

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Spermophilus brunneus endemicus*

COMMON NAME: Southern Idaho ground squirrel

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: April 22, 2010

STATUS/ACTION

Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status

New candidate

Continuing candidate

Non-petitioned

Petitioned - Date petition received: 1-29-01

90-day positive - FR date:

12-month warranted but precluded - FR date:

Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

Listing priority change

Former LP:

New LP:

Date when the species first became a Candidate (as currently defined): 10-30-2001

Candidate removal: Former LPN:

A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

- ___ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
- ___ F – Range is no longer a U.S. territory.
- ___ I – Insufficient information exists on biological vulnerability and threats to support listing.
- ___ M – Taxon mistakenly included in past notice of review.
- ___ N – Taxon does not meet the Act’s definition of “species.”
- ___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Mammal (Sciuridae, squirrels)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Idaho

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Idaho/
Gem, Payette, Washington counties

LAND OWNERSHIP:

A total of 516 occupied southern Idaho ground squirrel population sites have been located as of February 2007. Of the 516 sites, 46 percent (240) were determined to be on private lands, 49 percent (250) were under Federal management by the Bureau of Land Management (BLM), and 5 percent (26) were under management jurisdiction of the Idaho Department of Lands (IDL) (Carmen Thomas, in litt. 2007). However, of the 425,629 hectares (ha) (1,051,752 acres [ac]) of current, historical, or potential habitat for SIDGS, approximately 68 percent is on private land (IDFG et al. 2005). A new database mapping effort is currently underway that will help us better understand the land ownership pattern for occurrences of this species.

Table 1. Current distribution of known occupied southern Idaho ground squirrel population sites by ownership within Idaho. Data are compiled from Carmen Thomas, in litt. (2007).

Counties	Ownership		
	BLM	State/County	Private
Adams*	0	0	1
Gem	101	19	90
Payette	83	5	107
Washington	66	2	42
Total = 516 sites	250 (49%)	26 (5%)	240 (46%)

* There was a single positive identification for the species in Adams County by IDFG in 1999 (Jill Holderman, BLM, in litt. 2007). However, survey efforts by IDFG in the mid-2000’s did not detect southern Idaho ground squirrels or active burrows, indicating that the species may no longer occur in that county.

The above ownership analysis is based on macro-analysis, and should be considered subject to error. Field locations of squirrels represent a single point and do not reflect the home range of the

squirrels living in a specific area, which may overlap several landowners/managers. This multiple landownership overlap is not reflected in the above data comparison. In most years, the BLM and U.S. Forest Service (USFS) update the GIS database to include new locations identified during each successive year of surveying and other ground squirrel work (J. Holderman, pers. comm. 2007a). This database has not been updated to include all information from 2007 to present. A more complete GIS-based database of southern Idaho ground squirrel locations is currently being assembled, and should be completed by the spring of 2011.

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LEAD FIELD OFFICE CONTACT: Idaho Fish and Wildlife Office, Kendra Womack, 208-378-5243, kendra_womack@fws.gov.

BIOLOGICAL INFORMATION

Species Description

The southern Idaho ground squirrel is a relatively small member of the genus *Spermophilus*. Southern Idaho ground squirrels are about 235 to 241 millimeters (mm) (9 inches [in]) long, with a short, narrow tail, tan feet and ears, and a grey-brown throat (Yensen 1991).

Taxonomy

There are two distinct types of Idaho ground squirrels, and the current scientific nomenclature recognizes them as subspecies: the southern Idaho ground squirrel (*Spermophilus brunneus endemicus*), and the northern Idaho ground squirrel (*Spermophilus brunneus brunneus*) (Yensen 1991). The two ground squirrels are separated by differences in pelage coloration, pelage length and texture, cranial and external morphometrics, bacula (penis bone) size, allelic frequencies, genetics, timing of the life history cycle, and behavior. The baculum of the southern Idaho ground squirrel is generally larger than its northern counterpart (Yensen 1991). Genetic differentiation between the two subspecies was confirmed using enzyme analyses and DNA protein sequencing, both of which analyze blood constituents to determine genetic differences (Gill and Yensen 1992). Recent genetic analyses indicate that the Weiser River forms a significant migratory barrier for southern Idaho ground squirrels (Hoisington 2007). There is little evidence of gene flow between populations separated by the Weiser River. Connectivity among populations south of the river is greater than that among populations north of the river (Hoisington 2007).

Yensen (1991) thought that the two Idaho ground squirrels were close to species-level separation, and subsequent work has indicated that they could be validated as separate species (Gavin et al. 1999, Gill and Yensen 1992, Hoisington 2007). Recent work suggests that southern Idaho ground squirrels may be descended from northern Idaho ground squirrels, and the northern Idaho ground squirrel population in Round Valley may be the common link between the two subspecies (Hoisington 2007). Hoisington (2007) used the cohesion species concept to test whether genetic and ecological data support species level classification of the two subspecies of

Idaho ground squirrel. Her results support raising the two subspecies to species status. We will fully review the taxonomic status of the Idaho ground squirrel upon the publication of a peer reviewed paper on this topic.

Habitat/Life History

Habitat: Southern Idaho ground squirrels are found in the lower elevation shrub/steppe habitat of the lower Weiser and Payette River basins. Their habitat is typified by rolling hills, basins, and flats composed of lacustrine and fluvial sediments between 670 to 1,372 meters (m) (2,200-4,500 feet [ft]) elevation (J. Holderman, pers. comm. 2007b). They inhabit an area once dominated by big sagebrush (*Artemisia tridentata*), bitterbrush (*Purshia tridentata*), and a variety of native forbs and bunchgrasses (Yensen 1991). Prescott and Yensen (1999) suggested that these squirrels prefer areas with a high percentage of native cover types, especially areas with big sage; however, some nonnative features may enhance their survival as well, specifically alfalfa fields, haystacks, or fence lines. The predominant vegetation was formerly big sagebrush-bunchgrass-forb associations, with bitterbrush found in the sandier locations (Yensen 2000a). The big sagebrush-bunchgrass-forb complex has dramatically changed so that most of the former vegetative structure has been replaced by exotic annuals, primarily *Bromus tectorum* (cheatgrass) and *Taeniatherium asperum* (medusahead rye). In addition, substantial acreages within the range of southern Idaho ground squirrels were historically converted from the native shrub-steppe vegetative complex into agricultural lands and golf courses. While this conversion is no longer occurring on a meaningful scale, lands that were historically converted for agricultural use and golf courses remain cultivated and thereby unavailable for permanent occupation by southern Idaho ground squirrels.

The southern Idaho ground squirrel lives on lower elevation, paler colored soils formed by granitic sands and clays from the Boise Mountains when compared with the northern Idaho ground squirrel. The northern Idaho ground squirrel is found at higher elevation areas with shallow reddish parent soils of basaltic origin. Marked differences in pelage coloration between the two sub-species are related to soil color, with the southern Idaho ground squirrel being noticeably paler (Yensen 1985, 1991).

Ross (2007) examined the influence of habitat variables on densities of southern Idaho ground squirrels, using burrow density as a surrogate for squirrel density. She found higher squirrel densities in areas with a native vegetation component. Higher squirrel densities were found at sites with higher cover of perennial grasses, native perennial forbs, and higher species diversity. In contrast, lower densities of squirrels were associated with higher cover of exotic annuals and lower species diversity. Perennial grass cover (native and non-native species combined) was the most important variable influencing burrow density. Native perennial forb cover was the most important overall variable in the models tested, and produced the greatest increase in the likelihood of obtaining higher densities of squirrels than all other plant cover variables.

Ross (2007) also investigated whether ground squirrel densities were influenced by slope aspect (direction a slope is facing) and soil type. Aspect had a significant influence on burrow density, with greater burrow densities on north and east facing slopes. Burrow density was significantly

lower on slopes facing south and west. Soil consistency also influenced burrow density; high densities of squirrels were associated with soils containing higher percentages of silt, and less than 64 percent sand. Slope position may also influence burrow density. Slope position and aspect affect soil properties such as depth, moisture retention, and texture (Pachepsky et al. 2001) as well as plant composition and phenology (Moretti and Brotherson 1982, Brotherson and Masslich 1985).

Life History: The southern Idaho ground squirrel spends much of its time underground. Adults typically emerge from seasonal torpor in late January or early February, depending on elevation and micro-habitat conditions (Yensen and Sherman 1997). As with other small-eared ground squirrels in the northwest, the adults have an active season above ground of 4 to 5 months, which is spent reproducing and foraging before the long seasonal torpor begins (Moroz et al. 1995, Yensen and Sherman 1997, Sherman 2000). Females are bred within the first few days of emerging from torpor. Young are born about 3 weeks later and emerge from the nest burrow in about 50 days. Adult males are the first to begin torpor and typically cease above ground activity by late May (Kristin Ross, Boise State University, pers. comm. 2007). Adult females and juveniles typically remain above ground longer; all age groups generally cease above ground activity by late July to begin torpor.

Although studies specifically investigating burrow depth of southern Idaho ground squirrels have not occurred, it is thought that nesting burrows are between 50 to 121 centimeters (cm) (19.7 to 47.6 in) in depth (based on northern Idaho ground squirrel burrow depth in Yensen et al. 1991). The soils must be deep enough to allow construction of hibernation burrows below the frost line (Wagner and Drickhamer 2004).

Diet: A high quality diet of green vegetation and seeds is required to build sufficient fat reserves to survive long months of torpor. Though dietary requirements of the southern Idaho ground squirrel have not been studied extensively (Yensen and Sherman 1997), they are likely similar to those of other ground squirrels in Idaho (Dyni and Yensen 1996). In a study of southern Idaho ground squirrel diets at five locations, Tarifa and Yensen (2004a, b, and c) determined that diets were variable among sites, between years, and within each season. In general, the number of species represented in the diet of southern Idaho ground squirrel increased throughout the course of the season (Tarifa and Yensen 2004c). Early in the season, more than half of squirrel diets were comprised of non-native species, particularly *Poa bulbosa* (bulbous bluegrass) and *Bromus tectorum*. The proportion of forbs in squirrel diets increased in the middle of the season, but the species composition varied among sites. Overall, mid-season diets mostly consisted of non-native grass or native and non-native forbs. Late in the season, forbs dominated squirrel diets, comprising an average of 67 percent of the diet. Grasses made up approximately 22 percent of the diet late in the season. Tarifa and Yensen (2004c) also observed that green leaves dominated southern Idaho ground squirrel diets early in the season, and seeds were dominant in southern Idaho ground squirrel diets late in the season. This pattern generally follows the phenology of the available vegetation at the five study locations.

Tarifa and Yensen (2004c) also compared the species composition of the habitat to the species composition of southern Idaho ground squirrel diets. Their study found a greater number of non-

native plant species than native plant species in the southern Idaho ground squirrel diet. They concluded that southern Idaho ground squirrels are selective feeders, and are dependent on a subset of vegetative species compared to what is available.

Demography: Barrett (2005) applied a Leslie matrix-type population model to evaluate selected populations of southern Idaho ground squirrels long-term viability. He determined that the survival rates of females, and particularly juvenile females, were parameters with the largest influence on persistence rates of populations. Increasing the survival rate of males or the initial population size had little effect on population persistence. Similarly, increasing reproductive rates had only a modest effect on population persistence. For all age classes examined for body condition at emergence, yearling females had substantially less body fat; there were no significant differences detected among the remaining age and sex classes.

Barrett (2005) also investigated rates of persistence or survival among seven populations of southern Idaho ground squirrels. The two-year average juvenile over-winter survival rate was 10 percent for males and 21 percent for females. Over-winter persistence of juvenile male ground squirrels was positively correlated with the abundance of forbs at each site.

Dispersal: Panek (2005) studied the dispersal of yearling and juvenile southern Idaho ground squirrels, as well as factors that maximize success in translocating ground squirrels in 2003 and 2004. In this study, juveniles dispersed, and yearlings did not. Juvenile males dispersed farther and more often than females. The mean dispersal distance for males was 898 meters (m) (0.6 miles [mi]), and the mean dispersal distance for females was 526 m (0.3 mi); the difference between genders in dispersal distance was not significant. The mean intra-population dispersal distance was 147 m (0.09 mi); indicating animal movements occurred primarily between locations within a larger occupied site. The mean long distance (inter-population) dispersal was 739 m (0.5 mi).

Physical and Biological Factors (PBFs): Based on the preceding information, preliminary PBFs for southern Idaho ground squirrels include (1) areas with a mix of forbs and grasses that are predominantly comprised of native species; (2) areas with suitable habitat between 670 to 1,372 m (2,200-4,500 ft); (3) areas with a minimum soil depth of 1 m (3 ft); (4) areas with adequate soil consistency that allows burrow creation and retention; (5) adequate percent canopy cover to allow sheltering behavior but not preclude visual identification of aerial predators; (6) areas with an aspect between 315 and 90 degrees; and (7) other occupied sites within 735 m (0.5 mi) to allow dispersal and exchange of genetic material. These preliminary PBFs are derived from the biological needs of southern Idaho ground squirrels as described in the preceding sections of this CNOR. They include those habitat components essential to the species, including adequate food availability (including both timing and nutritional content), suitable habitat availability, adequate burrow capacity and depth to facilitate overwinter survival, and connectivity of occupied habitat to allow genetic exchange.

Additional analysis is underway to determine the importance of specific soil and slope characteristics, including soil type and aspect parameters, and to determine other habitat parameters necessary for southern Idaho ground squirrel occupation.

Historical Range/Distribution

Prior to 2001, the southern Idaho ground squirrel was known to occur within an approximately 209,628 hectare (ha) or 518,000 acre (ac) area extending from Emmett, Idaho, northwest to Weiser, Idaho, and the surrounding area of Squaw Butte, Midvale Hill, and Henley Basin in Gem, Payette, and Washington counties (Yensen 1991). Its range was bounded on the south by the Payette River, on the west by the Snake River, and on the northeast by lava flows with little soil development (Yensen 1991).

Beginning in the spring of 2001, Eric Yensen and the Idaho Department of Fish and Game (IDFG) conducted several surveys for southern Idaho ground squirrels. The 2001 survey identified a total of 76 previously undocumented sites which brought the total known sites to 295 (169 occupied and 126 unoccupied) (Yensen and Haak 2001). Survey results indicated that Gem County had the largest remaining populations, followed by Payette County, and Washington County. Generally, populations range from large in the southern portions of the range to smaller in the north.

Historically, the range of southern Idaho ground squirrels extended further north to the town of Goodrich, Idaho, in Adams County (Yensen 1980, 1991). However, studies have shown a contraction in the number of occupied population sites in the northern part of their range. For example, the only known historical site in Adams County was not occupied in 1999 (Yensen 1999, 2000a), and southern Idaho ground squirrels may be extirpated from Adams County (Yensen 2001). As of 2006, 90 sites out of a total of 200 historical occupied sites (45 percent) in Washington County (northwest portion of the species' range) were unoccupied.

Current Range/Distribution

During 2004-2006, the USFWS contracted with the IDFG to survey privately-held lands within the current range of southern Idaho ground squirrels to determine their distribution. This survey work was conducted in conjunction with a candidate conservation agreement with assurances (programmatic CCAA) that the USFWS developed and completed in 2005 for southern Idaho ground squirrels. Surveyors obtained permission from the landowners prior to surveying each of their lands. These surveys resulted in the identification of 114 new occupied sites for southern Idaho ground squirrels on private land. Approximately 10 new sites were identified in Washington County, 70 new sites were identified in Payette County, and 34 new sites were identified in Gem County, all on private land that had not been previously surveyed (Carmen Thomas, in litt. 2007). It should be noted that some of these sites may overlap with previously documented sites, and that in some cases, multiple sites may represent a single population.

From 2004 to 2009, the IDFG and BLM have surveyed approximately 1,214 ha (3,000 ac) of BLM administered lands each year (7,285 ha or 18,000 ac total to date). This has been and will likely continue to be done to better refine our understanding of the current range and distribution of southern Idaho ground squirrels on BLM lands. In 2004, new southern Idaho ground squirrel colonies were identified at 82 sites (J. Holderman, in litt. 2004). In 2005, an additional 38

previously unknown ground squirrel sites were identified, some of which were east of Squaw Butte (J. Holderman, pers. comm. 2005). The detection of populations east of Squaw Butte expanded the known range of the southern Idaho ground squirrel to the east. In addition, approximately 47 sites were obtained which confirmed previously known, but largely undocumented populations in Payette County. From 2006 to 2009, surveys in the northern and northwestern portions of the suspected range failed to detect any southern Idaho ground squirrels on BLM land (IDFG 2006, 2007, 2008; and K. Lohr, IDFG, pers. comm. 2009a); however, one site was detected on private land southeast of Midvale in 2007 (J. Holderman, pers. comm. 2007a). Since 2007, no new occupied southern Idaho ground squirrel sites have been identified.

Based on expanded survey efforts since 2001, the southern Idaho ground squirrel has been found at more than 500 population sites (though not all are known to be currently occupied) in an area of about 425,630 ha (1,051,752 ac) extending from the Henley Basin and Midvale (Washington County), east to Indian Valley (Adams County), and south to Payette (Payette County), Emmett, and Sweet (Gem County) (IDFG et al. 2005). Its range is bounded on the south by the Payette River and on the west by the Snake River (Yensen 1991, 2001). The eastern boundary of the range is uncertain but is now known to extend to Sweet and Ola valleys in Gem County; squirrels were detected in these areas during surveys conducted in 2002-2004. Southern Idaho ground squirrels are not known to occur east of the Payette River in Gem County. As of 2006, there were approximately 516 occupied sites and 122 unoccupied, historical southern Idaho ground squirrel sites in Gem, Payette, Washington, and Adams counties (Carmen Thomas, in litt. 2007). Of the 122 unoccupied sites, 91 are in Washington and Adams counties, while 31 are in Payette and Gem counties. A database update is underway to determine the current status of population sites across the range of the species.

Currently, the distribution of the species is patchy, with areas of localized abundance and large areas of apparently suitable habitat that are unoccupied, or are sparsely occupied. The areas of localized abundance are typically associated with human-altered landscapes such as golf courses, and row crop or farmed fields (particularly alfalfa and clover). One emerging trend derived from the surveys conducted to date is that the distribution of sites occupied by the southern Idaho ground squirrels has shifted from the northwest portion of its range (where it was regularly detected during surveys in the late 1990's) to the southeast portion of its range (where most recent sightings have been). Due to the difference in sampling coverage and effort between the mid 1980s and late 1990s, and more recent surveys (post 2002), this trend in shift in distribution may be an artifact of sampling intensity, but is generally unknown.

Population Estimates/Status

The population of southern Idaho ground squirrels was estimated at around 40,000 in 1985 (Yensen 2001). This estimate was based on the number of active burrow entrances detected along 30 randomly located 1,000 m (3,281 ft) transects. Although Yensen believed his estimate of past population numbers is reasonable (Eric Yensen, College of Idaho, pers. comm. 2007), the relationship between the number of active burrows and the number of southern Idaho ground squirrels has not been established. Multiple studies of the relationship between burrow counts

and population estimates of similar ground squirrel species have indicated that this method is not accurate for the production of population estimates (Van Horne et al. 1997, Powell et al. 1994),

Subsequent surveys indicated a decline in the number of sites occupied by southern Idaho ground squirrels between the early 1980s and 2000 (Yensen 2001; Eric Yensen, pers. comm. 2007). A 1999 survey of 145 of the 180 known historical population sites, indicated that only 53 sites (37 percent) were still occupied (Yensen 1999). The percentage of active sites for southern Idaho ground squirrels also decreased from south to north (Yensen 1999). Fifty-eight percent of the sites in Gem County (southern portion of the range) still had squirrels. The percentage dropped to 46 percent in Payette County, and decreased to 27 percent of the sites in Washington County (northern portion of the range). Southern Idaho ground squirrels were not always observed at the active sites, for example, at 18 of the occupied sites only a single individual was seen, fecal pellets were found at 13 sites, and vocalizations were heard at only one site.

Southern Idaho ground squirrel surveys conducted by IDFG and others in 2001, 2002, and 2003 located 72, 20, and 25 new, active population sites, respectively (Haak 2002, 2003; Carmen Thomas, in litt. 2007). All of these new sites occurred in Gem and Payette counties; none were located in the northwestern portion of the species' range. In addition, surveys conducted along 40 km (25 mi) of existing Idaho Power Company transmission line rights-of-way located 30 new, active population sites (Carpenter and Dumas 2003).

Using mark-recapture techniques, estimates of the number of breeding individuals were obtained at five sites located throughout the current range of southern Idaho ground squirrels in 2002 and in 2003 (Table 2).

Table 2. Trapping results from Idaho Department of Game (IDFG 2006) and Barrett (2005) for southern Idaho ground squirrels from five sites in southwest Idaho between 2002 and 2003. Breeding individuals are defined as adult males and females; juveniles are excluded.		
Year	Total Breeding Individuals	Average Breeding Individuals
2002	248	31
2003	341	56

Site-specific demographic information from 2002 and 2003 was used to predict the population persistence at each of the five sites. In that study, four of the five sites were estimated to have 100 percent probability of becoming extirpated within 15 years given current survival and reproductive rates (Barrett 2005). The fifth site was predicted to persist for approximately 73 years (Barrett 2005), despite exhibiting substantial population fluctuations. Overall, there was a negative correlation between the predicted persistence rate and the amount of invasive grasses present at the study sites, indicating that the achieved difference in persistence rates may be partially related to differences vegetation composition.

The apparent discrepancy between the persistence rates predicted by Barrett (2005), and the estimates of the total number of breeding individuals provided in Table 2 above, is likely due to the fact that juvenile females were not included in estimates of breeding individuals (e.g. IDFG 2006). The parameter with the greatest influence on the persistence rates of populations in the Barrett (2005) model was survival rates of females, and particularly juvenile females. Therefore, although populations at some sites appear to have stable numbers of breeding individuals, they still have a high likelihood of extirpation within the next 15 years due to low survival of juvenile females.

Trapping to obtain population estimates began in 2005, concurrent with the finalization of a programmatic CCAA for southern Idaho ground squirrels rangewide (IDFG et al. 2005). Total number of squirrels captured and population estimates from each year are provided below in Table 3. These data should not yet be used to determine population trends because the trapping area changed between the 2006 and 2007 field seasons. During all 4 years, trapping efforts were concentrated within a one hectare plot. During 2005 and 2006, however, trapping results included squirrels trapped outside the one hectare study plot because individuals would frequently run into or out of the plot. The area outside the one hectare plot was referred to as a “buffer.” Beginning in 2007, squirrels were no longer trapped outside the one hectare plot. The reason for this change was that the trapping effort outside the one hectare plot varied by trapper and year, and introduced variability into the resulting population estimates. For this reason, population estimates prior to and including 2006 are not comparable to those from 2007 to the present.

Table 3. Trapping results from Idaho Department of Game (IDFG 2009) for southern Idaho ground squirrels from five sites in southwest Idaho between 2005 and 2009. Population estimates were derived using a Chapman-modified Lincoln-Petersen formula (Pollock et al. 1990). M equals the number of males, and F equals the number of females.		
Year	Total Number Captured (M,F)	Population Estimate ^a
2005 ^b	104 (41, 63)	220
2006 ^b	207 (86, 121)	405
2007	131 (57, 74)	186
2008	91 (30, 61)	164
2009	132 (60,71)	184
^a Population estimate is only for the five monitoring sites and has not been extrapolated across the range of the species. Indices to allow such extrapolation are currently under development. ^b Population estimates prior to and including 2006 are not comparable to estimates from 2007 to current.		

Summary of Population Status: Initial population estimates of 40,000, produced in the mid-1980's, are based on the number of active burrows located along transects. Multiple studies of the relationship between burrow counts and population estimates of similar ground squirrel

species have indicated that this method is not accurate for the production of population estimates (Van Horne et al. 1997, Powell et al. 1994). Results from surveys conducted between 1980 and 2000 indicated a population decline, both in terms of the numbers of squirrels detected at each occupied site and the number of occupied sites. Surveys conducted between 2002 and 2006 indicated an increase in the number of breeding squirrels and likely corresponded to a similar increase in overall population numbers. More recent work, conducted from 2007 through 2009, is not comparable to previous population estimates due to a change in sampling methodology. However, based on the last three years of intensive population monitoring information, it appears as though populations have remained stable, at least for those sites sampled (Table 3). Future monitoring will use methods similar to those used from 2007 to 2009 and should help us better understand the population trend. Presence/absence surveys from 2005 to 2009 revealed no substantial changes in occupation of areas surveyed (IDFG 2009). Population modeling conducted in 2004 using data collected in 2002 and 2003 as part of a graduate student study, predicts local extirpations at five of seven monitored sites within the next 15 years (Barrett 2005). Although population estimates from 2002 to 2006 are not comparable to estimates made from 2007 to current, the populations monitored appear to be relatively stable and do not show a downward trajectory toward extinction (Table 3). However, it is important to note that small mammal populations tend to exhibit large population fluctuations through time. Population monitoring efforts are ongoing as part of the programmatic CCAA, and population trends at five intensive monitoring sites should be available in the coming years.

THREATS

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

Habitat deterioration appears to be a leading factor affecting the long-term persistence of southern Idaho ground squirrels in their former native habitats (Yensen 1999, Barrett 2005). In recent decades, invasion of exotic annuals has changed the species composition of vegetation and has altered the fire regime in a perpetuating cycle throughout much of the range of these squirrels (Whisenant 1990). *Bromus tectorum* and *Taeniatherium asperum* are believed to have limited forage value to the squirrels, have highly variable annual productivity, and now dominate much of the squirrels' geographic range (Yensen et al. 1992, Yensen 1999). Diversity of native forbs and grasses decreases where these exotics take over, and exotic species are believed to limit the dietary diversity available to ground squirrels (Yensen 1999; Tarifa and Yensen 2004a, b, c). Without the reliable and nutritious diet provided by native grasses and forbs, these squirrels are left with the highly variable productivity and nutritional value of exotic annuals. In years of low rainfall, low productivity of these exotics could prevent squirrels from storing enough fat to overwinter. Yensen et al. (1992) showed that local populations of Paiute ground squirrels (*Spermophilus mollis*) were highly unstable and prone to extinction in local areas that were invaded by exotic annuals.

Recently, research has shown that higher densities of southern Idaho ground squirrels occur in areas where a native component of the vegetation still exists, and that burrow density was negatively correlated with annual canopy cover (Ross 2007). Researchers observed that

variation in body condition at emergence was greater at sites with a higher abundance of non-native, invasive grasses, and lower at sites with a higher abundance of forb species (Barrett 2005). In addition, at seven sites located across the range of southern Idaho ground squirrels, a negative correlation existed between the predicted persistence rate of southern Idaho ground squirrels and the importance values of invasive grasses (Barrett 2005). This suggests that ground squirrel populations that occupy habitats composed of higher levels of non-native grasses may have lower reproductive/survival rates. At five of seven study sites, populations were estimated to become extirpated within 15 years, given current reproductive and survival rates (Barrett 2005).

While most of the negative effects of habitat degradation are thought to be caused directly by changes in food resources available to southern Idaho ground squirrels, negative effects may also be partially due to changes in the physical environment (Ross 2007). Sharpe and Van Horne (1999) found that Paiute ground squirrels (*Spermophilus mollis*) in sagebrush habitat could remain above ground, foraging beneath sagebrush, when ambient temperatures exceeded 25 degrees Celsius. In contrast, squirrels in habitats dominated by non-native annual grasses retreated to burrows, potentially reducing the amount of available foraging time. Van Horne et al. (1997) found that shade from sagebrush may reduce the drying effects of sun and result in more succulent vegetation beneath shrubs. A reduction in foraging time or forage availability (from senescence) would result in reduced fat accumulation and storage by ground squirrels, and may contribute to reduced overwinter survival.

Conclusion for Factor A

Habitat loss due to degradation appears to be the primary threat currently affecting southern Idaho ground squirrels. It is currently occurring and therefore imminent. It impacts the majority of the range of southern Idaho ground squirrel and is of moderate magnitude. Based on our evaluation of the on-going risk to southern Idaho ground squirrels from habitat modification resulting from invasion of annual, non-native vegetation species, we conclude that this species is threatened by the present and threatened destruction, modification, or curtailment of its habitat and range. It should be noted, however, that two relatively large populations currently exist on altered habitat, one on a golf course in Payette County, and one adjacent to farmed fields on a ranch in Gem County. Both of these populations are considered “pests” by the landowners, and both landowners have requested, and have received, assistance from IDFG and USFWS in reducing the number of southern Idaho ground squirrels on their property.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

Southern Idaho ground squirrels have been a “Species of Special Concern” in the State of Idaho since 1981; under this designation, it is illegal to shoot, trap, or poison this species without a permit. However, evidence exists that recreational shooting of ground squirrels has likely had a detrimental effect on populations of southern Idaho ground squirrels in some areas. Evidence of recreational shooting was found at a southern Idaho ground squirrel population site where squirrel activity ceased (Yensen 1999). More recent contacts with some landowners indicate that this practice still occurs in some areas (Deb Sparber, IDFG, pers. comm. 2004). In early spring

2010, a number of individuals were observed on several occasions illegally shooting southern Idaho ground squirrels in Gem and Payette Counties (Bruce Haak, IDFG, pers. comm. 2010). The total number killed was likely in the hundreds, or even higher (Kristin Lohr, IDFG, pers. comm. 2010). In response, IDFG Conservation Officers and biologists have placed “dozens” of “Don’t Shoot” signs and have increased law enforcement presence to notify the public that southern Idaho ground squirrels are a protected species, and it is illegal to shoot them (B. Haak, pers. comm. 2010). See section D and E below for more information on shooting and poisoning of southern Idaho ground squirrels.

It is estimated that fewer than 100 southern Idaho ground squirrels have been collected during a 30-year period for scientific and taxonomic study (Eric Yensen, College of Idaho, pers. comm. 2007). Since this number is low relative to estimated yearly mortality rates of approximately 69 percent for adults and 73 percent for juveniles (Barrett 2005), scientific collection is not considered a significant factor in their overall decline (Moroz et al. 1995), and is not considered a current threat.

Conclusion for Factor B

In summary, illegal shooting of southern Idaho ground squirrels is still occurring in Gem and Payette Counties, Idaho; this threat is imminent. It is unclear to what extent these activities are affecting individual populations or the overall status of the species. The scope of this threat is uncertain, but likely relatively low with localized areas of higher (moderate to high) intensity.

C. Disease or predation.

Disease has been suggested as potentially contributing to the decline of southern Idaho ground squirrels (Prescott and Yensen 1999, Yensen 1999), though no epizootic infestation has been noticed in either subspecies of Idaho ground squirrel (Yensen et al. 1996, Yensen and Sherman 1997). Blood analyses to determine whether pandemic diseases are present have not been done but should be considered in the future. Plague (*Yersina pestis*), a contagious bacterial disease found in rodents, has not been identified in southern Idaho ground squirrels (Yensen et al. 1996). This disease is of particular concern however, since once established it could decimate the remaining numbers of squirrels throughout their range. Given that this threat has not yet manifested, it is non-imminent.

Predation has not been suggested as a factor affecting the southern Idaho ground squirrels; however, predators can have a severe impact on populations that are at critically low numbers. Southern Idaho ground squirrels are likely preyed upon by many species including the red-tailed hawk (*Buteo jamaicensis*), prairie falcon (*Falco mexicanus*), northern harrier (*Circus cyaneus*), badger (*Taxidea taxus*), long-tailed weasel (*Mustela frenata*), and gopher snake (*Pituophis melanoleucus*) (Yensen and Sherman 1997). Although not documented, domestic cat (*Felis catus*) predation may be significant at some population sites that occur near ranch houses or along the fringe of urban areas. Similarly, domestic dogs (*Canis familiaris*), specifically cattle herding dogs, are known to kill squirrels opportunistically in some situations (USFWS, in litt. 2007). Predation is most likely a threat to small, isolated populations of southern Idaho ground

squirrels. In general, the threat to the species from predation is variable, but is not known to be of significant magnitude at this time.

Conclusion for Factor C

In summary, disease is not known to have affected southern Idaho ground squirrels in the past, and the likelihood of disease affecting them in the future is unknown. Therefore, this threat is currently of low magnitude and non-imminent.

Predation does not appear to be significantly affecting any populations of southern Idaho ground squirrels. However, predation is occurring, and is therefore imminent. The magnitude of this threat is low to moderate depending on the size of the subpopulation being affected.

D. The inadequacy of existing regulatory mechanisms.

The southern Idaho ground squirrel is not protected by Federal or local laws. The International Union for Conservation of Nature classified the southern Idaho ground squirrel as “vulnerable” (Hafner et al. 1998). The southern Idaho ground squirrel is a focus species in Idaho’s Comprehensive Wildlife Conservation Strategy (IDFG 2005), and is classified as critically imperiled (S1) by the state. The IDFG originally classified the southern Idaho ground squirrel as a “Species of Special Concern” in 1981, meaning that the subspecies is protected by State law from taking (shooting, trapping, poisoning) or possession. Prior to 2000, there was little concern for the protection of southern Idaho ground squirrels. However, since 2002, protection from recreational shooting or poisoning is being elevated through information and education provided to agencies and the public, and through discussions with State and Federal agencies including Idaho Department of Lands, BLM, and USDA -Wildlife Services. In 2003, the IDFG initiated a public awareness program by including a one-page notice in their Upland Game regulations booklet warning against shooting of the squirrel. In addition, since 2004, the USFWS, IDFG, BLM, and others have distributed and posted “Don’t Shoot” posters. This poster campaign has yet to be evaluated for its effectiveness in reducing shooting of southern Idaho ground squirrels. Although illegal, shooting of southern Idaho ground squirrels is still occurring; multiple incidents were reported in Gem and Payette Counties in spring 2010 (B. Haak, pers. comm. 2010; K. Lohr, pers. comm. 2010). State conservation officers have increased patrols and many new “don’t shoot” signs have been posted in response to these incidents. It is unclear the extent to which shooting is still occurring, or whether it is affecting southern Idaho ground squirrels at a population level.

The USFWS began intensive survey and outreach efforts in 2000. Since then, private landowners have become generally aware of the status of this subspecies. Some landowners have been very cooperative in allowing surveys and posting “Don’t Shoot” signs on their lands. One private company took the initiative to begin active southern Idaho ground squirrel conservation management through a CCAA with the USFWS (Soulen Livestock et al. 2002). The CCAA, approved in 2002, covers southern Idaho ground squirrel conservation on approximately 17,402 ha (43,000 ac), and requires implementation of a number of conservation measures (Soulen Livestock et al. 2002). In March 2005, the USFWS and IDFG completed a

programmatic CCAA covering all private land within the historical range of the subspecies. Under this programmatic CCAA, private landowners can enroll in the CCAA if they are willing to implement certain conservation measures on their property for the southern Idaho ground squirrel (IDFG et al. 2005). There are six private landowners currently enrolled in the programmatic CCAA, representing approximately 21,064 ha (52,050 ac) within the range of the southern Idaho ground squirrel. This acreage represents approximately five percent of the known range. In 2006, at the time five landowners enrolled in the CCAA, their lands contained approximately 104 known occupied locations, approximately 31 percent of the total known population at that time, and approximately 20 percent of the total known population as of 2006.

Beginning in 2004, the IDFG has issued permits to control southern Idaho ground squirrels in response to depredation and damage claims by private landowners and golf courses (IDFG in litt. 2009a and 2009b). In some cases, reporting on control efforts has been adequate; with methods, locations, and numbers of squirrels killed reported. However, in other cases little or no reporting has occurred (B. Haak, pers. comm. 2010), and the USFWS is not able to determine the potential impact of control actions to southern Idaho ground squirrel populations.

Before 2000, little or no regulatory consideration was given to southern Idaho ground squirrels by BLM. The BLM now includes southern Idaho ground squirrel conservation measures in their Resource and Fire Management Plan updates for the Weiser Basin. The BLM has provided funding for presence/absence surveys on BLM lands from 2000 to 2009 (Yensen 2000a; Yensen and Haak 2000; Haak 2002; Warner 2003; J. Holderman, pers. comm. 2007a, IDFG 2009) and also provided funding for past graduate studies. The BLM is currently updating the Four Rivers Field Office Resource Management Plan (which includes the entire occupied southern Idaho ground squirrel range) and is expected to consider land use impacts to the species as if it were listed as threatened. The draft Resource Management Plan is likely to be released for public review and comment in January 2011.

The USFWS has made State and Federal agencies aware of the status of the southern Idaho ground squirrel; this has resulted in increased consideration for the species when Federal agency actions are taken that may affect the species. The USFWS also consults with the Environmental Protection Agency (EPA), the BLM, and Natural Resources Conservation Service (NRCS) concerning the use of zinc phosphide (a chemical used to control rodents on public lands), and other chemical applications that may affect southern Idaho ground squirrels. These interactions frequently result in chemical use being subject to conditions and restrictions in those counties where the southern Idaho ground squirrel is found. In early 2009, the Service worked with the Federal Animal and Plant Health Inspection Service (APHIS) and Idaho State Department of Agriculture (ISDA) to reduce potential effects to southern Idaho ground squirrels from their annual insect control operations. APHIS and ISDA agreed to implement measures that would minimize the potential that southern Idaho ground squirrels would be exposed to harmful insect control chemicals. There is no requirement for a State agency to conference with the USFWS for an unlisted or candidate species.

Conclusion for Factor D

In summary, sufficient existing regulatory mechanisms are largely in place to allow for effective conservation of southern Idaho ground squirrels, given their current status and threats. However, illegal shooting continues to threaten this species, despite regulations that prohibit those activities. We are not aware of populations where illegal shooting is having population-level impacts; thus, we consider this threat low to moderate in magnitude. The threat is imminent.

E. Other natural or manmade factors affecting its continued existence.

Control Actions for Southern Idaho Ground Squirrels

Ground squirrels are considered to be pests by many farmers and ranchers (Prescott and Yensen 1999). Southern Idaho ground squirrels often occur near alfalfa fields, considered one of the preferred food sources for the species, resulting in localized crop losses during years of high squirrel populations (Prescott and Yensen 1999). Yensen (1998) suggested that use of pesticides associated with crop production and insect infestation may have been a factor in the historical decline of this subspecies. Another reason that some landowners attempt to eliminate southern Idaho ground squirrels is because they attract badgers, which often dig large holes at ground squirrel sites that can be dangerous to livestock (Prescott and Yensen 1999) and humans riding horseback, as well as potentially jeopardizing the integrity of earthen dams. Efforts to control ground squirrel populations are frequently undertaken regardless of species or subspecies, and most often include shooting or poisoning (D. Sparber, pers. comm. 2004; J. Holderman, pers. comm. 2005). USDA-Wildlife Services has been made aware of our concerns and coordinates their control work of rodents to avoid control programs in the vicinity of southern Idaho ground squirrels.

Control actions for southern Idaho ground squirrels have occurred on Scotch Pines Golf Course in Payette, Idaho, the Rolling Hills Golf Course in Weiser, Idaho, and on a private ranch is near Emmett, Idaho.

Scotch Pines Golf Course: In 2004, the USFWS obtained permission to survey the Scotch Pines Golf Course in Payette, Idaho for southern Idaho ground squirrels. The golf course is public and is surrounded by farmland. Visual surveys indicated a substantial population of ground squirrels at this location. Surveyors observed 94 animals during one 4.5-hour session conducted in early March; surveyors later observed 256 animals (adults and pups combined) during an 8-hour session in May. Populations of southern Idaho ground squirrels were so numerous at this site that golf course managers requested the removal of a number of animals from 2005 to 2007. Staff from the USFWS and IDFG conducted trap-and-removal efforts in May of all three years. During the 2005, 2006, and 2007 trapping efforts, approximately 470 southern Idaho ground squirrels were removed from the golf course and translocated to suitable habitat on BLM lands. All translocated individuals were released into areas already occupied by southern Idaho ground squirrels, as this technique appears to result in higher persistence of released animals. In 2006, the Scotch Pines Golf Course requested a lethal take permit from the IDFG for southern Idaho ground squirrels on the golf course. Lethal control actions were conducted in March 2007; the USDA - Wildlife Services, USFWS, and IDFG estimate that approximately 450 southern Idaho ground squirrels were killed during this control action. Areas targeted for the control effort

included all areas subject to previous attempts to trap and translocate ground squirrels by IDFG and USFWS. Scotch Pines Golf Course did not request a lethal take permit from IDFG in 2008 or 2009.

Rolling Hills Golf Course: In 2009, the Rolling Hills Golf Course in Weiser, Idaho, contacted IDFG about controlling southern Idaho ground squirrels (Weiser Golf Association, in litt. 2009). On May 22, 2009, the IDFG issued a permit to the Rolling Hills Golf Course to take action to control southern Idaho ground squirrels (IDFG, in litt. 2009). As of April 2010, the Rolling Hills Golf Course had not reported on the number of ground squirrels affected by their actions (Bruce Haak, IDFG, pers. comm. 2010).

Private Ranch: One private landowner with a relatively high density of southern Idaho ground squirrels used to shoot southern Idaho ground squirrels in an attempt to reduce crop damage. This landowner has enrolled in the programmatic CCAA and no longer shoots the ground squirrels on his land without a State- issued permit. Instead, he requested and received assistance from IDFG and USFWS in 2005 and 2006 to remove some southern Idaho ground squirrels from his land. All individuals were live-trapped from the ranch and released either on BLM lands that were known to be occupied (because this appears to enhance success of translocation efforts) or were released in study sites used by graduate students to assess effectiveness of differing translocation techniques (see also Conservation Measures below). The number of southern Idaho ground squirrels removed from the ranch during 2005 and 2006 is estimated to be small compared with the remaining population, and thus the translocation efforts did not appear to threaten the existing population on the ranch.

In 2009, the owner of the ranch contacted the Service again regarding problems with southern Idaho ground squirrels. His primary concern was the potential for failure of earthen water impoundment structures (dams) as a result of squirrel burrowing activities. While burrows of ground squirrels may compromise the integrity of dams, the greatest concern is burrowing by badgers that follow and hunt ground squirrels. If a dam was to fail and blowout, property downstream would be destroyed and human health could be compromised. Similar to past years, another concern expressed was depredation of cultivated fields by southern Idaho ground squirrels. In response to these concerns, the Service, IDFG, NRCS, and APHIS worked together to address them.

Poisoning of southern Idaho ground squirrels burrowing on the face of the dam was used initially. When results of the initial treatment were deemed insufficient, IDFG, in coordination with the Service, authorized the removal of southern Idaho ground squirrels from dams on ranch property (IDFG, in litt. 2009). The number of squirrels killed on the dam in 2009 was estimated to be 22 (USFWS, in litt. 2010). Soon after authorization, the landowner reported that shooters did not spend much time out, as squirrels were sparse and didn't provide sufficient shooting opportunity. Presumably, the squirrels had already begun estivating (late May) and/or had moved to other areas of the ranch. In early spring 2010, limited numbers (approximately ten as of late March) of squirrels on the dam had been shot (USFWS, in litt. 2010).

In 2009 the Service installed nine temporary raptor perches to address depredation concerns prior to permanent perches, discussed below, being constructed. Perches were installed on the border of cultivated fields and fallow upland habitats where southern Idaho ground squirrels are abundant and regularly depredate on crops grown on the ranch. Three additional temporary perches were placed on and near a small earthen dam on the southern most portion of the ranch in an attempt to reduce the density of squirrels present and their subsequent burrowing activity. The effectiveness of all 12 temporary perches in attracting raptors was poor. Our assessment was based on the lack of observations of birds of prey using perches by the landowner, hired hands, and agency biologists and the lack of large fecal material present when perches were taken down. The perch design was likely inadequate for raptor use.

While SIDGS were estivating during the late summer of 2009, the NRCS installed seven permanent raptor perches, likely of a better design than the temporary ones, in an attempt to address southern Idaho ground squirrel depredation on cultivated crops. Similar to the temporary perches, they were installed on the border of cultivated fields and fallow upland habitats where SIDGS are abundant and depredate on crops. We hope to learn more about the effectiveness of perches during the squirrels above ground season in 2010.

Pocket gophers (*Thomomys talpoides*) are prevalent near agricultural lands within the range of southern Idaho ground squirrels. Farmers commonly employ control efforts to reduce the impact of gopher depredation on roots of cultivated crops. Methods used to trap gophers are fairly species-specific; however, there is anecdotal evidence to suggest that trapping efforts occasionally result in the incidental catch and killing of southern Idaho ground squirrels (Chris Reign, USFWS, personal observation. 2008).

Control actions are still occurring where southern Idaho ground squirrel populations are locally abundant, and where they overlap with human uses such as golf courses and agricultural fields. In some cases, control actions may result in the loss of many individuals. However, the IDFG must issue a permit for any control actions to occur legally, and these permits contain terms and conditions and time limits on the control actions. This ensures that actions are only occurring where actual damage to human property is occurring, and only when southern Idaho ground squirrel populations are known to be abundant. In addition, these control actions are occurring in locations that represent artificial habitats for the species. We consider the threat associated with control actions to be imminent and ongoing, but of a low magnitude because they only occur in areas of high abundance and in few locations.

Competition

Competition with Columbian ground squirrels (*Spermophilus columbianus*) may constitute a threat to southern Idaho ground squirrels. The restricted range of Idaho ground squirrels occurs within the much wider range of the Columbian ground squirrel, and they occur sympatrically in some localities (Dyner and Yensen 1996). The two species are likely to overlap in the northeast portion of the southern Idaho ground squirrel's range, north and east of Midvale Hill and Squaw Butte. Where the two species occur sympatrically, southern Idaho ground squirrels are limited by interspecific competition with Columbian ground squirrels (Moroz et al. 1995, Yensen and

Sherman 1997, Haak 2000), including competition for burrow sites (Haak 2000), and for food resources (Dyni and Yensen 1996). In general, Columbian ground squirrels occupy the more productive, mesic habitat with deeper soils (Yensen 1980, Dyni and Yensen 1996, Haak 2000). Given the current distribution of southern Idaho ground squirrels (most occurrences are in the southeast portion of its range), there is little overlap between the species and the threat from competition with Columbian ground squirrels is non-imminent and of low magnitude.

Small Population Dynamics

Habitat destruction and fragmentation have resulted in a distribution of relatively isolated population sites of southern Idaho ground squirrels. Isolation of these small populations may play a role in the decline of this subspecies. Southern Idaho ground squirrels have been shown to have limited dispersal abilities (Panek 2005), with the predominant dispersers being juvenile males. The overall mean long-range dispersal distance reported by Panek (2005), was approximately 735 m (0.5 mi). Populations separated by greater than this distance may not be able to exchange genetic material and therefore may be more vulnerable to adverse genetic effects. Small, isolated populations are more susceptible to natural disasters, catastrophic invasions of predators, parasites, or diseases, and suffer from loss of viability associated with genetic drift and inbreeding (Moroz et al. 1995, Gavin et al. 1999, Garner 2004). Genetic mitigation of small populations often can become a balancing act between maintaining genetic diversity and safeguarding unique local adaptations. Southern Idaho ground squirrels exhibit relatively low levels of microsatellite diversity, high levels of divergence among isolated populations, and low divergence among other populations (Garner 2004). Garner (2004) recommended translocation or supplementation of existing populations with captive-bred squirrels of known sources that have been genetically fingerprinted. She also recommended a low-level exchange of individuals between wild populations in sub-regional areas to increase genetic diversity but maintain unique local adaptations. The USFWS, IDFG, BLM, and researchers from Boise State University and College of Idaho began implementing these recommendations in 2005, with the ground squirrels translocated from the Scotch Pines Golf Course and a private ranch in Gem County (see Section D above). However, Busscher (2009) found 100 percent overwinter mortality for southern Idaho ground squirrels that had been translocated. Due to these low success rates and high labor intensity, the USFWS and IDFG have not conducted major translocations in several years.

Climate Change

Climate change effects to southern Idaho ground squirrels are unknown at this time, although large-scale climate modeling indicates that changes to precipitation and temperatures will likely increase suitability for *Bromus tectorum* and wildfire (Bradley et al., in press, p. 5). Endemic species that have limited ranges and are adapted to localized conditions, such as this species, are expected to be more severely impacted by climate change (Midgley et al. 2002, p. 448).

Conclusion for Factor E

Many of the remaining southern Idaho ground squirrel habitats and associated population sites are vulnerable to one or more man-made and naturally occurring threats. The persistence of invasive exotic plants and associated changes in fire frequency has made much of their remaining habitat less suitable. Actions to control southern Idaho ground squirrels in areas where they are causing damage to property owners is resulting in the death of many individuals in some years. This threat is imminent, although the magnitude is considered low because it is only occurring in a small number of locations, and only under the guidance of an IDFG permit and terms and conditions. The low number of squirrels observed at many of the known population sites increases the risk of extirpation. The threats associated with small, isolated populations (inbreeding and genetic drift) are historical and imminent because populations already have low levels of diversity at some sites. These threats are of a regional scope because the majority of known squirrel populations are small, and many are isolated. The magnitude of this threat is uncertain at this time but likely of a moderate level due to small population dynamics.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The USFWS has supported four range-wide population surveys of southern Idaho ground squirrels during the past 20 years. The information from these surveys, additional data collected from annual monitoring since 2000, and information from the petition formed the basis on which the USFWS initiated a Candidate Species Form. The BLM, in cooperation with the IDFG, initiated a survey for squirrels on BLM-managed lands in the summer of 2000 and 2001, to determine the location of active population sites of squirrels. The Idaho Power Company initiated a habitat reclamation study plan in cooperation with BLM at one population site (Clay Peak). The results of this study can be applied to other sites being considered for habitat reclamation. The USFWS co-sponsored a symposium with other agencies and Albertson College of Idaho on the Conservation Biology of Ground Squirrels and the Shrub-Steppe Ecosystem on March 30, 2001.

In 2002, a CCAA was approved with the Soulen Livestock Company that provides for southern Idaho ground squirrel habitat conservation on approximately 17,402 ha (43,000 ac). A total of 125 squirrels were trapped and removed from the Rolling Hills Golf Course (59 in 2001 and 66 in 2002), and translocated to private property covered under a CCAA (Soulen Livestock et al. 2002). Population monitoring of this translocated population indicates that about 30 to 50 percent of the population survived the translocation through 2002. Reproduction within the population was verified in the summer of 2002; however, follow-up surveys conducted in 2005 failed to detect any ground squirrel presence at these translocation sites, and surveyors concluded that the site is no longer occupied (Yensen 2005).

In 2002, as part of the CCAA, the USFWS underwrote southern Idaho ground squirrel surveys for six years on the Soulen Livestock Company lands. Nine new southern Idaho ground squirrel population sites were found during the 2003 survey (Yensen 2003). The 2004 survey failed to detect any new population sites at or near Cinnabar Ranch (Yensen 2004). Work in 2004 also

focused on documenting the relatively large southern Idaho ground squirrel population in the Road Gulch and adjacent Dry Creek Road areas. Although no new southern Idaho ground squirrel populations were detected in 2005, a number of potentially suitable locations for translocating/reestablishing southern Idaho ground squirrel were identified (Yensen 2005). The population at Road Gulch/Dry Creek was revisited and the population seemed comparable to that detected in 2004. In addition, the release sites used in 2001 and 2002 were revisited; no evidence of southern Idaho ground squirrel was detected (Yensen 2005).

Several private landowners have cooperated in allowing studies of southern Idaho ground squirrels to be conducted on their lands. Since 2002, a total of five graduate students have conducted thesis work on southern Idaho ground squirrels. One student completed her M.S. thesis at the University of Idaho in April of 2004, on the conservation genetics on Idaho ground squirrels (Garner 2004). Two students completed their M.S. theses at Boise State University in 2005; they focused on demographics (Barrett 2005) and methods of translocating southern Idaho ground squirrels (Panek 2005). Results from the translocation study indicate a higher success rate (retention and survival of released individuals) when squirrels are released into occupied sites. A fourth graduate student at Boise State University finished her M.S. thesis in the summer of 2007 (Ross 2007); her focus was on microhabitat characteristics. Results from these studies are presented above in the sections on Habitat/Life History of the species. A fifth graduate student defended her thesis in March 2009 (Busscher 2009). Her study was a continuation of the initial translocation study and investigated other translocation methods. During the 2006 field season, no differences were found in the survival of soft and hard released squirrels; this was re-tested in 2007 using different cages. Results indicate that there was zero documented overwinter survival of translocated squirrels regardless of release type (Busscher 2009). The USFWS, BLM, and IDFG provided funding to support the studies of all five graduate students.

In 2005, the USFWS, IDFG, and Office of Species Conservation (OSC) (a branch of the Idaho Governor's office), completed and signed a programmatic CCAA covering all non-Federal land within the historical range of the subspecies (approximately 425,630 ha or 1,051,752 ac). Under this programmatic CCAA, private landowners can enroll in the CCAA if they are willing to implement certain conservation measures on their property (IDFG et al. 2005). In 2004 and 2005, the USFWS provided funding to IDFG to hire a technician to survey private lands where five landowners had indicated they might participate in the programmatic CCAA. All five landowners enrolled in the programmatic CCAA upon its completion. Currently, there are six private landowners enrolled in this programmatic CCAA, representing approximately 21,064 ha (52,050 ac) within the range of the southern Idaho ground squirrel. This acreage represents approximately five percent of the known range. In 2006, at the time five landowners enrolled in the CCAA, their lands contained approximately 104 known occupied locations, approximately 31 percent of the total known population at that time, and approximately 20 percent of the total known population as of 2006. Long-term monitoring sites were also established in 2005 to ensure repeatability of future efforts.

The BLM also has an ongoing commitment to implement conservation measures for candidate species such as the southern Idaho ground squirrel. Various conservation measures are briefly

described in RMP documents pertinent to the range of the southern Idaho ground squirrel. Please see Factor D for more discussion on RMPs and southern Idaho ground squirrels.

We are aware of two site-specific projects that contain conservation measures that will benefit southern Idaho ground squirrels. The Warm Springs Fire Emergency Stabilization and Rehabilitation Plan includes specific efforts to improve approximately 16 ha (40 ac) of occupied ground squirrel habitat. The Cherry Creek Fire Emergency Stabilization and Rehabilitation Plan also includes specific efforts to improve occupied southern Idaho ground squirrel habitat. Both the Warm Springs and Cherry Creek areas burned in wildfires in 2006 (B. Chaney, USFWS, pers. comm. 2008).

One landowner enrolled in the Programmatic CCAA for southern Idaho ground squirrels has an abundant population of ground squirrels. As a result, the ground squirrels annually depredate on the landowner's crops, particularly alfalfa. In 2005-2007, FWS and IDFG trapped and removed ground squirrels from ranch areas adjacent to cultivated fields in an effort to provide depredation relief to the landowner, to supplement existing ground squirrel populations in less densely populated portions of the range, and to reestablish populations where they were no longer present or were never known to be present. Graduate students were used to conduct the three years of relocation efforts. Graduate students are no longer available to conduct such work, and such efforts are now suspected to result in high levels of ground squirrel mortality (Busscher 2009). In an attempt to address some of the landowner's depredation concerns, the USFWS has participated in efforts to fund and construct predator perches as a way to attract natural predators to the area, and deter ground squirrels from occupying areas adjacent to cultivated fields. The success of these perches is unknown at this time. These efforts have helped to maintain good relations with the landowner and to reduce the potential for larger scale control efforts on this important, strong population of southern Idaho ground squirrels.

Also in 2008, the USFWS partnered with two additional landowners to implement habitat enhancement on six acres of private land (USFWS 2008). The two properties are adjacent, and southern Idaho ground squirrels occur on both properties in the vicinity of the habitat enhancement. The goal of the project was to establish an 80-foot wide strip of native vegetation straddling the property boundary and containing plant species preferred by southern Idaho ground squirrels. To date, the project has resulted in establishment of sparse native/planted species, but is still dominated by non-native, invasive plant species.

In cooperation with the USFWS, IDFG, and BSU, Zoo Boise built a propagation/research/and educational live exhibit for southern Idaho ground squirrels. A total of 31 southern Idaho ground squirrels were trapped from the Rolling Hills Golf Course and from several other population sites in 2002 and translocated to Zoo Boise to begin a propagation and education program. This program proved to be a success with 24 young produced in the spring of 2003 (Panek 2005), and 33 juveniles identified in 2007. The effort to captively breed southern Idaho ground squirrels at the Zoo continues. In 2005, 2006, and 2007, captive-bred southern Idaho ground squirrels were exported from the Zoo to suitable habitat on BLM land. No squirrels were released from the Zoo population in 2008 or 2009.

In 2010, the IDFG issued a permit to Eric Yensen to move southern Idaho ground squirrels as part of a study to test the effectiveness of different translocation techniques. Some of the squirrels are expected to be captured from populations that are problematic for private landowners (e.g., golf courses), and some releases are likely to occur with squirrels from the Zoo Boise population (Rex Sallabanks, IDFG, pers. comm. 2010). In total, the researchers anticipate moving 60-100 southern Idaho ground squirrels (E. Yensen, in litt. 2010). Released squirrels will be monitored both visually and using radio-telemetry (E. Yensen, in litt. 2009). The scientific collection permit contains several stipulations designed to protect both the captured squirrels and wild populations. Capture, translocation, and monitoring of southern Idaho ground squirrels is scheduled to start in spring 2010 and occur annually through 2012.

SUMMARY OF THREATS

Threats to southern Idaho ground squirrels include: habitat deterioration and fragmentation; direct killing from shooting, trapping or poisoning; predation; competition with Columbian ground squirrels; inadequacy of existing regulatory mechanisms; and other natural and human caused factors, including control actions on farms, golf courses, and other private properties.

Habitat deterioration appears to be the primary threat to southern Idaho ground squirrel (Yensen 1999, Barrett 2005). Nonnative annuals now dominate much of this species' range, have changed the species composition of vegetation, and have altered the fire regime in a perpetuating cycle throughout much of the range of these squirrels (Whisenant 1990). While southern Idaho ground squirrels feed on green shoots of *Bromus tectorum* and this grass may represent a significant portion of their diet in the early season at several study sites, *Bromus tectorum* and *Taeniatherium asperum* have highly variable annual productivity (Yensen 1999, Yensen et al. 1992). In years of low rainfall, low productivity of these exotics could prevent squirrels from storing sufficient fat reserves to overwinter and result in significant overwinter mortality across large portions of their range. Southern Idaho ground squirrels occupying sites with higher abundance of non-native, invasive grasses have been shown to have variable body mass and fat, and that late-season body condition of juvenile ground squirrels was negatively correlated with the abundance of non-native grasses (Barrett 2005). Ross (2007) found higher densities of southern Idaho ground squirrels occur in areas where a native component of the vegetation still exists, and that burrow density was negatively correlated with annual canopy cover. Habitat degradation and fragmentation are likely the primary or proximal causes of the current patchy distribution of southern Idaho ground squirrels. Panek (2005) determined that the mean long distance (inter-population) dispersal was 739 m (0.5 mi); and suggested populations farther apart than 1,000 m (0.6 mi) are unlikely to be able to exchange genetic material and maintain adequate genetic diversity. Once populations become isolated, the adverse effects of genetic drift and inbreeding occur which further depresses populations. Based on recent genetics work, southern Idaho ground squirrels are subject to more genetic drift and inbreeding than expected for other related, ground squirrel species (Garner 2004).

Recreational shooting and other direct killing of southern Idaho ground squirrels is occurring in parts of its range, although no studies have been conducted to determine the specific effects on ground squirrel populations. Illegal shooting appears to have increased in spring 2010 (K. Lohr,

pers. comm. 2010). Ground squirrels are sometimes considered pests by farmers and ranchers (Prescott and Yensen 1999). When available, alfalfa and clover crops are one of the preferred food sources for southern Idaho ground squirrel, resulting in localized crop losses in localized areas of abundance. Efforts to control ground squirrel populations are frequently undertaken regardless of the ground squirrel species present, and most often include shooting or poisoning. Control efforts, such as the one that occurred at Scotch Pines Golf Course in March 2007, can adversely affect local populations of southern Idaho ground squirrel (Yensen 1998, Prescott and Yensen 1999, Yensen 2000b). Authorized trapping and translocation in areas where local abundance is high also decreases local populations. There has been no evidence of disease impacts to the southern Idaho ground squirrel, and this threat factor is not imminent at this time.

Predation is a potential threat factor but it likely impacts populations that are already isolated and/or depressed. Competition with Columbian ground squirrels is a potential threat to nearby populations in the northeast portion of the southern Idaho ground squirrel's range, but currently not a threat to the species due to limited overlap in the two species' distributions.

The primary threats to southern Idaho ground squirrels are still imminent and widespread. Thus the status of the species as a candidate for listing remains unchanged. It should be noted that there are a number of activities (ongoing and developing) that either do, or will, provide some degree of amelioration. The Soulen CCAA was completed in 2002 and the rangewide programmatic CCAA was completed in 2005. Both CCAAs include conservations measures that provide additional protection to southern Idaho ground squirrel from recreational shooting and other direct killing on enrolled lands, and also allow the agencies (USFWS, IDFG, and OSC) to investigate ways of restoring currently degraded habitat. Together, the acreage protected by lands enrolled through these two CCAAs is approximately 38,756 ha (95,767 ac), or 9 percent of the known range. However, it should be noted that, to date, efforts to improve habitat have had mixed results, and no large-scale efforts to restore habitat been undertaken throughout the range of the species.

Based on our evaluation of the on-going risk to southern Idaho ground squirrels from habitat modification resulting from invasion by non-native annual vegetation, ongoing direct illegal killing of the species, and genetic risks due to populations being small and isolated, we conclude that there is sufficient information to develop a proposed listing rule for this species. At this time, based on the best available information, we continue to find that the species meets our definition of a candidate due to factors A, B, and E. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES

Based on the information currently available on southern Idaho ground squirrels and the work either completed or in progress, we recommend the following conservation measures.

1. Continue to implement the programmatic CCAA completed in 2005 (IDFG et al. 2005). Since this CCAA covers the entire known range of the species and was designed for

private lands on which the predominant use is agriculture (farming or ranching), it is a valuable tool for squirrel conservation. We further recommend that the focus of implementation of current and future site-specific plans remain on habitat improvements. This will address the primary threat of habitat modification to the species. Additional work is also needed to survey lands and to assess population and habitat status, and continued outreach and education efforts are needed to further reduce direct mortality from shooting/poisoning.

2. Actively recruit additional landowners to participate in the CCAA. In addition to fully implementing existing site-specific plans, we recommend actively recruiting additional landowners to enroll in the CCAA. Increasing the area of land covered by the CCAA and protected for ground squirrels could further reduce threats.
3. Pursue other CCAAs. The programmatic CCAA was designed primarily for private lands used primarily for agriculture (farming or ranching). Other potential uses, such as golf courses, city parks, or utility corridors were not the primary target of the programmatic CCAA. Depending upon the situation, different conservation actions/commitments may be needed for these lands.
4. Continue to work cooperatively with the BLM on surveys and habitat enhancement/restoration measures. From 2004 to 2009, the BLM conducted surveys for southern Idaho ground squirrels on parcels of their lands not previously surveyed for this species. They have also allocated funds or resources to be used for habitat restoration for ground squirrels since 2005.
5. Develop a comprehensive database containing all known southern Idaho ground squirrel locations. Currently there is no one location that includes information on all known sites. This work was undertaken in 2010 by the IDFG, with financial assistance from the USFWS.
6. Conduct additional research and/or monitor the vegetation conditions across the species' range to better determine the relationship between the species' status and habitat conditions.
7. Increase efforts to educate the public about southern Idaho ground squirrels to prevent or reduce illegal shooting activities. Increase enforcement efforts if necessary.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9*
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

The magnitude of the primary threat for this species, habitat degradation, remains constant because current methods of restoring native plants species are minimally successful, and only feasible on a small scale. Although suitable habitat areas that can support southern Idaho ground squirrels still persist, many of these areas are dominated by non-native annual grasses, which likely provide insufficient nutritional value (lower digestibility and early senescence) for southern Idaho ground squirrels, which in turn results in (1) variable body condition for all age classes, (2) suboptimal body condition for juveniles, and (3) reduced over-winter survival of juveniles (Barrett 2005). In 2005, populations of southern Idaho ground squirrels at six of seven study areas were projected to be extirpated by 2019 primarily as a result of low juvenile survival of females. Predictions made by Barrett (2005) were based on information collected from 2002 to 2004. Although population estimates from 2002 to 2006 are not comparable to estimates made from 2007 to current, the populations monitored appear to be relatively stable and do not show a downward trajectory toward extinction (Table 3). However, it is important to note that small mammal populations tend to exhibit large population fluctuations through time.

Conservation and habitat rehabilitation actions have begun in some areas, with variable success. A private landowner entered into a cooperative agreement with the Service in 2003 to enhance (through seeding and control of non-native plants) 20 ha (50 ac) of wildlife habitat, primarily for southern Idaho ground squirrels (USFWS 2003). These seedings have occurred and have been successful. Habitat enhancement was attempted at another (1 ac) site in 2006, and success of

these efforts has not yet been fully determined. Habitat rehabilitation on about 2.4 ha (6 ac) was attempted at a third site in 2009 and has been minimally successful to date.

Other threats are also considered moderate to low in magnitude. Illegal shooting continues to occur throughout portions of the range. We are unsure about how these activities affect the overall population, although it is likely that hundreds of squirrels were killed in early 2010 (K. Lohr, pers. comm. 2010), making the magnitude of this threat moderate. Southern Idaho ground squirrels are also being controlled to protect farm and other human activities from depredation impacts; these control actions are regulated by IDFG control permits and require certain conservation and monitoring measures to be implemented. In addition, control actions are occurring in a limited number of locations, and primarily in artificially created habitats. We consider the magnitude of this threat to be low.

Studies have been completed on the genetic diversity, demographics, dispersal, and microhabitat characteristics of southern Idaho ground squirrel (Ross 2007, Barrett 2005, Panek 2005, and Garner 2004). A programmatic CCAA was completed in 2005 that covers all private lands within the known geographic range of the species. Six landowners with a total of approximately 21,000 ha (51,785 ac) are enrolled under the programmatic CCAA. When combined with the acreage enrolled in the Soulen Livestock CCAA for southern Idaho ground squirrels, the acreage protected by lands enrolled in these two CCAAs is approximately 38,756 ha (95,767 ac), or 9 percent of the known range. These actions, in combination with information on habitat quality and its impact on southern Idaho ground squirrel demographics, lead us to conclude that the magnitude of threats is moderate.

Imminence:

Threats from habitat degradation are ongoing, and many of the remaining southern Idaho ground squirrel habitats and associated population sites are vulnerable to one or more man-made and naturally occurring threats. The persistence of invasive non-native plants and associated changes in fire frequency has made much of the remaining habitat less suitable for southern Idaho ground squirrels. The low number of squirrels observed at many of the known population sites increases the risk of extirpation. Although provisions for habitat enhancement/restoration were included in the programmatic CCAA, successful and significant implementation of these measures has not yet occurred. Illegal shooting and depredation control actions also continue to occur. All of these threats to the southern Idaho ground squirrel are ongoing and, therefore, are imminent.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. Annual surveys and monitoring conducted since 2000 have found over 451 additional southern Idaho ground squirrel population sites, and the USFWS has expanded and revised the initial historical range. The State and several private landowners are willing participants in allowing intensive studies to be conducted on their lands, and several Federal agencies including BLM, USDA-Wildlife Services, and NRCS are cooperators towards

implementing conservation measures including habitat restoration on Federal, State, and private lands. Due to studies and the work of cooperating partners, the USFWS is in a position to implement long-term recovery and habitat restoration efforts. In addition, the IDFG has taken swift action to address increased incidence of illegal shooting in 2010, and other activities that are likely to affect the species. The USFWS concludes that emergency listing of this subspecies is not warranted at this time.

MONITORING

Intensive and/or extensive monitoring of southern Idaho ground squirrels has been an ongoing, annual event since the spring of 2000. Monitoring includes trapping, weighing, ear-tag marking and conducting local population counts by staff from IDFG and supported through section 6 and USFWS Recovery funds. BLM supervisors, biologists and GIS specialists have also cooperated and supported monitoring and survey efforts over time. Private landowners have provided permission to the IDFG and USFWS to survey, monitor, and translocate squirrels on their lands. Golf course managers and one private landowner have allowed us to survey squirrel populations and to remove (via translocation) squirrels from their lands. Idaho Power Company ecologists have met numerous times with USFWS staff to coordinate surveys and habitat rehabilitation studies. Concerned staff from the Idaho Department of Lands has met with USFWS biologists during the past several years to better understand our conservation approach, and to integrate it into activities on State endowment lands. The above survey and monitoring work has required frequent coordination and cooperation among the USFWS and other agencies, private landowners, and university personnel. It has allowed the USFWS to establish a positive rapport with other Federal and State agency personnel, and build trust with private landowners.

GIS is being used extensively to store survey and monitoring data, create and integrate maps, and to update status information about the southern Idaho ground squirrel. Currently, the USFWS has contracted with the IDFG to develop a comprehensive database of information on distribution, habitat, and landownership for the species. The updated database should be available by spring 2011.

Since 2004, the USFWS has provided cost-share funding to the IDFG to hire nongame technicians to complete survey and monitoring activities for southern Idaho ground squirrels on private lands. In addition to gathering data on the presence/absence of ground squirrels, we have established long-term monitoring plots. Currently there are five intensive monitoring plots and an additional eight extensive monitoring sites; and a monitoring protocol has been finalized. Intensive monitoring includes multiple visits to each site throughout the breeding season to trap ground squirrels. Information on emergence weights and breeding population structure is collected. Extensive monitoring includes a minimum of two visits per site within a breeding season. During these visits, no trapping takes place, but visual surveys are conducted to determine proportion of area occupied. We also conduct additional presence/absence surveys if technicians are available.

We believe the current level of monitoring is sufficient to track populations of southern Idaho ground squirrels. However, additional monitoring of habitat conditions would be useful to look at the relationship between the species' status and specific habitat conditions on a broad scale.

COORDINATION WITH STATES

Since 2004, the USFWS has annually provided funding to the IDFG to assist in monitoring efforts with this species. We coordinate closely with IDFG technicians and biologists to address problems that arise, and cooperate to provide appropriate technical or financial support where necessary and available. In 2010, the USFWS cooperated and funded the IDFG to develop an updated database of southern Idaho ground squirrel sites and locations.

The southern Idaho ground squirrel is a focus species in Idaho's Comprehensive Wildlife Conservation Strategy (IDFG 2005). It is classified as critically imperiled (S1) by the state; the basis for its inclusion is that it is a candidate under the Endangered Species Act; it consists of small populations, and is an Idaho endemic species.

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: Acting Carolyn D. Bohan 5/18/10
Regional Director, Region 1, Fish and Wildlife Service Date

Rowan W. Gould
ACTING
Director, Fish and Wildlife Service October 22, 2010

Concur:

Do not concur: _____
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review:

Conducted by: Chris Reighn Date: May 4, 2010
Fish and Wildlife Biologist

Reviewed by: Kendra Womack Date: May 4, 2010
Supervisory Fish and Wildlife Biologist

Steve Duke Date: May 5, 2010
Assistant Field Supervisor

Gary L. Burton Date: May 5, 2010
Acting State Supervisor, Idaho FWO