is currently being implemented and will continue until it is accomplished.

Asterisk - (*) Indicates lead agency(s).

Implementation Schedule for the Northern Idaho Ground Squirrel Recovery Plan											
Priority Number	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimates ($1,000)						Comments
					Total Cost	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	
1	1.1.1.1	Habitat restoration - thinning ($80/acre)	Ongoing	PNF*	40	8	8	8	8	8	
1	1.1.1.1	Habitat restoration - burning ($150/acre)	Ongoing	PNF*	75	15	15	15	15	15	
1	1.1.1.2	Habitat restoration - reseeding ($300/acre)	Ongoing	PNF*	25	5	5	5	5	5	
1	1.1.1.3	Habitat restoration - livestock management ($100/acre)	Ongoing	PNF*	50	10	10	10	10	10	
1	1.1.2.1	Habitat maintenance - prescribed re-burns ($50/acre)	Continual	PNF*	10	2	2	2	2	2	
1	1.1.2.2	Habitat maintenance - vegetation management (*e.g.* noxious weed control)	Continual	PNF*	5	1	1	1	1	1	
1	1.1.2.3	Habitat maintenance - grazing regimes	Continual	PNF*							Combined with Action 1.1.1.3.
1	1.3	Develop site-specific management plans for each metapopulation	Ongoing	PNF*, USFWS, IDFG, BNF	40		40				Field work, consulting fees, GIS, coordination meetings.

Implementation Schedule for the Northern Idaho Ground Squirrel Recovery Plan											
Priority Number	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimates ($1,000)						Comments
					Total Cost	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	
1	2.1	Develop a translocation plan - population genetics management	Ongoing	IDFG*, USFWS	10		5		5		Consultants, preparation of plan.
1	2.1.1	Translocate into existing populations	Continual	IDFG*, USFWS	4	0	1	1	1	1	
1	2.2.1	Develop a reintroduction plan	Ongoing	IDFG*, USFWS, PNF	10		5			5	Develop plan and follow-up genetics monitoring.
1	2.2.2	Implement reintroductions	Continual	IDFG*, USFWS	4		1	1	1	1	
1	2.4.2.2	Conduct squirrel ecology research - overwinter survival (weather, supplemental feeding, hibernaculum, etc.)	Ongoing	USFWS*, IDFG, PNF	100		40	30	30		Graduate study.
1	2.5.2	Law enforcement - enforcement of existing PNF regulations	Continual	PNF*							Travel plan. Cost linked to Action 2.5.1.
1	3.1.1	Habitat monitoring - establish vegetation plots and transects	Ongoing	PNF* USFWS	25	5	5	5	5	5	Pre-treatment.
1	3.1.2	Habitat monitoring - monitor outcome of treatments	Ongoing	PNF*	25	5	5	5	5	5	Post-treatment.

Implementation Schedule for the Northern Idaho Ground Squirrel Recovery Plan											
Priority Number	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimates ($1,000)						Comments
					Total Cost	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	
1	3.2.2	Ground squirrel monitoring - monitor annual population size and trajectory	Continual	USFWS*, IDFG	230	20	45	50	55	60	Linked to other actions.
1	3.2.3	Ground squirrel monitoring - monitor pre-hibernation and emergence weight									
1	3.2.4	Ground squirrel monitoring - monitor overwintering survival									
1	3.2.5	Ground squirrel monitoring - determine sex ratios and age structure									
1	3.2.6	Ground squirrel monitoring - monitor reproduction	Continual	USFWS*, IDFG	40		10	10	10	10	Linked to other actions.
1	4.2	Maintain technical working group guidance	Continual	USFWS, IDFG, PNF							Linked to Action 4.1.
1	4.4	Develop and maintain central database	Continual	USFWS, IDFG, PNF							Linked to Action 4.1.
2	1.1.3	Review and renew USFWS/PNF MOU	Ongoing	PNF*, USFWS	0						Renew in FY 2006.

Implementation Schedule for the Northern Idaho Ground Squirrel Recovery Plan											
Priority Number	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimates ($1,000)						Comments
					Total Cost	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	
2	1.2	Habitat restoration on private lands and HCPs	Continual	USFWS*, IDFG	100	20	20	20	20	20	
2	1.2.2	Monitor Safe Harbor Agreements	Continual	USFWS*, IDFG	25	5	5	5	5	5	
2	2.3	Captive propagation	Continual	USFWS*, Zoo Boise, IDFG	50		35	5	5	5	Cages, signs, maintenance, consulting.
2	2.4.1.1	Conduct habitat research - nutrient cycling (post-fire succession)	Ongoing	USFWS*, PNF	40		10	10	10	10	
2	2.4 1.2	Conduct habitat research - Fire regime at each site	Ongoing	PNF*	8		2	2	2	2	Connected to site-specific plans.
2	2.4.1.3	Conduct habitat research - Effects of livestock grazing	Ongoing	USFWS*, PNF	100		25	25	25	25	
2	2.4.2.1	Conduct squirrel ecology research - diet and nutrition	Ongoing	USFWS*, IDFG	45		15	15	15		Consultant, laboratory.
2	2.4.2.5	Conduct squirrel ecology research - dispersal	Continual	USFWS	65	40	25				
2	2.4.3.1	Population genetics studies - genetics and dispersal	Continual	USFWS*, IDFG							Linked to Actions 2.4.1 and 2.4.2.

Implementation Schedule for the Northern Idaho Ground Squirrel Recovery Plan											
Priority Number	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimates ($1,000)						Comments
					Total Cost	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	
2	2.4.3.2	Population genetics studies - estimation of population sizes	Ongoing								Linked to Actions 2.4.1 and 2.4.2.
2	2.4.3.4	Population genetics studies - evaluation of translocation techniques	Ongoing	USFWS*, IDFG							Linked to Actions 2.4.1 and 2.4.2.
2	2.5.1	Law enforcement - Recreational shooting	Continual	USFWS*, IDFG, PNF	15	3	3	3	3	3	
2	3.2.1	Ground squirrel monitoring - refine standard protocols for metapopulation monitoring	Continual	USFWS*, IDFG	20		10	10			Large population sampling.
2	3.3.1	Ground squirrel surveys - establish protocols	Ongoing	USFWS*, IDFG	5		5				Looking for new populations.
2	3.3.1.1	Ground squirrel surveys - conduct surveys	Ongoing	USFWS*, IDFG, PNF	40		10	10	10	10	
2	3.3.2	Ground squirrel surveys - standardize reporting format	Ongoing	USFWS*, IDFG, PNF	1		1				
2	4.3	Develop, evaluate, and update a public outreach program and materials	Continual	USFWS, IDFG, PNF							Linked to Action 4.1.

Implementation Schedule for the Northern Idaho Ground Squirrel Recovery Plan											
Priority Number	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimates ($1,000)						Comments
					Total Cost	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	
2	4.5	Assess implementation of the recovery plan and revise as necessary	Ongoing	USFWS, IDFG, PNF							Linked to Action 4.2.
3	2.4.2.3	Conduct squirrel ecology research - diseases (plague)	Continual	USFWS*, IDFG							Parasite collection incidental to Actions 2.4.2.1 and 2.4.2.2.
3	2.4.2.4	Conduct squirrel ecology research - contaminants	Continual	USFWS*, IDFG	6		2	2	2		Gopher control still on-going on the PNF. May be pesticide use on private land within or adjacent to PNF.
3	2.4.3.3	Population genetics studies - captive breeding	Ongoing	USFWS*, IDFG							Linked to Actions 2.4.1 and 2.4.2.
3	2.6	Predator management	Ongoing	USFWS*, IDFG	5	1	1	1	1	1	Local as needed with contractor.
3	2.7	Competitor management	Ongoing	USFWS*, IDFG	5	1	1	1	1	1	Local as needed.
3	4.1	Establishment of an Interagency Program Coordinator	Continual	USFWS, IDFG, PNF	300	60	60	60	60	60	
3	4.6	Establish ground squirrel as a PNF Management Indicator Species for grassland communities	Ongoing	USFWS, IDFG, PNF							Linked to Action 1.1.
Total Estimated Costs:					$1,523	201	428	312	312	270	

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APPENDIX A - Stakeholder Involvement

Development of the Draft Northern Idaho Ground Squirrel Recovery Plan was initiated on November 13, 2000, when a recovery strategy meeting was convened. As a result of this meeting, a document titled the Northern Idaho Ground Squirrel Recovery Strategy Framework (U.S. Fish and Wildlife Service 2000b) was distributed on January 26, 2001, to nine biologists who were involved with pre-listing recovery implementation, a U.S. Forest Service administrator, a rancher who owns private land containing key habitat - a stronghold for northern Idaho ground squirrels, and an environmental coordinator for the Boise Cascade Corporation. Comments from seven of the nine biologists were received, and oral comments were received from the rancher. The Forest Service administrator and the representative from Boise Cascade Corporation did not respond to our invitation. We incorporated the Framework responses into the Draft Recovery Plan; our Regional Office review began November 30, 2001. We provide Endangered Species Act section 6 funds to the Idaho Department of Fish and Game to implement recovery strategies for the northern Idaho ground squirrel. The Idaho Department of Fish and Game intends to coordinate survey and monitoring on the OX Ranch in 2003, with the ranch manager. This will allow population monitoring of northern Idaho ground squirrels by a State agency as a continuation of 12 years of monitoring conducted by scientists from Cornell University.

We elected not to formalize a recovery team since the listing of the northern Idaho ground squirrel (*Spermophilus brunneus brunneus*). However, a Northern Idaho Ground Squirrel Conservation Committee has been in place since 1996, when a Conservation Agreement was jointly signed by us and the Payette National Forest.

The Committee consists of agency biologists from the U.S. Fish and Wildlife Service, U.S. Forest Service, and Idaho Department of Fish and Game, and is open to participating stakeholders from environmental, ranching, and forest products organizations. Two coordination meetings are held each year, one in the spring to decide the specifics of field work both in areas of population monitoring and habitat modifications, the other in the late summer to review

annual accomplishments, address issues, and to set the direction for the next field season.

Two annual reports are submitted to us in November of each year. One is from Idaho Department of Fish and Game and documents population monitoring and survey work that was done during the field season. The other report is from the Payette National Forest and documents habitat modifications, enforcement actions, and other recovery activities as they relate to Federal lands where northern Idaho ground squirrels are found. These and technical studies, for example a nutrient analysis study on plant species initiated in 2001, a plant species and composition study initiated in 2000, a supplemental feeding feasibility project initiated in 2001, and a genetics study initiated in 2002, have been shared with all stakeholders.

Stakeholders who have consistently participated in meetings and/or have received annual reports and research study results include:

John Dyer and Frank Anderson, OX Ranch
Bob and Peggy Mack (Safe Harbor Agreement)
Brian Kernohan, Boise Corporation
Joe Hinson, Northwest Natural Resources Group
Jim Caswell, Office of Species Conservation (Governor's Office liaison)
Bruce Haak, Idaho Department of Fish and Game
Sheldon Keifer, Idaho Department of Lands
Bob Giles, Floyd Gordon, Lon Schultz, Payette National Forest
Layne Bangerter, USDA, Wildlife Services
Dr. Eric Yensen, Albertson College of Idaho
Dr. Paul Sherman, Cornell University
Dr. Michael Runge, USGS-BRD, Laurel, Maryland
Dr. Janet Rachlow, University of Idaho
Steve Duke, U.S. Fish and Wildlife Service
Dennis Mackey, U.S. Fish and Wildlife Service
Ben Matibag, U.S. Fish and Wildlife Service
Rich Howard, U.S. Fish and Wildlife Service
Ray Vizgirdas, U.S. Fish and Wildlife Service

APPENDIX B - Glossary

The consistent use of terminology is important to eliminate confusion when addressing the site characteristics and population dynamics of the northern Idaho ground squirrel. Terms such as "colonies" and "populations" have been applied to prairie dogs and ground squirrels to characterize their social behavior and genetic linkage. However, more specific and distinct definitions were developed for the listing document and this recovery plan. These definitions are based on the behavior of this subspecies, which is not colonial, but does not live as isolated as the rock squirrel (*Spermophilus variegatus*). They also are based on topography and ultimately genetics. References for this terminology include Gavin *et al.* (1999) and Runge (2001). The following definitions are used throughout this recovery plan:

Metapopulation. This is a network of semi-isolated populations with some level of regular or intermittent migration and gene flow among them, in which individual populations may go extinct but then be recolonized from other populations (Meffe and Carroll 1994). A metapopulation implies that genetic exchange between population subsites (demes) is occurring through dispersal or linkage corridors. Populations must be within reasonable dispersal distance from one another. In the case of northern Idaho ground squirrel, this means less than 1 kilometer (0.6 mile).

Effective population size (*Ne*). This is the average size of a population expressed in terms of individuals assumed to contribute genes to the next generation; generally smaller than the actual size of the population, depending on variation in reproductive success among individuals (Ricklefs 1990).

Population complex. A population complex is composed of several population sites that are not separated by geographic barriers to dispersal, but that are far enough apart to make exchange of migrants very rare.

Colony. A group of organisms that is highly integrated with division of labor, castes, or a high degree of social organization.

Population site. A population site is composed of sub-sites that are within several hundred meters of each other and are not separated by geographic barriers. Movement back and forth among sub-sites within a population site is not routine, but natal and adult dispersal among sub-sites occurs on a regular basis (yearly, or at least as often as once every several years).

Extensive monitoring. Annually during the spring or summer, one or more visits are made to a population site to conduct a visual estimate of the number of ground squirrels at the site. No attempt is made to trap or mark squirrels. Standardized and time-efficient monitoring protocols are used to conduct this type of population assessment.

Intensive monitoring. Annually during the spring and summer, numerous visits are made to a population site to conduct a population assessment. This process includes trapping, weighing, sexing, and marking of adults and yearlings. An attempt is made to capture all the ground squirrels at a population site during these visits. However, it is unusual that juvenile squirrels are trapped during intensive monitoring because of the amount of time and staff required, stage of vegetation, and overall difficulty.

APPENDIX C

Summary of Public, Agency and Peer Review Comments on the Draft Recovery Plan for the Northern Idaho ground Squirrel

On April 5, 2000, we listed the northern Idaho ground squirrel as a threatened species, under the Endangered Species Act of 1973, as amended. On May 11, 2000 a draft recovery outline was prepared. On January 26, 2001, we sent a draft recovery plan framework to twelve people involved in recovery planning for the northern Idaho ground squirrel. We used the framework and reviews of it as guides in developing the draft recovery plan.

The Draft Recovery Plan for Northern Idaho Ground Squirrel was made available to the public through a 60-day comment period that ran from July 15, 2002, to September 13, 2002. More than 60 copies of the draft recovery plan were sent out for review during the comment period. Copies were sent to Federal, State, and local government offices within the range of the subspecies. Copies were also sent to the Payette National Forest, Idaho Department of Fish and Game, Idaho Department of Lands, industry groups, conservation groups, local libraries, scientists and interested parties.

Eighteen responses were received from the public and various agencies, and from the Idaho Governor's Office of Species Conservation, Idaho Department of Fish and Game, Boise Cascade (Boise) Corporation, Idaho Conservation League, ranchers, and the general public. Revisions to the draft recovery plan were sent out for peer review to: Dr. Michael Runge, U. S. Geological Survey, Patuxent Wildlife Research Center; Dr. Tom Gavin, Cornell University; and Dr. Paul Sherman, Cornell University. All three scientists responded to the request for peer review of the recovery plan. We assembled a Technical Working Group of six people in 2002, to address the various issues concerning recovery implementation on Federal lands. The Technical Working Group included: Dr. Eric Yensen, Albertson College; Bruce Haak, Idaho Department of Fish and Game; Faye Kruger, Payette National Forest; Lon Schultz, Payette National Forest; Bill Rautsaw, Payett, National Forest; and Ray Vizgirdas, U. S. Fish and Wildlife Service. The Technical Working Group submitted a letter of response to

the draft recovery plan. The Technical Working Group was formalized in 2003 and was also ask to review a draft of the final recovery plan, ongoing population monitoring and habitat modification efforts, proposed research activities, and the delisting criteria for the final recovery plan.

Number of letters received by affiliation:

Federal agencies	3 letters
State and local governments	2 letters
Industry interest (ranching/timber)	6 letters
Environmental interest	1 letter
General public	2 letters
Technical Working Group	1 letter
Peer Reviews	1 letter, 2 email responses

Summary of significant issues and comments raised by the public, agencies, and peer reviewers :

We received 18 responses during the comment period for the draft recovery plan. Some comments provided updated information about northern Idaho ground squirrels and their habitat. This information was incorporated into the appropriate section of the final recovery plan. The substantive issues and comments, and our responses, are summarized in this appendix.

Issue 1: Several commenters suggested that recovery criteria regarding population objectives was too prescriptive, and others suggested that population targets should be based on effective rather than actual population sizes.

Response: In response to these concerns, and to provide more focus in the final recovery plan, we developed recovery objectives based on effective population size. Using the survey by Yensen (1985) as a basis, and delineating possible metapopulations for recovery, we established the recovery goal of an effective population size of greater than 5,000 individuals distributed among 10 viable metapopulations. This would maintain at least known historic numbers and a distribution that would ensure genetic diversity and therefore long-term survival

of the subspecies. Our recovery plans need to state a specific population recovery goal. We find the recovery goal stated in the final plan serves the biological purpose and recovery plan requirement. While prescriptive, as required, some flexibility has been maintained by establishing the goal at 10 viable metapopulations, rather than the maximum known. Recovery plans are typically reviewed and, if necessary, rewritten every 5 years. If this recovery goal requires substantive changes after the next 5 years of recovery implementation due to new information, we will develop a revised plan.

Issue 2: One commenter questioned the population status of northern Idaho ground squirrels from the 1980's to the 1990's.

Response: A population summary in the executive summary of the final recovery plan states that "the species declined from an estimated 5,000 individuals in 1985, to less that 1,000 by 1998, when it was proposed for listing under the Endangered Species Act of 1973, as amended." More recently, census data from 2002 revealed declines that estimate the total number to be at 450 to 500 individuals.

Issue 3: One commenter questioned the listing status (endangered) of the northern Idaho ground squirrel, and felt that the listing was a tactic for the Fish and Wildlife Service to take over land management.

Response: We listed the northern Idaho ground squirrel as a "threatened" species on April 5, 2000. The definition of a threatened species under the Endangered Species Act is: any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Our mission is to protect and maintain federally-listed species. We conduct extensive evaluations of a species' population, habitat, and threats before listing it under the Endangered Species Act. Recovery of a species may involve working with other Federal and State agencies and private landowners to restore habitat and to monitor populations of listed species. Our mission is focused on species' needs, including habitat.

Issue 4: A statement in the draft recovery plan indicated that, "grazing practices could adversely affect northern Idaho ground squirrel habitat on some State and private lands." Several commenters disagreed with this assertion.

Response: We recognize that additional evaluation needs to be done on grazing because it may be a tool for vegetation recovery in some areas where northern Idaho ground squirrels occur. The statement in the final recovery plan has been changed to "grazing practices have unknown impacts on northern Idaho ground squirrel habitat." Other revisions address evaluation of grazing as a management tool, and on intensity, timing, and use of sheep or cattle at ground squirrel population sites.

Issue 5: Assessment of population numbers may have been made at a low point in the cycle, and may not be a true reflection of the population status of the ground squirrel. Southern Idaho ground squirrels were found in abundance in the late 1980's.

Response: Most ground squirrel populations can fluctuate greatly in response to environmental changes. It is well documented that northern Idaho ground squirrels have continued to decline from their former numbers of about 5,000 in the mid 1980's to an estimated 500 animals in 2002. It is highly unlikely that this represents a natural range of variation.

Issue 6: The cost of recovery for this species is extremely high, and no cost estimates are made on a per-individual basis.

Response: Recovery costs for any federally-listed species can be high. We conduct cost analyses for the species, or subspecies, and do not focus on individual animals. The implementation schedule, action descriptions, action priorities, and cost estimates are developed for recovery plans. This is a guide to recovery actions that are recommended as funds and resources become available. The actions conducted to recover the northern Idaho ground squirrel can be considered "ecosystem restoration," and will benefit a host of native species that rely on open meadow and edge habitat. A list of these species, such as the great gray owl (*Strix nebulosa*), was developed during the creation of this plan.

Issue 7: The decline of the northern Idaho ground squirrel directly correlates to the timing of biological studies being done on the squirrels.

Response: While studies began on some populations of northern Idaho ground squirrels in the late 1980's, and have continued through 2003, we believe there is little causal relationship between the studies and the population decline. For example, some populations that were extirpated because of natural factors during this time were revived through direct management by biologists. Burning and thinning activities at historical sites have already resulted in recolonization by ground squirrels.

Issue 8: What efforts have been made to establish a captive breeding population?

Response: The final recovery plan identifies captive breeding as an option to prevent the extinction of the subspecies, and to provide research and education opportunities. To meet these same objectives, southern Idaho ground squirrels were captured in 2002, and brought to Zoo Boise in Boise, Idaho. They will be used as a surrogate to establish how best to keep and breed northern Idaho ground squirrels in captivity, and to translocate them back to their natural habitat. Once these protocols are developed, northern Idaho ground squirrels may be brought to Zoo Boise for propagation and education purposes.

Issue 9: How was the recovery number target determined in the draft recovery plan? In the draft plan, the recovery population goal ranges from 3,500 to 15,000 animals. Conservation biologists would maintain that at least 10,000 individuals are needed to ensure a sustainable population.

Response: The recovery criteria in the draft recovery plan was based on restoration of squirrels at individual population sites, with each maintaining a 5-year average population size. The final recovery plan is more ecologically-based, and delineates 12 primary and 5 secondary possible metapopulations of northern Idaho ground squirrels. The population goal is based on an effective population size greater than 5,000 distributed across 10 possible metapopualtion areas.

Issue 10: Man-made threats such as golf courses, dams, road construction are not significant threats to ground squirrels.

Response: Human-caused threats are significant if they contribute to habitat loss, habitat fragmentation, or induce direct or indirect mortality to ground squirrels. The final recovery plan still documents the primary threat to northern Idaho ground squirrels as being habitat loss due to forest encroachment into formerly suitable meadow habitats.

Issue 11: One commenter observed that the draft recovery plan lacked direction, and was a very elaborate document that seems to do nothing for the squirrels. During the past 4 years, there have been numerous meetings where only talk about the needed actions to save the squirrel gets accomplished.

Response: Draft recovery documents are subject to the public comment process. From those comments, we revise the document so that the final recovery plan more directly addresses the strategies for recovering the subspecies. For example, the final recovery plan recommends the establishment of an interagency program coordinator for implementing the recovery plan. In 2003, the Idaho Department of Fish and Game, with assistance from us, established a Nongame Biologist position in McCall, Idaho to actively conduct recovery implementation and work with private landowners. Meetings have been an effective method for coordinating recovery actions during the past 4 years. Staff from the Payette National Forest have increased available habitat through habitat modifications, and the Idaho Department of Fish and Game has monitored populations and conducted surveys for new populations.

Issue 12: Squirrels have never been documented as moving between population sites. Why is the draft recovery plan focusing on dispersal corridors?

Response: The final recovery plan focuses on dispersal corridors between population sites and between metapopulations to increase genetic exchange and to open opportunities for animals to disperse into more desirable habitat when it is available. Studies by Sherman and Runge (2002) at Bear Meadow, Adams County, Idaho have documented both short <500 meters (1,640 feet) and long 500

to 1200 meters (1,640 to 3,936 feet) dispersal movements. These studies form a basis for modifying habitat on the Payette National Forest, and for delineating possible metapopulation areas.

Issue 13: Two commenters suggested that the northern Idaho ground squirrel should be reclassified as "endangered" to increase protection measures and resources for recovery.

Response: While biologists have debated changing the status of the northern Idaho ground squirrel to endangered, we have determined that the recovery actions in the final recovery plan should provide strong direction to Federal and State agencies to obtain the necessary resources for recovery. Some key private landowners who have core populations of northern Idaho ground squirrels on their lands have cooperated with agencies monitoring the status of subspecies.

Issue 14: Several commenters observed that the recovery goals and objectives were too vague in the draft recovery plan.

Response: The final recovery plan has been revised to address in-depth management goals for both population monitoring and habitat restoration. Twelve possible primary metapopulation areas have been delineated that serve as a basis for developing site-specific management plans. Site-specific analysis within the metapopulation areas should help target local habitats for increasing the number of northern Idaho ground squirrels.

Issue 15: The Step-Down Narrative in the draft recovery plan indicated that the Payette National Forest should amend the Payette National Forest Plan, but did not discuss implementation of the plan.

Response: After the draft recovery plan for the northern Idaho ground squirrel was completed, stipulations were included in the Payette National Forest Land and Resource Management Plan that set specific time frames for implementation. Habitat restoration on Federal lands was made the highest priority in the Recovery Action Narrative in the final recovery plan.

Issue 16: A strong public education and outreach program is needed for conserving ground squirrels.

Response: A specific section has been developed in the final recovery plan (Action 4.3) that outlines steps to be taken to increase the awareness of the public about ground squirrels, and particularly the northern Idaho ground squirrel. Printed, audio-visual, educational, media, and enforcement aspects are covered in this outreach program. The program will be taken to schools and made available to private landowners, conservation organizations, livestock industry, elected officials, and State and Federal agencies. A field guide on ground squirrels of the northwest including Idaho, Oregon, and Washington has just been completed, and is part of the outreach program in the final recovery plan. The Idaho Department of Fish and Game initiated a multimedia campaign in April 2003, about northern Idaho ground squirrels being protected under the Endangered Species Act and the southern Idaho ground squirrel being protected under State law.

Issue 17: Predators should not be killed. There are other more humane means to control predators. Capture and relocation is an alternate means of control.

Response: We provide consideration for relocation of badgers in the final recovery plan, but reserve the option of using more direct means if it becomes necessary. Control of other predators is probably unnecessary or impractical.

Issue 18: A recovery implementation team needs to be created. This team needs to include more diverse stakeholders than biologists from agencies and several landowners.

Response: The assessment of the northern Idaho ground squirrel began with the involvement of 60 to 80 interested individuals. All participation was encouraged as the process moved forward. We officially created a Technical Working Group in January 2003, to implement this recovery plan. The Technical Working Group will invite various kinds of expertise from academic, Federal, State, and independent organizations, and including interested individuals, to participate in constructive discussions involving recovery implementation. A program coordinator position for the Technical Working Group was identified in the final

recovery plan. In April 2003, the Idaho Department of Fish and Game hired a Nongame Biologist in McCall, Idaho to fulfill this role.

Issue 19: The recovery sites are not specified in the draft recovery plan. The plan needs to be more specific and have more specific maps as to where recovery will take place.

Response: The final recovery plan includes a map of recovery sites in Figure 3. Twelve primary and five secondary recovery areas are identified as possible metapopulations. The metapopulations are further identified by name and ownership in Table 3. Population complexes and population sites found within the metapopulation sites are given by name in Tables 1 and 2. Site-specific geographical information system maps have not yet been developed for each of the possible metapopulation polygons.

Issue 20: The draft recovery plan did not reflect all the population sites that may be active or the total population numbers of the species.

Response: Tables 1 and 2 have been updated in the final recovery plan to more accurately reflect the total known population of squirrels. Also, the number of squirrels being counted each year since 1999 when the Idaho Department of Fish and Game began trapping and counting northern Idaho ground squirrel represents an index of the total population numbers of this subspecies. The index is based on intensive and extensive surveys of those lands that are accessible to Idaho Department of Fish and Game. Populations of ground squirrels found on Federal and State lands are accessible. With the exception of the OX Ranch and the Bob Mack property, agencies have not been invited on private lands to count squirrels. Steps to improve relations with private landowners may allow additional populations of squirrels to be counted. This would improve the accuracy of the population index.

Issue 21: In preparing the draft recovery plan, the we adopted a framework approach and did not specify fire frequency and forestry practices that could be defined through an array of prescriptions and applied across the range of habitats.

Response: Fire frequency and forestry practices are included in the final recovery plan. In the Recovery Action Narrative, the first prioritites (1.1 through 1.1.2.2) are habitat restoration and maintenance, thinning and burning prescriptions, re-seeding, vegetation management for noxious plants, and evaluating fire frequency. Understanding how these variables interact to maintain appropriate seral stages and plant community composition will be the primary focus as site-specific management plans are developed.