United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946

IN REPLY REFER TO:
ES/GJ-6-CO-05-F-002
MS 65412 GJ

August 23, 2005

Michael A. Yeary, State Director
USDA-APHIS-Wildlife Services
12345 W. Alameda Parkway, Suite 204
Lakewood, Colorado 80228

Dear Mr. Yeary:

This document transmits the Fish and Wildlife Service's (Service) final biological opinion based on our review of the biological assessment (BA) for the Animal and Plant Health Inspection Service - Wildlife Services Program (WS); Wildlife Damage Management (WDM) and its effects on the threatened Canada lynx (*Lynx canadensis*), in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). The project is located within the State of Colorado.

Consultation History

On July 28, 1992, the Service issued a programmatic biological opinion (no number) to the U.S. Department of Agriculture, Animal Damage Control Program (now Wildlife Services). Since that time the Canada lynx was listed as a threatened species. The prior consultation did not include the lynx since it was not listed at that time. To date, informal consultation has occurred between WS and the Service at the national level, formal consultation has not yet been initiated, so that consultation has not been completed.

Subsequent to the April 24, 2000, listing of the Canada lynx, WS issued Interim Policy Guidelines for Canada lynx, which provided conservation measures to minimize or eliminate the likelihood that a lynx would be taken by their activities.

On August 11, 2003, the Service's Western Colorado Field Office received an August 8, 2003, request from WS in Colorado, to initiate formal consultation for their actions and the potential effects to lynx. The cover letter stated that they were submitting a draft biological assessment. On October 29, 2003, the Service responded that we would not initiate formal consultation on a draft BA, since the BA lacked sufficient information to initiate formal consultation. Our response effectively initiated informal consultation with WS and we requested additional information which we believed to be missing from the document.

Colorado WS and the Service have been in informal discussions on numerous occasions since the 2000 listing, and the Service provided recommendations for an emergency consultation on

October 1, 2001. The Service provided recommendations to WS for avoiding the potential for take of lynx. No lynx were taken as a result of WS actions. The informal discussions and the emergency consultation were not programmatic in nature, but rather were site specific actions taken by WS.

In October of 2004, Colorado WS informally submitted a second draft BA, to which the Service provided comment, regarding additional information required. On January 31, 2005, we received a letter requesting initiation of formal consultation from Colorado WS, which included an updated BA.

BIOLOGICAL OPINION

Background

This biological opinion is based on our review of your January 21, 2005, BA, regarding the effects of the ongoing WS WDM program conducted in Colorado on the Canada lynx. A complete administrative record of this consultation is on file at this office.

The Colorado Division of Wildlife initiated a Canada lynx reintroduction program in February 1999. The program augmented any existing population with transplants from Canada and Alaska, with the intent of reestablishing viable, self-sustaining populations in primary blocks of suitable habitat throughout the Southern Rocky Mountains in Colorado. Ninety-six lynx were released into the San Juan Mountains, Colorado during the winter/spring periods of 1999 and 2000 by the CDOW. In 2002, the Service received a request to amend Colorado's then current Section 6 Cooperative Agreement based on a October 2002 Conservation Plan and its related subsequent versions. Section 6(c)(1) of the Endangered Species Act states that "In furtherance of the purposes of this Act, the Secretary is authorized to enter into a cooperative agreement in accordance with this section with any State which established and maintains an adequate and active program for the conservation of endangered species and threatened species. Upon receipt of such a proposed State program, the Service, on behalf of the Secretary, shall make a determination whether such program is in accordance with the Act. Unless we determine that the proposed State program is not in accordance with the Act, we shall enter into a cooperative agreement with the State for the purpose of assisting in implementation of the State program."

The Service reviewed the Conservation Plan according to the Endangered Species Act section 7 interagency cooperation regulations, and issued biological opinion ES/GJ-6-CO-02-F-034 pursuant to Section 6(c)(1) in November 2002. In the Conservation Plan, the Colorado Division of Wildlife (CDOW) proposed to augment the existing Colorado lynx population by releasing up to 186 Canada lynx by the spring of 2008. The Plan also included; measures to minimize the unintentional incidental take of lynx, maintain public support for lynx recovery, and distribution of educational materials that compare the differences between lynx and bobcats (USFWS 2002).

Two hundred and four lynx have been released by CDOW since 1999 during the reintroduction program. The State is currently tracking 110 relocated adult lynx and 7 immature lynx born in Colorado. There are 65 known mortalities and 29 missing animals. One hundred and two kittens have been born in Colorado with 30 known or presumed mortalities leaving 72 kittens still possibly surviving. CDOW plans to release up to 15 lynx/ year from 2006-2008. Most of the lynx released remain in the vicinity of the San Juan Mountains in Colorado. Movement of lynx

in Colorado has proceeded north of Interstate highway 70 and into Utah, Wyoming, New Mexico, Nebraska and Montana. Of the 204 adult lynx released in Colorado, there have been 66 known mortalities

As stated above, some of the released lynx have ventured into Utah, Nebraska, Wyoming, New Mexico and Montana. As with most translocation of species there is a tremendous desire to return to their home range. This has been demonstrated with gray wolves, elk, bears, and a host of other species. The "hard" release, releasing a species captured in the wild immediately upon reaching the release site, tends to lend itself to the homing behavior. The "soft" release technique, holding a species at the release site until acclimated, tends to retain the species to that specific area. Both of these release techniques were well documented during the gray wolf reintroduction into Yellowstone National Park and central Idaho (Fritts et al. 2001). CDOW continues to use the "hard" release technique and as a result some of the released lynx exhibit the homing behavior and wander into habitat not recognized as lynx range as exhibited by the 2 lynx that were killed in Nebraska (CDOW 2001, Appendix A). In some cases the "hard" released lynx may not like the release site and search for adequate prey or lynx range where they instinctively establish a territory.

As CDOW continues to augment the lynx population and the population continues to increase and expand into new areas, there will be an increase in dispersing young lynx from their natal home range and the core establishment area. Dispersing to establish new territories is how most species re-colonize new areas and maintain viable populations.

In 68 FR 40076 (2003), the Service concluded that in the western United States lynx habitat occurs primarily on a federally owned land base. Boreal forests, which are preferred by lynx, are located at higher elevations and are predominantly under Federal ownership.

Throughout their range, lynx have been documented in habitats that are unable to support them long-term. Such occurrences are associated with cyclic population highs when lynx tend to disperse long distances. These unpredictable and temporary occurrences are not included within either the historic or current range of lynx because they are well outside of lynx habitat (65 FR 16052, March 24, 2000; 68 FR 40076, July 3, 2003). This includes records from Nevada, North Dakota, South Dakota, Iowa, Nebraska, Indiana, Ohio, and Virginia (Hall and Kelson 1959; Burt 1954; Gunderson 1978; Mech 1980; McKelvey et al. 2000b; Johnson 1994; Jones 1994; South Dakota Natural Heritage Program 1994; Jobman 1997; Smithsonian Institute 1998).

Lynx may be present in areas where WDM activities will be conducted in Colorado. The majority of lynx habitat occurs on public lands, where WS does conduct some activities. However, these activities are very selective in terms what animals are taken. WS typically conducts coyote damage management operations on private lands where livestock grazing is occurring.

In addressing the likelihood that lynx could be taken by WS activities, the reintroduction effort currently being conducted by the CDOW must be considered. The behavior of some of the lynx is outside what is considered normal. Some animals have been captured and/or killed well outside of lynx habitat. This behavior is not entirely unexpected, and is likely to continue while the reintroduction continues. The reintroduction effort is expected to continue through 2008

(Lynx Conservation Plan, CDOW, 2002). Once the reintroduction effort is completed, the lynx are expected to behave more normally. Normal behavior should result in the lynx generally staying in their appropriate habitat. One consideration is that lynx have large home ranges, and may cross non-habitat areas in search of prey, find mates and make exploratory movements. This may place lynx at a greater danger of being captured or killed. The Service assumes that as the population continues to grow and recover, there will be dispersal movements.

Colorado State Constitution, Article XVIII, Section 12b,) restricts the use of leg-hold traps, snares, gas cartridges, and M-44s. These tools may not be used on public lands. On private lands the use of these specific tools is limited to one 30-day period per calendar year, per private parcel.

The statutory language in Article XVIII, Section 12b of the Colorado State Constitution defines the procedures for WDM. As stated in 33-6-207 Colorado Regulatory Statutes and in 35-40-101 CRS, Colorado Department of Agriculture (CDA) has the authority for the control of depredating animals within the State of Colorado. As stated in 35-40-100.2 CRS, CDA has the authority for control of the following species when causing damage to agricultural resources:

> "... coyotes, foxes, bobcats, bears, mountain lions, wolves, beavers, muskrats, raccoons, opossums, and striped skunks and any animals identified by rule promulgated by the commissioner and approved by the wildlife commission."

The duties of the Commissioner of Agriculture in regards to depredating animals are stated in 35-40-101 CRS.

Description of Proposed Action

The proposed action consists of WS continuing their WDM programs within the State of Colorado, the action area. WS presently uses Integrated Wildlife Damage Management (IWDM), to resolve wildlife damage by integrating the use of several methods simultaneously or sequentially. IWDM is the implementation and application of safe and practical methods for the prevention and reduction of damage caused by wildlife based on local problem analyses and the informed decisions of trained personnel. WS applies IWDM by using the WS Decision Model (Slate et al. 1992). The Decision Model allows WS personnel greater flexibility and more opportunity to tailor an effective damage management strategy for each problem that is encountered.

IWDM is used to implement effective management techniques, in a cost-effective manner while minimizing the potentially harmful effects to the public, target and non-target species, and the environment. IWDM draws from the largest possible array of options to create a combination of techniques appropriate for the specific circumstances. IWDM may incorporate cultural practices (i.e., animal husbandry), localized habitat modification, animal behavior modification (i.e. scaring techniques), individual animal removal, local population reduction, or any combination of these, depending on the characteristics of the damage situation. In selecting management techniques for specific damage situations, consideration is given to the following:

- Local environmental conditions
- Potential biological, physical, economic, and social impacts
- Potential legal restrictions
- Species responsible
- Magnitude of the damage
- Geographic extent of damage
- Duration and frequency of the damage
- Status of target and non-target species, including T&E species
- Prevention of future damage (e.g., lethal and non-lethal techniques)

Wildlife Services WDM in Colorado is conducted in cooperation with other Federal, State, and local agencies, as well as private organizations and individuals. WS works to reduce wildlife and feral animal damage to agricultural resources, natural resources, and property, and to protect human health and safety. WS also provides assistance with monitoring and management of wildlife diseases. WS, as an agency, has been conducting WDM in the United States for more than 85 years, and has changed WDM activities to reflect societal values and minimize impacts to people, wildlife and the environment (Wildlife Services, 2005 BA).

WS conducts WDM in cooperation with and under the authorities of the CDOW and the CDA. The Colorado WS Program works cooperatively with local livestock associations and county governments to provide WDM assistance for its constituents. WDM assistance is provided statewide in areas where funding has been provided. WDM activities occur on both private and public lands, but leg-hold traps, snares, and toxicants cannot be used on public lands as stated in the Colorado Constitution Article 18, Section 12b. This law outlines the specific WDM methods that can be used in different wildlife damage situations. As a result of these restrictions, and since most lynx habitat occurs on public lands where only live traps and shooting can be used, the likelihood of impacting lynx from WDM is greatly reduced.

Integrated Wildlife Damage Management Strategies

WS personnel provide technical assistance to a requestor in the form of information, demonstrations, and advice on available WDM techniques. Technical assistance includes demonstrations on the proper use of some management devices and information on animal husbandry, wildlife habits, habitat management and animal behavior modification. Technical assistance is generally provided following an on-site visit or verbal consultation with the requestor. Generally, several management strategies are described to the requestor for short and long-term solutions to damage problems; these strategies are based on the level of risk, need and practical application.

Operational damage management assistance is implemented when the problem cannot be resolved through technical assistance. The initial investigation defines the nature and history of the problem, extent of damage, and the species responsible for the damage. Professional skills of WS personnel are often required to resolve problems effectively, especially if restricted pesticides are proposed or if the problem is complex, requiring the direct supervision of wildlife professionals. WS considers the biology and behavior of the damaging species and other factors using the WS Decision Model (Slate et al. 1992). The recommended strategies may include any

combination of preventive and corrective actions that could be implemented by the requester, WS, or other agency personnel, as appropriate. These strategies are preventive or corrective in nature, and may be lethal or non-lethal to target animals and possibly non-target animals as well.

Preventive Damage Management is applying WDM strategies before damage occurs, based on historical problems and data. Most non-lethal methodologies, whether applied by WS or resource owners, are employed to prevent damage from occurring and, therefore, fall under this heading.

Corrective Damage Management is applying WDM to stop or reduce current losses. As requested and appropriate, WS personnel in Colorado provide information and conduct demonstrations, or take action to prevent additional losses from recurring.

Methods Available for Use

A wide range of methods are used by WS personnel in WDM and strategies are based on applied IWDM principles. WS employs or recommends three general strategies to reduce wildlife damage: resource management, physical exclusion, or wildlife management. Each of these approaches represents a general strategy or recommendation for addressing wildlife damage situations. Within each approach, specific methods or tactics are available for WDM, including many that are specific to individual species as described below. WS conducts operational WDM involving take of depredating wildlife on private lands only where signed Agreements for Control on Private Property have been executed. WS conducts operational WDM on municipal, county or other government lands only after Agreements for Control on Non-private Property or work plans are in place covering the government land. These agreements and work plans list the intended target animals and the methods to be used.

These general methods are used in WDM nationwide and many of these are used by WS. As discussed, WS conducts most all WDM for predators, aquatic rodents, birds, terrestrial rodents, and cervids for the protection of agricultural resources, property, natural resources, and human health and safety. Some of WS WDM activities, and methods used in reducing predator damage have been identified that could result in the take of lynx. It has been determined that all other WDM activities conducted by WS in Colorado will have "no effect" on lynx.

Resource Management

Resource management includes a variety of practices that may be used by agriculture producers and other resource owners to reduce their exposure to potential predator depredation losses. Implementation of these practices is appropriate when the potential for depredation can be reduced without significantly increasing the cost of production or diminishing the resource owner's ability to achieve land management and production goals. Changes in resource management are not conducted operationally by WS.

- Guard Animals
- Crop Selection and Scheduling Management
- Supplemental Feeding/Lure Crops

- Habitat Management
- Beaver Dam Removal
- Water-level Control Devices
- Modification of Human Behavior

Wildlife Services in Colorado may recommend the use of guard Animals to livestock owners to protect livestock from predation, but does not employ their use. WS may also recommend habitat modification or modification of human behavior. However, WS does not modify habitat, and any recommendations made by WS for the modification of human behavior would be carried out by others. Therefore, resource management will not be considered further in this BO.

Physical Exclusion

The use of fencing and netting are used to preclude entry by predatory animal and protect agricultural and other resources. Based on the information provide in the BA, use of fencing and netting is rarely used by WS in Colorado.

- Fencing
- Sheathing (hardware cloth, solid metal, chain link)
- Barriers, Netting, Wire Grids, Porcupine Wire (Nixilite), and other methods

Wildlife Management

Reducing wildlife damage through wildlife management is achieved through the use of many techniques. The objective of this approach is to alter the behavior of or repel the target species, remove specific individuals from the population, reduce or suppress local population densities, or extirpate exotic species populations to eliminate or reduce the potential for loss or damage to property and natural resources.

- Frightening Devices
- Chemical Repellents
- Relocation
- Capture Methods (lethal and non-lethal)
- Immobilization/Euthanasia
- Chemical Medications
- Chemical Pesticides (Toxicants)

Frightening Devices.
Frightening devices are used to repel predators from an area where they are a damage risk (i.e., airport, livestock bedding areas). The success of frightening methods depends on an animal's fear of, and subsequent aversion to, offensive stimuli (Shivak and Martin 2001). A persistent effort is usually required to effectively apply frightening techniques and the techniques must be sufficiently varied to prolong their effectiveness.

Harassment and other scaring devices and techniques to frighten animals are probably the oldest methods of combating wildlife damage. These devices may be either auditory or visual and

generally only provide short-term relief from damage. A number of sophisticated techniques have been developed to scare or harass wildlife from an area, the use of noise-making devices (i.e. electronic distress sounds, alarm calls, propane cannons, and pyrotechnics) are the most popular. Other methods include harassment with visual stimuli (e.g., flashing or bright lights, scarecrows, human effigies, balloons, mylar tape, wind socks, vehicles, or people). Some methods such as the Electronic Guard use a combination of stimuli (siren and strobe light). These are used to frighten predators from the immediate vicinity of the damage prone area.

Relocation

Translocation may be appropriate in some situations (i.e., if the problem species' population is at very low levels, there is a suitable relocation site, and the additional dollars required for relocation can be obtained). If an animal is captured by WS personnel, they are required to either release the animal onsite, or transport the animal to the nearest CDOW office. WS is not responsible for the relocation of lynx. Therefore, relocation will not be given further consideration in this biological opinion.

Chemical Repellents

Chemical repellents are non-lethal chemical formulations used to discourage or disrupt particular behaviors of wildlife. Chemical repellents are categorized by their delivery mechanism: olfactory, taste, and tactile. Olfactory repellents must be inhaled to be effective. These are normally gases, or volatile liquids and granules, and require application to areas or surfaces that need protecting. Taste repellents are compounds (i.e., liquids, dusts, granules) that are normally applied to trees, shrubs, and other materials that are likely to be eaten or gnawed by the target species. Tactile repellents are normally thick, liquid-based substances which are applied to areas or surfaces to discourage travel of wildlife by causing irritation such as to the feet. Colorado WS has not used any repellents in WDM and does not anticipate their use in lynx habitat. Therefore, chemical repellents will not be given further consideration in this biological opinion.

Capture or Take Methods

Several methods are available to capture or take offending predators. The appropriateness and efficacy of any technique will depend on a variety of factors, and is determined through the IWDM process.

Leg-hold Traps

Leg-hold traps are versatile and widely used by WS for capturing many species. These traps can be used to live-capture a variety of animals. These are frequently used by WS to capture predators (coyote (*Canis latrans*), red fox (*Vulpes vulpes*), feral dog (*Canis familiaris*), bobcat (*Lynx rufus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), badger (*Taxidea taxus*), and mountain lion (*Felis concolor*)). Leg-hold traps cannot be used on public lands as stated in the Colorado Constitution Article 18, § 12b. Traps placed in the travel lanes of the targeted animal, using location to determine trap placement rather than attractants, are known as *"blind sets."* More frequently, traps are placed as "baited" or "scented" sets. These trap sets use an attractant consisting of visual attractants (e.g. feathers) or food bases, such as fetid meat, urine, or musk, to attract the animal. In some situations a "draw station," such as a carcass, animal parts, or large piece of meat, are used to attract target predators. In this approach, one to several traps is placed in the vicinity of the draw station. WS program policy prohibits the placement of

traps closer than 30 feet to a draw station or visible bait (with the exception of traps placed for bears, mountain lions, or raptors) for the protection of scavenging birds. Advantages of the leg-hold trap are: 1) they can be set under a wide variety of conditions; 2) some targets can be relocated after capture; 3) non-target captures can be released if it is deemed that they will survive; and 4) pan-tension devices can be used to reduce the probability of capturing non-target animals smaller than the target species (Turkowski et al. 1984, Phillips and Gruver 1996). Disadvantages of using leg-hold traps include the difficulty of keeping them in operation during rain, snow, or freezing weather, and they lack selectivity where non-target species are of a similar or slightly heavier weight as the target species (animals much larger than the target species usually can pull themselves free from leg-hold traps).

Cage Traps

Cage traps come in a variety of styles for WDM to target different species. The most commonly known cage traps used in the current WS program are box traps. Box traps are usually rectangular, made from wood or heavy gauge wire mesh. These traps are used to capture animals alive and can often be used where many lethal or more dangerous tools would be too hazardous. Box traps are well suited for use in residential areas. Cage traps usually work best when baited with foods attractive to the target animal. They are used to capture animals ranging in size from mice to deer, but are usually impractical in capturing most large animals. However, large cage traps do work well for capturing bears and suburban mountain lions provided the traps can be transported by vehicle to the damage sites.

Net Guns

Net guns of various sizes have occasionally been used by WS to catch target predators from aircraft or ground. These shoot from a "rifle with prongs", go about 20 yards, and wrap around the target animal. This technique is mostly used in research to capture animals that will be sampled or equipped with radio telemetry devices. These are target specific and will have no effect on lynx since WS will not be using this device to capture lynx during WDM actions. Therefore, net guns will not be given further consideration in this biological opinion.

Snares

Neck snares made of wire or cable, are among the oldest existing WDM tools. They can be used effectively to catch most species, but are most frequently used to capture coyotes, fox, mountain lions and bears. Snares cannot be used on public lands as stated in the Colorado Constitution Article 18, § 12b. They are much lighter and easier to use than leg-hold traps and are not generally affected by inclement weather. Snares may be employed as either lethal or live-capture devices depending on how or where they are set. Snares set to capture an animal by the neck are usually lethal but "stop," devices are used to keep the snare loop from tightening to the extent that they kill the animal, and can be attached to the cable to make the snare a live capture device. Snares can incorporate a breakaway feature to release non-target wildlife and livestock where the target animal is smaller than potential non-targets (Phillips 1996). These snares can be effectively used wherever a target animal moves through a restricted lane of travel (e.g., "crawls" under fences, trails through vegetation, or den entrances). When an animal moves forward into the loop formed by the cable, the noose tightens and the animal is held.

Foot Snares
The foot or leg snare is a non-lethal restraining device set to capture target animals with a cable snare, similar to the neck snare, but placed on the ground or slightly below ground level and activated when an animal places its foot through the snare loop or on the "throwing-arm" trigger. When triggered, a spring-activated throwing arm throws the snare loop up onto the leg where it tightens and holds the animal. The amount of weight required to trigger the throwing arm of the device can be increased by use of a pan-tension device. Foot snares are used most effectively and most often to capture larger predators such as black bears and mountain lions. This method is not commonly used by Colorado WS. From FY-01 to FY-03 Colorado took 10 target black bears and mountain lions with this method throughout the State. WS in Colorado likely uses this method in less than 10 situations per year.

Catch-poles
Catch-poles are made of a snare cable on a pole that can be tightened around an animal to capture it by hand (typically diseased or entrapped animals) or safely handle predators to remove them from traps. Catch poles are used primarily to remove live animals from traps without danger to or from the captured animal.

Denning
Denning is the practice of seeking out the dens of depredating coyotes or red fox, excavating them, and destroying the young, adults, or both to stop or prevent depredations on livestock. Denning is used in coyote and fox damage management efforts, but is fairly limited because dens are often difficult to locate and den use by the target animal is restricted to about 2 to 3 months during the spring.

Shooting
Shooting is conducted with rifles, shotguns, and air guns and is very selective for the target species. Shooting is limited to locations where it is legal and safe to discharge firearms. Shooting is rarely used alone as the primary WDM method in a control operation because, for many species, opportunities to shoot a target animal are random and unpredictable. Shooting predators is frequently performed in conjunction with calling, particularly for coyotes, bobcats, and red fox (*Vulpes vulpes*). Vocal calls, handheld mouth-blown calls, and electronic calls can be used to mimic the target species vocalizations (e.g., coyote howls and raccoons fighting) or prey (e.g., injured jackrabbit (*Lepus* spp.) and chicken vocalizations).

Aerial Shooting
Aerial shooting or aerial hunting (shooting from an aircraft) is a commonly used coyote and red fox damage management method on all lands where authorized and deemed appropriate; it is especially effective in removing offending coyotes that have become "bait-shy" to trap sets or are not susceptible to calling and shooting. Aerial hunting consists of visually sighting target animals in the problem area and shooting them with a shotgun from an aircraft.

Denning and Shooting
Denning, shooting and aerial shooting are three methods used by WS. When Colorado WS personnel conduct WDM in lynx habitat, shooting will be the preferred method whenever it can be used practically and effectively to resolve a problem situation. These methods are assumed to

be 100 percent selective and are unlikely to affect lynx because WS will positively identify target and not shoot lynx.

Hunting Dogs
Hunting dogs are frequently used in WDM to locate, pursue, or decoy animals. WS uses trailing/tracking, decoy, and trap-line companion dogs.

Tracking and Trailing Dogs
Tracking dogs or trailing dogs are commonly used to track and "tree" target wildlife species such as black bears, mountain lions, bobcats, and raccoons. Though not as common, they sometimes are trained to track coyotes (Rowley and Rowley 1987, Coolahan 1990). They become familiar with the scent of the animal they are to track and follow, and will strike (howl) when the scent is detected. Tracking dogs are trained not to follow the scent of non-target species. WS specialists typically find the track of the target species at fresh kills or drive through the area of a kill site until the dogs strike. WS Specialists then put their dogs on the tracks of the predator. Typically, if the track is not too old, the dogs can follow the trail and "tree" the animal. When the dogs "tree" the animal, it usually seeks refuge up a tree, in a thicket on the ground, on rocks or a cliff, or in a hole. The dogs stay with the animal until the WS specialists arrives and dispatches, tranquilizes, or releases it, depending on the situation. A possibility exists that dogs will switch to a fresher trail of a non-target species while pursuing the target species. This can occur with any animal that they have been trained to follow, and can also occur with an animal that is similar to the target species. Dogs are trained to pick up and trail a specific scent (mountain lion and bear) at the site of livestock kills and human safety situations, which minimizes the chance of dogs trailing non-target animals. If a lynx were inadvertently trailed and treed, the dogs would be pulled-off and the lynx will be allowed to escape.

Lynx can be more difficult for hounds to tree than other felids because lynx are known to be able to outrun hounds especially in deep snow, and if treed by dogs, often refuse to remain at that location and abandon the tree to run again, escaping capture (Cameron 1999).

Decoy Dogs
Decoy dogs are frequently used in coyote damage management in conjunction with calling. Dogs are trained to spot, lightly engage, and lure coyotes into close shooting range for WS Specialists. Decoy dogs are especially effective for territorial pairs of coyotes. Decoy dogs are typically medium sized dogs that are trained to stay relatively close to the Specialist. These dogs typically will get close to coyotes but return when the coyotes start chasing them.

Trap-line Companion Dogs
Trap-line companion dogs often accompany WS Specialists in the field while they are setting and checking equipment. They are especially effective in finding sites to set equipment by alerting their owners to areas where coyotes or other predators have traveled, urinated or defecated; these are often good sites to make sets. Trap-line companion dogs stay with the WS Specialists.

Chemical Immobilizing and Euthanizing Drugs
Chemical immobilizing and euthanizing drugs are important tools for managing wildlife. Under certain circumstances, WS personnel are involved in the capture of animals where the safety of

the animal, personnel, or the public are compromised and chemical immobilization provides a good solution to reduce these risks. For example, chemical immobilization has often been used to take mountain lions, coyotes, and raccoons in residential areas where public safety is at risk. WS employees that use immobilizing drugs are certified for their use and follow the guidelines established in the WS Field Operational Manual for the Use of Immobilization and Euthanasia Drugs. Since the use of immobilizing drugs requires the user to be in close quarters to the target animal, the take of non-targets is nullified.

Chemical Medication Drugs

Chemical medication drugs are being be used by WS to treat animals that are infected with a disease or other malady, or prevent their spread such as rabies, and are in a different category from chemical pesticides. WS is involved in disease surveillance, monitoring, and management programs to assist in minimizing the spread of such disease and reduce the potential for humans to be infected. Chemical medication drugs are not currently being used by WS in Colorado. However, the vaccine has been extensively evaluated in the laboratory for safety in more than 50 vertebrate species with no adverse effects regardless of route or dose. If used in Colorado to reduce the spread of rabies, it will have no effect on lynx. Therefore use of chemical medication drugs will not be further considered in this biological opinion.

Chemical Pesticides

Chemical pesticides have been developed to reduce or prevent wildlife damage and are widely used because they are often very effective at reducing or stopping damage. Although some pesticides are specific to certain groups of species (e.g. birds *vs.* mammals), pesticides are typically not species specific, and their use may be hazardous to non-target species unless used with care by knowledgeable personnel. The proper placement, size, type of bait, and time of year are keys to selectivity and successful use of pesticides for WDM. When a pesticide is used according to its Environmental Protection Agency (EPA) registered label, it poses minimal risk to people, the environment, and non-target species. WS personnel are required by policy to adhere to label requirements including any literature that accompanies the label, but is not attached to the product. WS personnel that use these chemicals must be certified as chemical applicators and are required to adhere to all certification requirements set forth by the Federal Insecticide Fungicide and Rodenticide Act and the Colorado Department of Agriculture. No WDM chemical methods are used on Bureau of Land Management or U.S. Forest Service lands, but can be used on private lands with proper authorizations. Chemical pesticides cannot be used on public lands as stated in the Colorado Constitution Article 18, § 12b. EPA pesticide registration requires rigorous testing to determine potential effects on humans and the environment including risks to non-target species. Suitable pesticides for controlling wildlife damage are limited. Following are the pesticides used by WS in WDM.

M-44/Sodium Cyanide (EPA. Reg. No. 56228-15) is used in the M-44 device, a spring-activated ejector device developed specifically to kill coyotes and other canids. The M-44 is a mechanical device that ejects sodium cyanide powder into the mouth of an animal that pulls up on it with its teeth. Sodium cyanide works by converting to hydrogen cyanide gas when it comes in contact with moisture, which inhibits an enzyme reaction that is essential to mammalian cellular respiration. This results in central nervous system depression, cardiac arrest and gross respiratory failure. Any animal that is able to activate the trigger of the cyanide ejector device will get a dose of sodium cyanide in the mouth and will die. M-44s are highly selective for

canids because the fetid baits used are selected for their attractiveness to canids. Also, WS Specialists are selective in their choice of placement locations targeting areas frequented by canids. When properly used, the M-44 presents little risk to humans and the environment, and provides an additional tool to reduce predator damage. WS personnel must be certified to use the M-44. The EPA label for the M-44 includes 26 use restrictions, which would preclude use within lynx habitat where a lynx may be adversely affected.

Environmental Protection Agency M-44 (Sodium cyanide) Use Restrictions: Wildlife Services Directive 2.415 (Appendix B) provides policy requirements for WS personnel in the use of the M-44 device. Included in the policy statement is the requirement that the M-44s must be used in accordance with the EPA 26 use restrictions (Appendix B).

Large Gas Cartridges (EPA. Reg. No. 56228-21) are fumigant devices that emit gases to take burrowing wildlife and reduce damage associated with them. The WS Program's Pocatello Supply Depot manufactures gas cartridges especially formulated for fumigation of dens. These are very efficient, but often expensive. In WDM, WS only uses gas cartridges in coyote, fox, and skunk dens. The cartridges are placed in the active burrows of target animals, the fuse is lit, and the entrance is then tightly sealed with soil. When ignited, the cartridge burns in the den of an animal and produces large amounts of carbon monoxide, a colorless, odorless, and tasteless, poisonous gas. The combination of oxygen depletion and carbon monoxide exposure kills the animals in the den. WS would only use gas cartridges in dens that show signs of active target animal use. Since lynx will not be a target animal, large gas cartridges will not be given further consideration in this biological opinion.

WS Standard Operating Procedures for WDM in Colorado

Described below are the standard operating procedures that WS implements in Colorado, under the Colorado State Constitution, Colorado Division of Wildlife, Colorado Department of Agriculture and Commissioner of Agriculture. These details are being provided as background information, and are also part of the proposed action of this section 7 consultation and WS adheres to the restrictions as stated below.

Mechanical WDM methods (leg-hold traps, neck and foot snares, and shooting) consist primarily of tools or devices used to capture or kill a particular depredating animal or to reduce a local population of depredating animals to alleviate or prevent resource damage. Due to Colorado State Constitutional mandated restrictions (Article XVIII, Section 12b) leg-hold traps, snares, gas cartridges, and M-44s may not be used on public lands. On private lands the use of these specific tools is limited to one 30-day period per calendar year per parcel. A private landowner must declare the use of this 30-day period to CDOW. CDOW is then responsible for documenting that agricultural damage has occurred and may ask for such verification. Once a landowner has initiated the 30-day period, any of the restricted tools may be used at the discretion of the landowner, or his/her designated employees or agents. Prior to conducting operational WDM, WS personnel must have an *Agreement for Control* in place to work on the property. When WS works on Federal lands, WS personnel apply mechanical methods under an *Agreement for Control on Non-private Property* with the appropriate agency that identify where, when, and how WDM may be expected to occur based on livestock use and historic information. Federal land managers are responsible for identifying areas where other resource concerns may

conflict with WDM so that plans can be developed to avoid or minimize conflicts or potential adverse effects on other resources and the public.

The standard operating procedures for WS to use leg-hold traps, snares, gas cartridges, or M-44s is to have the affected livestock producer contact CDOW to notify them that their 30-day exemption period will start on a given date. The equipment can be placed after the notification has been made. CDOW then contacts the landowner within a ten day period following notification to obtain the information needed to complete their records. Colorado WS personnel monitor their equipment (*check interval*) based upon CDA regulations pursuant to the *Rules Pertaining to Depredating Predator Animal Control* as amended on October 30, 1998. These are the rules under which WDM is conducted by the WS Program in Colorado for the predator species listed in 35-40-100.2 CRS. For non-lethal traps, including padded leg-hold traps and non-lethal snares, the checking regulations require that the equipment be checked a minimum of 3 times a week; twice two days apart and once 3 days apart in a seven day period. Lethal snares, lethal traps and drown sets must be checked a minimum of once every seven days. For M-44s, each device must be inspected at least once a week, weather permitting access, to check for interference or unusual conditions and are serviced when necessary as required by the *M-44 Label* and *Use Restrictions*.

Proposed Conservation Measures

Wildlife Services in Colorado has committed to the following measures as part of their proposed action (Mike Yeary, Wildlife Services State Director, pers comm., 2005). The actions are designed to minimize the potential for take that could result from WS actions.

Shooting: All Colorado WS personnel conducting WDM in or near lynx occupied habitat will be trained to positively identify lynx and their sign from bobcats and other predators to eliminate the possibility of non-target lynx being mistaken for bobcats or other species.

Cage Traps: Cage traps set in lynx habitat will be set in shaded areas and checked frequently enough to release any non-target lynx captured. The release of any lynx will be coordinated with CDOW so an examination can be performed and individuals may be fit with a radio collar if practicable.

Neck Snares: Neck snares will be used for coyotes, foxes, or bobcats only on private lands within lynx habitat. As stated in the BA no lynx have been taken in the last 30 years by this method. Since the majority of lynx habitat occurs on public lands the exposure of lynx in these areas will be minimal. All snares will be set to comply with Colorado Constitution restrictions which means snares can only be set for a maximum of 30 days per year on each parcel of property. Neck snares set in areas above 8000 feet elevation will be equipped with stops to reduce the likelihood of lethal take of lynx.

Leg-hold Traps and Spring-activated Foot-snares: Leg-hold traps and spring-activated foot-snares will be used in lynx habitat only under the following conditions:

1. Leg-hold traps placed for coyotes will not be used in conjunction with any visual attractants of the type normally expected to attract bobcats or other feline species (i.e., pieces of fur, feathers, shiny metal or fabric, etc.)
2. Leg-hold traps placed for coyotes will not be used in conjunction with any olfactory attractants containing fish oil, catnip, anise, or castor as ingredients, to reduce the likelihood of attracting lynx or other feline species.
3. Leg-hold traps and foot-snares set to capture larger predators (such as mountain lions, black bears, or adult wolves) will have pan-tension adjusted such that it would require 8-10 pounds of pressure to trigger the trap (This would be expected to minimize the likelihood of capturing a lynx or any other animal up to about 30-35 pounds in weight). Pipe sets which require a bear to reach into a small opening to retrieve bait do not require pan tension.
4. All leg-hold traps and snares will be set to comply with Amendment 14 restrictions which mean leg-hold traps and snares can only be set for a maximum of 30 days per year on each parcel of private property.

In the unlikely event that a lynx is ever captured in a leg-hold trap or leg-snare, WS will use all practical efforts to coordinate with CDOW to facilitate radio-collaring the animal prior to release, if it is not already collared. If WS determines that it would be impractical to arrange for radio-collaring the animal, and if the animal was judged likely to survive on its own, it would be immediately released. If the animal were judged unlikely to survive on its own, the lynx would be turned over to CDOW. If the animal is dead, it will be left in the trap or snare and reported to the CDOW and Service immediately.

M-44s: In Colorado, M-44s will be used for coyotes or foxes only on private lands within lynx habitat. As stated in the BA no lynx have been taken in the last 30 years by this method. Since the majority of lynx habitat occurs on public lands the exposure of lynx to M-44s will be minimal. All M-44s will be set to comply with Colorado State Constitutional restrictions which means M-44s can only be set for a maximum of 30 days per year on each parcel of private property.

Dogs: If dogs are being used to pursue target mountain lions or black bears and it is determined that they are following a lynx track, the dogs would be removed from the track as soon as possible. If a lynx were treed, the dogs would be gathered quickly and taken from the area so the lynx could escape unharmed.

STATUS OF THE SPECIES /CRITICAL HABITAT DESCRIPTION

Species/Critical Habitat Description

The lynx is a medium-sized cat with long legs; large, well-furred paws; long tufts on the ears; and a short, black-tipped tail (McCord and Cardoza 1982). The winter pelage of the lynx is dense and has a grizzled appearance with grayish-brown mixed with buff or pale brown fur on the back, and grayish-white or buff-white fur on the belly, legs and feet. Summer pelage of the lynx is more reddish to gray-brown (Koehler and Aubry 1994). Adult males average 10 kilograms (22 pounds) in weight and 85 centimeters (33.5 inches) in length (head to tail), and

females average 8.5 kilograms (19 pounds) and 82 centimeters (32 inches) (Quinn and Parker 1987). The lynx's long legs and large feet make it highly adapted for hunting in deep snow.

Classification of the Canada lynx (also called the North American lynx) has been subject to revision. In accordance with Wilson and Reeder (1993), the lynx in North America is *Lynx canadensis*. Previously the Latin name *L. lynx canadensis* was used for lynx (Jones *et al.* 1992; S. Williams, Texas Tech University, pers. comm. 1994). Other scientific names still in use include *Felis lynx* or *F. lynx canadensis* (Jones *et al.* 1986; Tumlison 1987).

In 1998, the lynx was proposed for listing as a threatened species under the Act (63 FR, July 8, 1998). The lynx in the contiguous United States was listed as threatened effective April 23, 2000 (65 FR 16052, March 24, 2000). The Service identified one distinct population segment in the lower 48 states. No critical habitat has been designated for the threatened population of Canada lynx in the contiguous United States. As explained in the final rule (65 FR 16052, March 24, 2000), designation of critical habitat would be prudent, but has been deferred until other higher priority work can be completed within the Service's current budget.

Life History

Home range and dispersal - Lynx home range size varies by the animal's gender, abundance of prey, season and the density of lynx populations (Hatler 1988; Koehler 1990; Poole 1994; Slough and Mowat 1996; Aubry et al. 2000; Mowat et al. 2000). Documented home ranges vary from 8 to 800 square kilometers (3 to 300 square miles) (Saunders 1963; Brand et al. 1976; Mech 1980; Parker et al. 1983; Koehler and Aubry 1994; Apps 2000; Mowat et al. 2000; Squires and Laurion 2000). Preliminary research supports the hypothesis that lynx home ranges at the southern extent of the species' range are generally large compared to those in the core of the range in Canada (Koehler and Aubry 1994; Apps 2000; Squires and Laurion 2000).

Lynx are capable of dispersing extremely long distances (Mech 1977; Washington Department of Wildlife 1993); for example, a male was documented traveling 616 kilometers (370 miles) (Brainerd 1985). Lynx disperse primarily when snowshoe hare (*Lepus americanus*) populations decline (Ward and Krebs 1985; Koehler and Aubry 1994; O'Donoghue *et al.* 1997; Poole 1997). Subadult lynx disperse even when prey is abundant (Poole 1997), presumably as an innate response to establish home ranges.

During the early 1960s and 1970s, there were numerous occurrences of lynx documented in atypical habitat, such as in North Dakota. In those years, harvest returns indicated unprecedented cyclic lynx highs for the 20th century in Canada (Adams 1963; Harger 1965; Mech 1973; Gunderson 1978; Thiel 1987; McKelvey et al. 2000b). Many of these unusual observations were probably dispersing animals that either were lost from the population or later returned to suitable habitat.

Diet - Snowshoe hares (*Lepus americanus*) are the primary prey of lynx, comprising 35-97 percent of the diet throughout the range of the lynx (Koehler and Aubry 1994). Other prey species include red squirrel (*Tamiasciurus hudsonicus*), grouse (*Bonasa umbellus*, *Dendragopus* spp., *Lagopus* spp.), flying squirrel (*Glaucomys sabrinus*), ground squirrel (*Spermophilus parryii*, *S. richardsonii*), porcupine (*Erethrizon dorsatum*), beaver (*Castor canadensis*), mice

(*Peromyscus* spp.), voles (*Microtus* spp.), shrews (*Sorex* spp.), fish, and ungulates as carrion or occasionally as prey (Saunders 1963; Van Zyll de Jong 1966; Nellis et al. 1972; Brand et al. 1976; Brand and Keith 1979; Koehler 1990; Staples 1995; O'Donoghue et al. 1998).

During the cycle when hares become scarce, the proportion and importance of other prey species, especially red squirrel, increases in the diet (Brand et al. 1976; O'Donoghue et al. 1998; Apps 2000; Mowat et al. 2000). However, Koehler (1990) suggested that a diet of red squirrels alone might not be adequate to ensure lynx reproduction and survival of kittens.

Most research has focused on the winter diet. Summer diets are poorly understood throughout the range of lynx. Mowat et al. (2000) reported through their review of the literature that summer diets have less snowshoe hare and more alternate prey species, possibly because of a greater availability of other species.

There has been little research on lynx diet specific to the southern portion of its range except in Washington (Koehler et al. 1979; Koehler 1990). Southern populations of lynx may prey on a wider diversity of species than northern populations because of lower average hare densities and differences in small mammal communities. In areas characterized by patchy distribution of lynx habitat, lynx may prey opportunistically on other species that occur in adjacent habitats, potentially including white-tailed jackrabbit (*Lepus townsendii*), black-tailed jackrabbit (*Lepus californicus*), sage-grouse (*Centrocercus urophasianus*), and Columbian sharp-tailed grouse (*Tympanuchus phasianellus*) (Quinn and Parker 1987; Lewis and Wenger 1998).

In northern regions, when hare densities decline, the lower quality diet causes sudden decreases in the productivity of adult female lynx and decreased survival of kittens, which causes the numbers of breeding lynx to level off or decrease (Nellis et al. 1972; Brand et al. 1976; Brand and Keith 1979; Poole 1994; Slough and Mowat 1996; O'Donoghue et al. 1997). Relative densities of snowshoe hares at southern latitudes are generally lower than those in the north, and differing interpretations of the population dynamics of southern populations of snowshoe hare have been proposed (Hodges 2000b).

Snowshoe hares have evolved to survive in areas that receive deep snow (Bittner and Rongstad 1982). Primary forest types that support snowshoe hare are *Abies lasiocarpa* (subalpine fir), *Picea engelmannii* (Engelmann spruce), *Pseudotsuga menziesii* (Douglas-fir), and *Pinus contorta* (lodgepole pine) in the western United States, and spruce/fir, pine, and deciduous forests in the eastern United States (Hodges 2000b). Within these habitat types, snowshoe hares prefer stands of conifers with shrub understories that provide forage, cover to escape predators, and protection during extreme weather (Wolfe et al. 1982; Monthey 1986; Koehler and Aubrey 1994). Hares' use of habitat is correlated with understory cover (Hodges 2000a). Early successional forest stages generally have greater understory structure than do mature forests and therefore support higher hare densities (Hodges 2000a, b). However, mature forests can also provide snowshoe hare habitat as openings are created in the canopy when trees succumb to disease, fire, wind, ice, or insects, and the understory develops (Buskirk et al. 2000b).

Lynx seem to prefer to move through continuous forest, using the highest terrain available such as ridges and saddles (Koehler 1990; Staples 1995). Cover is important to lynx when searching for food (Brand et al. 1976) but lynx often hunt along edges (Mowat et al. 2000). Kesterson

(1988) and Staples (1995) reported that lynx hunted along the edges of mature stands within a burned forest matrix and Major (1989) found that lynx hunted along the edge of dense riparian willow stands. Lynx have been observed (via snow tracking) to avoid large openings (Koehler 1990; Staples 1995) during daily movements within the home range.

Den site selection - Lynx use large woody debris, such as downed logs, root wads and windfalls, to provide denning sites with security and thermal cover for kittens (McCord and Cardoza 1982; Koehler 1990; Koehler and Brittell 1990; Mowat et al. 2000; Squires and Laurion 2000). During the first few months of life, kittens are left alone at these sites when the female lynx hunts. Downed logs and overhead cover provide protection of kittens from predators, such as owls, hawks and other carnivores during this period.

The age of the forest stand does not seem as important for denning habitat as the amount of downed, woody debris available (Mowat et a*l.* 2000). Den sites may be located within older regenerating stands (>20 years since disturbance) or in mature conifer or mixed conifer-deciduous (typically spruce/fir or spruce/birch) forests. In Washington, lynx used lodgepole pine, *Picea* spp. (spruce), and *Abies lasiocarpa* (subalpine fir) forests older than 200 years with an abundance of downed woody debris for denning (Koehler 1990). A den site in Wyoming was located in a mature subalpine fir/lodgepole pine forest with abundant downed logs and a high amount of horizontal cover (Squires and Laurion 2000). A lynx den site found in Maine in 1999 was located in a forest stand in *Picea rubra* (red spruce) cover type that was logged in 1930 and again in the 1980s and is regenerating into hardwoods (Organ 1999). The site had a dense understory and an abundance of dead and downed wood.

Denning habitat must be in or near foraging habitat to be functional. The hunting range of females is restricted at the time of parturition, and their need to feed kittens requires an abundance of prey. Lynx, like other carnivores, frequently move their kittens until they are old enough to hunt with their mother. Multiple nursery sites are needed that provide kittens with overhead cover and protection from predators and the elements. Downed logs and overhead cover must also be available throughout the home range to provide security when lynx kittens are old enough to travel (Bailey 1974).

Recruitment - Breeding occurs through March and April in the north (Quinn and Parker 1987). Kittens are born in May to June in south-central Yukon (Slough and Mowat 1996). The male lynx does not help with rearing young (Eisenberg 1986). Slough and Mowat (1996) reported yearling females giving birth during periods when hares were abundant; male lynx may be incapable of breeding during their first year (McCord and Cardoza 1982).

In northern study areas during the low phase of the hare cycle, few, if any, live kittens are born and few yearling females conceive (Brand and Keith 1979; Poole 1994; Slough and Mowat 1996). However, Mowat et al. (2000) suggested that in the far north, some lynx recruitment occurs when hares are scarce and this may be important in lynx population maintenance during hare lows. During periods of hare abundance in the northern taiga, litter size of adult females averages 4-5 kittens (Mowat et al. 1996).

Koehler (1990) suggested that the low number of kittens produced in north-central Washington was comparable to northern populations during periods of low snowshoe hare abundance. In his

study area, 2 radio-collared females had litters of 3 and 4 kittens in 1986 and 1 kitten in 1987 (the actual litter size of 1 of the females in 1987 was not determined) (Koehler 1990). Of the known-size litters in Washington, 1 kitten survived the first winter.

In Montana, Squires and Laurion (2000) reported that 1 marked female produced 2 kittens in 1998. In 1999, 2 of 3 females produced litters of 2 kittens each. In Wyoming (Squires and Laurion 2000), 1 female produced 4 kittens in 1998, but snow tracking indicated that the kittens were not with the female in November and were presumed dead. The same female produced 2 kittens in 1999.

Mortality - Reported causes of lynx mortality vary between studies. The most commonly reported causes include starvation of kittens (Quinn and Parker 1987; Koehler 1990), and human-caused mortality, mostly fur trapping (Ward and Krebs 1985; Bailey et al. 1986).

Significant lynx mortality due to starvation has been demonstrated in cyclic populations of the northern taiga, during the first two years of hare scarcity (Poole 1994; Slough and Mowat 1996). Various studies have shown that, during periods of low snowshoe hare numbers, starvation can account for up to two-thirds of all natural lynx deaths. Trapping mortality may be additive rather than compensatory during the low period of the snowshoe hare cycle (Brand and Keith 1979). Hunger-related stress, which induces dispersal, may increase the exposure of lynx to other forms of mortality such as trapping and highway collisions (Brand and Keith 1979; Carbon and Patriquin 1983; Ward and Krebs 1985; Bailey et al. 1986).

Paved roads have been a mortality factor in lynx translocation efforts within historical lynx range. In New York, 18 translocated lynx were killed on highways (Brocke et al. 1990). It has been suggested by Brocke et al. (1990) that translocated animals may be more vulnerable to highway mortality than resident lynx. Six lynx were killed on 2- and 4-lane Colorado highways following their release as part of a reintroduction effort (CDOW 2003).

Other than translocated animals, there have been documented occurrences of highway mortality of lynx in Wisconsin (Theil 1987), Minnesota (DonCarlos 1994; J. Cochrane, USFWS, pers. comm. 2003), and Montana (G. Joslin, Montana Department of Fish, Wildlife and Parks, pers. comm. 2003).

Predation on lynx by mountain lion (*Felis concolor*), coyote (*Canis latrans*), wolverine (*Gulo gulo*), gray wolf (*Canis lupus*), fisher (*Martes pennanti*) and other lynx has been confirmed (Berrie 1974; Koehler et al. 1979; Poole 1994; Slough and Mowat 1996; O'Donoghue et al. 1997; Apps 2000; Vashon *et al.* 2003; Squires and Laurion 2000). Squires and Laurion (2000) reported 2 of 6 mortalities of radio-collared lynx in Montana were due to mountain lion predation. Observations of such events are rare, and the significance of predation on lynx populations is unknown.

Inter-specific relationships with other carnivores - Buskirk et al. (2000a) described the two major competition impacts to lynx as exploitation (competition for food) and interference (avoidance). Of several predators examined (birds of prey, coyote, gray wolf, mountain lion, bobcat (*Lynx rufus*), and wolverine), coyotes were deemed to most likely pose local or regionally important exploitation impacts to lynx, and coyotes and bobcats were deemed to possibly impart

important interference competition effects on lynx. Mountain lions were described as interference competitors, possibly impacting lynx during summer and in areas lacking deep snow in winter, or when high elevation snow packs develop crust in the spring.

Exploitation competition may contribute to lynx starvation and reduced recruitment. During periods of low snowshoe hare numbers, starvation accounted for up to two-thirds of all natural lynx deaths in the Northwest Territories of Canada (Poole 1994). Major predators of snowshoe hare include lynx, northern goshawk (*Accipiter gentilis*), great horned owl (*Bubo virginianus*), bobcat, coyote, red fox (*Vulpes vulpes*), fisher, and mountain lion. In southern portions of snowshoe hare range, predators may limit hare populations to lower densities than in the taiga (Dolbeer and Clark 1975; Wolff 1980; Koehler and Aubry 1994).

Based on only anecdotal evidence, Parker et al. (1983) discussed competition between bobcats and lynx on Cape Breton Island. Lynx were found to be common over much of the island prior to bobcat colonization. Concurrent with the colonization of the island by bobcats, lynx densities declined and their presence on the island became restricted to the highlands, the one area where bobcats did not become established.

Population Dynamics

In Canada and Alaska, lynx populations undergo extreme fluctuations in response to snowshoe hare population cycles, enlarging or dispersing from their home ranges and ceasing the recruitment of young into the population after hare populations decline (Mowat et al. 2000). In the southern portion of the range in the contiguous United States, lynx populations appear to be naturally limited by the availability of snowshoe hares, as suggested by large home range size, high kitten mortality due to starvation, and greater reliance on alternate prey. These characteristics appear to be similar to those exhibited by lynx populations in the taiga during the low phase of the population cycle (Quinn and Parker 1987, Koehler 1990, Aubry et al. 2000). This is likely due to the inherently patchy distribution of lynx and hare habitat in the contiguous United States and corresponding lower densities of hares.

A lack of accurate data limits our understanding of lynx population dynamics in the contiguous United States and precludes drawing definitive conclusions about lynx population trends. Formal surveys designed specifically to detect lynx have rarely been conducted. Many reports of lynx (e.g., visual observations, snow tracks) have been collected incidentally to other activities, but cannot be used to infer population trends. Long-term trapping data have been used to estimate population trends for various species. However, trapping returns are strongly influenced by trapper effort, which varies between years, and therefore may not accurately reflect population trends. Another important problem is that trapping records of many States did not differentiate between bobcats and lynx, referring to both as "lynxcats." Overall, the available data are too incomplete to infer much beyond simple occurrence and distribution of lynx in the contiguous United States (McKelvey et al. 2000b)

Lynx populations in the contiguous United States occur at the southern periphery of a metapopulation whose core is located in the northern boreal forest of central Canada (McCord and Cardoza 1982; Quinn and Parker 1987; McKelvey et al. 2000a). Lynx population dynamics may emanate from the core to the periphery, as evidenced by a lagged correlation of lynx trap

records and observations (McKelvey et al. 2000b; Mowat et al. 2000). In the Great Lakes Geographic Area, population dynamics in recent decades appear to be strongly driven by immigration from Canada (McKelvey et al. 2000b). In other areas and time periods, however, it is not known to what extent the correlation is due to immigration from Canada, population responses to the same factors controlling northern populations, or a combination of the two.

We suspect that some areas in the contiguous United States naturally act as sources of lynx (recruitment is greater than mortality) that are able to disperse and potentially colonize other patches (McKelvey et al. 2000a). Other areas may function as sinks, where lynx mortality is greater than recruitment and lynx are lost from the overall population. Sink habitats are most likely those places on the periphery of the southern boreal forest where habitat becomes more fragmented and more distant from larger lynx populations. Fluctuations in prey populations may cause some habitat patches to change from being sinks to sources, and vice versa. The ability of naturally dynamic habitat to support lynx populations may change as the habitat undergoes natural succession following natural or manmade disturbances (i.e., fire, clearcutting).

Status and Distribution

The lynx in the contiguous United States was listed as threatened effective April 23, 2000 (65 FR 16052, March 24, 2000). At least one of five listing factors must be met for listing under the Act. These factors include: present or threatened destruction of habitat or range, over-utilization, disease or predation, inadequacy of existing regulatory mechanisms or other natural or human-made causes. The sole factor for listing the Canada lynx as threatened was inadequacy of existing regulatory mechanisms, specifically the lack of Forest Land and Resource Management Plans guidance to address the needs of lynx.

The following discussion of the status and distribution of lynx is largely excerpted from the Service's final rule (65 FR 16052, March 24, 2000). The historical and present range of the lynx north of the contiguous United States includes Alaska and that part of Canada that extends from the Yukon and Northwest Territories south across the United States border and east to New Brunswick and Nova Scotia. In the contiguous United States, lynx historically occurred in the Cascades Range of Washington and Oregon; the Rocky Mountain Range in Montana, Wyoming, Idaho, eastern Washington, eastern Oregon, northern Utah, and Colorado; the western Great Lakes Region; and the northeastern United States region from Maine southwest to New York (McCord and Cardoza 1982; Quinn and Parker 1987).

The distribution of lynx in North America is closely associated with the distribution of North American boreal forest (Agee 2000). In Canada and Alaska, lynx inhabit the classic boreal forest ecosystem known as the taiga (McCord and Cardoza 1982; Quinn and Parker 1987; Agee 2000; McKelvey et al. 2000b). The range of lynx extends south from the classic boreal forest zone into the subalpine forest of the western United States, and the boreal/hardwood forest ecotone in the eastern United States (Agee 2000; McKelvey et al. 2000b). Forests with boreal features (Agee 2000) extend south into the contiguous United States along the Cascade and Rocky Mountain Ranges in the west, the western Great Lakes Region, and along the Appalachian Mountain Range of the northeastern United States. Within these general forest types, lynx are most likely to persist in areas that receive deep snow, to which the lynx is highly

adapted (Ruggiero et al. 2000). Lynx are rare or absent from the wet coastal forests of Alaska and Canada (Mowat et al. 2000).

At its southern margins in the contiguous United States, forests with boreal features, or southern boreal forests, become naturally fragmented as they transition into other vegetation types. Southern boreal forest habitat patches are small relative to the extensive northern boreal forest of Canada and Alaska, which constitutes the majority of lynx range. Many southern boreal forest habitat patches within the contiguous United States cannot support resident populations of lynx and their primary prey species.

The complexities of lynx life-history and population dynamics, combined with a general lack of reliable population data for the contiguous United States, make it difficult to ascertain the past or present population status of lynx in the contiguous United States. It is impossible to determine with certainty whether reports of lynx in many States were: 1) animals dispersing from northern populations that were effectively lost because they did not join or establish resident populations, 2) animals that were a part of a resident population that persisted for many generations, or 3) a mixture of both resident and dispersing animals.

The final rule (65 FR 16052, March 24, 2000) determining threatened status for the lynx in the contiguous United States summarized lynx status and distribution across four regions that are separated from each other by ecological barriers consisting of unsuitable lynx habitat. These distinct regions are the Northeast, the Great Lakes, the Northern Rocky Mountains/Cascades, and the Southern Rocky Mountains. While these regions are ecologically unique and discrete, the lynx is associated with southern boreal forest in each and, with the exception of the Southern Rocky Mountain Region, each area is geographically connected to the much larger population of lynx in Canada.

Northeast Region (Maine, New Hampshire, Vermont, New York) - Based on an analysis of cover types and elevation zones containing most of the lynx occurrences, McKelvey et al. (2000b) determined that, at the broad scale, most lynx occurrence records in the Northeast were found within the "Mixed Forest-Coniferous Forest-Tundra" cover type at elevations ranging from 250-750 meters (820-2,460 feet). This habitat type in the northeast United States occurs along the northern Appalachian Mountain range from southeastern Quebec, western New Brunswick, and western Maine, south through northern New Hampshire. This habitat type becomes naturally more fragmented and begins to diminish to the south and west, with a disjunct segment running north-south through Vermont, a patch of habitat in the Adirondacks of northern New York, and with a few more distant and isolated patches in Pennsylvania (McKelvey et al. 2000b).

As it did historically, the boreal forest of the Northeast continues to exist primarily in Maine where habitat is currently optimal and a resident, breeding population of lynx continues to exist. Maine's lynx population is currently much larger than we knew at the time of the final listing rule in 2000 and habitat is directly connected to substantive lynx populations and habitat in southeastern Quebec and New Brunswick. The potential exists for lynx to occur in New Hampshire because of its direct connectivity with Maine. Lynx in Vermont have always existed solely as dispersers. Lynx occurring in New York since 1900 have been dispersers. Detailed

information on the status and distribution of lynx in this region is found in the Final Rule (65 FR 16052; March 24, 2000) and the Clarification of the Final Rule (68 FR 40076; July 3, 2003).

Great Lakes Region (Minnesota, Wisconsin, Michigan) - The majority of lynx occurrence records in the Great Lakes Region are associated with the "mixed deciduous-coniferous forest" type (McKelvey et al. 2000b). Within this general forest type, the highest frequency of lynx occurrences were in the *Acer saccharum* (sugar maple), *Tilia* spp. (basswood), *Pinus banksiana* (jack pine), *P. strobus* (white pine), and *P. resinosa* (red pine) forest types (McKelvey et al. 2000b). These types are found primarily in northeastern Minnesota, northern Wisconsin, and the western portion of Michigan's Upper Peninsula.

The Service concluded that northeastern Minnesota has historically supported and currently supports a resident lynx population, based on the number of lynx records, evidence of reproduction, and the presence of boreal forest contiguous with occupied habitat in Ontario. We conclude records of lynx in Wisconsin and Michigan constitute dispersing animals, rather than individuals from resident populations, based on the lack of evidence of reproduction, lack of connectivity with suitable habitat, and limited amount of habitat. Detailed information on the status and distribution of lynx in this region is found in the Final Rule (65 FR 16052; March 24, 2000) and the Clarification of the Final Rule (68 FR 40076; July 3, 2003).

Northern Rocky Mountains/Cascades Region (Washington, Oregon, Idaho, Wyoming, Utah, Montana) - In this region, the majority of lynx occurrences are associated at a broad scale with the "Rocky Mountain Conifer Forest"; within this type, most of the occurrences are in moist Douglas-fir and western spruce/fir forests (McKelvey et al. 2000b). Most of the lynx occurrences are in the 1,500-2,000 meters (4,920-6,560 feet) elevation class (McKelvey et al. 2000b). These habitats are found in the Rocky Mountains of Montana, Idaho, eastern Washington, and Utah, the Wallowa Mountains and Blue Mountains of southeast Washington and northeastern Oregon, and the Cascade Mountains in Washington and Oregon. The majority of verified lynx occurrences in the United States and the confirmed presence of resident populations are from this region. The boreal forest of Washington, Montana, and Idaho is contiguous with that in adjacent British Columbia and Alberta, Canada.

We conclude that the Northern Rocky Mountains/Cascades Region continues to support resident lynx populations in north central, and northeastern Washington, western Montana and likely northern Idaho based on current evidence of reproduction in Washington and Montana and the presence of habitat able to support resident populations. We conclude that lynx have always occurred as dispersers in Oregon and Utah because habitat capable of supporting lynx is limited and there are relatively few historic records of lynx in these states. In northern Wyoming it appears habitat is less suitable to support resident populations and, therefore, we conclude animals in this area are most likely dispersers. Detailed information on the status and distribution of lynx in this region is found in the Final Rule (65 FR 16052; March 24, 2000) and the Clarification of the Final Rule (68 FR 40076; July 3, 2003).

Southern Rocky Mountains Region (Colorado, SE Wyoming) - Colorado represents the extreme southern edge of the range of the lynx. The southern boreal forest of Colorado and southeastern Wyoming is isolated from boreal forest in Utah and northwestern Wyoming by the Green River Valley and the Wyoming basin (Findley and Anderson 1956). These areas likely

reduce opportunities for immigration from the Northern Rocky Mountains/Cascades Region and Canada (Halfpenny et al. 1982; Koehler and Aubry 1994).

A majority of the lynx occurrence records in Colorado and southeastern Wyoming are associated with the "Rocky Mountain Conifer Forest" type. The occurrences in the Southern Rockies were generally at higher elevations (2,450 to over 3, 650 meters (8, 000-12, 000 feet)) than were all other occurrences in the West (Ruediger et al. 2000).

There are relatively few historic lynx records from this region (McKelvey et al. 2000b). We are uncertain whether the Southern Rockies supported a small resident population historically or whether such records were of dispersers that arrived during extremely high population cycles. If these historic records represent resident populations rather than dispersing animals that emigrated from the Northern Rocky Mountains, Cascades or Canada, then we believe a viable native resident lynx population no longer exists in the Southern Rocky Mountains. Although habitats in the Southern Rockies are far from source populations and more isolated, it is still possible that dispersers could arrive in the Southern Rocky Mountains during extreme highs in the population cycle. Detailed information on the status and distribution of lynx in this region is found in the Final Rule (65 FR 16052; March 24, 2000) and the Clarification of the Final Rule (68 FR 40076; July 3, 2003).

Reports from other locations -

Status In the Southern Rockies - Canada lynx occur primarily in spruce-fir and lodgepole pine forests, at elevations between 8,000 and 12,000 feet (Ruggiero et al. 2000). *Populus tremuloides* (Quaking aspen) stands and forest edges, as well as open grass meadows and forest ecotones, may also support high numbers of hares and Canada lynx. On a landscape scale, Canada lynx habitat includes a mosaic of early seral stages that support snowshoe hare populations and late seral stages of dense old growth forest that provide ideal denning and security habitat. Connectivity between Canada lynx populations is critical: Dispersal corridors should be several miles wide with only narrow gaps. Large tracts of continuous coniferous forest are the most desirable for Canada lynx travel and dispersal (Tanimoto 1998).

Records of lynx occurrence are available from throughout most of the Southern Rocky Mountains. The last specimens of lynx taken in the Southern Rockies were from the late 1960s and early 1970s. In 1969, three lynx specimens were taken in adjacent counties in the central core of the Southern Rockies. One was shot along the Fryingpan River in Pitkin County, another on Vail Mountain (Eagle County), and a third was trapped south of Leadville in Lake County (G. Byrne, pers. comm. 1999). In 1971, the State of Colorado closed the season on lynx, making it illegal to take this species. Since then, only a few specimens have been obtained. In 1972, a lynx was trapped on Guanella Pass and another caught in a snow slide east of Bakerville, Colorado, both in Clear Creek County. During the 1973-74 winter, a pair of lynx was illegally trapped within Vail Ski Area boundaries (Thompson and Halfpenny 1989). No lynx specimens are available since those last illegal takes.

Despite the resulting lack of recent specimens, strong evidence of lynx persistence continued to surface. A Statewide lynx verification program conducted from 1978-80 by the CDOW concluded that viable, low-density lynx populations persisted in Eagle, Pitkin, Lake, and Clear

Creek counties. Because Summit County is sandwiched between three of those counties, it is likely that lynx existed there as well. In addition, the program provided evidence of lynx occurrence in Grand and Park counties. Lack of evidence from other portions of the State was as likely a consequence of survey effort as lack of lynx.

Thompson and Halfpenny (1989) confirmed lynx in the vicinity of Vail Ski Area during the winter of 1988-89 as part of studies conducted by Vail Associates for the Category III expansion. They state in their report, "there is no question that lynx exist at Vail Ski Area and in the surrounding mountains." Follow-up work by the CDOW in 1990 and 1991 lead to the discovery of additional lynx tracks in the area. In 1991, Thompson and Halfpenny also confirmed two sets of lynx tracks at a proposed ski area site south of Wolf Creek Pass in the eastern San Juan Mountains (Andrews 1992; Thompson, pers. comm.). They believed the pair was probably a female and its kitten.

Occasional credible sighting reports and track evidence continue to be received from various parts of the State, providing additional evidence that native lynx likely still persist in low numbers in the Southern Rockies. Since the 1991 track discoveries near Vail, Colorado and in the San Juan Mountains, Colorado, the CDOW has recorded seven lynx sightings or track locations between 1992 and 1998 that they rate as probable lynx. Three of those were by CDOW biologists. Carney (1993) reported lynx tracks from the east side of the Gore Range in Summit County. Tom Beck, a carnivore researcher with CDOW, found a set of lynx tracks in the Dolores River drainage in the west San Juans, Montezuma County, Colorado in 1993. A CDOW Area Wildlife Manager observed a lynx in the southern Sangre de Cristos of Costilla County, Colorado also in 1993. Two sightings and one set of tracks were reported from Eagle County and another set of tracks was located in Larimer County north of Rocky Mountain National Park.

In 1997, photographs were taken of tracks believed to be those of lynx in the Tennessee Creek drainage on the border of Lake and Eagle counties. This is an area where possible lynx tracks were located just a few years earlier. Among the most recent credible sighting reports include one from Boreas Pass on the border of Summit and Park Counties in 1995, another from the Vail vicinity in January 1998, one from a Forest Service biologist in July 1998 on the Flattops in northwestern Colorado, and from a Park Ranger in Rocky Mountain National Park (Larimer County) in December 1998. During the 1998-99 winter, CDOW trackers following radio-collared lynx just transplanted into the San Juan Mountains, located a several-day-old lynx trail they believed may be that of a native lynx (Byrne and Shenk, pers. comm.). This location was in the same general area where Thompson and Halfpenny located lynx tracks in 1991.

Lynx were confirmed in Eagle County as late as 1991 and in Summit County (Gore Range) as late as 1993. Evidence has continued to indicate lynx occupancy of the central and, possibly, northern mountains through the 1990s. This evidence includes a sighting by a Forest Service biologist in July 1998 in the Flattops in northwestern Colorado, and tracks in Larimer County north of Rocky Mountain National Park. The CDOW found evidence of lynx in Eagle County and in Grand County. Radio tracking in 2000 of lynx trans-located to Colorado indicated that a few individuals spent time in the Gore Range. In July 2001, CDOW reported a collared lynx in the Flattops Wilderness Area (Shenk, pers. comm. 2002). It is conceivable that native lynx may yet occupy the high mountain landscapes in Colorado.

The Canada lynx has been classified by the State of Colorado as a State endangered species since 1976. In 2000, the Service classified the lynx as a federally threatened species. Since 1978, there have been 14 investigations into naturally occurring lynx presence in Colorado conducted by the CDOW and other private and public conservation groups. Definitive evidence has not been found to document the presence of lynx from these studies though tracks attributed to lynx were found on a number of occasions.

ENVIRONMENTAL BASELINE

The environmental baseline is defined as the past and present impacts on the Canada lynx of all Federal, State or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impacts of State or private actions that are contemporaneous with the consultation in process (50 CFR 402.02).

Status of the species within the action area

The range of lynx within Colorado is within the Southern Rockies Geographic Area, and in general is associated with the subalpine and upper montane forest zones within the Rocky Mountain conifer type, typically between 2,450-3,650 meters (8,000-12,000 feet) in elevation (Ruediger et al. 2000). Lynx habitat in the Southern Rockies makes up approximately 16.8 percent of lynx habitat in the west (Cascades, Northern Rockies, and Southern Rockies). The montane and subalpine forest ecosystems in Colorado are naturally highly fragmented (Thompson 1994 in Ruediger et al. 2000).

Because of the fragmented nature of the landscape in Colorado, there are inherently important natural topographic features and vegetation communities that link these fragmented subalpine forested landscapes together; providing for dispersal movements and interchange among individuals and subpopulations of lynx. Landscape connectivity may take the form of narrow forested mountain ridges or plateaus connecting more extensive mountain forest habitats. Wooded riparian communities may provide travel cover across open valley floors between mountain ranges, or lower elevation ponderosa pine, pinyon-juniper woodlands or shrublands that separate high elevation spruce-fir forests (Ruediger et al. 2000).

After the first year of the Colorado Reintroduction program, there was evidence suggesting that there was insufficient prey availability in the Southern Rockies. Diet analysis conducted by the CDOW showed that only 67 percent of the diet consisted on snowshoe hare. At present however, 89 percent of the diet of the released lynx population consists of snowshoe hare (Shenk, CDOW, 2003, pers comm.). This suggests that after release, lynx were seeking out areas within the ecosystem that supported high numbers of prey, and, in the meantime relied on other prey to sustain them. Most of these lynx are currently known to occupy the San Juan Mountains. A number of lynx have made and continue to make exploratory movements throughout the Southern Rockies. Several animals have taken up residence for extended periods in the central and northern mountains of Colorado. Currently, lynx exist in most major portions of the Southern Rockies Ecosystem in Colorado and southern Wyoming. CDOW confirmed reproduction in 2004 consisting of the birth of 39 kittens to 14 females. Seventeen of the 2004

cohort are known or presumed dead and the status of 4 is unknown. The remaining 18 have all been tracked during the winter of 2004-2005. Thirty eight lynx were released by CDOW in 2005.

The Service assumes that due to the reintroduction effort conducted by CDOW that there are more lynx present in Colorado than have occurred here in the past 30 years. This is supported by the lack of specimens collected during that time period and that minimal evidence is available that would suggest that lynx in Colorado were more prevalent.

The State is currently tracking 110 adult lynx and 7 immature lynx born in Colorado. Two hundred and four lynx have been released during the reintroduction program. There are 66 known mortalities and 29 missing animals (Table 1). One hundred and two kittens have been born in Colorado with 30 known or presumed mortalities leaving 72 kittens still possibly surviving (Shenk, CDOW, 2005, pers comm.).

Table 1. Causes of death for adult lynx released into southwestern Colorado from 1999-2005.

Cause of Death	Number of Mortalities
Unknown	22
Starvation	9
Hit by Vehicle	9
Shot	8
Probable Shot	6
Plague	4
Probable Predation	3
Probable Hit by Vehicle	2
Other Human Caused	2
Illness	1
Total Mortalities	66

One result of the CDOW's lynx reintroduction effort in Colorado is that some of the released animals dispersed widely in the first years of the release, including into several adjacent states. Lynx released by CDOW have been recorded in New Mexico, Utah, Wyoming and Nebraska. In more recent years most individuals have tended to stay within suitable habitat in Colorado. Evidence still demonstrates that some animals are moving long distances after being released. Some of these movements occur across and into non-habitat areas including 2 animals into Nebraska (CDOW, 2001, Appendix A), and one individual that traveled as far north as Montana (Shenk, pers Comm. 2005). A female lynx released by the CDOW gave birth to 2 kittens in Wyoming in 2004, but this female was killed and the kittens are assumed to be dead as well. Additionally, ongoing studies in Montana, Wyoming and southern British Columbia have documented exploratory movements by resident lynx during the summer months (Apps 2000, and Squires and Laurion 2000 in Ruediger et al. 2000). Aubry et al. (2000) described this type of movement as long-distance movements beyond identified home range boundaries, but returning to the original home range.

Wildlife Services Activities

The following information describes the WDM methods identified that have the potential to affect lynx. To examine the risk of incidental take of lynx, both non-target lynx and non-target bobcat take were evaluated in the seven states that contain the lynx DPS in the WS Western Region (Colorado, Idaho, Montana, Oregon, Washington, Wyoming, Utah). Because bobcats and lynx are felids, it was assumed that the program's experiences in non-target take of bobcats would provide some insight into the risk of incidental lynx take should these methods be used within lynx habitat. Table 2 shows data based on regional take regardless of land class for FY-71 to FY-00. Table 3 shows take, on U.S. Forest Service lands identified as having suitable lynx habitat, which could be identified from MIS[1]. Tables 4 and 5 show similar information described in tables 2 and 3 specifically for the Colorado WS Program. These data show that the national WS Program has only taken 1 lynx in the last 30 years. A non-target animal was captured in a leg-hold trap outside of typical lynx habitat in Idaho in 1991 (this lynx was immediately released alive on-site). WS also assisted the CDOW in the recapture of a lynx outside of Fruita, Colorado. This activity was conducted under an existing section 10 permit issued to CDOW by the Service.

Table 2. Data on coyote, lynx, and bobcat take by WS WDM in seven western states (Colorado, Idaho, Montana, Oregon, Washington, Wyoming, Utah) compiled from WS annual reports from FY-71 to FY-00.

Method	Target Coyotes Taken	Lynx Taken	Target Bobcats Taken	Non-target Bobcats Killed	Non-target Bobcats Freed
Traps	74,419	1 (released alive)	3,142	161	511
Neck Snares	29,306	0	232	78	17
Foot Snares	6	0	5	1	0
M-44s	59,298	0	0	18	0
LP Collars	7	0	0	0	0
Dogs*	4,688	0	128	4	12

*Most coyotes taken by use of dogs are with the use of decoy dogs in conjunction with calling and shooting.

[1] MIS = Management Information System – a computer system initiated to track field activities of WS including take of target and non-target species on different land classes and their location. The MIS was put into effect at varying times in different states (Colorado - 4/1/94; Idaho - 1/1/94; Montana - 1/1/92; Oregon - 10/1/91; Washington - 10/1/92; Wyoming - 2/1/94; Utah - 10/1/92)

Table 3. Data on coyote, lynx, and bobcat take by WS WDM on U.S. Forest Service lands containing areas identified as "suitable lynx habitat" in seven western states (Colorado, Idaho, Montana, Oregon, Washington, Wyoming, Utah) compiled from WS MIS data from the earliest point in time from which data were collected for each state through FY-03.

Method	Target Coyotes Taken	Lynx Taken	Target Bobcats Taken	Non-target Bobcats Killed	Non-target Bobcats Freed
Traps	1,672	0	13	3	31
Neck Snares	29	0	1	0	0
Foot Snares	2	0	0	0	0
M-44s	33	0	0	0	0
LP Collars	0	0	0	0	0
Dogs*	565	0	0	2	0

*Most coyotes taken by use of dogs are with the use of decoy dogs in conjunction with calling and shooting.

Factors affecting species environment within the action area

Tables 4 and 5 document method of take and number of species taken by WS within the State of Colorado.

Table 4. Data on coyote, lynx, and bobcat take by the Colorado WS Program during WDM compiled from WS annual reports from FY83 to FY03.

Method	Target Coyotes Taken	Lynx Taken	Target Bobcats Taken	Non-target Bobcats Killed	Non-target Bobcats Freed
Traps	2,372	0	16	4	2
Cage Traps	0	0	5	0	0
Neck Snares	2,635	0	5	6	0
Foot Snares	6	0	0	0	0
M-44s	5,347	0	0	0	0
Aerial Shooting	35,092	0	0	0	0
Ground Shooting	8,214	0	4	0	0
Denning	4,531	0	0	0	0
Dogs*	2,389	1 (relocated)**	5	2	0

*Most coyotes taken by use of dogs are with the use of decoy dogs in conjunction with calling and shooting.

** WS assisted in the capture of this animal at the request of CDOW near Fruita, Colorado.

Table 5. Data on coyote, lynx, and bobcat take by the Colorado WS Program during WDM on U.S. Forest Service lands containing areas identified as "suitable lynx habitat" compiled from WS MIS data from April 1, 1994 through FY-03.

Method	Target Coyotes Taken	Lynx Taken	Target Bobcats Taken	Non-target Bobcats Killed	Non-target Bobcats Freed
Traps	0	0	0	0	0
Neck Snares	1	0	0	0	0
Foot Snares	0	0	0	0	0
M-44s	0	0	0	0	0
Aerial Shooting	1,017	0	0	0	0
Ground Shooting	187	0	0	0	0
Denning	6	0	0	0	0
Dogs*	295	0	0	0	0

*Most coyotes taken by use of dogs are with the use of decoy dogs in conjunction with calling and shooting.

The data show that few bobcats are taken as non-targets compared to the number of target coyotes and bobcats taken. In the 7 western states, non-target take of bobcats represented approximately 0.5 percent of the total take; of these, approximately 0.2 percent resulted in mortality (Table 2). In Colorado, a total of 12 non-target bobcats were taken by WS, which is approximately .02 percent of the total take for the time frame represented (Table 4). The data in tables 3 and 5 shows a significant reduction in overall take compared to tables 2 and 4. However, the reduction in overall take is likely a function of overall effort. Additionally, the data presented in the tables are from differing time frames, with no indication of the level of effort applied to the data. Therefore, the data in the tables cannot be directly compared.

WS Standard Operating Procedures (SOP's) for WDM in Colorado

Wildlife Service's standard operating procedures have been detailed in the proposed action. Since this biological opinion addresses WS ongoing actions, the SOP's are included in the environmental baseline as well.

Although most lynx tend to stay within appropriate habitat after they have been released, a few individuals have ventured into or have crossed non-lynx habitat. Wildlife Services assisted the CDOW in the recapture of a lynx near Fruita, Colorado, which is approximately 20 miles from the nearest suitable lynx habitat. Two animals have been documented in Nebraska, one in 1999 (CDOW, 2001) and another in 2005 (Appendix A). A report from the CDOW (Appendix A) documented the mortality of a 2nd lynx in Nebraska. This lynx, which was released in Colorado in 1999, was relocated in Colorado as late as March 2002. This animal was killed when it got caught in a neck snare set for coyote control. These examples are just a few of the known instances where lynx have ventured outside of lynx habitat. It is likely that as the CDOW continues to reintroduce animals, some of these animals will continue to venture outside of lynx habitat. Although the CDOW will only be releasing animals over the next 2-3 years, lynx are likely to continue to cross areas of non-habitat as they make exploratory movements.

In some cases these animals have also come into close proximity to livestock herds. In one case, a private citizen contacted the CDOW concerning an alleged depredation that may have involved a lynx (CDOW memo in Appendix A). Although evidence of depredation by a lynx is inconclusive, it suggests that lynx may be in proximity to livestock herds, and could be present while predator control measures are being implemented. Another depredation case occurred in New Mexico when a rancher found a lynx killing a lamb (Appendix A). The Rancher shot the lynx assuming it was a bobcat. A total of 2 lynx have been killed in New Mexico where individuals were protecting livestock (CDOW, Conservation Plan for Canada Lynx, 2002). The Service believes that lynx may be present near livestock herds, and we believe that this will continue in the future, potentially placing these individuals at some risk of being captured or killed where predator control measures are being implemented.

As stated previously, WS trap check frequency SOP, states that non-lethal traps will be checked 3 times per week and lethal traps and snares, including M-44s will be checked once a week. WS interim guidelines, issued in May 2000 by WS Western Regional Office, implemented restrictions to minimize the likelihood of adverse effects that could occur through continued implementation of the WDM program. It is difficult to determine how successful these guidelines have been to date, considering the WS has incidentally trapped one lynx in the past 30 years, and has not captured any lynx since the 2000 listing. Although mortalities of lynx have been documented, and have been connected to predator control activities, there is no evidence that WS has taken a lynx in Colorado, and only one lynx has been taken (captured and released) by WS in the 7 western states in the past 30 years.

The take of 4 animals per year has been authorized through an amendment to the Section 6 Agreement with the State of Colorado (biological opinion number ES/GJ-6-CO-02-F-034, November 2002). The amendment to the Section 6 Agreement consisted of a conservation plan including the continuation of the reintroduction of lynx into Colorado. Currently, within the State of Colorado, bobcat hunters are covered for the take 2 animals per year where they may mistake a lynx for a bobcat. To date, no animals have been taken through mistaken identity by bobcat hunters. Additionally, the take of 2 animals per year was authorized for livestock producers protecting their property. Since issuance of the biological opinion covering the Section 6 Agreement, no take has occurred from livestock producers protecting livestock. Prior to issuance of the biological opinion a few incidences of alleged lynx depredation did occur. These levels of take were determined not to jeopardize the continued existence of the lynx. The level of take authorized in the Section 6 biological opinion is contingent on the reintroduction effort, with coverage expiring 5 years from the date that opinion was issued (November 2007).

EFFECTS OF THE ACTION

Physical Exclusion

The Service anticipates that the use of physical exclusion techniques will have only a minimal effect to lynx. As stated in the BA, this technique is infrequently used in Colorado. The Service does not anticipate that sufficient area will be fenced that would have any significant affect on feeding breeding or sheltering of individual lynx. The Service anticipates that no more than 5 linear miles of fencing will be constructed by WS personnel within lynx habitat in Colorado, which would be used to preclude predators from entry into an area. Lynx are a wide-ranging

species and are unlikely to be significantly affected by being excluded from a small area of habitat.

Wildlife Management

Frightening Devices
The anticipated effect of the use of frightening devices is that if a lynx was near one of these devices, the animal would be frightened away from the area. The Service anticipates that this would have minimal effect to any individual, and would not likely affect the species ability to feed, breed or find shelter.

Capture or Take Methods

Leg-hold traps
Leg-hold traps are commonly used in WDM for capturing most predators, but are primarily used by WS to capture coyotes. Non-visual lures (i.e., fetid scents) are used to attract target predators, but sometimes visual attractants (i.e., scent-post sticks, bones) may be used. Many of the baits used for coyotes would typically not interest felids. Leg-hold traps can be set to preclude lighter weight non-target animals from being caught in the trap. The amount of weight required to trigger the leg-hold trap can be increased by using a pan-tension device, which can improve the selectivity and efficacy of trapping predatory animals by excluding smaller non-target species. Turkowski et al. (1984) reported that pan-tension devices excluded 90 to 100 percent of smaller, non-target species, depending on the type of pan-tension device used and soil conditions where the trap was set. Phillips and Gruver (1996) also reported similar results in that 91 to 99.1 percent of smaller non-target species were excluded from being captured in traps equipped with a pan-tension device. By increasing pan-tension trip pressure, this method may effectively exclude lynx from being captured while allowing the capture of heavier target species, minimizing or eliminating the risk to lynx. Depending on the weight of the target animal, pan tension used for bobcats and coyotes may capture lynx. Leg-hold traps used for coyotes or bobcats may pose a risk to lynx when used in occupied lynx habitat (USDI 2000, USDI 2003). A review of 30 years (1971 to 2000) of data from the nationwide WS program (Table 2) indicates that WS captured one lynx with a leg-hold trap. That lynx was taken by the Idaho WS Program in 1991 in non-lynx habitat and was released alive (USDI 2000). During the same time frame, WS nationally took 74,419 target coyotes (2,481/yr) and 3,142 target bobcats (105/yr), suggesting a lower probability of taking a lynx with leg-hold traps (Table 2).

Most coyote damage management is done in areas also occupied by bobcats with some areas believed to have relatively high bobcat density. Table 2 shows that 161 non-target bobcats were killed by use of leg-hold traps over that 30 year period, and another 511 were captured but released alive, indicating that about 75 percent of non-target bobcats captured may be capable of being released. However, table 3 shows that no lynx and only a fraction of the coyotes and non-target bobcats were captured on U.S. Forest Service lands where the majority of suitable lynx habitat occurs. This is especially true in Colorado since WS cannot use leg-hold traps on public lands. In Colorado, Table 5 shows that no bobcats or coyotes were captured on U.S. Forest Service lands with leg-hold traps since implementation of the Colorado State Constitutional restrictions. The data suggest that leg-hold traps set to capture coyotes within occupied lynx habitat, do pose a risk of capturing and killing a lynx, but the risk is minimal for a few reasons;

first, leg-hold traps are expected to be used infrequently by Colorado WS within lynx habitat, primarily due to the Colorado State Constitution, and the WS Program nationally has experienced an extremely low incidence of lynx take with leg-hold traps.

Although the extent of non-target bobcat take may represent a risk to lynx, bobcat populations are likely higher than lynx, and this method is more frequently used at lower elevations, outside of lynx habitat. Furthermore, the risk of killing a lynx by this method is low, evidenced by the fact that the one lynx captured by WS using this method was released alive and 75 percent of the non-target bobcats captured were also released alive.

In their contracts with Alaska, British Columbia, and the Yukon for obtaining lynx by trapping for their reintroduction program, CDOW stipulated that lynx would not be trapped at temperatures below -20 °F. CDOW has indicated that they have received some lynx with frozen toes, but did not experience any problems with frozen feet (M. Wild, CDOW, pers. comm. April 2000). Most WS use of traps in lynx habitat areas would be during the summer, which would eliminate this concern. However, if the use of leg-hold traps were to be used during cold winter days, there is a risk of injury to a lynx caught in a trap. Although injury could occur, there is little evidence that the injury would result in harm to an individual lynx.

Cage Traps

Cage traps are sometimes used to target bobcats. Table 4 shows that 5 bobcats were taken in Colorado with this method over a 21 year period. Cage traps could be used within lynx habitat because they can be used on public and private lands. However, cage traps are not often used in WDM because coyotes are extremely difficult to catch in them and are the species most frequently targeted by WS. Target species for cage traps typically include black bears, raccoons, skunks, and bobcats. Lynx would most likely be caught in a trap set for bobcats or bears. This method of take is unlikely to result in harm to an individual lynx. Lynx caught in cage traps could typically be released uninjured and unharmed.

WS proposed Conservation Measures for use of Cage Traps: Cage traps set within lynx habitat will be set in shaded areas and checked frequently enough to release any non-target lynx captured. The release of any lynx will be coordinated, to the maximum extent practicable, with CDOW so they can examine and radio collar the animal if feasible. This conservation measure should reduce the potential for mortality from over-heating of a lynx caught in this manner.

Neck snares

Neck snares used to capture mountain lions and bears pose little risk to lynx since the cable loop size is large enough (12 inches or larger loop size) to preclude capture of lynx. In livestock protection situations involving bears or lions, neck snares are only used following confirmed depredation by the target species, and are set to capture the offending individual when it attempts to return to the kill and passes through a "cubby hole" constructed by the WS specialist at the kill site. They may also be set in a nearby trail that might be used by the offending animal in returning to the kill. Use of these types of snare sets for bears or mountain lions in livestock depredation situations is infrequent, low in number in terms of sets made (generally only 1-3 sets at a given depredation incident), and are generally only used for a short duration (a few days to a week). Colorado WS took 2 lions in neck snares (1 each in FY-96 and FY-97) from FY-96 to FY-03 (0.25/yr).

A review of 30 years (1971 to 2000) of data from the nationwide WS program (Table 2) indicates that WS's use of neck snares captured 29,306 target coyotes (977/yr) and 232 target bobcats (8/yr) without killing or capturing a lynx. During this same period, 95 non-target bobcats were captured and, of these, 78 were killed using snares. From April 1, 1994, until September 30, 2003 (Table 4), a total of 2,635 target coyotes (277/yr) and 5 target bobcats were taken with snares by the Colorado WS Program while 6 non-target bobcats were killed. Since there is some overlap of bobcat and lynx habitat, the non-target take of bobcats indicates that there is some likelihood that lynx could be captured and killed by neck snares. Behaviorally, some individual lynx released by the CDOW have demonstrated that they will move across non-lynx habitat, and could be captured in a neck snare as evidenced by the lynx mortality in Nebraska (Appendix A). Although this animal was not killed by equipment set by WS personnel. It demonstrates some likelihood of mortality through their use.

These data suggest there is a potential risk to lynx from WS's use of neck snares to capture coyotes, but based on the WS Program's experience, the risk is relatively low because WS infrequently use this method in or near lynx habitat. In Colorado, neck snares cannot be used on public lands, but can be used on private lands for a maximum of 30 days per year on the same parcel due to the restrictions in the State Constitution. The risk of incidental take may be lower for lynx than non-target bobcats since lynx are less likely to occur in lower elevation areas where most coyote control work with snares occurs. WS has not documented the capture of a lynx in a neck snare within the last 30 years. Some risk still remains by the use of this tool. A lynx, released by the CDOW was killed in Nebraska when it was captured in a neck snare (Appendix A). Little additional information is available related to this incident, and therefore the reasons why this individual was captured are unknown.

WS Proposed Conservation Measures for use of Neck Snares: Neck snares will be used for coyotes, foxes, or bobcats only on private lands within lynx habitat. As stated in the BA no lynx have been taken in the last 30 years by this method. Since the majority of lynx habitat occurs on public lands the risk to lynx is reduced. All snares will be set to comply with Colorado Constitutional restrictions which means snares can only be set for a maximum of 30 days per year on each parcel of private property. Neck snares set in areas above 8,000 feet elevation on private land will be equipped with stops to reduce the likelihood of lethal take of lynx. Although there is some risk that a lynx could be captured and killed in a neck snare, the use of a stop on the snare should reduce the chance of mortality and the animal could be release unharmed. A lynx captured in a neck snare will likely result in the mortality of that individual. Harassment of an individual will occur if a lynx is captured in a neck-snare equipped with a stop, the individual will not be able escape until freed by WS personnel.

Foot snares

Table 2 shows that the use of foot snares has never resulted in the incidental take of a lynx, and that it resulted in the capture and death of 1 non-target bobcat. Tables 3 and 5 show that this method has not resulted in any incidental take of lynx or bobcats on U.S. Forest Service lands where the majority of lynx habitat occurs. By increasing the pressure required to trip the device, this type of foot snare can effectively exclude lynx or bobcat from being captured while allowing the capture of the target species.

These data suggest that if foot snares are used, incidental take of a lynx is unlikely. The risk can be further minimized through the use of pan-tension devices. For example, adjusting the trip weight of these devices to require 8-10 pounds or more to activate should be adequate to exclude animals up to 35 pounds in weight. This should be a reasonable adjustment because adult male lynx average 22 pounds and adult females average 19 pounds (USDI 2000). However, at least two male lynx released by the CDOW during State reintroduction program exceeded 35 pounds when released.

WS Proposed Conservation Measures for Leg-hold Traps and Spring-activated Foot-snares:
Leg-hold traps and spring-activated foot-snares will be used in lynx habitat only under the following conditions:

(a) Leg-hold traps placed for coyotes will not be used in conjunction with any visual attractants of the type normally expected to attract bobcats or other feline species (i.e., pieces of fur, feathers, shiny metal or fabric, etc.)
(b) Leg-hold traps placed for coyotes will not be used in conjunction with any olfactory attractants containing fish oil, catnip, anise, or castor as ingredients, to reduce the likelihood of attracting lynx or other feline species.
(c) Leg-hold traps and foot-snares set to capture larger predators (such as mountain lions, black bears, or adult wolves) will have pan-tension adjusted such that it would require 8-10 pounds of pressure to trigger the devise (This would be expected to minimize the likelihood of capturing a lynx or any other animal up to about 30-35 pounds in weight). Pipe sets which require a bear to reach into a small opening to retrieve bait do not require pan tension.
(d) All leg-hold traps and snares will be set to comply with Amendment 14, Colorado Constitutional restrictions which means leg-hold traps and snares can only be set for a maximum of 30 days per year on each parcel of private property.

In the unlikely event that a lynx is ever captured in a foothold trap or foot-snare, all practical efforts will be made to coordinate with CDOW to facilitate radio-collaring the animal prior to release, if it is not already collared. If WS determined that it would be impractical to arrange for radio-collaring the animal, and if the animal was judged likely to survive on its own, it would be immediately released and reported to CDOW and the Service immediately. If the animal were judged unlikely to survive on its own, the lynx would be turned over to CDOW. If the animal is dead, it will be left in the trap or snare and reported to the CDOW and the Service immediately.

Harassment and harm could result from an individual captured in a leg-hold trap. If a lynx is captured and released unharmed and uninjured, harassment will have occurred. If an individual is injured or is killed as a result of being captured in a leg-hold trap, harm to that individual will have occurred.

Catch-poles
As stated in the proposed action catch-poles are generally used to remove captured animals from traps without danger to the animal or WS personnel. If this device is used, the Service assumes that a take, in the form of harassment, has already occurred and will be reported to the appropriate Service office. The Service does not anticipate any additional effect to a lynx handled by a catch-pole that has already been captured in a trap.

Denning
The Service does not anticipate significant effects to result from this activity. The Service assumes that WS retains sufficient expertise to identify the animal using a den and avoid disrupting the site if lynx are detected through sign.

Shooting, and Aerial Shooting
Shooting during WDM by WS, used alone or in conjunction with calling, decoy dogs, or aircraft, should have an insignificant effect on lynx. Target species can be positively identified before the animal is shot. Lynx have been reported to be mistakenly shot by people (USDI 2000, USDI 2003), but WS personnel are trained and expected to positively identify target species to avoid accidental shootings. Therefore, WS's use of methods that involve shooting have been and are expected to continue to be 100 percent selective for target species, and should not pose a threat to lynx.

Conservation Measures for Shooting: All Colorado WS personnel conducting WDM in or near lynx occupied habitat will be trained to positively identify lynx and their sign from bobcats and other predators to minimize the possibility of non-target lynx being mistaken for bobcats or other species. There is no evidence to suggest that mistaken identity by WS personnel has occurred in the past. Training of personnel may provide some benefit in avoiding the likelihood that mistaken identity will occur and a lynx inadvertently shot.

Tracking and Trailing Dogs
Trailing dogs are used to pursue target animals such as mountain lions or bears, usually for protecting livestock or human safety. It is conceivable that using dogs to trail mountain lions or bears could result in an inadvertent pursuit or capture of a lynx if used in occupied lynx habitat. The worst case scenario would most likely be for dogs to encounter and kill a juvenile lynx or kitten as a result of encountering a lynx on the ground that did not take refuge in a tree. In September, 2003, the Colorado WS Program was requested by CDOW to use hounds to assist in the capture of a lynx in Mesa County, Colorado. This lynx was treed by hounds and then captured with the use of immobilizing drugs.

Table 2 shows that bobcats are vulnerable to trailing dogs in that 4 of 16 non-target bobcats taken were killed from FY-71 to FY-00. In Colorado, 2 non-target bobcats were killed by trailing dogs. The data suggest that the risk of incidental killing of a lynx is possible but unlikely. It is further unlikely that a lynx would be significantly affected by hounds for the following reasons:

If dogs are being used to pursue target mountain lions or black bears and it is determined that they are following a lynx track, the dogs would be removed from the track as soon as possible. If a lynx were treed, the dogs would be gathered quickly and taken from the area so the lynx is allowed to escape unharmed.

Decoy Dogs and Trap-line Companion Dogs
As stated in the proposed action section decoy dogs stay close to WS personnel. Since this technique is usually used during shooting activities, the Service anticipates that target animals will be identified properly before being shot and take of a lynx will not occur from the use of

decoy dogs. Trap-line companion dogs are unlikely to have any significant effect to lynx since they stay with WS personnel.

Chemical Immobilizing and Euthanizing Drugs
The Service anticipates that the use of these drugs would only occur after a take, in the form of harassment, has already occurred. In unusual circumstances, WS personnel may find it necessary to use these drugs on lynx either to immobilize an injured lynx that has been treed so that it can be captured and delivered to CDOW, or in the case of a euthanizing drug, when an animal is trapped and is in such poor condition that it would not survive anyway. In either case, a take will already have occurred and WS must report the incident to the Service.

M-44 (Sodium Cyanide) Devise
Table 2 shows that although the M-44 was used extensively as a tool within the 7 western states as discussed in the BA, no lynx have ever been taken by this device. Over the last 30 years, 18 non-target bobcats have been killed via M-44s which suggests there is some risk to felids, although the risk is low. There is a high probability that bobcats were not specifically excluded with available mitigation such as using scents that would not be attractive to felids. Table 3 indicates there has been little use of M-44s on U.S. Forest Service lands, and is not anticipated in Colorado in the future. Table 3 also shows there has been no mortality of lynx or bobcats by M-44s on U.S. Forest Service lands. M-44s will not be used on Federal lands in Colorado due to the restrictions of the Colorado State Constitution. That factor, plus the presumption that lynx densities are lower than bobcats, and lynx tend to prefer higher elevation areas where use of this tool will occur less frequently, should reduce the likelihood that take of lynx will occur. However, if a lynx were to trip this devise, the animal will be killed.

The use restrictions should minimize the likelihood that a lynx is killed using the device. However, considering the non-target take of bobcats from use of this device, there is some likelihood that harm could occur to individual lynx in areas adjacent to lynx habitat or within the landscape linkages. Also, considering the dispersal of lynx after being released, a lynx could be killed anywhere where it encountered and pulled the device.

Conservation Measures for M-44s: As stated in the BA no lynx have been taken in the last 30 years by this method. Since the majority of lynx habitat occurs on public lands, the exposure of lynx to M-44s should be negligible. All M-44s will be set to comply with Colorado State Constitutional restrictions which means M-44s can only be set for a maximum of 30 days per year on each parcel of private property.

SUMMARY OF EFFECTS

Take is defined by the Act (section 3(19) to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct". Although most of these terms are commonly understood, harass and harm, have been further defined as follows:

- Harass means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

- Harm means an act which actually kills or injures wildlife. Such acts may include significant habitat modification or degradation when it actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding or sheltering.

Clearly the possibility exists that actions taken by WS personnel, through there WDM activities could result in the take of lynx. Resource management practices are actions that could be taken by WS that would not result in effects to lynx. Table 1 in the BA lists a summary of WDM methods available to WS. Wildlife management techniques, as described in the proposed action section, and implemented by WS may have effects to lynx which are likely to result in harassment and harm to individual lynx.

Tables 2-5 in the BA list the methods used by WS and the species taken by those methods. Several methods are employed that are likely to have insignificant effects to lynx. These methods include: shooting, where personnel are expected to avoid taking of lynx due to the selectivity of the target, and the expectation that all WS personnel will be able to identify their targets; use of cage traps may result in the capture of lynx, but any animal captured in this device should be able to be released uninjured and unharmed; denning, as described in the BA, requires that there is some evidence that an animal is using a particular site. This method should allow WS personnel to determine the species present at a den site and avoid any impact to lynx. Furthermore, lynx do not typically use underground burrows as den sites, but it is possible that a female lynx could use an abandoned den from another animal. Also, lynx do not typically remain at the same den site.

CUMULATIVE EFFECTS

Cumulative effects are the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The State of Colorado has planned to continue their reintroduction of lynx through 2008. The original plan was to release 50 lynx per year starting in 2003 and continue with that number of releases for approximately 3 years. Future releases were anticipated to reach as many as 15 animals per year for up to 3 years depending on mortality figures. However, the number of animals is not fixed and the number released may be somewhat higher or lower than originally proposed. Also, the CDOW may not continue to release through 2008 as originally proposed due to the reproduction documented by CDOW.

The following future State, Tribal, local or private activities may affect lynx in Colorado and result in direct mortality, habitat loss, or reduction of habitat suitability: Loss, modification and fragmentation of breeding habitat and loss of wintering habitat from residential and commercial development, recreational activities such as snowshoeing, and snowmobiling, agricultural development, and livestock grazing.

Bobcat hunting and livestock protection will likely continue in the future. It is not possible to accurately anticipate the number of bobcat hunters, or the number of livestock producers who

will request a 30-day trapping exemption under the State Constitution. However, the Service has anticipated that up to 4 lynx may be taken by these activities annually.

Private citizens can use cage traps to live capture wildlife in Colorado, which could result in the harassment of lynx.

Tribal activity that may affect lynx in the future is somewhat nebulas. The Southern Ute Tribe allows trapping and hunting under a fur-bearer permit; however very few permits are actually issued to tribal members (approximately 12 per year). The Service has no additional information on Tribal activities. The Southern Ute and Ute Mountain Ute Reservation do not contain lynx habitat and few lynx will likely be encountered. Therefore, we anticipate minimal effects to lynx.

CONCLUSION

After reviewing the current status of the Canada lynx, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is the Service's biological opinion that the Animal and Plant Health Inspection Service - Wildlife Service's Wildlife Damage Management Program in Colorado as proposed is not likely to jeopardize the continued existence of the Canada lynx. No critical habitat has been designated for this species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measure described below are non-discretionary, and must be undertaken by Wildlife Services so that they become binding conditions , as appropriate, for the exemption in section 7(o)(2) to apply. Wildlife Services has a continuing duty to regulate the activity covered by this incidental take statement. If WS fails to assume and implement the terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, WS must annually report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)]

Amount or Extent of Take

The Service does not anticipate that WS will conduct actions that will result in habitat modification or degradation. The Service anticipates that up to a maximum of 2 individual lynx could be taken by WS conducting WDM activities in Colorado through 2008. Any lynx released in the spring of 2008 will be assumed to have established a home range by December 31, 2008, and erratic dispersal behavior resulting from hard release of lynx will be negligible. This date coincides with the termination of the State of Colorado's lynx reintroduction project. On January 1, 2009, the level of anticipated incidental take will change to zero in Colorado. Upon completion of the programmatic consultation regarding the WS WDM, the biological opinion issued for that consultation will take precedence and supersede this opinion and the anticipated take herein.

Rationale for Incidental Take of 2 through December 31, 2008

As CDOW continues to augment the lynx population and the population continues to increase and expand into new areas, there will be an increase in dispersing young lynx from their natal home range and the core establishment area. Additionally, the "hard" release tends to lend itself to the homing behavior. The homing behavior that has been demonstrated by lynx released in Colorado is likely to result in lynx being seen, captured, and trapped in unanticipated locations like Nebraska and Wyoming and outside of lynx habitat in Colorado. This behavior increases the potential of lynx being in habitat not normally occupied by lynx, which will increase the potential for the incidental take of lynx by WS personnel conducting WDM in Colorado.

Effect of the Take

In the accompanying biological opinion, the Service determined that a level of anticipated take of 2 individual lynx, maximum, through December 31, 2008, is not likely to result in jeopardy to the Canada lynx.

Reasonable and Prudent Measures

The following Reasonable and Prudent measures will be implemented to minimize incidental take by WS. WS will:

1. restrict their normal predator damage management activities in areas of lynx habitat, as determined by interagency (Service, U.S. Forest Service, Bureau of Land Management, CDOW) lynx habitat mapping for Colorado, to minimize the likelihood of encountering lynx.

Terms and Conditions

The following Terms and Conditions supersede the WS Interim Policy Guidelines for Canada Lynx dated May 15, 2000, which previously applied to lynx habitat as defined by interagency (Service, U.S. Forest Service, Bureau of Land Management, CDOW) lynx habitat mapping for Colorado.

In order to comply with Reasonable and Prudent measure number 1, WS shall:

1. maintain regular contact with the appropriate Federal and State agencies to keep apprised of lynx occurrence, locations, and lynx habitat as identified on maps prepared by or in consultation with the Service.

2. be trained in identification of lynx and lynx sign, and snowshoe hare and their sign if conducting predator damage management activities in lynx habitat, as determined by the Service. Training of WS personnel in lynx identification will be conducted by WS in collaboration with the local Service office.

3. not use fetid baits and attractants in coyote sets within lynx habitat, as identified on maps as determined by interagency (Service, U.S. Forest Service, Bureau of Land Management, CDOW) lynx habitat mapping for Colorado

4. utilize leg-hold traps and foot or leg snares set for larger predators (e.g., mountain lions, black bears, and wolves) equipped with pan tension devices sufficient to reduce the likelihood of capturing lynx or other animals up to 35 pounds (e.g., 8 to 10 pound trip weight) in lynx habitat, as determined by interagency (Service, U.S. Forest Service, Bureau of Land Management, CDOW) lynx habitat mapping for Colorado.

5. not set neck snares for coyotes or bobcats within lynx habitat, as identified on maps as determined by interagency (Service, U.S. Forest Service, Bureau of Land Management, CDOW) lynx habitat mapping for Colorado. Neck snares with stops may be used within lynx habitat as determined by interagency (Service, U.S. Forest Service, Bureau of Land Management, CDOW) lynx habitat mapping for Colorado for bears, lions, and wolves.

6. not use M-44 devices or large gas cartridges within lynx habitat, as identified on as determined by interagency (Service, U.S. Forest Service, Bureau of Land Management, CDOW) lynx habitat mapping for Colorado.

7. remove a tracking dog from trailing a lynx.

8. immediately release any lynx incidentally captured in a leg-hold trap or snare, or inadvertently treed only after notification to the Service, and/or the appropriate State wildlife agency, if notification is practical. If a lynx has been injured and cannot be rehabilitated or safely released, it may be euthanized by WS after receiving Service approval. WS shall use humane measures to euthanize the injured animal.

9. report any trapped, lethally taken, or lynx-related observations to the nearest Service office and appropriate State wildlife agency, including the date, specific location, method of taking or observation, and the nature and extent of any injuries sustained. WS shall make all practical efforts to contact the Service when a lynx is captured to determine if WS should radio collar the lynx. If not practical, the lynx should be released immediately.

10. notify the appropriate State and Service offices within 24 hours if a lynx is killed, and assist in preserving and transporting the carcass to the appropriate State, Federal, or Tribal wildlife agency for biological analysis.

11. provide the Service with an annual report detailing implementation of the Reasonable and Prudent Measures and adherence to the terms and conditions.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act requires Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

One method by which WS can meet the above requirement is to assist the Service and State wildlife agencies with lynx recovery and conservation by educating the public about lynx; their sign, primary prey species, behavior, and avoidance measures, and ways to avoid injury and mortality whenever possible.

REINITIATION NOTICE

This concludes consultation for the potential effects of WS's Wildlife Damage Management Program on the Canada lynx. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded, 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Thank you for your continued interest in the conservation of endangered, threatened, and proposed species. If you have any questions or comments, please contact Kurt Broderdorp at the letterhead address or (970) 243-2778, extension 24.

Sincerely,

Allan R. Pfister

Allan R. Pfister
Western Colorado Supervisor

cc: FWS/ES, Helena (Attn: Lori Nordstrum)
FWS/WO, Washington D.C. (Attn: Deb Carter)
FWS/ES, Helena (Attn: Joe Fontaine)

KBroderdorp:USDAAPHISWSPredatorDamageManagementFBO.doc:081705

LITERATURE CITED

Adams, A.W. .1963. The lynx explosion. North Dakota Outdoors 26:20-24.

Agee, J.K. 2000. Disturbance ecology of North American boreal forests and associated northern mixed/subalpine forests. Chapter 3 *in* Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al., tech. eds. The scientific basis for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. Ogden, UT: U.S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station.

Andrews, T. 1992. Colorado lynx survey: winter 1992. Unpublished Report. 59 pp.

Apps, C.D. 2000. Space-use, diet, demographics, and topographic associations of lynx in the southern Canadian Rocky Mountains: a study. Chapter 12 *in* L.F. Ruggiero, K.B. Aubrey, S.W. Buskirk, et al., tech. eds. Ecology and Conservation of Lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.

Aubry, K.B., G. Koehler, and J.R. Squires. 2000. Ecology of Canada lynx in southern boreal forests. Chapter 13 *in* L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, et al., tech. eds. Ecology and Conservation of Lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.

Bailey, T.N. 1974. Social organization in a bobcat population. J. Wildl. Manage. 38:435-446.

Bailey, T.N., E.E. Bangs, and M.F. Porter. 1986. An apparent overexploited lynx population on the Kenai Peninsula, Alaska. J. Wildl. Manage. 50:279-290.

Bell, W.B. 1972. Animal response to sonic booms. The Journal of Acoustical Society of America. Volume 51, Number 2 (Part 3).

Berrie, P.M. 1974. Ecology and status of the lynx in interior Alaska. Pages 4-41 *in* R.L. Eaton, ed. The world's cats. Volume 1. World Wildlife Safari, Winston, Oregon.

Bittner, S.L., and O.J. Rongstad. 1982. Snowshoe hare and allies *in* J.A. Chapman and G.A. Feldhamer, eds. Wild mammals of North America biology, management and economics. Johns Hopkins University Press, Baltimore, Maryland.

Brainerd, S.M. 1985. Reproductive ecology of bobcats and lynx in western Montana. MS. Thesis, University of Montana, Missoula.

Brand, C.J., and L.B. Kieth. 1979. Lynx demography during a snowshoe hare decline in Alberta. J. Wildl. Manage. 43:827-849.

Brand, C.J., L.B. Kieth, and C.A. Fisher. 1976. Lynx responses to changing snowshoe hare densities in central Alberta. J. Wildl. Manage. 40:416-428.

Brocke, R.H., K.A. Gustafson, and L.B. Fox. 1990. Restoration of the lynx in New York: biopolitical lessons. Transactions of the North American Wildlife and Natural Resources Conference 55:590-598.

Burt, W.H. 1954. The mammals of Michigan. Univ. of Michigan Press, Ann Arbor.

Buskirk, S.W., K.B. Aubry, and C.J. Krebs. 2000a. Habitat fragmentation and interspecific competition: implications for lynx conservation. Chapter 4 *in* L.F. Ruggiero, K.B. Aubrey, S.W. Buskirk, et al., tech. eds. Ecology and Conservation of Lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.

Buskirk, S.W., L.F. Ruggiero, K.B. Aubry, D.E. Pearson, J.R. Squires, and K.S. McKelvey. 2000b. Comparative ecology of lynx in North America. Chapter 14 *in* L.F. Ruggiero, K.B. Aubrey, S.W. Buskirk, et al., tech. eds. Ecology and Conservation of Lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.

Cameron, D. 1999. Call of the Hounds. Stonydale Press, Stevensville, MT.

Carbon, L.N., and D. Patriquin. 1983. Observations on home range sizes, movements and social organization of lynx, *Lynx canadensis*, in Riding Mountain National Park, Manitoba. Canadian Field Naturalist 97:262-267.

Carney, I.M. 1993. Colorado lynx study: Winter 1993. Colorado Division of Wildlife, Glenwood Springs. Unpublished Report.

Cochrane, J. 2003. U.S. Fish and Wildlife Service, pers. comm.

Colorado Division of Wildlife. 2001. Available on-line at http://wildlife.state.co.us/species_cons/lynx.asp

Colorado Division of Wildlife. 2003. Report providing information on lynx.

Coolahan, C. 1990. The use of dogs and calls to take coyotes around dens and resting areas. Proc. Vertebr. Pest Conf. 14:260-262.

Dolbeer, R.A., and W.R. Clark. 1975. Population ecology of snowshoe hares in the central Rocky Mountains. J. Wildl. Manage. 39:535-549.

DonCarlos, M.W. 1994. Fact sheet: Management of the lynx (*Felis lynx*) in Minnesota. Unpublished, Minnesota Department of Natural Resources, St. Paul, MN.

Eisenberg, J.F. 1986. Life history strategy of the Felidae: variations on a common theme. Pages 293-303 *in* S.D. Miller and D.D. Everett. Cats of the world: biology, conservation, and management. National Wildlife Federation, Washington, D.C.

Findley, J.S. and S. Anderson. 1956. Zoogeography of the montane mammals of Colorado. Journal of Mammalogy 37:80-82.

Fritts, S. H., C.M. Mack, D.W. Smith, K.M. Murphy, M.K. Phillips, M.D. Jimenez, E.E. Bangs, J.A. Fontaine, C.C. Niemeyer, W.G. Brewster, and T.J. Kaminski. Outcomes of hard and soft releases of reintroduced wolves in Central Idaho and the Greater Yellowstone area. Pages 125-147 in Large Mammal Restoration: Ecological and Sociological Challenges in the 21st Century, D.S. Maehr, R.F. Noss and J.L. Larkin, eds. Island Press, Washington, D.C.

Gunderson, H.L. 1978. A mid-continent irruption of Canada lynx, 1962-1963. Prairie Naturalist 10:71-80.

Halfpenny, J.C., S.J. Bissell, D.M. Nead. 1982. Status of the lynx (Felis lynx Felidae) in Colorado with comments on its distribution in the western United States. Unpublished manuscript, Institute of Arctic and Alpine Research, Boulder, CO.

Hall, E.R., and K.R. Kelson. 1959. The mammals of North America. Vol. II. Ronald Press, New York.

Harger, E.M. 1965. The status of the Canada lynx in Michigan. Jack-pine Warbler. 43:150-153.

Hatler, D.F. 1988. A lynx management strategy for British Columbia. Wildlife Bulletin No. B-61. B.C. Ministry of the Environment, Wildlife Branch, Victoria, B.C.

Hodges, K.E. 2000a. The ecology of snowshoe hares in southern boreal and montane forests. Chapter 7 *in* L.F. Ruggiero, K.B. Aubrey, S.W. Buskirk, et al., tech. eds. Ecology and Conservation of Lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.

Hodges, K.E. 2000b. The ecology of snowshoe hares in northern boreal forests. Chapter 6 *in* L.F. Ruggiero, K.B. Aubrey, S.W. Buskirk, et al., tech. eds. Ecology and Conservation of lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.

Jobman, W. 1997. U.S. Fish and Wildlife Service memo.

Johnson, S. 1994. Letter providing information on lynx. Indiana Department of Natural Resources.

Jones, J.K., Jr., R.S. Hoffman, D.W. Rice, C. Jones, R.J. Baker, M.D. Engstrom. 1992. Revised checklist of North American mammals north of Mexico, 1991. Occas. Papers No. 146, Texas Tech University.

Jones, J.K., D.C. Carter, H.H. Genoways, R.S. Hoffman, D.W. Rice, C. Jones. 1986. Revised checklist of North American mammals north of Mexico, 1986. Occas. Papers Mus. No. 107, Texas Tech University.

Jones, P. 1994. Letter providing information on lynx. Ohio Department of Natural Resources.

Joslin, G. 2003. Montana Department of Fish, Wildlife and Parks, pers. comm.

Kesterson, B.A. 1988. Lynx home range and spatial organization in relation to population density and prey abundance. M.S. Thesis. University of Alaska, Fairbanks.

Koehler, G.M. 1990. Population and habitat characteristics of lynx and snowshoe hares in north central Washington. Canadian Journal of Zoology 68:845-851.

Koehler, G.M., and J.D. Brittell. 1990. Managing spruce-fir habitat for lynx and snowshoe hares. Journal of Forestry 88:10-14.

Koehler , G.M., and K.B. Aubry. 1994. Pages 74-98 *in* L.F. Ruggiero *et al.*, tech. eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-254. 184 pp.

Koehler, G.M., M.G. Hornocker, and H.S. Hash. 1979. Lynx movements and habitat use in Montana. Canadian Field Naturalist 93:441-442.

Lewis, L., and C.R. Wenger. 1998. Idaho's Canada lynx: pieces of the puzzle. Idaho Bureau of Land Management Technical Bulletin No. 98-11. 19 pp.

Major, A.R. 1989. Lynx, *Lynx canadensis canadensis* (Kerr) predation patterns and habitat use in the Yukon Territory, Canada. Unpubl. M.S. Thesis, State University of New York, Syracuse.

McKelvey, K.S., K.B. Aubry, and Y.K. Ortega. 2000a. History and distribution of lynx in the contiguous United States. Chapter 8 *in* L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, et al., tech. eds. Ecology and Conservation of Lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.

McKelvey, K.S., S.W. Buskirk, C.J. Krebs. 2000b. Theoretical insights into the population viability of lynx. Chapter 2 *in* L.F. Ruggiero, K.B. Aubrey, S.W. Buskirk, et al., tech. eds. Ecology and Conservation of Lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.

McCord, C.M., and J.E. Cardoza. 1982. Bobcat (*Felis rufus*) and lynx (*F. lynx*). Pages 728-766 *in* J.A. Chapman and G.A. Feldhamer, eds. Wild mammals of North America. Johns Hopkins University Press, Baltimore, Maryland.

Mech, L.D. 1973. Canadian lynx invasion of Minnesota. Biological Conservation. 5:151-152.

Mech, L.D. 1977. Record movement of a Canadian lynx. Journal of Mammalogy 58:676-677.

Mech, L.D. 1980. Age, sex, reproduction, and spatial organization of lynxes colonizing northeastern Minnesota. Journal of Mammalogy 61:261-267.

Monthey, R.W. 1986. Responses of snowshoe hares, *Lepus americanus*, to timber harvesting in northern Maine. Canadian Field-Naturalist 100:568-570.

Mowat, G., G. Slough, and S. Boutin. 1996. Lynx recruitment during a snowshoe hare population peak and decline in southwest Yukon. Journal of Wildlife Management. 60:441-452.

Mowat, G., K.G. Poole, and M. O'Donoghue. 2000. Ecology of lynx in northern Canada and Alaska. Chapter 9 *in* L.F. Ruggiero, K.B. Aubrey, S.W. Buskirk, et al., tech. eds. Ecology and Conservation of Lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.

Nellis, C.H., S.P. Wetmore, and L.B. Kieth. 1972. Lynx-prey interactions in central Alberta. Journal of Wildlife Management 36:320-329.

O'Donoghue, M., S. Boutin, C.J. Krebs, and E.J. Hofer. 1997. Numerical responses of coyotes and lynx to the snowshoe hare cycle. Oikos 74:115-121.

O'Donoghue, M., S. Boutin, C.J. Krebs, G. Zuleta, D.L. Murrey, and E.J. Hofer. 1998. Functional responses of coyotes and lynx to the snowshoe hare cycle. Ecology 79(4):1193-1208.

Organ, J. 1999. Memo regarding lynx den sites. U.S. Fish and Wildlife Service.

Parker, G.R., J.W. Maxwell, and L.D. Morton. 1983. The ecology of lynx (*Lynx canadensis*) on Cape Breton Island. Canadian Journal of Zoology 61:770-786.

Phillips, R. L. 1996. Evaluation of 3 types of snares for capturing coyotes. Wildl. Soc. Bull. 24:107-110.

Phillips, R. L., and K. S. Gruver. 1996. Performance of the Paws-I-Trip™ pan tension device on 3 types of traps. Wildl. Soc. Bull. 24: 119-122.

Poole, K.G. 1994. Characteristics of an unharvested lynx population during a snowshoe hare decline. Journal of Wildlife Management 58:608-618.

Poole, K.G. 1997. Dispersal patterns of lynx in the Northwest Territories. Journal of Wildlife Management 61(2):497-505.

Quinn, N.W.S., and G. Parker. 1987. Lynx. Pages 683-694 *in* M. Novak, J. Baker, M. Obbard, eds. Wild furbearer management and conservation in North America. Ontario Ministry of Natural Resources, Toronto.

Rowley, G. J., and D. Rowley. 1987. Decoying coyotes with dogs. Proc. Great Plains Wildl. Damage Cont. Work. 8:179-181.

Ruggiero, L.F., K.B. Aubrey, S.W. Buskirk, et al. 2000. Tech. eds., Ecology and Conservation of Lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.

Saunders, J.K. 1963. Food habits of the lynx in Newfoundland. Journal of Wildlife Management 27:384-390.

Shivak, J. A., and D. J. Martin. 2001. Aversive and disruptive stimulus applications for managing predation. Proc. Wildl. Damage Manage. Conf. 9:111-119.

Slate, D. A., R. Owens, G. Connolly, and G. Simmons. 1992. Decision making for WDM. Trans. N. A. Wildl. Nat. Res. Conf 57:51-62.

Slough, B.G., and G. Mowat. 1996. Lynx population dynamics in an untrapped refugium. Journal of Wildlife Management 60:946-961.

Smithsonian Institute. 1998. List of museum specimens.

South Dakota Natural Heritage Program. 1994. Letter providing information on lynx.

Squires, J.R., and T. Laurion. 2000. Lynx Home Range and Movements in Montana and Wyoming: Preliminary Results. Chapter 11 *in* L.F. Ruggiero, K.B. Aubrey, S.W. Buskirk, et al., tech. eds. Ecology and Conservation of Lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.

Staples, W.R. 1995. Lynx and coyote diet and habitat relationships during a low hare population on the Kenai Peninsula, Alaska. M.S. Thesis. University of Alaska, Fairbanks.

Tanimoto, P.D. 1998. Lynx management assessment and comment to the U.S. Fish and Wildlife Service's proposal to list lynx under the Endangered Species Act of 1973. Unpublished report. Predator Project, Bozeman, Montana.

Thiel, R.P. 1987. The status of Canada lynx in Wisconsin, 1865-1980. Wisconsin Academy of Sciences, Arts and Letters 75:90-96.

Thompson, R.W., and J.C. Halfpenny. 1989. Canada lynx presence on the Vail ski area and proposed expansion areas. Unpublished report. Western Ecosystems, Lafayette, Colorado.

Tumlison, R. 1987. *Felis lynx*. Mammalian Species 269:1-8.

Turkowski, F. J., A. R. Armistead, and S. D. Linhart. 1984. Selectivity and effectiveness of pan tension devices for coyote foothold traps. J. Wildl. Manage. 48: 700-708.

U.S. Department of Interior (USDI). 2000. Final Rule. Endangered and Threatened Wildlife and Plants: Determination of Threatened Status of the Contiguous U.S. Distinct Population Segment of the Canada Lynx and Related Rule. USDI, USFWS 50 CFR Part 17, March 24, 2000.

USDI. 2003. Final Rule. Endangered and Threatened Wildlife and Plants; Notice of Remanded Determination of Status for the Contiguous United States Distinct Population Segment of the Canada Lynx; Clarification of Findings. USDI, IUSFWS 50 CFR Part 17, July 3, 2003.

Van Zyll de Jong, C.G. 1966. Food habits of the lynx in Alberta and the Mackenzie District, N.W.T. Canadian Field-Naturalist 80:18-23.

Vashon, J., A. Vashon, and S. Crowley. 2003. Partnership for lynx conservation in Maine. December 2001 - December 2002, field report. Maine Dept. of Inland Fisheries and Wildlife, Bangor, Maine. 19 pp.

Ward, R.M.P., and C.J. Krebs. 1985. Behavioral responses of lynx to declining snowshoe hare abundance. Canadian Journal of Zoology 63:2817-2824.

Washington Department of Wildlife. 1993. Status of the North American lynx (Lynx canadensis) in Washington. Unpubl. rpt. Washington Department of Wildlife, Olympia.

Williams, S. 1994. Texas Tech University, pers. comm.

Wilson, D.E., and D.M. Reeder. 1993. Mammal species of the world. Smithsonian Institution Press, Washington, DC.

Wolfe, M.L., N.V. Debyle, C.S. Winchell, and T.R. McCabe. 1982. Snowshoe hare cover relationships in northern Utah. Journal of Wildlife Management 46:662-670.

Wolff, J.O. 1980. The role of habitat patchiness in the population dynamics of snowshoe hares. Ecol. Monog. 50:111-130.