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BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

PRINCIPAL CONSIDERATIONS

This biological opinion will focus primarily on the implementation of current Plans and the interrelated actions of implementing the CAs. This consultation has an additional benefit of streamlining the consultations on future Plan amendments and revisions agreed to in the CAs.

Current Plans and the Conservation Agreements

The proposed action is to continue FS and BLM implementation of the current Plans. The Plans represent the first level of the decision making process for both agencies. The BA describes the FS decision making process as a 2-level staged process. The first level is the development of a Forest Plan that provides direction for all resource management programs, practices, uses and protection measures. Forest Plans set forth goals, objectives, and limitations to actions in the form of standards and guidelines, both forest wide and at smaller scales. Forest Plans are permissive in that they allow, but do not mandate, certain activities. Forest Plans do not compel the FS to propose a particular action. The second level of Forest planning involves the analysis and implementation of management actions designed to achieve the goals and objectives of the Forest Plan. Projects that will implement a Forest Plan will need to be consistent with its framework of goals, objectives, standards and guidelines, and can also provide additional mitigation requirements specific to the project area.

Public lands managed by the BLM are administered under Land Use Plans (U.S. Forest Service and U.S. Bureau of Land Management 2000). The Land Use Plans generally identify how and where lands and resources will be managed or allocated for various purposes, identifying types of land uses that are allowed or prohibited in specific areas within a planning or administrative unit. Public land management decisions are made in three levels. The first level is the Land Use Plan, which is often general and allows subsequent management discretion in managing lands and resources. The second decision level is the activity or program-specific plans, such as plans for grazing allotments and areas of high environmental concern. The third decision level is at specific project plans.

In this biological opinion, the Service will evaluate the effects on lynx of implementing the Plans in conjunction with implementing the FS CA and BLM CAs (herein collectively referred to as CAs), actions that are interrelated to the ongoing implementation of the Plans. The CAs commit the agencies to consider the information and recommendations in the Science Report, the LCAS, and the Service's final listing document as projects are evaluated, selected, and implemented. The CAs indicate that the agencies agree that Plans should include measures necessary to conserve lynx for all administrative units identified as having lynx habitat, considering the

information and recommendations in the Science Report, the LCAS, and the Service's final listing document. While the CAs were not complete at the time the agencies were preparing the BA, the Service will, through this consultation, assess the effects on lynx of implementing the CAs. The conclusions in this biological opinion are based on the anticipated effects of implementing the CAs along with the effects of continued implementation of Plans.

The CAs do not change current Plan direction but affect priorities for selecting and implementing management actions. The CAs identify actions that will be taken to reduce or eliminate adverse effects or risks to the lynx and its habitat, and maintain the ecosystems on which this species depends. Specific terms of the CAs that are pertinent to this consultation and biological opinion are as follows:

- The Science Report and LCAS, together with locally specific information as appropriate, will be used as the basis for streamlining section 7 consultations.
- The agencies agree that the LCAS contains recommendations that are based on the best currently available scientific information about lynx, current habitat conditions, risks to the species and/or individual lynx posed by current management activities, and measures that are likely needed to conserve the species.
- The FS and BLM agree that Plans should include measures necessary to conserve lynx for all administrative units identified as having lynx habitat, and any necessary changes will be made through amendments and/or revisions, or other appropriate mechanisms consistent with laws, regulations, and policies. The CAs indicate that the process of revisions and/or amendments will include consideration of the Science Report, the LCAS, and the Service's final rule. The FS and BLM agree to coordinate with FWS on approaches to the programmatic planning process for lynx.
- The FS and BLM will identify and map lynx habitat and lynx analysis units on all administrative units, coordinating with the Service and using direction in the LCAS. Key linkage areas will also be identified and mapped.
- The FS CA commits the FS to using and referencing the LCAS in all determinations of effect for lynx during project planning. Actions proposed by the FS that do not involve third parties will be evaluated, and if the evaluation indicates an action is likely to adversely affect the lynx, the agency will not authorize the activity until Forest Plans are revised or amended, if necessary. After such amendments or revisions are made, projects may be authorized provided they are consistent with the Forest plans and comply with ESA and other applicable laws. For actions that are proposed by or involve third parties, the agencies agree to review and consider the information on lynx in the LCAS and Science Report, and appropriate local information to ensure compliance with all applicable Federal laws during analysis and decision-making processes.
- The BLM CA commits the BLM to review and consider new information on the lynx, the LCAS, and Science Report, to determine whether an activity may affect the lynx, prior to making new decisions for actions in lynx habitat. For proposed actions, decision documents will not be signed until the decision maker has determined that the action will be in compliance with the Act.

- The FS, BLM, and Service will look for opportunities to undertake pro-active management actions to benefit lynx, based on the LCAS, to the extent they are consistent with current Plans.
- New information on the lynx will be reviewed and considered, as appropriate, for all ongoing actions to ensure compliance with applicable Federal laws including ESA.
- The CAs are expected to be in effect until December 31, 2004, at which time they will be reviewed for renewal, amendment, or termination or expiration.

Future Plan Revisions or Amendments

This biological opinion has an additional benefit of streamlining any necessary future consultations on the Plan amendments and revisions agreed to in the CAs. Because of the substantial influence of the LCAS in the CAs, the analysis of the effects of the CAs will necessarily assess the effects of implementing conservation measures in the LCAS on lynx. Therefore, to facilitate streamlining of future Plan revision or amendment consultation processes, this biological opinion will assess the sufficiency of the conservation measures in the LCAS to provide Plan guidance and direction that reduces the potential for adverse effects to lynx and precludes jeopardy to the lynx population.

The BA examined each Plan within the range of lynx, and identified the deficiencies, if any, in each of the Plans related to the conservation of lynx. Furthermore, the BA summarized, by geographic region, the shortfalls of the Plans. For each geographic region, the LCAS identified both specific risk factors related to effects of Federal land management actions and provides relevant conservation measures. The LCAS was developed using information in the Science Report, as well as information from across the range of lynx, from all geographic areas, to assess potential effects of management actions on lynx. Thus, the conservation measures contained within the LCAS are applicable to lynx habitat across the range of lynx. If the conservation measures are found adequate to conserve lynx and minimize the potential for adverse effects to lynx, they would be appropriate for inclusion into individual Plans.

Therefore, if future revisions or amendments of the Plans include the substantive direction, objectives, standards and guidelines in the LCAS, or the substantive equivalent thereof, consultations that occur for such amendments or revisions may tier to this biological opinion.

OTHER CONSIDERATIONS

The purpose of the BA was to determine to what extent the existing programmatic Plans may affect lynx, to either conclude conferencing or to set the stage for subsequent consultation if lynx were listed. This biological opinion thus addresses only the effects of programmatic plans, in conjunction with the CAs, and considers only lynx. The impacts of Plans on other listed species have been analyzed in other section 7 consultations. The overall goals established in the LCAS are based on strong consideration of natural process and historic condition. Therefore, many of

the conservation measures in the LCAS will likely compliment and assist in the conservation of other listed species. Project level section 7 consultations will also identify potential impacts to other listed species, based on local information.

Programmatic plans are considered permissive, in that they may allow but do not authorize or approve any site-specific projects or actions. They are much like zoning ordinances under which future decisions are made. Decisions at the Plan level establish goals and objectives, identify the types of activities that are allowed or prohibited in specific areas, and may specify management standards and minimum habitat condition goals either unit-wide or for specific areas and establish a monitoring and evaluation program. The evaluation of potential effects presented in the BA was based solely on an assessment of the existing and current Plans as written and amended. Other policies or agreements that may influence how the Plans are implemented were not considered. Regional Guides for each region of the FS provided standards and guidelines for addressing major issues and management concerns which needed to be considered at the Regional level to facilitate Forest planning, but did not lead to effects on lynx separate from those attributed to Forest Plans in the BA. The standards and guidelines included in the Regional Guides have assisted in the development of the Forest Plans that are the subject of this consultation. Therefore, this consultation does encompass the Regional Guides for the five regions.

STATUS OF THE SPECIES

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).

No critical habitat has been designated for the threatened population of Canada lynx in the contiguous United States. As explained in the final rule, 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 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% 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 1963a; 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 *(Tympanichus 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 subalpine fir, Englemann spruce, Douglas fir, and 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; U.S. Fish and Wildlife Service, in litt. 1999). 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 al. 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 *Pinus contorta* (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 (U.S. Fish and Wildlife Service, in litt. 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 southcentral 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 to 5 kittens (Mowat et al. 1996).

Koehler (1990) suggested that the low number of kittens produced in northcentral 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 one of the females in 1987 was not determined) (Koehler 1990). Of the known-size litters in Washington, one kitten survived the first winter.

In Montana, Squires and Laurion (2000) reported that one marked female produced two kittens in 1998. In 1999, two of three females produced litters of two kittens each. In Wyoming (Squires and Laurion 2000), one 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; Carbyn 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. Two lynx were killed on 2- and 4-lane Colorado highways following their release as part of a reintroduction effort there (G. Byrne, Colorado Dept. of Wildlife, pers. comm. 1999).

Other than translocated animals, there have been 2 documented occurrences of highway mortality in Wisconsin (Theil 1987) and Minnesota (Don Carlos, unpubl. report 1997). Twelve resident lynx were documented being killed on highways in Canada and Alaska (Staples 1995; Gibeau and Heur 1996; T. Clevenger, pers. comm. 1999; Alexander, pers. comm. 1999).

Predation on lynx by mountain lion, coyote (*Canis latrans*), wolverine (*Gulo gulo*), gray wolf (*Canis lupus*), 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; 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.

Interspecific 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, 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). As described previously, major predators of snowshoe hare include lynx, northern goshawk, great horned owl, bobcat, coyote, red fox, 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 following discussion of status and distribution is largely excerpted from the final rule. 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. 2000b). 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 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 Mountains Region, each area is geographically connected to the much larger population of lynx in Canada.

The following recapitulates status and distribution information presented in the final rule:

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 to 750 meters (820 to 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, an extensive patch of habitat in the Adirondacks of northern New York, and with a few more distant and isolated patches in Pennsylvania (see Figure 8.23 in McKelvey et al. 2000b).

Based on documentation of lynx presence and reproduction in Maine, the substantial lynx harvest in southeastern Quebec, and the connectivity of boreal forest south of the St. Lawrence River in Quebec, New Brunswick, Maine, and New Hampshire, we conclude that a population of lynx continues to exist in the core of the region in the north; however, the range appears to have retracted northward. Connectivity between the United States and Canada north of the St. Lawrence River has been reduced by development in southeastern Canada and ice breaking to allow year-round shipping on the river.

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.

Mixed deciduous-coniferous forest covers an extensive area in this region, but much of this area is considered marginal habitat for lynx because it is a transitional forest type at the edge of the snowshoe hare range. Habitat at the edge of hare range supports lower hare densities (Buehler and Keith 1982) that may not be sufficient to support lynx reproduction. Snow depths within appropriate habitat that allow lynx a competitive advantage over other carnivores (i.e., coyotes) occur only in limited areas in northeastern Minnesota, extreme northern Wisconsin, and Michigan's upper peninsula.

The historical and current status of lynx in the Great Lakes Region is uncertain. Minnesota has a substantial number of lynx reports, primarily trapping records (McKelvey et al. 2000b), as expected because of the connectivity of the boreal forest with that of Ontario, Canada, where lynx occur. Wisconsin and Michigan have substantially fewer records of lynx (McKelvey et al.

2000b). Researchers have debated whether lynx in this region are simply dispersing lynx emigrating from Canada, are members of a resident population, or are a combination of a resident population and dispersing individuals (McKelvey et al. 2000b; R. Sando, Minnesota Department of Natural Resources, in litt. 1998). In recent decades, lynx dynamics in the Great Lakes appear to have been driven by immigration, because lynx occurrence records did not show a response to local cycles of hare abundance (McKelvey et al. 2000b) as would have been expected of a resident lynx population.

Using the best available information, we cannot determine whether resident populations of lynx exist currently or existed historically in the Great Lakes Region. Within this region, we consider northeastern Minnesota to be most likely to support a resident population. We suspect that historically there might have been a small resident population in northeastern Minnesota, but the lack of evidence precludes confirmation of the past or present existence of a resident population. Records of lynx from Wisconsin and Michigan most likely were transient, dispersing animals.

Northern Rocky Mountain/Cascades Region (Washington, Oregon, Idaho, Wyoming, Utah) - 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 (*Pseudotsuga menziesii*) 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.

The Northern Rocky Mountains/Cascades Region supports the most viable resident lynx populations in the contiguous United States, while recognizing that, at best, lynx in the contiguous United States are naturally rare. Strong evidence exists to support the presence of resident lynx populations distributed throughout much of the forest types considered lynx habitat in Montana and Washington. Resident lynx populations probably exist in contiguous habitats in Idaho and northwestern Wyoming. Lynx have probably always occurred intermittently in Oregon and Utah, although the historical or current presence of resident populations in either of these States has not been confirmed.

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 in McKelvey et al. 2000b). These areas likely reduce or preclude opportunities for genetic interchange with the Northern Rocky Mountains/Cascades Region and Canada, effectively isolating lynx in the southern Rocky Mountains Region (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 (1,250 to over 3,750 meters (4,100-12,300 feet)) than were all other occurrences in the West (McKelvey et al. 2000b).

The Service believes that a resident lynx population historically occurred in the Southern Rocky Mountains Region, based on the records of lynx in Colorado and the persistence of contiguous habitat in southeastern Wyoming with the Colorado habitat. This resident population may have been extirpated, which led the Colorado Division of Wildlife to undertake a reintroduction effort that is currently in progress.

Reports from other locations - During the early 1960s, concurrent with an unprecedented cyclic high in Canada, lynx moved into the Great Plains and the Midwest Region of the United States (Gunderson 1978; Mech 1980; DeStefano 1987; South Dakota Natural Heritage Program, in litt. 1994). These records are outside of the southern boreal forests where most lynx occurrences are found (McKelvey et al. 2000b). We consider lynx observations in Nevada, North Dakota, South Dakota, Iowa, Nebraska, Indiana, Ohio, and Virginia to be individuals dispersing subsequent to periods of cyclic high lynx numbers in Canada (Hall and Kelson 1959; Burt 1954 in Brocke 1982; McKelvey et al. 2000b; S. Johnson, Indiana Department of Natural Resources, in litt. 1994; P. Jones, Ohio Department of Natural Resources, in litt. 1994; W. Jobman, U.S. Fish and Wildlife Service, in litt. 1997; Smithsonian Institute, in litt. 1998). We do not consider these States to be within the contiguous United States range of lynx (65 FR 16052, March 24, 2000)**.**

ANALYSES OF THE SPECIES LIKELY TO BE AFFECTED

Lynx are wide-ranging species requiring large, interconnected areas of suitable habitat. Habitat connectivity within geographic areas and with Canada may be important for long-term lynx population viability and maintenance of the contiguous United States DPS.

Lynx on FS and BLM lands may be affected by management activities that reduce or degrade essential habitat elements used by lynx for denning, foraging, and recruitment, or that increase habitat fragmentation and lynx mortality. Effects may occur and/or continue without appropriate management direction at broad scales. This biological opinion evaluates current Plans, in conjunction with the CAs, with respect to life requisites of lynx.

ENVIRONMENTAL BASELINE

STATUS OF THE SPECIES WITHIN THE ACTION AREA

The Act defines ``species'' as a species, subspecies, or DPS (distinct population segment) of a vertebrate species. On February 7, 1996, the Service and the National Marine Fisheries Service published final policy guidance concerning recognition of DPSs for consideration under the Act (61 FR 4722). The final listing rule found that the lynx population in the contiguous United States is discrete and significant and, therefore, qualifies as a DPS to be considered for listing under the Act. The final rule provides the Service's rationale as to why each lynx region did not qualify as separate DPSs.

Within the contiguous United States, all of the geographic areas that support lynx include one or more Plans considered here, and thus include lands that are part of the action area. The geographic areas are separated from each other by expanses of unsuitable habitats that limit or preclude lynx movement between these regions, except the Northern Rockies and the Cascades. Unsuitable habitat along the southeastern Great Lakes isolates the Northeast and Great Lakes geographic areas; the Great Plains isolates the eastern regions from the west. Although there may be some limited potential for dispersal between the Southern and Northern Rockies, lynx in the Southern Rockies are likely isolated by the Green River basin and the Red Desert. All of the geographic areas that support lynx within the contiguous United States are directly contiguous with lynx habitat or lynx populations in Canada, except the Southern Rockies, although connectivity with the Northeast Region is largely limited to areas south of the St. Lawrence Seaway in southern Quebec and New Brunswick.

The BA included a GIS map delineating primary lynx habitat, based on lynx occurrence data associated with potential vegetation described in McKelvey et al. (2000b). The map depicted distribution of historical and current lynx habitat across the contiguous United States. Lands administered by FS and BLM constitute a significant proportion of lynx habitat, particularly in the west.

The BA broadly categorized programmatic land allocations into "developmental" and "nondevelopmental allocations." Nondevelopmental land allocations (prescriptions 1, 2, and 3 *in* BA Appendix F, page 145) generally were characterized as roadless, allowing non-motorized travel, and/or dominated by natural disturbance processes. Examples of lands in nondevelopmental allocations include wilderness, Wild and Scenic River corridors, Research Natural Areas, and late successional reserves. Fire suppression, grazing, mining, and dispersed recreation activities may occur in these areas, but less extensively than in developmental allocations. Activities such as extensive timber harvest and road construction, and recreation developments are generally not expected to occur within these areas. Developmental land allocations (prescriptions 4-8 in BA Appendix F, page 145), on the other hand, were characterized as areas subject to more intensive management and consumptive resource use, with motorized transportation and concentrated recreation use and development.

According to the BA, primary lynx habitat distribution on Federal lands occurs as described below (Table 1) . The BA used Kuchler (1964) vegetation types in the west, and Bailey (1998) subsections in the east to map lynx habitat (U.S. Forest Service and U.S. Bureau of Land Management 1999). Inclusions of non-lynx habitat occur in both schemes, however, to greater extent in the east. Recent, more refined mapping of lynx habitat, described earlier in this document (Appendix C), identified several specific vegetation associations (e.g. dry Douglas fir and dry lodgepole types, Pacific silver fir/mountain hemlock, and others) as not considered primary vegetation components for lynx. These types were included in the broader-scaled analysis in the BA. Therefore, we expect that the following acreages reported in the BA are overly inclusive for each geographic area; the actual total acres of lynx habitat in each geographic region is smaller than that indicated, especially in the Great Lakes and Northeast regions.

Table 1. Estimated amount of primary lynx habitat (PH) in geographic regions in the contiguous U.S., amount of PH on Forest Service and Bureau of Land Management lands, and Federal land allocations in PH (data from U.S. Forest Service and U.S. Bureau of Land Management 1999).

Geographic Area	Total acres (000's) primary lynx habitat (PH)	Total acres (000's) PH on FS/BLM	Total acres (000's) FS *and* BLM PH in nondev. allocations[1]	% PH on FS/BLM	% of FS *and* BLM PH in nondev. allocations	% of all PH in nondev. allocations
Cascades	4,192	4,112 / 32	3,577	**98% / <1%**	**87%**	**85%**
N. Rockies	34,330	23,168 / 1,559	14,094	**67% / 5%**	**57%**	**41%**
S. Rockies	6,591	4,987 / 349	1,357	**76% / 5%**	**25%**	**21%**
Gr. Lakes[2]	23,783	4,459 / 0	1,828	**19% / 0%**	**41%**	**8%**
Northeast[2]	16,145	1,097 / 0	244	**7% / 0%**	**23%**	**2%**

1 Nondevelopmental land allocations (prescriptions 1, 2, and 3 *in* BA Appendix F, page 145) generally were characterized as roadless, allowing non-motorized travel, and dominated by natural disturbance processes.
2 Data for the Great Lakes and Northeast (east) are not directly comparable to the Cascades, N. Rockies, and S. Rockies (west). Map base in the east was Bailey (1998) and in the west, Kuchler (1964).

The BA described the following:

Cascade Mountains Geographic Area: This area encompasses the Cascade Mountains of Washington and Oregon. The BA indicated that about 4 million acres of the 20 million acres covered by affected FS and BLM administrative units is primary lynx habitat. Approximately 3.5 million acres (87%) of the primary lynx habitat is included within nondevelopmental land allocations where natural processes are expected to predominate. The FS manages approximately 98% of lynx habitat and private owners manage about 1% in this area.

Northern Rocky Mountains Geographic Area: The Northern Rocky Mountains Geographic Area encompasses northern, central, and southeastern Idaho, western Montana on both sides of the Continental Divide, northeastern and southeastern Washington, northeastern Oregon, northeastern Utah, and western Wyoming. The area covered by affected FS and BLM administrative units totaled about 126 million acres, of which about 25 million acres is primary lynx habitat. Approximately 14 million acres (57%) of the primary lynx habitat is included within nondevelopmental land allocations where natural processes are expected to predominate. The FS manages 67% of the lynx habitat and the BLM manages about 5%. Private lands account for about 27% of lynx habitat in this area.

Southern Rocky Mountains Geographic Area: The Southern Rocky Mountains Geographic Area encompasses the mountainous regions of Colorado, south-central Wyoming, and north-central New Mexico. The BA indicated that about 5 million acres of the 35 million acres covered by the affected FS and BLM administrative units is primary lynx habitat. Approximately 1.4 million (25%) of the primary lynx habitat is included within nondevelopmental land allocations where natural processes are expected to predominate. The FS manages 76% of the lynx habitat in this area and the BLM manages about 5%. Private lands account for about 19% of this area.

Great Lakes Geographic Area: The Great Lakes Geographic Area encompasses northeastern and north-central Minnesota, northern Wisconsin, and the Upper Peninsula and northern portions of Michigan. The majority of lynx occurrence records in the Great Lakes Region are associated with the broad ``mixed deciduous-coniferous'' forest type (McKelvey et al. 2000b). The BA indicated about 4.5 million acres of the 6 million acres encompassed by the affected National Forests is mapped as primary lynx habitat. Approximately 2 million acres (41%) of the primary lynx habitat is included within nondevelopmental land allocations where natural processes are expected to predominate. The FS manages 19% of lynx habitat in this area and the BLM manages none. Private lands account for about 81% of lynx habitat in this area. Mixed deciduous-coniferous forest type covers an extensive area in this region, but much of this area is considered marginal habitat for lynx because it is a transitional forest type, highly variable in vegetation composition, at the edge of the snowshoe hare range (65 FR 16052, March 24, 2000).

Northeast Geographic Area: The Northeast Geographic Area encompasses western Maine, central and northern New Hampshire, Vermont, the northeastern portion of New York, small portions in northwestern Massachusetts, and the very northeastern corner of Pennsylvania. The two affected National Forests comprise about 1 million acres, all of which was identified as primary lynx habitat. Approximately 244,000 acres (23%) of the primary lynx habitat is included within nondevelopmental land allocations where natural processes are expected to predominate. The BA indicates that FS manages 7% of lynx habitat in this area and the BLM manages none. Private lands account for about 93% of this area.

In summary, in the west, Federal land accounts for the preponderance of lynx habitat. Of this habitat the FS manages the vast majority of acres, the BLM manages only a small portion of lynx habitat. In the east, private lands account for most lynx habitat. The FS manages all of the Federal lynx habitat in the east, the BLM manages none.

In the west, Federal land management, specifically under the FS Plans, has the potential to exert substantive effects on lynx populations in geographic areas. The BLM Plans, which direct management on 5% or less of lynx habitat in each western geographic area, may impart local effects on lynx. However, these effects for the most part would not substantively affect the affect the lynx population within the geographic area. Exceptions would include impacts on connectivity.

Large proportions of Federal lands in the west are in nondevelopmental land allocations, where natural processes predominate. Negative effects of FS or BLM management actions in nondevelopmental land allocations would be minimal, according to the BA.

In the east, private land management may have the potential to exert substantive influence on lynx populations. National Forest lands account for less than 20% and 7% of lynx habitat in the Great Lakes and Northeast geographic areas, respectively. Thus, Forest Plans have limited impact on lynx populations in the east, with the exception of connectivity issues. Of FS lynx habitat, substantive portions are in nondevelopmental land allocations where natural processes predominate.

The final rule concluded that the relative importance of each region to the persistence of the contiguous United States DPS varies. The Northern Rockies and the Cascades together support the largest amount of lynx habitat and records provide strong evidence of persistence of resident lynx populations, both historically and currently. In the Northeast (where resident lynx populations continue to persist) and Southern Rockies regions, the amount of lynx habitat is naturally limited and does not contribute substantially to the persistence of the contiguous United States DPS. Much of the habitat in the Great Lakes Region is naturally marginal, may not support prey densities sufficient to sustain lynx populations, and does not currently contribute substantially to the persistence of the contiguous United States DPS. Collectively, the Northeast, Great Lakes, and Southern Rockies do not constitute a significant portion of the range of the DPS.

The final rule concluded that the Northern Rockies/Cascades Region is the primary area necessary to support the continued long-term existence of the contiguous United States DPS. However, the role that each region plays in the long-term conservation of the species will be explored further in recovery planning for the species. For the purposes of this consultation, the effects of all Plans affecting lynx habitat in all geographic areas will be considered.

FACTORS AFFECTING THE SPECIES ENVIRONMENT WITHIN THE ACTION AREA

Factors Identified in the Final Rule

The final rule concluded that the single factor threatening the lynx DPS is the inadequacy of existing regulatory mechanisms, specifically the lack of guidance for conservation of lynx in the Plans. The Service concluded that the lack of Plan guidance for conservation of lynx, as evidenced by the fact that Plans allow or direct actions that cumulatively adversely affect lynx (as indicated in the BA), was a significant threat to the contiguous United States DPS of lynx. Additionally, the Service identified other factors in 3 of the 4 geographic regions (Northeast, Great Lakes, Southern Rockies, and Northern Rockies/Cascades) that impact lynx, but not to levels constituting a threat to the DPS. In the Northeast, the main factor affecting lynx forest types was timber harvest on non-Federal lands, although the extent and nature of current forest practices on lynx is unknown. In the Great Lakes region, timber harvest and fire suppression on non-Federal lands also impact lynx. In the Southern Rockies, lynx may be impacted by loss of habitat connectivity resulting from high-use highways and associated suburban development.

Land Management Authorities

National Forest Management Act regulations (36 CFR 219.19) provide the following direction to the Forest Service, ``Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species." The Federal Land Policy and Management Act (43 USC 1701, as amended) provides similar guidance to the BLM: ``the public lands [shall] be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use."

The lynx has been listed as a sensitive species by both agencies. FS policy (FMS 2670.32) is to ``avoid or minimize impacts to sensitive species; if impacts cannot be managed to maintain viable populations, a decision must not result in loss of existing native and desired non-native vertebrate species viability or create a significant trend toward Federal listing." The BLM policy [6840.06(D)] affords sensitive species the same level of protection given to species listed as candidate species by the Service. However, there is no regulatory mandate or accountability for implementation of these policies.

As described previously, the final rule identified the single factor threatening the contiguous United States DPS of lynx as the inadequacy of existing regulatory mechanisms, specifically the lack of guidance provided in the Plans for avoiding adverse impacts to lynx and for the conservation of lynx on FS and BLM administered lands. Federal lands encompass a preponderance of lynx habitat, especially in the western States. Thus, it is imperative that Federal land management practices maintain lynx habitat and the prey upon which lynx depend. Many of the existing Plans have general provisions for conservation/management of wildlife and

wildlife habitats, but very few specifically address lynx. Plans that specifically address have not incorporated the Science Report or LCAS, now considered to be the most current knowledge regarding lynx conservation.

Risk Factors Within Federal Authority and Jurisdiction

Lands under Federal management are clearly necessary to lynx conservation locally, or regionally, especially in the western United States In each region, Federal lands account for some lynx habitat and therefore Federal land management has the potential to adversely affect lynx. Therefore, the Lynx Biology Team identified potential risk factors to lynx that are within the authority and jurisdiction of the Federal land management agencies (Table 2) . Relevant risk factors were discussed in the LCAS at each of four spatial scales: range-wide, specific geographic areas, planning area, and home range. Some or all or these risk factors occur in each lynx geographic area.

Table 2. Lynx risk factors (from Ruediger et al. 2000).

I. Factors affecting lynx productivity
   A. Timber management
   B. Wildland fire management
   C. Recreation
   D. Forest/backcountry roads and trails
   E. Livestock grazing
   F. Other human developments (oil and gas leases, mines, reservoirs, agriculture)
II. Factors affecting lynx mortality
   A. Trapping (legal or non-target)
   B. Predator control
   C. Incidental or illegal shooting
   D. Competition and predation as influenced by human activities
   E. Highways (vehicular collisions)
III. Factors affecting lynx movements
   A. Highways, railroads, and utility corridors
   B. Land ownership pattern
   C. Ski areas and large resorts
IV. Other large-scale risk factors
   A. Fragmentation and degradation of lynx refugia
   B. Lynx movement and dispersal across shrub-steppe habitats
   C. Habitat degradation by non-native invasive plant species

Current Non-Federal Regulatory and Conservation Mechanisms within the Action Area

Most States across the range of the lynx have laws and regulations regarding environmental issues that may indirectly promote the conservation of lynx habitat on non-Federal lands. Many States have also classified the lynx as State-listed or species of special concern. States across

lynx range in the contiguous United States protect lynx from legal harvest (Table 3). Protection from legal harvest represents a significant conservation benefit to the lynx DPS.

Table. 3. Status of lynx by State classification.

Maine	Species of Special Concern, 1997
New Hampshire	State-listed Endangered, 1980
Vermont	State-listed Endangered, 1972
New York	Protected from harvest, 1967
Michigan	State-listed Endangered, 1987
Wisconsin	Protected Wild Animal, 1998
Minnesota	Protected from harvest, 1984
Montana	Protected from harvest, 1999
Idaho	Species of Special Concern, protected from harvest, 1997
Washington	State-listed Threatened, 1993
Oregon	Not considered resident
Wyoming	Species of Special Concern
Colorado	State-listed Endangered, 1976
Utah	State-listed Sensitive

For most States, there is no regulatory protection in addition to closed trapping seasons for species listed as State-sensitive, special concern, threatened or endangered. Because most conservation actions are voluntary under these designations, no assurance of habitat protection can be attributed to State species designations.

EFFECTS OF THE ACTION

FACTORS TO BE CONSIDERED

The proposed action is to continue FS and BLM implementation of the current Plans in conjunction with the FS and BLM CAs, interrelated actions. In assessing the effects of the action, one factor considered by the Service is that the Federal agencies chose a conservative approach in determining whether existing Plans might result in adverse affects to lynx. For the BA, effects determinations were based on what the Plans permit or prohibit, not on a quantitative assessment of the effects to lynx of actions as a result of past or current implementation of the Plans. In other words, the BA assessed primarily the language or direction in the Plans, rather than the realized effects of implementation of the Plans. Many activities allowed by the current Plans are never carried out for a variety of reasons, such as funding limitations and environmental or policy considerations. For example, many Plans allow timber harvest. However, timber harvest levels on Federal lands across the western United States have declined consistently and dramatically (approximately 80 percent) over the past decade or longer (R. Gay, United States Forest Service, in litt. 1999). The same trend holds in forest types that provide lynx habitat (B. Bollenbacher, U.S. Forest Service, in litt. 1999; B. Ferguson, U.S. Forest Service, pers. comm. 1999; F. Zenson, U.S. Forest Service, pers. comm. 1999; B. Short, U.S. Forest Service, in litt. 1999). Future implementation of the Plans as currently written is partly dependent on political, economic, and local considerations.

Additionally, an analysis of the effects of Plans on lynx populations must include consideration of the proportion of lynx habitat managed by the FS, the BLM, and private owners (see Environmental Baseline section). The BA indicated the the BLM manages no lynx habitat in the east, and a very small proportion of lynx habitat (5% or less) in the west (see Environmental Baseline section). The FS manages the preponderance of lynx habitat in the west and therefore FS management has the potential to impact lynx populations in western geographic areas. Although BLM management may not impact lynx populations within western geographic regions (with the exception of potential connectivity issues), BLM Plans may result in localized impacts on lynx. In the east, FS Plans influence a much smaller proportion of lynx habitat than in the west. Private lands account for the majority of lynx habitat in the east. However, considering the information in the final rule related to the relative importance of each geographic area to conservation of the lynx DPS, FS Plans assume the substantive influence on this jeopardy analysis.

The CAs are also factors important to this assessment. The CAs identify the actions the signatories agree to take to reduce or eliminate adverse effects or risks to the species and its habitat, and to maintain the ecosystems upon which lynx depend. The CAs do not change current Plan direction, but for an interim period, affect priorities for selecting and implementing management actions. The CAs commit the agencies to consider the information and recommendations in the Science Report, the LCAS, and the Service's final listing document as projects are evaluated, selected, and implemented. The FS CA directs that the implementation of all proposed actions that may adversely affect lynx, and do not involve third parties, be deferred (i.e. postponed) until Plans are amended or revised to consider the needs of lynx. The

CAs further commit both agencies to including measures necessary to conserve lynx into the Plans for all administrative units identified as having lynx habitat, considering the information and recommendations in the Science Report, the LCAS, and the Service's final listing document. The CAs stipulate that any necessary changes in these Plans will be made through amendments, revisions, or other appropriate mechanisms consistent with laws, regulations, and policies. The conclusions in this biological opinion are based on the anticipated effects of implementing the Plans in accordance with the CAs.

Another factor considered is our limited knowledge of lynx ecology specific to the contiguous United States. Uncertainty exists regarding the level and type of effects that land use management decisions at both project and programmatic levels may have on the contiguous United States lynx DPS. Land management plans should thus be conservative in their retention of known important lynx habitat components (McKelvey et al. 2000a).

In the face of these uncertainties and knowledge gaps, the Service, FS, BLM, and NPS accumulated available information on lynx through development of the Science Team Report and the LCAS. These efforts demonstrate a commitment by the Federal action agencies to improve our knowledge of lynx ecology and to develop and implement appropriate management plans to conserve lynx.

ANALYSIS OF EFFECTS OF THE PROPOSED ACTION

The BA Team considered the aforementioned risk factors (in the Environmental Baseline section) in designing and conducting the analysis of existing Plan direction. The assessment addressed three spatial scales: the largest scale was the lynx DPS, the intermediate scale was the geographic area, and the local scale was the administrative unit. The BA examined individual Plans to determine how well they directly or indirectly provide for lynx conservation, based on 15 evaluation criteria: denning habitat, foraging habitat, habitat conversions, thinning, fire management, landscape patterns, forest roads, developed recreation, non-winter dispersed recreation, winter dispersed recreation, minerals and energy, connectivity, land adjustments, coordination, and monitoring.

The FS and BLM chose a conservative approach to analyzing the Plans. There was no attempt to weight or prioritize the 15 criteria. If at least one of the 15 criteria was ``likely to adversely affect'' the lynx, this was the determination for the Plan as a whole. Using this method, the BA determined that continued implementation of the Plans ``may affect, and are likely to adversely affect'' the lynx, due to the lack of protective direction to address all 15 criteria evaluated.

As mentioned previously, the analysis in the BA did not consider the effects of implementing current Plans under the CAs. Here, our analysis will include consideration of the effects of implementing current Plans as influenced by the provisions of the CAs, considered interrelated actions. The FS and BLM are implementing the provisions of the CAs for all ongoing and new projects.

Further, our analysis will assess the sufficiency of the LCAS to provide programmatic direction and guidance for incorporation into Plans. Thus, in the future, if the revision or amendment of the Plans include the substantive direction, objectives, standards and guidelines in the LCAS, or the equivalent thereof, this consultation and the information that supports it shall be pertinent to the consultation that occurs for the amendment/revision process.

BA Summary of the Effects of Plans on Lynx at the Geographic Scale

The BA used 15 criteria to assess the risk of adverse effects to lynx by one of the following: 1) reduction in habitat quality or quantity, 2) habitat fragmentation contributing to loss of connectivity, 3) improved access for competing carnivores, or 4) direct mortality to lynx. There was no attempt to weight or prioritize the 15 criteria. If at least one of the 15 criteria was ``likely to adversely affect'' the lynx, this was the determination for the Plan as a whole. Using this method, the BA determined that continued implementation of the Plans ``may affect, and are likely to adversely affect'' the lynx, due to the lack of protective direction to address all 15 criteria evaluated.

While most Plans directly or indirectly incorporate some positive measures for lynx, the BA includes the following conclusions regarding the Northeast, Great Lakes, Northern Rockies, Southern Rockies, and Cascades geographic regions:

$ The Great Lakes geographic area gives weak direction to provide denning habitat, coupled with a high percentage of the geographic area in developmental allocations.

$ Plans in the Great Lakes geographic area lack direction to provide a mix of forest species and age classes across the landscape needed for lynx foraging. Plans in the Northern Rockies, Southern Rockies, and Northeast geographic areas may risk adversely affecting lynx foraging habitat by allowing type conversions and because of limited direction pertaining to [precommercial] thinning. Limited thinning direction also exists in portions of the Cascades geographic area. However, in the Cascades, even though thinning may site-specifically reduce foraging habitat and affect individual lynx, foraging habitat is anticipated to be adequate to sustain lynx subpopulations.

$ Plans within the Northern Rockies, Southern Rockies, and Northeast geographic areas generally direct an aggressive fire suppression strategy within developmental land allocations. While understandable in terms of protection of resources and property, this strategy may be limiting the availability of foraging habitat within these areas.

$ Plans within the Southern Rockies, Great Lakes, and portions of the Northeast geographic areas provide weak direction for distributing lynx habitat components across the landscape.

$ Plans within portions of the Northern Rockies, Southern Rockies, Great Lakes, and within the Northeast geographic areas allow levels of human access via forest roads that may present a risk of incidental trapping or shooting of lynx or access by other competing carnivores. The risk of road-related adverse affects is primarily a winter season issue.

$ Plans within the Northern Rockies, Southern Rockies, and Northeast geographic areas are weak in providing guidance for new or existing recreation developments.

$ Plans within all geographic areas allow both mechanized and non-mechanized recreation that may contribute to a risk of adverse effects to lynx. Potential effects occur by allowing compacted snow trails and plowed roads which may facilitate the movements of lynx competitors and predators.

$ Plans within portions of the Northern Rockies and within the Southern Rockies, Great Lakes, and Northeast geographic areas provide weak direction for maintaining habitat connectivity within naturally or artificially fragmented landscapes. Plans within all geographic areas lack direction for coordinating construction of highways and other movement barriers with other responsible agencies.

$ Plans within the Northern Rockies, Southern Rockies, Great Lakes, and Northeast geographic areas are weak in providing direction for coordinating management activities with adjacent landowners and other agencies to assure consistent management of lynx habitat across the landscape.

$ Plans within all geographic areas except the Northeast fail to provide direction for monitoring lynx, snowshoe hares, and their habitats. While failure to monitor does not directly result in adverse effects, the detection and assessment of adverse effects from other management activities are consequently difficult or impossible to ascertain.

$ For all geographic areas, forest management has reduced the area where natural ecological processes were historically allowed to occur, thereby increasing the area affected by known risk factors to lynx. The Plans have continued this trend. The Plans have also continued the process of fragmenting habitat and reducing its quality and quantity. Consequently, the Plans may contribute to a reduction in the geographic range of lynx.

Effects of Plans in Conjunction with the CAs, Based on the 15 Criteria in the BA

As mentioned earlier, the CAs affect the realized implementation of the Plans in several ways. The effects of the Plans on lynx are realized by the effects of all actions conducted under the Plans. Key to this analysis are the CAs' requirement that all proposed actions must be evaluated using the information and recommendations in the LCAS and Science Report. If the evaluation results in a determination that a proposed action is likely to adversely affect lynx, the FS CA commits the FS to deferring (postponing) implementation of that action (where no third parties are involved). This requirement substantively reduces the potential for actions developed under existing Plan direction to adversely affect lynx on the majority of Federal lands.

The BLM CA does not require deferral of those proposed projects that may adversely affect lynx. However, in these instances, as well as in cases where third parties are involved in FS actions that may adversely affect lynx, formal section 7 consultation would occur. Further, the

Service acknowledges that the CAs commit both the BLM and FS to undertake pro-active management actions to benefit lynx, based on the LCAS, to the extent they are consistent with current Plans. The LCAS and Science Report are currently being used as information sources (U.S. Forest Service, in litt. 2000c). The LCAS is being considered in the design of new projects to the extent that project design is in compliance with existing Plans. This is a substantive influence on the actual effects on lynx imparted by the current Plans.

The CAs therefore lessen the potential negative effects of existing Plans. The following discussion summarizes the possible adverse effects of the Plans identified in the BA related to each criterion. The discussion will then also identify the relevant direction contained in the LCAS that will influence Plan implementation under provisions of the CAs. Finally, the analysis evaluates the sufficiency of the direction contained in the LCAS to provide Plan direction that would avoid adverse effects and achieve conservation of lynx.

This biological opinion assumes that, in accordance with the CAs, the agencies will consider all of the conservation measures identified in the LCAS. Note that the following discussion does not provide an exhaustive list of all pertinent conservation measures (objectives, standards, guidelines). Rather, the nature and scope of direction contained in the LCAS is portrayed to provide an understanding of the sufficiency of LCAS direction to: (1) remedy the adverse effects on lynx imparted by current Plan direction as presented in the BA; and (2) provide adequate Plan direction to conserve lynx if incorporated during future amendments or revisions.

The criteria used by the BA are listed first, followed by evaluation. Note that an additional 3 items are added at the end of this section. These are 3 factors identified as potential risks in the LCAS, but not evaluated in the BA. They are included here as part of the analysis of the sufficiency of the LCAS to provide Plan direction.

1.) Denning Habitat: Denning habitat is used for parturition and rearing of young. The common component of denning habitat appears to be large amounts of coarse woody debris (Koehler 1990; Staples 1995). This structure must be available throughout the home range, in or adjacent to foraging habitat. Vegetation management activities such as salvage harvesting and prescribed fire may remove existing coarse woody debris and/or affect its recruitment.

Possible adverse effects of Plans identified in the BA: Timber harvest and fire management activities can directly affect the quality and quantity of available lynx denning habitat. Removal of coarse woody debris by salvage harvesting and prescribed fire may affect the survival of lynx kittens.

Within nondevelopmental land allocations (e.g., wilderness, roadless, late successional reserves) in all geographic areas, the BA concluded that denning habitat would likely be maintained at or above levels that occurred historically. Within developmental land allocations, existing Plan direction to maintain old growth habitat was judged to be adequate to provide for lynx denning habitat in for all geographic areas except the Great Lakes. In the Great Lakes Geographic Area, the BA concluded that lack of Plan direction coupled with the high percentage of land in developmental allocations (59 %) may result in adverse effects related to denning habitat.

Relevant Direction Contained in the LCAS: Conservation measures specific to denning habitat are found in the LCAS in sections Conservation Measures Applicable to All Programs and Activities, I.A. Timber Management, I.B. Wildland Fire Management, and I.C. Recreation Management, on pages 77-83. The LCAS provides the following types of direction:

> Inventory: Lynx habitat, including potential denning habitat, is to be mapped within all involved National Forests and BLM units [standard, applicable to all programs and activities].
>
> Amount and Distribution of Habitat**:** The minimum amount (at least 10% of the area that is capable of producing stands with these characteristics within a LAU) and patch size (generally larger than 5 acres) of denning habitat to be maintained within lynx habitat are specified [standard, timber management].
>
> Guidance for Management Activities:
> - Vegetation and fire management activities are to be designed to retain, restore or recruit adequate denning habitat [objective, wildland fire management].
> - Timber management practices are addressed, and salvage harvesting is specifically subject to certain restrictions in areas that could contribute to lynx denning habitat [standard, timber management].
> - Methods for recruiting additional denning habitat are recommended [guidelines, timber management].
> - Following a large wildfire, an assessment of the potential for lynx denning habitat is to be conducted prior to salvage harvest [standard, wildland fire management].
> - Burn prescriptions and, where feasible, fire suppression actions are to be conducted in a manner that maintains adequate lynx denning habitat [guideline, wildland fire management].

The BA concluded that, in most geographic areas, denning habitat is not likely limiting to lynx, and existing Plan direction will not result in adverse effects. The exception was the Great Lakes Geographic Area.

2.) Foraging Habitat: The primary prey of lynx is snowshoe hare. Within the forest types that support snowshoe hare, certain successional stages and stand structures are favored, with dense horizontal cover being the key component (Wolfe et al. 1982; Litvaitis et al. 1985; Sievert and Keith 1985; Fuller and Heisey 1986; Thomas et al. 1997; Sullivan and Sullivan 1988; Hodges 2000a,b). Dense horizontal cover of conifers, just above snow level in winter, is critical for snowshoe hares. Available literature suggests that red squirrel is the most important alternate prey species throughout most of the range of the lynx, although a diet of this species alone likely is not adequate to ensure lynx reproduction and survival of kittens (O'Donoghue et al. 1988; Koehler 1990; Apps 2000).

*Possible Adverse Effects of Plans Identified in the BA***:** Timber and wildland fire management activities modify vegetation structure and mosaics of forested landscapes, and thereby affect the habitat of lynx prey. Within nondevelopmental land allocations in all geographic areas, the BA

stated that lynx foraging habitat is likely to be maintained at a level somewhat less than the level provided under natural disturbance regimes. Within developmental allocations within the Northern Rocky Mountains, Southern Rocky Mountains and the Northeast, the BA found that Plans provide an inadequate strategy and direction to maintain foraging habitat for lynx and may result in adverse effects. Within the Great Lakes Geographic Area, past timber harvest practices converted forests to less suitable types on a broad scale, and current Plans tend to perpetuate this condition.

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address foraging habitat are found in Conservation Measures applicable to All Programs and Activities, I.A. Timber Management, and I.B. Wildland Fire Management, and I.B. Recreation Management, on pages 77-83. The LCAS emphasizes monitoring and production of snowshoe hares, and contains the following types of direction.

> Inventory: Lynx foraging habitat (primarily snowshoe hare habitat, but also habitat for important alternate prey such as red squirrels) will be mapped within all involved National Forests and BLM units [standard, applicable to all programs and activities].
>
> Amount and Distribution of Habitat: A broad-scale assessment of landscape patterns that compares historical and current ecological processes and vegetation patterns, such as age-class distributions and patch size characteristics is to be prepared. In the absence of guidance developed from such an assessment, limit disturbance within each LAU as follows: if more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no further reduction of suitable conditions shall occur as a result of vegetation management activities by Federal agencies [standard, applicable to all programs and activities].
>
> In addition, timber management actions (e.g., timber sales, salvage sales) shall not change more than 15 percent of lynx habitat within a LAU to an unsuitable condition within a 10-year period [standard, timber management].
>
> Guidance for Management Activities:
> - Maintain suitable acres and juxtaposition of lynx habitat through time [objective, timber management].
> - Design vegetation treatments to develop characteristics suitable for snowshoe hare, and to retain/enhance existing habitat conditions for important alternate prey (particularly red squirrel) [objectives, timber management].
> - In lynx habitat, pre-commercial thinning will be allowed only when stands no longer provide snowshoe hare habitat [standard, timber management].
> - Methods for recruiting additional foraging habitat are recommended [guidelines, timber management].
> - Lynx habitat objectives are to be integrated into fire management plans [objective, wildland fire management].
> - Design of ski area expansions should maintain snowshoe hare habitat [guideline, recreation management].

Monitoring: Distribution and abundance of snowshoe hares across the range of lynx is identified as a priority for monitoring efforts (page 93).

In the southern portion of its range, lynx populations appear to be naturally limited by the availability of snowshoe hare prey, as suggested by large home range sizes, high kitten mortality due to starvation, and greater reliance on alternate prey, especially red squirrels, as compared with populations in northern Canada. Dense horizontal cover of conifers, just above the snow level in winter, is critical for snowshoe hare habitat. The LCAS encourages vegetation management practices that will maintain or enhance habitat for snowshoe hare and alternate prey such as red squirrel.

3. Habitat Conversions: Forest management activities can result in conversion of vegetation types. For example, silvicultural prescriptions might be designed to change species composition to favor western larch, which has a high economic value, at the expense of lodgepole pine, which has low economic value but provides better winter habitat for snowshoe hare. This kind of type conversion could reduce lynx foraging habitat.

Possible Adverse Effects of Plans Identified in the BA: Plans in the Northern Rockies, Southern Rockies, and Northeast geographic areas allow type conversions and Plans allow this to potentially occur on a large percentage of the land. In the Great Lakes geographic area, conversion from more desirable to less desirable habitats has already occurred in many areas (for example, replacing conifer and mixed conifer-hardwood stands with aspen stands managed for pulpwood production).

Relevant Direction Contained in the LCAS: As described previously, conservation measures in the LCAS that address foraging habitat are presented in sections Conservation Measures applicable to All Programs and Activities, I.A. Timber Management, and I.B. Wildland Fire Management, I.B. Recreation Management, on pages 77-83. Direction related more specifically to type conversions includes the following types of protection.

Amount and Distribution of Habitat: A broad-scale assessment of landscape patterns that compares historical and current ecological processes and vegetation patterns, such as age-class distributions and patch size characteristics is to be prepared. In the absence of guidance developed from such an assessment, limit disturbance within each LAU as follows: if more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no further reduction of suitable conditions shall occur as a result of vegetation management activities by Federal agencies [standard, applicable to all programs and activities].

Guidance for Management Activities:
- Maintain suitable acres and juxtaposition of lynx habitat through time. Design vegetation treatments to approximate historical landscape patterns and disturbance processes [objective, timber management].
- Management practices are to be adjusted to produce forest composition, structure, and patterns more similar to those that would have occurred under historical disturbance regimes [objective, timber management].

- In the Great Lakes geographic area, tree species composition and structure are to be restored so that fire can be returned to the ecosystem, where feasible [objective, wildland fire management].

The BA indicated that direction to restore historical vegetation patterns could be beneficial in the Great Lakes Geographic Area, where large areas were converted.

4.) Thinning**:** As described above for Foraging Habitat, precommercial thinning can reduce horizontal cover that is critical to maintain the snowshoe hare prey base.

Possible Adverse Effects of Plans Identified in the BA: In the southern portion of the range of lynx in the contiguous United States, lynx populations appear to be naturally limited by the availability of snowshoe hare prey, as evidenced by large home range size, high kitten mortality due to starvation, and greater reliance on alternate prey (Aubry et al. 2000). Thinning of young dense stands could adversely affect lynx by reducing foraging habitat.

Thinning is not expected to occur within nondevelopmental land allocations. Within developmental allocations, Plans are generally weak in providing compatible direction for thinning in relation to lynx habitat, and there is a potential for this activity to occur over broad areas. Thus, there was a risk of adverse effects from thinning identified in all geographic areas, although this is of lesser significance in the Great Lakes due to extensive conversion to aspen and birch stands that has already occurred.

*Relevant Direction Contained in the LCAS***:** Conservation measures in the LCAS that address thinning are found in Conservation Measures applicable to All Programs and Activities, I.A. Timber Management, and I.B. Wildland Fire Management, on pages 77-83. The following types of direction are contained in the LCAS:

Amount and Distribution of Habitat: A broad-scale assessment of landscape patterns that compares historical and current ecological processes and vegetation patterns, such as age-class distributions and patch size characteristics is to be prepared. In the absence of guidance developed from such an assessment, limit disturbance within each LAU as follows: if more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no further reduction of suitable conditions shall occur as a result of vegetation management activities by Federal agencies [standard, applicable to all programs and activities].

Guidance for Management Activities:
- Maintain suitable acres and juxtaposition of lynx habitat through time. Design vegetation treatments to approximate historical landscape patterns and disturbance processes [objectives, timber management].
- In lynx habitat, pre-commercial thinning will be allowed only when stands no longer provide snowshoe hare habitat [standard, timber management].
- Improvement harvests (commercial thinning, selection, etc.) should be designed to retain and improve recruitment of an understory of small diameter conifers and shrubs preferred by hares [guideline, timber management].

Monitoring: The LCAS recommends monitoring to provide a better understanding of the relationships between precommercial thinning and snowshoe hare habitat.

The LCAS would clearly preclude precommercial thinning in lynx habitat and thereby reduce the potential for degradation of existing snowshoe hare habitat caused by precommercial thinning. Conservation measures also assure that thinning would not degrade currently suitable lynx foraging habitat.

5). Fire Management: In the Great Lakes Geographic Are and the western United States, fire historically played an important role in maintaining the mosaic of forest successional stages that provide habitat for both snowshoe hare and lynx (Fox 1978; Bailey et al. 1986; Quinn and Thompson 1987; Koehler and Brittell 1990; Poole et al. 1996; Slough and Mowat 1996). Periodic vegetation disturbances maintain the snowshoe hare prey base for lynx. In the period immediately following large stand-replacing fires, snowshoe hare and lynx densities are low. Populations increase as the vegetation grows back and provides dense horizontal cover, until the vegetation grows out of the reach of hares. Low to moderate intensity fires may also stimulate understory development in older stands.

Possible Adverse Effects of Plans Identified in the BA: Fire exclusion may have altered the pattern and composition of vegetation in boreal forests. Within nondevelopmental land allocations, natural processes are expected to predominate. In these areas, fire could have a significant role in creating natural mosaics of vegetation, except in the Great Lakes Geographic Area, where Plans have strong fire suppression direction. Within the developmental allocations, aggressive fire suppression direction in many Plans may limit the creation of foraging habitat and creates a risk of adverse effects.

Relevant Direction Contained in the LCAS: Conservation measures that address wildland fire management are found in Conservation Measures applicable to All Programs and Activities, I.A. Timber Management, and I.B. Wildland Fire Management, on pages 77-81. The following types of direction are included in the LCAS:

Amount and Distribution of Habitat: A broad-scale assessment of landscape patterns that compares historical and current ecological processes and vegetation patterns, such as age-class distributions and patch size characteristics is to be prepared. In the absence of guidance developed from such an assessment, limit disturbance within each LAU as follows: if more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no further reduction of suitable conditions shall occur as a result of vegetation management activities by Federal agencies [standard, applicable to all programs and activities].

Guidance for Management Activities:
- Restore fire as an ecological process in lynx habitat [objective, wildland fire management].
- Revise or develop fire management plans to integrate lynx habitat objectives [objective, wildland fire management].

- Design burn prescriptions in lynx habitat to regenerate or create snowshoe hare habitat [standard, wildland fire management].
- Guidance is provided to minimize impacts on lynx habitat during fire suppression actions [guidelines, wildland fire management].

The LCAS promotes the use of fire as a tool to maintain or restore lynx habitat and would influence the planning and design of vegetation management projects, including prescribed burning.

6). Landscape Patterns**:** Lynx use a variety of forest age and structure classes within dynamic forest ecosystems. Late seral forests provide denning habitat and produce red squirrels, while snowshoe hares generally reach highest abundance in younger seral stages. The spatial and temporal interspersion of habitat is influenced both by natural disturbance events, such as wind and wildland fire, and by vegetation management activities, including timber harvest and prescribed fire. Because lynx occur at low densities and occupy large home ranges, conservation objectives cannot be achieved on small parcels of land (McKelvey et al. 2000a).

Possible Adverse Effects of Plans Identified in the BA: This was identified as a critical issue in the Northeast Geographic Area, due to the fragmented ownership pattern, resulting in a risk of adverse effects. In the Southern Rocky Mountains, due to high natural fragmentation and weak Plan direction, a risk of adverse effects was identified. In the Great Lakes, weak Plan direction to maintain suitable vegetation patterns also led to a risk of adverse effects.

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address landscape patterns are found in Conservation Measures applicable to All Programs and Activities, I.A. Timber Management, and I.B. Wildland Fire on pages 77-81. The following types of direction are included.

Amount and Distribution of Habitat: A broad-scale assessment of landscape patterns that compares historical and current ecological processes and vegetation patterns, such as age-class distributions and patch size characteristics is to be prepared. In the absence of guidance developed from such an assessment, limit disturbance within each LAU as follows: if more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no further reduction of suitable conditions shall occur as a result of vegetation management activities by Federal agencies [standard, applicable to all programs and activities].

Guidance for Management Activities:
- Design vegetation management strategies that are consistent with historical succession and disturbance regimes [objective, applicable to all programs and activities].
- Maintain suitable acres and juxtaposition of lynx habitat through time [objective, timber management].
- Lynx habitat objectives are to be integrated into fire management plans [objective, wildland fire management].

The LCAS would promote the development of landscape patterns that maintain or restore lynx habitat.

7.) Forest Roads: Lynx have been documented using less-traveled roadbeds for travel and foraging Parker 1981; Koehler and Brittell 1990). A recent analysis of the Okanogan National Forest in Washington indicated that lynx show no preference or avoidance of unpaved forest roads, and that road density does not appear to affect lynx habitat selection (McKelvey et al. 2000c). Forest/ backcountry roads and trails may facilitate snowmobile use and other snow-compacting activities, which may provide competing predators access into lynx habitat during the critical winter period.

Recreational, administrative, and commercial uses of forest roads are known to disturb many species of wildlife (Ruediger 1996). However, preliminary information suggests that lynx do not avoid roads (Ruggiero et al. 2000b), except at high traffic volumes (Apps 2000). The effects of new forest road construction in lynx habitat are largely unknown.

Possible Adverse Effects of Plans Identified in the BA: The BA assumed that lack of standards restricting road density and winter road use would have negative effects on lynx. Road-related effects were primarily a winter season concern. A risk of adverse effects was identified for the Northern Rocky Mountain, Southern Rocky Mountain, Great Lakes, and Northeast Geographic Areas, due to generally weak Plan direction.

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address roads and trails are in I.D. Forest/ Backcountry Roads and Trails are found on page 83, and include the following:

> Guidance for Management Activities:
> - Maintain the natural competitive advantage of lynx in deep snow conditions [objective, forest/backcountry roads and trails].
> - Allow no net increase in groomed or designated over-the-snow routes and snowmobile play areas within lynx habitat on Federal lands [standard, forest/backcountry roads and trails].
> - Minimize building of roads directly on ridgetops [guideline, forest/backcountry roads and trails].
> - Determine where high total road densities coincide with lynx habitat, and consider prioritizing road restrictions or reclamation in those areas [guideline, forest/backcountry roads and trails].

The identified effects of roads were largely focused on winter access into lynx habitat. The LCAS would reduce the potential for increases in snow compaction that could allow competitors into lynx habitat that would otherwise have been inaccessible.

8.) Developed Recreation: Most investigations indicate that lynx do not alter their behavior to avoid human activities (Staples 1995; Roe et al. 1999; Aubry et al. 2000; Mowat et al. 2000). The exception may be activities that may cause abandonment of a den site, possibly affecting kitten survival (Ruggiero et al. 2000). However, large developed sites, such as four-season

resorts, may alter habitats and fragment the landscape. Developed recreation sites such as ski areas and warming huts may encourage snow compaction in lynx habitat.
Possible Adverse Effects of Plans Identified in the BA: Recreational developments are generally not expected to occur within nondevelopmental land allocations. Potential effects of major developments such as ski areas or resorts include loss of suitable habitat and impeding lynx movements. The prominence of this type of development is greatest in the Southern Rocky Mountains. Risk of adverse effects were identified for the Northern Rocky Mountain, Southern Rocky Mountain, and Northeast Geographic Areas due to the amount of this type of activity and generally weak Plan direction.

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address developed recreation are found in I.B. Recreation Management, II.D. Competition and Predation..., and III.C. Ski Areas/Large Resorts..., on pages 82-83, 86, and 89-90. The following types of direction are contained in the LCAS:

> Guidance for Management Activities:
> - Concentrate recreational activities within existing developed areas, rather than developing new recreational areas within lynx habitat [objective, recreation management].
> - Minimize snow compaction in lynx habitat [objective, recreation management].
> - Ensure that Federal actions do not degrade or compromise landscape connectivity when planning and operating new or expanded developments, and ensure that key linkage areas are protected habitat [standard, recreation management].
> - Ski area expansions should be designed to maintain snowshoe hare habitat [guideline, recreation management].
> - Evaluate, and adjust as necessary, ski area operations in expanded or newly developed areas to provide for nocturnal foraging opportunities habitat [guideline, recreation management].
>
> Monitoring: Additional information needs on the interrelationships between lynx and other carnivores during deep snow periods, and the influence of compacted snow routes on interspecific competition are identified in the LCAS.

The LCAS would provide direction for the design, operation and expansion of developed recreation sites.

9.) <u>Non-winter Dispersed Recreation:</u>

Possible Adverse Effects of Plans Identified in the BA: The BA explained that due to the low susceptibility of lynx to displacement by humans, this activity presents low risk of adverse effects except possibly for disturbance near den sites. Because Plans in the Cascades, Northern Rockies, Southern Rockies, and the Northeast geographic areas generally provide for adequate and widely distributed denning habitat, no adverse effects were identified related to non-winter dispersed recreation (BA pages 63, 70-71, 78,and 91). In the Great Lakes geographic area, availability of denning habitat is of concern (BA page 85).

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address non-winter dispersed recreation are found on page 82, I.B. Recreation Management, and include the following:

Guidance for management activities:
- Concentrate recreational activities within existing developed sites, rather than developing new recreational areas within lynx habitat [objective, recreation management].
- Ensure that Federal actions do not degrade or compromise landscape connectivity when planning and operating new or expanded developments [standard, recreation management].

It is unlikely that non-winter dispersed recreation activities would affect lynx. The LCAS would further minimize the possibility of disturbance at den sites.

10.) Winter Dispersed Recreation: Dispersed recreational uses and activities, such as snowmobiling, cross-country skiing, and snowshoeing are increasing within higher elevation environments. Buskirk et al. (2000) hypothesize that the usual spatial segregation of lynx and coyotes conditions (Murray and Boutin 1991; Litvaitis 1992; Murray et al. 1994) may break down where snow compaction facilitates access by coyotes to deep snow areas. The distribution and numbers of coyotes have expanded in recent decades (Fuller and Kittredge 1996).

Possible Adverse Effects of Plans Identified in the BA: This activity may occur in both developmental and nondevelopmental land allocations, although motorized recreation is generally not expected to occur within nondevelopmental allocations. These activities may provide packed trails that allow competitors to more easily enter lynx habitat. The overall lack of direction was found to result in a risk of adverse effects across all geographic areas.

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address winter dispersed recreation are found in I.B. Recreation Management, I.D. Forest/Backcountry

Roads and Trails, and II.D. Competition and Predation...,on pages 82-83 and 86, and include the following:

Guidance for Management Activities:
- Maintain the natural competitive advantage of lynx in deep snow conditions [objective, forest/backcountry roads and trails].
- Allow no net increase in groomed or designated over-the-snow routes and snowmobile play areas within lynx habitat on Federal lands [standard, recreation management].
- Concentrate recreational activities within existing developed areas, rather than developing new recreational areas within lynx habitat [objective, recreation management].
- Evaluate and amend as needed, winter recreation special use permits that promote snow-compacting activities in lynx habitat [standard, recreation management].
- Provide a landscape with interconnected blocks of foraging habitat where snowmobile, cross-country skiing, snowshoeing or other snow-compacting activities are minimized or discouraged [guideline, recreation management].

Inventory and Monitoring: Map and monitor the location and intensity of snow compacting activities that coincide with lynx habitat [standard, recreation management].

Additional information needs on the interrelationships between lynx and other carnivores during deep snow periods, and the influence of compacted snow routes on interspecific competition are identified in the LCAS.

While dietary overlap suggests the possibility of competition between coyotes and lynx (Staples 1995; O'Donoghue et al. 1998b), there are no data available that demonstrate that coyote competition currently is negatively affecting lynx populations. The LCAS would limit the expansion of winter dispersed recreation activities within lynx habitat until more conclusive information is available.

11.) Minerals and Energy: Mining and energy development may directly impact habitat and can promote recreational activity into certain areas. The primary effects of leases and mines on lynx are probably related to the potential for plowed roads to provide access for lynx competitors, particularly coyotes.

Possible Adverse Effects of Plans Identified in the BA: Because these activities are not widespread in most geographic areas, are subject to specific laws and regulations, and effects are appropriately evaluated and mitigated site-specifically, no adverse effects attributable to the programmatic Plans were anticipated (BA pages 63, 71, 78, 85, and 92).

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address minerals and energy development are found on page 85, in I.F. Other Human Development, and include the following:

Guidance for Management Activities:
- Design developments to minimize impacts on lynx habitat [objective, other human developments].
- On projects where over-the-snow access is required, restrict use to designated routes [standard, other human developments].
- Develop stipulations for the timing of activities and surface use and occupancy within lynx habitat at the leasing stage [guideline, other human developments].
- Develop a reclamation plan for abandoned well sites and closed mines to restore lynx habitat [guideline, other human developments].

No adverse effects were anticipated in the BA as a result of current Plan direction. The LCAS measures further reduce potential for negative impacts on lynx. Site-specific mitigation may be needed to avoid adverse effects at a local level.

12.) Land Adjustments: Contiguous tracts of public lands provide an opportunity for management to maintain connectivity. Throughout most of the lynx range in the lower 48 States, maintaining connectivity of populations and habitats with Canada is an important consideration. Particularly in the Great Lakes and Northeast geographic areas, the ability to ensure habitat

connectivity is made difficult by current land ownership and land use patterns between tracts of lynx habitat occurring on National Forests.

Possible Adverse Effects of Plans Identified in the BA: The BA evaluated Plans to determine whether they contained direction to maintain or improve lynx habitat during land tenure adjustments. Plans within the Northern and Southern Rockies, Great Lakes, and Northeast were determined to be weak in addressing land adjustment issues, but these projects are uncommon and any necessary mitigation will occur at the project level. Therefore no adverse effects to lynx were anticipated as a result of Plan direction.

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address land adjustments are found on page 89, III.B. Land Ownership, and include the following:

> Guidance for Management Activities:
> - Retain lands in key linkage areas in public ownership [objective, land ownership].
> - Identify key linkage areas in management plans and prescriptions [standard, land ownership].
> - Evaluate proposed land exchanges, land sales, and special use permits for effects on key linkage areas [standard, land ownership].
> - In land adjustment programs, identify key linkage areas. Work towards unified management direction via habitat conservation plans, conservation easements or agreements, and land acquisition [guideline, land ownership].

The LCAS provides for identification and protection of key linkage zones, and provides direction to guide land adjustment programs.

13.) Connectivity: At the southern periphery of its range, lynx habitat is more fragmented, naturally or as a result of human developments, than in the core of its range in the taiga. Connected forest habitats allow lynx and other forest carnivores to move long distances to find food, cover, and mates.

Possible Adverse Effects of Plans Identified in the BA: The BA evaluated barriers to lynx movement, such as highways and major four-season resorts, and riparian area management direction. Connectivity was thought to be an important concern in the Northern Rocky Mountains, Southern Rocky Mountains, Great Lakes, and Northeast geographic areas, especially in the naturally fragmented habitats of the southern portions of the Rockies and, in the east, the non-contiguous nature of Federal lands. The weakness of Plans in addressing connectivity issues in these geographic areas contributed to a risk of adverse effects to lynx.

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address connectivity are found in Conservation Measures applicable to All Programs and Activities, I. E. Livestock Grazing, III.A. Highways, III.B. Land Ownership, and III. Ski Areas/Large Resorts..., on pages 78, 84, and 87-90. Additional discussion related to shrub-steppe habitat is found on pages 91-92. Direction in the LCAS include the following:

Guidance for Management Activities:
- Maintain habitat connectivity within and between LAUs [standard, applicable to all programs and activities].
- Identify key linkage areas that may be important in providing landscape connectivity within and between geographic areas [standard, movement and dispersal].
- Develop and implement a plan to protect key linkage areas on Federal lands from activities that would create barriers to movement [standard, movement and dispersal].
- Within the range of lynx, prepare a biological assessment for all proposed highway projects on Federal lands [standard, movement and dispersal - highways].
- Dirt and gravel roads traversing lynx habitat should not be paved or otherwise upgraded in a manner that would lead to significant increases in traffic volume, speeds, or widening of the right-of-way [guideline, movement and dispersal - highways].
- Evaluate the potential importance of shrub-steppe habitats in providing landscape connectivity [standard, movement and dispersal].
- Manage livestock grazing in riparian areas and willow carrs in lynx habitat to provide cover and forage for lynx prey [standard, grazing].

For most areas of the contiguous United States, we have no evidence that human-caused factors have significantly reduced the ability of lynx to disperse or have resulted in the loss of genetic interchange. However, we suspect that highways with high-speed, high-volume traffic and associated developments inhibit lynx home range movement and dispersal, and may contribute to loss of habitat connectivity. The LCAS addresses the identification and protection of key linkage zones and riparian areas and provides direction to maintain connectivity within and between geographic areas.

14.) Coordination: Because lynx have large home ranges and move long distances, effective management must be coordinated across different jurisdictions.

Possible Adverse Effects of Plans Identified in the BA: The BA evaluated Plans to determine whether they contained direction for coordination with nearby units and other agencies. Plans within the Northern and Southern Rockies, Great Lakes, and Northeast were determined to be weak in addressing coordination issues, and therefore contributed to a risk of adverse effects to lynx.

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address coordination are found in Conservation Measures applicable to All Programs and Activities, II.A. Trapping, III. Conservation Measures to Address Movement and Dispersal, and III.A. Highways, on pages 77, 85 and 87-89, and include the following types of direction:

Guidance for Management Activities:
- Coordinate delineation of LAUs with adjacent administrative units and State wildlife management agencies, where appropriate [guideline, applicable to all programs and activities].

- Work cooperatively with States and tribes to reduce incidental take of lynx related to trapping [guideline, trapping].
- Within key linkage areas, pursue opportunities for cooperative management with other landowners [guideline, movement and dispersal].
- Work cooperatively with Federal Highway Administration and State Departments of Transportation to maintain connectivity and map the locations of key linkage areas [standard, highways].
- For Federal highway projects, review and coordinate with highway departments on development of the biological assessment [standard, highways]

The LCAS addresses coordination among Federal agencies, State agencies, and private landowners.

15.) Monitoring: The complexities of lynx life history and population dynamics, combined with a lack of reliable population data, make it difficult to assess the status of lynx. In addition, many aspects of the ecology of lynx are poorly understood.

Possible Adverse Effects of Plans Identified in the BA: The BA determined that all Plans except in the Northeast fail to provide direction to monitor lynx and snowshoe hare or their habitats. This may make detection and assessment of adverse effects difficult or impossible to ascertain.

Monitoring, or the lack thereof, by itself does not result in adverse effects. However, the BA concluded that lack of monitoring would make it difficult or impossible to assess adverse effects. The LCAS, page 93 addresses inventory and monitoring of lynx, lynx habitat, and lynx prey.

Potential Risk Factors Included in the LCAS

In addition to the 15 criterion addressed in the BA, the LCAS contained direction related to additional risk factors. The following three criterion were not used in the BA, but were included as potential risk factors in the LCAS:

1.) Livestock Grazing: Snowshoe hare densities and overwinter survival appear to be positively correlated with understory density (Adams 1959, Wolff 1980, Litvaitis et al. 1985). The LCAS suggested that livestock may compete with snowshoe hares for forage resources. Livestock grazing could have the greatest potential to impact snowshoe hare habitat and populations, thus indirectly affecting lynx, in aspen stands and high elevation riparian willow communities. Browsing or grazing could also impact plant communities that connect patches of lynx habitat within a home range.

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address grazing are found in Conservation Measures applicable to All Programs and Activities, and I.E. Livestock Grazing, on pages 83-84. The types of direction contained in the LCAS include:

Guidance for Management Activities:

- Do not allow livestock use in openings created by fire or timber harvest that would delay successful regeneration of shrub and tree components [standard, livestock grazing].
- Manage grazing in aspen stands to ensure sprouting and sprout survival [standard, livestock grazing].
-Manage livestock grazing in riparian areas and willow carrs to provide cover and forage for lynx prey species [standard, livestock grazing].

Inventory: Within each LAU, map lynx habitat. Identify potential denning and foraging habitat, and also identify non-forest vegetation adjacent to and intermixed with forested lynx habitat that may provide habitat for alternate prey species [standard, applicable to all programs and activities].

In the final rule, the Service found no evidence indicating that grazing negatively impacts the contiguous United States DPS of lynx. The LCAS would reduce the potential for grazing to adversely affect lynx.

2.) Trapping, predator control, shooting: Incidental or illegal mortality of lynx may occur from trapping, predator control, and hunting/poaching activities. Based on new information contained in the Science Team's report (Ruggiero et al.2000), the Service now recognizes that lynx have always been rare in the contiguous United States due to low inherent habitat productivity, and that the high harvest levels of the early 1960s and 1970s were driven by an unprecedented high in the lynx population cycle. Low numbers of lynx typically reflected in harvest data are not a result of overtrapping, but of naturally limiting fragmentation, topography, and climate (65 FR 16052, March 24, 2000). Still, the LCAS includes conservation measures that would benefit individual lynx may otherwise be adversely affected by incidental or illegal trapping.

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address these risk factors are found in II.A. Trapping, II.B. Predator Control, and II.C. Shooting, on pages 85-86. The types of direction contained in the LCAS include the following.

Guidance for Management Activities:
- Reduce incidental harm or capture of lynx during regulated and unregulated trapping activity, and ensure retention of an adequate prey base [objective, trapping and predator control].
- Predator control activities will be conducted by Wildlife Services personnel in accordance with FWS recommendations established through a formal Section 7 process [standard, predator control].
- Initiate interagency information and education efforts throughout the range of lynx [guideline, shooting].

Although we are concerned about the illegal or incidental trapping, we have no information to indicate that the loss of these individuals is negatively affecting the overall ability of the DPS to persist. At the present time, mortality of lynx through legal trapping has been virtually eliminated in the continuous United States, except in locations where Tribal regulations permit the taking of lynx.

3.) Habitat Degradation by Non-native Invasive Plant Species: The impact of non-native invasive plants on biological diversity is a major concern. Although the magnitude of effects of non-native invasive plant infestations specifically on lynx habitat are uncertain, the potential exists for large-scale impacts.

Relevant Direction Contained in the LCAS: Conservation measures in the LCAS that address this risk factor are found on pages 77-81, 84 and 92, and include the following types of direction:

Guidance for Management Activities:
- Design vegetation management strategies that are consistent with historical succession and disturbance regimes. It may be necessary to moderate the timing, intensity, and extent of treatments to maintain all required habitat components and to be responsive to current social and ecological constraints [objective, applicable to all programs and activities].
- Design regeneration harvest, planting and thinning to develop characteristics suitable for snowshoe hare habitat [objective, timber management].
- Design burn prescriptions to promote response by shrub and tree species favored by snowshoe hare [guideline, wildland fire management].
- Manage shrub-steppe habitats within the elevation ranges that encompass forested lynx habitat to maintain or achieve mid seral or higher condition [standard, livestock grazing].

Summary of effects of Plans in conjunction with CAs

The LCAS addresses each of the criteria evaluated in the BA, as well as 3 additional risk factors. The LCAS incorporated a comprehensive amount of information, including information contained in the Science Report and other available information on lynx and forest management activities, in the development of risk factors and conservation measures. The CAs, by requiring consideration of the information and recommendations included in the LCAS, and deferral of FS projects that adversely affect lynx, substantively reduce the potential for current Plans to result in adverse effects to lynx.

Further, if Plans were amended to include the conservation measures in the LCAS, or an equivalent, Plans would provide substantive and measurable direction for the management of lynx habitat. We conclude, based on the best available information, that if Plans are revised or amended to incorporate the conservation measures in the LCAS, or the equivalent thereof, Plans would reduce or avoid the potential for adverse effects on lynx.

Effects of Plans in Areas Outside of Lynx Habitat

The LCAS states that the conservation recommendations generally apply only in lynx habitat on Federal lands within LAUs, with exceptions such as recommendations pertaining to connectivity. Therefore, the direction in the CAs related to the use of the LCAS recommendations generally applies only to lynx habitat within LAUs, with the exception of linkage areas. However, the administrative units covered in this biological opinion (Appendix B) typically encompass lands that provide lynx habitat and also lands that are not considered lynx habitat (see Environmental

Baseline, Status of the Species within the Action Area). Thus, the Plans being analyzed here affect both lynx habitat and areas without lynx habitat.

Lynx are known to occur outside lynx habitat in anomalous habitats adjacent to as well as far from primary lynx habitat (McKelvey et al. 2000b). The Service fully expects that lynx will occasionally use habitats outside primary lynx habitat. Based on our examination of the risk factors to lynx, the analysis in the BA, the information in the LCAS and Science Report, as well as other information in our files, we conclude that the current direction in programmatic Plans for lands outside of lynx habitat within LAUs is not likely to adversely affect lynx for the following reasons:

1) In the contiguous United States, the distribution of lynx is associated with southern boreal forests that receive deep snow conditions and support their primary prey, the snowshoe hare (Ruggiero et al. 2000b; 65 FR 16052, March 24, 2000). The Plans should focus on maintaining and improving prey populations within lynx habitat. Lynx habitat within the range of the DPS is typically comprised of those vegetation associations that support the highest numbers of snowshoe hares. Habitats outside lynx habitat generally do not have inherent potential to produce snowshoe hares at densities that would support lynx residency and reproduction. Alternate prey species are important to lynx in the southern periphery of their range. However, available evidence suggest that lynx populations are not likely to persist where snowshoe hares do not predominate in the diet (Ruggiero et al. 2000b).

2) Conclusive information on lynx and lynx habitats is limited in the contiguous United States. However, we can logically define and map primary lynx habitats, that habitat upon which lynx populations depend to meet survival needs, based on current knowledge, including a) lynx research from Canada and Alaska (Mowat et al. 2000), b) lynx research in Montana, Washington, and Wyoming (McKelvey et al. 2000c, Squires and Laurion 2000), c) relationships between lynx occurrence records and vegetation types in the contiguous United States (McKelvey et al. 2000b), d) trapping data, e) knowledge about prey species (Hodges 2000b), f) knowledge about prey abundance and lynx population responses (McKelvey et al. 2000b, Ruggiero et al. 2000b), g) knowledge regarding lynx response to human activities (Staples 1995; Aubry et al. 2000; Ruggiero et al. 2000b) and h) local site-specific analyses. Extensive effort has been expended to accumulate and interpret existing knowledge of lynx and their habitats, culminating with publication of the Science Report and LCAS. Lynx occurrence records in the 20th century correspond with our current biological understanding of lynx habitat (McKelvey et al. 2000b).

3) We know and expect that lynx will occur outside of primary lynx habitat types. We conclude, based on but not limited to the research information detailed in 3) above, that these occurrences represent (a) lynx that are dispersing to lynx habitat elsewhere, (b) lynx that are on relatively short exploratory movements near or adjacent to lynx habitat that will ultimately return to lynx habitat, or (c) individuals that have emigrated from lynx habitat due to prey species declines and ultimately will not successfully establish home ranges and reproduce, and may succumb to starvation for lack of prey.

4) We concur with the direction of the LCAS to focus habitat management efforts in lynx habitat, that habitat that supports resident populations and contributes to the long-term conservation of lynx.

5) The CA and LCAS direct mapping and protection (see Highways, Recreation sections of LCAS) of additional important non-lynx habitats such as shrub-steppe habitats and key linkage areas which likely provide connectivity and opportunistic foraging habitats for lynx. Thus connectivity issues are addressed to the extent Federal land management has jurisdiction or authority.

6) Continued lynx research could change our understanding of lynx habitat use patterns in the contiguous United States and/or the effectiveness of currently recommended conservation measures. Opportunities exist to modify the LCAS and CA accordingly as new research becomes available; the LCAS is considered an interim document that includes the best available scientific knowledge of lynx. The CA requires continued lynx surveys, from which information on lynx occurrence both within and outside lynx habitat can be used to expand our knowledge base of lynx use of various habitat types.

SPECIES RESPONSE TO PROPOSED ACTION

Lynx populations occur at naturally low densities in the contiguous United States, largely due to low densities of snowshoe hares, their primary prey. Low snowshoe hare densities are likely a result of naturally fragmented boreal habitat at southern latitudes that prevents hare populations from achieving densities similar to those in the extensive northern boreal forest of Canada. Lynx in the contiguous United States also have relatively large home ranges compared to lynx in Canada and Alaska.

Rarity of lynx does not necessarily mean that management actions have or will cause population reductions. At the same time, rarity and large home ranges makes it essential to develop and apply broad, programmatic approaches that ensure the adequate and appropriate analyses of potential management impacts and the development of effective lynx conservation measures.

The BA indicates that current Plans do not provide this broadscale approach to lynx management. The BA analysis at the geographic area level concluded that past and current forest management has resulted in a reduction of the area in which natural ecological processes were historically allowed to operate, thereby increasing the area potentially affected by potential risk factors to lynx. The BA concludes that future land management under existing Plan direction has the potential to result in habitat degradation and fragmentation that ultimately could reduce the geographic range of the lynx.

Therefore, the Service agrees with the conclusions reached in the BA that there is reasonable potential for adverse effects to individual lynx and to lynx subpopulations within geographic areas as a result of continued implementation of existing Plans. Federal land management assumes the largest single role in the conservation of the lynx in the contiguous United States because of the preponderance of lynx habitat types on Federal lands, particularly in the western United States. Because the FS and BLM manage a substantial amount of lynx habitat types in the contiguous United States, particularly in the west, it is imperative that lynx habitat and habitat for lynx prey be maintained and conserved on Federal lands. The BA concluded that current Plans lack guidance for conservation of lynx and have the potential to allow or direct actions that adversely affect lynx, particularly on a broad scale.

The Service thus remains concerned about future maintenance of suitable lynx habitat conditions across the DPS, especially on Federal lands in areas outside lands in nondevelopmental status. In the final rule, the Service concluded that at present time, the contiguous United States lynx DPS as a whole does not appear to be threatened by destruction, modification, or curtailment of its habitat or range. However, a preponderance of quality lynx habitat occurs on Federal lands, especially in the west. A large proportion of Federal land remains subject to management under developmental allocations. Management activities on these lands, under current Plan direction, could result in future degradation of lynx habitat. The status of the lynx DPS could be affected if Federal land use planning affects large-scale habitat conditions such as availability, juxtaposition, and connectivity of habitat components. The final rule concluded that the lack of Plan direction to conserve lynx, as evidenced in the BA, represented inadequate regulatory mechanisms that threatened the lynx DPS.

In the final rule, the Service did not necessarily consider all of the risks identified in the LCAS to be factors currently threatening the contiguous United States DPS of lynx. Further, the Service acknowledges that potential risks may impart different impacts to lynx between geographic areas. Nonetheless, there is reasonable potential for future land management decisions (under existing Plans) to affect individual lynx, lynx subpopulations within geographic areas, and cumulatively, the DPS.

The BA identifies, at local, geographic regions, and DPS scales of analysis, the areas where current Plans are deficient in considering the needs of lynx. The BA demonstrates that the current Plans would likely result in adverse effects to lynx, based on 15 different criteria related to the impacts of various Federal land management programs and activities on lynx.

The CAs however, affect how current Plans are implemented in several key ways. **The CAs remedy the adverse effects of Plans in several ways:**

1) The CAs require that the FS and BLM identify and map lynx habitat and linkage areas on Federal lands.

2) The CAs require that actions proposed by the FS and BLM on the Federal lands be reviewed and assessed considering the recommendations in the LCAS prior to making a decision on the action. The LCAS was designed to provide programmatic guidance and to guide project planning to avoid adverse effects to lynx (Ruediger et al. 2000). The LCAS provides objectives, standards, and guidelines for each of the criteria identified in the BA as potentially adversely affecting lynx, and also provides conservation measures that address additional risk factors.

3) The FS CA requires that FS actions that do not involve third parties, and that are likely to adversely affect the lynx, will be deferred until the Forest Plan is revised or amended, if it has been determined that such revision or amendment is necessary, and projects will comply with the Act and other applicable laws. This requirement substantively reduces the level of adverse impacts on lynx imparted by current Forest Plans.

For actions on BLM lands, and FS actions that involve a third party, the agencies agree to review and consider new information including the LCAS, the Science Report, and appropriate local information to ensure compliance with all applicable laws. Based upon the effects determination in the biological assessment, the appropriate section 7 consultation will follow.

4) Because all projects on FS and BLM are assessed using the LCAS, and actions that are likely to adversely affect lynx on FS lands are deferred, or will require separate consultations, the CAs decrease the potential for adverse effects to lynx under current Plans.

Based on our review of the LCAS in its entirety, the Service concludes that most agency actions in lynx habitat (mapped according to the Lynx Steering Committee direction in Appendix C) that are in compliance with standards in the LCAS would either have no effect on lynx or would not likely adversely affect lynx. For most agency actions in lynx habitat, we conclude that noncompliance with the standards in the LCAS increases the likelihood that actions would adversely affect lynx. The CAs, by requiring consideration of the information and recommendations included in the LCAS, would substantively reduce the potential for adverse effects on lynx. We also believe, based on the best available information, that if Plans are revised or amended to incorporate the conservation measures in the LCAS, or the substantive equivalent thereof, the Plans would reduce or avoid the potential for adverse effects on lynx.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological 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.

Of potential lynx habitat within the scope of the BA, private land accounts for proportionately more lynx habitat in the eastern United States than in the west. According to the analysis in the BA, approximately 93% and 81% of potential lynx habitat occurs on private, State, or tribal lands in the Northeast and Great Lakes, respectively. In comparison, approximately 19%, 28%, and 1% of potential lynx habitat occurs on private, State, or tribal lands in the Southern Rockies, Northern Rockies, and the Cascades, respectively.

In the western regions, most lynx forest types occur on Federal lands. According to the BA, the Northern Rockies encompass more privately owned lynx forest types than elsewhere in the West; about one-third of lynx forest types are in private ownership. Due to the forested nature of lynx habitat, large portions of this habitat likely occur on private, State, and corporate timber lands where timber harvest and thinning occurs. Other private lands may be developed for residential or business uses. There is a potential for current and future management of these lands to adversely affect lynx.

The Cascades and Southern Rockies regions encompass substantively smaller proportions of lynx forest types. In both areas, some proportion of privately owned lynx habitat occurs on private, State or corporate timber lands where timber harvest and thinning occurs. Because of the smaller proportion of total lynx habitat in private ownership as compared to Federal ownership, the impacts of private timber harvest may affect individual lynx in the Cascades region, but are unlikely to impact the lynx population there. In the Southern Rockies, a larger proportion of lynx habitat occurs on private land where development and/or forestry practices could impact the lynx population there. Connectivity concerns with, for instance, highways and development are especially relevant to the more fragmented nature of lynx habitat in the mountains of the Southern Rocky region.

Eighty-four percent of forest lands in the Northeast geographic area are privately owned. Commercial forestry continues to be the dominant land use on 60% of private lands in northeastern forests. The rapid pace of subdivision for recreational home sites has been identified as a concern in maintaining the integrity of Northeast forests (Harper et al. 1990), though this is not currently posing a significant threat to the lynx DPS (65 FR 16052, March 24, 2000).

In the Great Lakes region, 80% of the area encompassing lynx forest types is in State, county, or tribal lands, or is privately owned. Timber harvest is prevalent on these lands and may be impacting lynx and prey habitat. However, regional or local impacts in the Great Lakes and in the Northeast are not considered to currently threaten the contiguous DPS (65 FR 16052, March 24, 2000). **Recent interagency efforts to use local information to identify and map lynx habitat in the Great Lakes have led to conclusions that much of the mixed deciduous forest initially included in the BA analysis, does not represent lynx habitat (J. Trick, United States Fish and Wildlife Service, pers. comm. 2000).**

In addition to timber management, activities on non-Federal lands may include mineral extraction, oil and gas exploration, grazing, urban and rural development, recreation site construction and use, road construction, and utility corridors. Habitat loss or degradation and direct mortality of lynx are possible adverse impacts on lynx. Cumulatively, urbanization and highway development may impact connectivity in lynx habitat. The final rule did not find that present conditions on private lands threaten the DPS, although the connectivity issues in the Southern Rockies were noted.

Two programs in the Northeast and in Washington may provide some benefit to the species. The Northern Forest Lands Council has a charter to maintain traditional patterns of landownership and use in the Northeast. Maintenance of traditional landownership may prevent fragmentation and/or development of lynx habitat. Conservation and management of non-Federal lands for lynx is very beneficial in the Northeast because the majority of lynx habitat occurs on non-Federal land in this geographic area.

In Washington, three primary, non-Federal land managers of lynx habitat adopted and implemented lynx habitat management plans: 1) Lynx Habitat Management Plan for Department of Natural Resources (Washington Department Natural Resources 1996a), 2) North American Lynx Habitat Management Plan for Boise Cascade Corporation, 3) Salmo-Priest and Little Pend Oreille Lynx Management Plan (Gilbert 1996; Duke Engineering and Services 1998). In Washington, these conservation efforts on non-Federal lands are beneficial to lynx at local scales. However, because the vast majority of lynx forest types occur on Federal lands in this region (99%), Federal land management must assume a much greater role in the conservation of lynx at the geographic and DPS scale.

CONCLUSIONS

After reviewing the current status of Canada lynx, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the current Plans as implemented in conjunction with the CAs, are not likely to jeopardize the continued existence of the lynx. No critical habitat has been designated for this species, therefore, none will be affected. Our no jeopardy conclusion is based upon continued implementation of the CAs until such time Plans are amended or revised to consider the needs of lynx.

Furthermore, if Plans are amended or revised incorporating the conservation measures in the LCAS, or the equivalent thereof, we conclude at this time that the Plans would likely not jeopardize the continued existence of lynx. The LCAS and Science Report are part of the best commercial and scientific information available with which to analyze the effects of Federal land management on lynx. The LCAS incorporated a comprehensive amount of information, including information contained in the Science Report and other available information on lynx and forest management activities. The LCAS addressed risks to lynx at several scales of analysis, addressed all of the criteria evaluated in the BA, as well as several additional risk factors to lynx. We conclude that the programmatic and project-level objectives, standards, and guidelines in the

LCAS provide comprehensive conservation direction for Plans adequate to reduce the potential for adverse effects to lynx and to preclude jeopardy to the lynx DPS. Future consultations on Plan revisions or amendments would necessarily consider include any new or otherwise pertinent information not considered in this consultation.

As stated in the final rule, we believe Plan amendments for those administrative units with lynx habitat are necessary for long-term conservation of habitat for lynx and its prey on Federal lands. Absent programmatic planning to conserve lynx, assessment of land management effects to lynx and development of appropriate conservation strategies are left to project-specific analyses without consideration for larger landscape patterns.

The Service concludes that continued implementation of the Plans, in conjunction with the CAs, may result in some level of adverse effects to lynx. These adverse effects are most likely to occur either as a result of third party actions on FS lands, and on as a result of actions on BLM lands because the BLM CA does not require deferral of actions that may adversely affect lynx. However the level of adverse effects to lynx are not reasonably expected to, directly or indirectly, reduce appreciably the likelihood of both the survival and recovery of the lynx DPS in the wild by reducing the reproduction, numbers, or distribution of lynx.

The following factors, among others, were important in our assessment of jeopardy:

- The FS and BLM have demonstrated an increased commitment toward conservation of lynx and lynx habitat on a programmatic level. In March, 1998, the FS, BLM, and NPS began a collaborative process with the Service to assess the conservation needs of lynx and develop a lynx conservation strategy applicable to Federal land management. The products and results of this effort have been described earlier and at length, in this biological opinion.
- Considering the environmental baseline for lynx, the final rule indicated that although several factors may be impacting lynx at smaller scales, only one factor was currently threatening the lynx DPS: inadequate Plans that reflect inadequate regulatory mechanisms.
- Under State and Federal regulations, lynx are protected from legal harvest, which represents a substantive conservation benefit to lynx.
- Per the CAs, the FS and BLM have agreed that Plans should include measures necessary to conserve lynx for all administrative units identified as having lynx habitat (Appendix B).
- Per the CAs, the FS and BLM have agreed that the process of amending or revising a Plan will include consideration of the Science Report, the LCAS, and the final rule. The FS and BLM agree to coordinate with the Service on comprehensive approaches to the programmatic planning process for the conservation of lynx on Federal lands.
- Per the CAs, the FS and BLM agreed to immediately begin identifying and mapping lynx habitat on Federal lands, using interagency coordination. Mapping efforts are ongoing and have been completed, or are nearly so, in most lynx geographic areas.
- A large proportion of lynx habitat on Federal lands in the west occurs in nondevelopmental status where management focuses on the maintenance of natural ecological processes, or conservation of rare ecological settings or components. Under current Plans, while negative

effects on lynx may not be totally eliminated under this status, negative effects are reduced due to the management objectives.

- Substantive proportions of all lynx habitat in the west occurs on Federal lands in nondevelopmental status in the west where management focuses on the maintenance of natural ecological processes, or conservation of rare ecological settings or components.
- Per the CAs, the FS and BLM agree to consider the recommendations in the LCAS to determine whether a proposed action may affect lynx, prior to making any new decisions to undertake actions in lynx habitat.
- On FS lands, projects that do not involve third parties and may adversely affect lynx will be deferred until Plans incorporate the measures necessary to conserve lynx. The commitment to postpone such actions substantively reduces the potential for adverse effects to lynx under current Plans because the FS manages the preponderance of lynx habitat on Federal lands.
- **BLM proposed actions, and FS actions that involve third parties, that may adversely affect lynx will not necessarily be deferred, but appropriate section 7 consultation will occur. Furthermore, the BLM manages a only small proportion of lynx habitat and the level of adverse effects that might occur due to BLM actions, considering the commitments in the BLM CA, are not likely to rise to levels that would jeopardize the lynx DPS .**
- A large proportion of proposed actions and projects on FS and BLM lands can be designed considering the conservation measures in the LCAS and information in Science Report, to the extent they are consistent with current Plans, and therefore would avoid adverse effects on lynx.
- Amendments to some Plans are in progress and are considering provisions of the LCAS.
- Section 7 analyses for ongoing actions on Federal lands have occurred or are being finalized in all States within the contiguous United States lynx range.
- The CAs are consistent with section 7(a)(1) of the Act by committing to undertake proactive management actions to benefit lynx, based on the LCAS, to the extent they are consistent with current Plans.
- The FS began and is continuing a three-year (as a minimum) range-wide lynx survey effort.

INCIDENTAL TAKE

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 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 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 an incidental take statement.

In general, an incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize the impacts of the take and sets forth terms and conditions which must be complied with in order to implement the reasonable and prudent measures.

Plans are permissive, in that they allow, but do not authorize actions to occur. The BA documents that current Plan language may allow actions that adversely affect lynx. As such, specific actions conducted under some current Plans may impart a level of adverse effects to individual lynx that rises to the level of take. However, the CAs substantively reduce the potential for incidental take to occur as a result of actions implemented under the current Plans. The CAs require that all actions be evaluated using the LCAS and Science report. Projects that comply with the standards and guidelines in the LCAS in most cases would not adversely affect lynx, and therefore no take would be anticipated in most instances. Where FS projects do not comply with standards in the LCAS, and are likely to adversely affect lynx, and do not involve third parties, the FS CA requires that they be deferred until Plans themselves are amended. Therefore, if projects that are likely to adversely affect lynx are deferred, no incidental take is anticipated. Further, the FS manages the majority of lynx habitat on Federal lands, the BLM manages a relatively minor portion. Although the BLM CA does not require deferral of projects that adversely affect lynx, nor does the FS CA require deferral of such projects involving third parties, formal consultation under section 7 would be required for those projects. Project level consultations would appropriately identify reasonable and prudent measures, and terms and conditions, to minimize the impact of any anticipated take than might occur. Further, the agencies are using the LCAS to aid in the determination of effects, and projects that may adversely affect lynx may be deferred or modified to be consistent with the LCAS, to the extent the final action is consistent with current Plans.

At the broad scale of this consultation (48 FS and 45 BLM administrative units), the Service is unable to anticipate all possible circumstances that may possibly involve the take of lynx due to actions implemented under current Plans in conjunction with the CAs. The Service therefore conservatively anticipates that some low level of incidental take may occur due to some specific actions implemented under some of the current Plans in conjunction with the CAs. The Service believes that the level of take would be low for reasons including, but not limited to, those outlined in the previous paragraph.

However, the best scientific and commercial information are not sufficient to enable the Service to estimate a specific amount of incidental take to the species for the following reasons: programmatic Plan effects are too broad in scale and difficult to predict to accurately identify actions that will result in incidental take; current and historic population levels of lynx are unknown in most areas; lynx are solitary, occur at low densities, and are therefore difficult to detect; take may occur in the form of alteration of habitat. In these instances, the Service designates the expected level of take as ``unquantifiable''.

In this biological opinion, for reasons described earlier, the Service determined that continued implementation of the Plans in conjunction with the CAs is not likely to result in jeopardy to the species. Therefore, the Service has determined that the level of anticipated incidental take associated with actions implemented under the Plans in conjunction with the CAs is not likely to jeopardize the lynx DPS. However, the Service cannot exempt, through this biological opinion, the incidental take of lynx for any action carried out under the direction of the Plans. The Service is unable to anticipate all possible circumstances related to continued implementation of the Plans, including programmatic and individual actions that might be developed in the future. Therefore, the Service is not able to issue a ``blanket'' incidental take statement with a comprehensive list of reasonable and prudent measures to sufficiently cover all programs and actions subsequently implemented pursuant to the Plans and the CAs. Any actions implemented under the Plans and the CAs that may adversely affect lynx would require section 7 consultation. Therefore, incidental take will appropriately be assessed, and coverage under the terms of section 7(b)(4) and section 7(o)(2) of the Act will be granted as appropriate, at the project level during formal consultations.

The CAs call for Plans to be revised or amended considering the LCAS, the Science Report, and the Service's final rule. In addition to the assessment of effects of current Plans, this biological opinion has included an assessment of the effects on lynx of Plan direction if Plans were amended or revised with the conservation measures in the LCAS. The Service has concluded that such amendments or revisions would likely not jeopardize the lynx DPS. The conservation measures in the LCAS were intended to conserve the lynx, and reduce or eliminate adverse effects from the spectrum of management activities on Federal lands. The direction provided by the conservation measures would assist Federal agencies in avoiding negative impacts on lynx. Based on the best scientific and commercial information currently available, we believe that Plans that incorporate the conservation measures, and projects that implement them, are generally not expected to have adverse impacts on lynx. Implementation of the measures in the LCAS across the range of lynx is expected to lead to the conservation of the species.

If in the future, Plans are amended or revised with the conservation measures in the LCAS, or the equivalent thereof, the Service at this time concludes that based upon the best scientific and commercial information available presently, no reasonable and prudent measures, or terms and conditions, would likely be necessary at the Plan scale to minimize the effects of the take that might occur. Revision or amendment of the Plans incorporating the programmatic objectives, programmatic and project level standards and guidelines found the LCAS, or substantive equivalent thereof, would likely sufficiently minimize the potential for adverse effects and the effects of any take that might occur at the programmatic scale. Consultations on Plan revision or amendments will necessarily consider any new or otherwise pertinent information not considered in this consultation.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs 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 programs, or to develop information.

The Service believes that the FS and BLM have initiated important efforts to increase our understanding of lynx and lynx habitat with completion of the Science Report. The LCAS identified known risk factors and conservation measures for lynx, based on best available knowledge to date.

1. Using the FS protocol, continue the monitor/survey effort to improve our information base related to lynx occurrences both within and outside lynx habitat on FS and BLM lands.

2. Research efforts should be initiated to improve our knowledge of lynx ecology in the contiguous United States. Specific research needs are described in the Science Report, and include the following items:

    a. *Present and historical patterns of lynx distribution*: Our current understanding of what constitutes suitable lynx and hare habitat in the contiguous United States is not complete and should be further studied.

    b. *Factors limiting the geographic distribution of lynx*: Most lynx records in North America are found in habitat types that can be characterized as mesic coniferous forests with cold, snowy winters. We have not identified additional factors that limit lynx distribution. Geographic areas exist (e.g., Cascades and Coastal ranges, southern Rocky Mountains, northeast Minnesota) that appear to have the necessary features to support lynx, yet occurrence records are scare or absent from these areas.

    c. *Principal habitat features affecting lynx*: Limited understanding of lynx- habitat relationships at all spatial scales hampers the development of specific habitat management prescriptions, and should be further studied.

    d. *Food habits of lynx*: Research is needed on lynx food habits in southern boreal forests during both snow and snow-free periods.

    e. *Habitat requirements of key prey species*: Optimal amounts and arrangement of habitat components for prey species relative to lynx persistence is unknown and represents an important research need.

    f. *Population dynamics of key prey species*: Populations of snowshoe hares and red squirrels exhibit strong population fluctuations. Prey population fluctuations could result in local extirpations of lynx, particularly if both primary prey species (showshoe hares and red squirrels) bottom out simultaneously. Further research should be conducted.

    g. *Principal community features affecting lynx*: Factors that facilitate movement of generalist predators (e.g., cougar, coyote) into areas occupied by lynx may be a conservation

risk. Data addressing these relationships are very few. A better understanding of community interactions and the ways landscape patterns may mediate these interactions is a research need.

h. *Principal factors affecting lynx movements and dispersal*: The Science Report concludes that lynx can move long distances, but it is unknown if these movements result in successful dispersal or augmentation of distant populations. Factors that may affect dispersal should also be identified.

i. *Key demographic properties and dynamics of lynx populations*: We know nothing about the vital rates of southern lynx populations, thus assessments of population viability via demographic modeling are not currently possible. Additional information regarding the influence of prey abundance on lynx population dynamics is needed.

j. *Geographic variation among lynx populations*: Understanding the range of genetic, ecological, and behavioral variation among lynx populations is limited.

3. Research efforts should be initiated to better understand the potential for human activities to impact lynx, particularly on Federally-managed lands. Specific research efforts are described in the LCAS, and include a list of research items specific to the following activities:

a. *Precommercial thinning*: More information should be developed to determine where, when, or if precommercial thinning can benefit snowshoe hare or lynx habitat.

b. *Snow compaction*: More information would be beneficial on the relationships between lynx and other carnivores (including competition for prey) during deep snow conditions and the impacts of compacted snow routes into lynx habitat.

c. *Highways and key linkage areas*: Research should be conducted on the effects of highways on lynx dispersal and movements, and the potential effectiveness of crossing structures.

d. *Forest road density*: Several wildlife species have been shown to be sensitive to forest road densities (e.g., grizzly bears and elk). Further study should be conducted to determine the effects of open forest roads and associated human activities on lynx.

e. *Human disturbances*: The effects of human activities on lynx activity patterns and energetics not well understood and should be formally studied.

f. *Aspen and snowshoe hare*: Snowshoe hares use aspen habitats, however the importance of this habitat to hares and lynx is not known and should be studied. This is particularly important in areas that contain a large component of aspen.

g. *Shrub-steppe habitat*: Since almost all lynx research has occurred in northern habitats, there is little information about how lynx utilize shrub-steppe habitats. This habitat may be

considerably important for lynx during snowshoe hare population lows and for dispersal to maintain metapopulation connectivity. Further study is warranted.

h. *Grazing*: Existing research has shown that grazing by large herbivores can affect the habitat of black-tailed jackrabbits. Research is needed to determine if the same effects may occur with snowshoe hares.

i. *Refugia*: Refugia should be identified as part of an overall carnivore strategy. Further study is needed to determine the appropriate size and characteristics of areas that could function as refugia.

REINITIATION REQUIREMENT

This concludes formal consultation on the effects of FS and BLM land management Plans. As required by 50CFR 402.16, reinitiation of formal consultation is required if:

1. new information reveals effects of the agency or corporate action that may affect listed species in a manner or to an extent not considered in this opinion;
2. an agency action is subsequently modified in a manner that causes an effect to the listed species that was not considered in this biological opinion;
3. a new species is listed or critical habitat is designated that may be affected by the action.

The Service arrived at a nonjeopardy opinion based, in part, on the assumption that the CAs would be implemented. The CAs commit the FS and BLM to ensure that programmatic planning identifies potential impacts to lynx and incorporates conservation measures that reduce or eliminate possible adverse effects to lynx.

The FS and BLM shall continue to implement the CAs on each administrative unit with lynx habitat mapped according to the August 22, 2000 direction provided by the Steering Committee, until applicable Plans are amended or revised with consideration of the lynx conservation measures in the LCAS. The CAs expire in December, 2004. At that time, on administrative units with Plans that have not been amended or revised to consider the lynx conservation measures in the LCAS, an extension of the CA and continuation of the provisions in the CA, will be necessary or reinitiation of consultation will need to occur. Amendments and revisions to Plans shall be completed in accordance with the schedule developed as per the direction in the CAs, and in coordination with the Service. Should any revisions be made to a CA, such revisions or amendments shall be reviewed and approved in writing by the Service before revisions become effective.

If funding, time, and/or any other issues restrict implementation of any provisions in the CA, the semi-annual documentation of CA implementation progress, as required in Part 4.C. of the CA, in addition to other relevant information, shall serve as the basis for the Service to decide whether reinitiation of consultation is necessary or not. Formal consultation, if required, could be required at the national programmatic scale, or at smaller scales depending upon the magnitude of adverse effects caused by failure to implement the CA at range wide, geographic area, or Forest or BLM district levels.

As the Service is co-signatory to the CA, the Service shall remain part of the processes mandated by the CA, aware of compliance with the CA, aware of schedules and time frames developed for Forest Plan amendments and revisions, and therefore aware of whether the provisions and intent of the CA are being met. The CA requires semi-annual reviews by the agencies to document progress in implementing the CA. If non-compliance with the CA occurs, the Service and agency(ies) will discuss the possible impacts of the non-compliance on lynx and/or their habitat, and decide on appropriate action.

As stated in the CA and LCAS, revisions or amendments to both documents may occur upon the agencies' receipt of new information regarding lynx, or upon information gained through implementation that suggests modifications may be appropriate. The FWS reserves the right to review and approve such revisions or amendments, and to determine whether reinitiation of consultation is warranted under conditions 1) through 3) above.

Further, FWS acknowledges that the LCAS contains a number of requirements, recommendations, and guidance. As stated in the LCAS, compliance with the standards (and with the guidelines unless rationale is provided in the project level biological assessments) in the LCAS is expected to result in projects that are not likely to adversely affect lynx. In limited instances, minor deviations from the standards in the LCAS may not necessarily result in adverse effects on lynx, and/or the level of adverse impacts may not necessarily rise to the level of take. Any such deviations will be assessed at the project level and do not necessarily trigger conditions 1) through 3) above, requiring reinitiation of this consultation.

We appreciate your cooperation in meeting our joint responsibilities under the Act. If you have questions or comments regarding this biological opinion, please contact Susan Linner of my staff, or Mark Wilson or Anne Vandehey, Montana Field Office, at (406) 449-5225.

Sincerely
Ralph O. Morgenweck

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Appendix A.
Lynx Science Team, Lynx BA Team, Lynx Biology Team Members

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Kevin McKelvey, Scientist, USDA Rocky Mountain Research Station, Missoula, MT
John R. Squires, Research Associate, University of Montana, Missoula, MT

Lynx BA Team:
J. Randal Hickenbottom (initial team leader) USDA Forest Service, Pike-San Isabel National Forest, Morrison, CO
Bob Summerfield (final team leader), Wildlife Biologist, USDA Forest Service, Kootenai National Forest, Libby, MT
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Lynn Jackson, Forest Planner, USDA Forest Service, Chippewa National Forest, Cass Lake, MN
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Lynx Biology Team (authored the LCAS)
Bill Ruediger, Wildlife Biologist, USDA Forest Service (team lead)
Jim Claar, Wildlife Biologist, USDA Forest Service, Northern Region
Steve Mighton, Wildlife Biologist, USDA Forest Service, Eastern Region
Bob Naney, Wildlife Biologist, USDA Forest Service, Pacific Northwest Region
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Fred Wahl, Wildlife Biologist, USDA Forest Service, Rocky Mountain Region
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Steve Gniadek, Wildlife Biologist, USDI National Park Service

Appendix B.
List of Administrative Units.

Based on mapping and delineation of LAUs that has been completed as of September 2000, the list of administrative units that provide lynx habitat is shown in Table 1. Further refinements may occur when mapping and local consultations are completed.

Table 1. Programmatic plans for Forest Service and BLM administrative units considered in this consultation.

CASCADE MOUNTAINS GEOGRAPHIC AREA

Administrative Unit	State(s)
Mt. Baker-Snoqualmie NF	WA
Okanogan NF	WA
Wenatchee NF	WA
Gifford Pinchot NF	WA
Mt. Hood NF	OR
Deschutes NF	OR
Willamette NF	OR
Umpqua NF	OR
BLM Spokane District Office, Spokane District RMP	WA

NORTHERN ROCKY MOUNTAINS GEOGRAPHIC AREA

Administrative Unit	State(s)
Ochoco NF	OR
Malheur NF	OR
Wallowa-Whitman NF	ID, OR, WA
Umatilla NF	OR, WA
Colville NF	WA
Idaho Panhandle NFs	ID, WA
Clearwater NF	ID
Nez Perce NF	ID
Lolo NF	MT
Kootenai NF	MT, ID
Flathead NF	MT
Lewis and Clark NF	MT
Helena NF	MT
Bitterroot NF	MT, ID
Beaverhead-Deerlodge NF	MT
Gallatin NF	MT
Custer NF	MT, SD
Payette NF	ID

Boise NF	ID
Sawtooth NF	ID, UT
Salmon-Challis NF	ID
Targhee NF	ID, WY
Caribou NF	ID, WY
Wasatch-Cache NF	ID, UT, WY
Uinta NF	UT
Ashley NF	UT, WY
Bridger-Teton NF	WY
Shoshone NF	WY
Bighorn NF	WY
BLM Butte Field Office, Headwaters Resource Area RMP	MT
BLM Dillon Field Office, Dillon Resource Area MFP	MT
BLM Lewistown Field Office, West HiLine RMP	MT
BLM Missoula Field Office, Garnet RMP	MT
BLM Burley Field Office, Cassia RMP	ID
BLM Idaho Falls Field Office, Big Lost MFP	ID
BLM Idaho Falls Field Office, Little Lost/Birch Creek MFP	ID
BLM Idaho Falls Field Office, Mackay MFP	ID
BLM Idaho Falls Field Office, Medicine Lodge RMP	ID
BLM Pocatello Field Office, Malad RMP	ID
BLM Pocatello Field Office, Pocatello RMP	ID
BLM Shoshone Field Office, Bennett-Timmerman RMP	ID
BLM Shoshone Field Office, Sun Valley RMP	ID
BLM Challis Field Office, Challis MFP	ID
BLM Challis Field Office, Mackay MFP	ID
BLM Challis Field Office, Ellis/Pahsimeroi MFP	ID
BLM Salmon Field Office, Lemhi RMP	ID
BLM Cascade Field Office, Cascade RMP	ID
BLM Coeur d'Alene Field Office, Emerald Empire Resource Area MFP	ID
BLM Cottonwood Field Office, Chief Joseph MFP	ID
BLM Burns District Office, Three Rivers RMP	OR
BLM Baker Resource Area, Baker RMP	OR
BLM Malheur Resource Area, Malheur RMP	OR
BLM Prineville District Office, Two Rivers RMP	OR
BLM Prineville District Office, John Day & Brothers RMP	OR
BLM Prineville District Office, LaPine RMP	OR
BLM Kemmerer Field Office, Kemmerer RMP	WY
BLM Lander Field Office, Lander RMP	WY
BLM Pinedale Field Office, Pinedale RMP	WY
BLM Salt Lake Field Office, Box Elder RMP	UT
BLM Salt Lake Field Office, Randolph MFP	UT
BLM Salt Lake Field Office, Wasatch-Pony Express RMP	UT
BLM Vernal Field Office, Book Cliffs RMP	UT
BLM Vernal Field Office, Diamond Mountain RMP	UT

SOUTHERN ROCKY MOUNTAINS GEOGRAPHIC AREA

Administrative Unit	State(s)
Arapaho-Roosevelt NF	CO
Medicine Bow-Routt NF	CO, WY
San Juan-Rio Grande NF	CO
White River NF	CO
Grand Mesa, Uncompahgre and Gunnison NFs	CO
Pike-San Isabel NF	CO
BLM Royal Gorge Field Office, Royal Gorge RMP	CO
BLM Saguache Field Office, San Luis Valley RMP	CO
BLM Little Snake Field Office, Little Snake RMP	CO
BLM Kremmling Field Office, Kremmling RMP	CO
BLM Grand Junction Field Office, Grand Junction RMP	CO
BLM White River Field Office, White River RMP	CO
BLM Gunnison Field Office, Gunnison RMP	CO
BLM Glenwood Springs Field Office, Glenwood Springs RMP	CO
BLM San Juan Field Office, San Juan/San Miguel RMP	CO
BLM Uncompahgre Field Office, Uncompahgre RMP	CO

GREAT LAKES GEOGRAPHIC AREA

Administrative Unit	State(s)
Chippewa NF	MN
Superior NF	MN
Hiawatha NF	MI
Ottawa NF	MI

NORTHEAST GEOGRAPHIC AREA

Administrative Unit	States
White Mountain NF	ME, NH

APPENDIX C.
Lynx Steering Committee Mapping Direction (August 22, 2000)

United States Department of Agriculture Forest Service	United States Department of Interior Bureau of Land Management	United States Department of Interior Fish and Wildlife Service

File Code: 2670 **Date:** August 22, 2000

Subject: Lynx Habitat Mapping Direction

To: Regional Foresters and Forest Supervisors (Regions 1,2,4,6,9)
Bureau of Land Management State Offices and Districts (MT,OR,ID,WA,WY,UT,CO)
U.S. Fish and Wildlife Service (Regions 1,3,5,6)

Since implementation of the Lynx Conservation Assessment and Strategy (LCAS), questions have arisen from the field regarding mapping of lynx habitat. At the request of the Lynx Steering Committee, the Lynx Biology Team met on July 11-12, 2000, to respond to the questions. Several members of the Lynx Science Team and U.S. Fish and Wildlife Service consultation biologists from Idaho, Oregon, and Washington joined the Lynx Biology Team.

The Biology Team presented their recommendations to the Steering Committee on July 18; the recommendations were accepted, and the Steering Committee is providing the following direction to field units on mapping criteria and procedures (direction for mapping lynx habitat is enclosed). Please review your existing lynx habitat maps to ensure they are consistent with the following criteria:

1) Begin using the outer boundary as described in figures 8.20 (for the western U.S. – note: modifications have been made for the Blue Mountains and Southern Colorado areas), figure 8.22 (for the Great Lakes), and figure 8.23 (for the Northeast). These figures are found in Chapter 8, History and Distribution of Lynx in the Contiguous United States, in the Ecology and Conservation of Lynx in the United States. If you would like an electronic copy of the above maps, contact a Lynx Biology Team member from your Geographic Area.
2) In the western U.S., areas below 4,000 feet usually should be excluded.
3) Within the boundaries defined by Steps 1 and 2, map vegetation that can contribute to lynx habitat as described in the enclosure for each Geographic Area. These vegetation descriptions are being incorporated into the updated LCAS, which will be available and posted in August 2000.
4) Delineate Lynx Analysis Units (LAUs) around the habitat defined above.

Conservation Measures listed in the LCAS apply only within lynx habitat in the LAUs, except for those specific to connectivity.

Units involved in the national lynx monitoring effort should continue to participate until lynx presence or absence is established.

If you have questions about the mapping procedures, contact your agency's Lynx Biology Team representative.

/s/ KATHLEEN A. McALLISTER	*/s/ TERRY SEXSON (for)*	*/s/ CHRIS JAUHOLA*
KATHLEEN A. MCALLISTER Deputy Regional Forester Northern Region, FS	RALPH MORGENWECK Region 6 Director, FWS	CHRIS JAUHOLA Group Manager, Fish, Wildlife, & Forests, BLM

Enclosure

cc: Lynx Steering Committee, Biology Team, Science Team

To: Lynx Steering Committee

From: Lynx Biology Team

Date: 8/23/00

Re: Recommendations - Lynx Habitat Mapping

At the Lynx Steering Committee conference call on May 23, 2000, several questions about habitat mapping were raised. The Lynx Biology Team met on July 11 and 12, 2000, to discuss and resolve these issues. Five members of the Science Team participated on July 11 in an advisory capacity, and three FWS consultation biologists from Washington, Oregon, and Idaho attended both days.

A set of mapping criteria and procedures was developed to guide and clarify the mapping process. The consequences of applying these criteria were also assessed.

Criteria and Procedures for Lynx Habitat Mapping

1) Information contained in the Science Team Report (Ruggiero et al. 2000a) provides the starting point for lynx habitat mapping. The outer boundary that should be used for each geographic area is shown in Chapter 8 (McKelvey et al. 2000): Figs 8.20 for western U.S., Fig. 8.22 for the Great Lakes, and Fig. 8.23 for the Northeast (these are combined into the insert map entitled "Vegetation Types and Elevation Zones Associated with Lynx Occurrences"), with the following exceptions.

In southern Colorado and northeastern Oregon and southeastern Washington, the Rocky Mountain Conifer Forest type as depicted in Fig. 8.19 should be added to the outer boundary. These areas were lost in the transition to Fig. 8.20 due to vagaries of the Kuchler delineations of vegetation subtypes, rather than lack of historical occurrences (K. McKelvey, pers. comm. 2000).

2) In the western U.S., lynx occurrences generally are found only above 4,000 ft. elevation (McKelvey et al. 2000). Areas below 4,000 ft. usually should be excluded. Note that elevation ranges are specified in the geographic area descriptions in the Lynx Conservation Assessment and Strategy.

3) Within the boundaries defined by the first two steps, map vegetation that could contribute to lynx habitat, as described for each geographic area in the Lynx Conservation Assessment and Strategy, using the finest-scale vegetation information that is available. The following clarifies primary and secondary vegetation for the western U.S.
   a) Mesic subalpine fir forests in the western U.S. are extensions of boreal forests. Subalpine fir habitat types dominated by cover types of spruce/fir, Douglas-fir, and seral lodgepole pine should be mapped as primary vegetation. These types must be present to support foraging, denning and rearing of young.

b) Other cool, moist habitat types (e.g., some Douglas-fir, grand fir) may contribute to lynx habitat where intermingled with and immediately adjacent to primary vegetation. These types are described as secondary vegetation.
c) Lynx do not appear to be associated with dry forest habitat types (e.g., ponderosa pine, dry Douglas-fir, and dry or climax lodgepole pine) except to move among mesic stands (Ruggiero et al. 2000b). These dry types should not be included as vegetation contributing to lynx habitat.

4) The next steps are to identify lynx habitat within a Lynx Analysis Unit (LAU), which involves consideration of several additional factors:
   a) Determine whether the amount and spatial arrangement of vegetation is sufficient to warrant delineating a LAU (amount, patch size, inter-patch distance).
   b) Evaluate land ownership pattern (to assess feasibility of achieving lynx conservation objectives on federally administered lands, to determine appropriate size and configuration of the LAU, etc.).
   c) Review occurrence records of all types to assess validity of identifying the area as lynx habitat – location, pattern, consistency, year in relation to Canadian population cycles. Evaluate the records as described in Chapter 8 (McKelvey et al. 2000). Lack of records in an area does not necessarily indicate lack of habitat; conversely, detections do not necessarily indicate lynx habitat. Independently, occurrence records indicate only occurrence. Collectively, as a data set, occurrences can reveal habitats that likely are important to lynx.
   d) Snow depth information may be useful to exclude ungulate winter ranges and areas that do not retain adequate snow cover during the winter.

Note: Once identified as "lynx habitat," there is no longer a distinction between primary and secondary vegetation. Conservation measures of the Lynx Conservation Assessment and Strategy (LCAS) apply to lynx habitat.

Consequences of Applying the Criteria

The lynx Biology Team reviewed methods used to date in each geographic area, to determine whether mapping was consistent with the above set of criteria. The team also indicated whether changes might be needed in LCAS Appendix A, "List of Administrative Units Involved in Conferencing/Consultation for Lynx."

***Northeast and Great Lakes Geographic Areas*:** Mapping is believed to be consistent with these criteria and process. Two units (Green Mountain and Chequamegon-Nicolet National Forests) should be deleted from Appendix A (concurrence already received from FWS).

***Southern Rockies Geographic Area*:** Mapping is believed to be consistent with these criteria and process (with the addition of the southern Colorado Kuchler type). No changes are needed in Appendix A.

***Northern Rockies Geographic Area*:**

Montana - Mapping is believed to be consistent with these criteria and process. No changes are needed for the list of units included in Appendix A.

Wyoming - Mapping is believed to be consistent with these criteria and process, although it was uncertain whether slope had been used to screen out areas (not supported by the Biology Team). The Biology Team was asked to review the Bighorns, and recommended that they continue to be included. Therefore no changes to Appendix A are anticipated.

Idaho - Mapping is believed to be consistent with these criteria and process, except that in central Idaho, moist Douglas-fir has been mapped as primary vegetation. In this region, Douglas-fir differs ecologically from other areas, occurring at higher elevations and on cooler sites, and provides high-quality snowshoe hare habitat. Mapping within the isolated mountain ranges of southeastern Idaho had been put on hold, and will be completed with consideration of the amount and spatial arrangement of vegetation. No changes to Appendix A are anticipated at this time.

Utah - Mapping is believed to be consistent with these criteria and process. Although there are comparatively few occurrence records in Utah, their distribution is very clumped, which suggests persistence of a local population. No changes to Appendix A are anticipated.

SE Washington and NE Oregon - Mapping is believed to be consistent (with the addition of the Rocky Mountain Conifer Kuchler type from Fig. 8.19). No changes to Appendix A are anticipated.

***Cascade Mountains Geographic Area*:** Discussion centered on whether the Pacific silver fir and mountain hemlock Kuchler types should be considered as primary vegetation. Both the Rocky Mountain Conifer Forest (RMC) and Pacific Northwest Conifer Forest (PNC) are included in Fig. 8.19, while Fig. 8.20 narrows this down to the Douglas-fir and western spruce/fir subtypes of the RMC type, and the fir/hemlock subtype of the PNC type. Lynx are absent or uncommon in dense, wet forests along the Pacific coast (Aubry et al. 2000). In the western U.S., Rocky Mountain Conifer Forest contained 83% of all lynx records, but only 27% of the area, suggesting a strong association between lynx occurrences and this type. The Pacific Northwest Conifer had the second highest point frequency, but this represented only 7% of occurrences within about 7% of the area, indicating a weaker association. The Pacific Northwest Conifer type extends west of the Cascade Range to the coast and southward into northern California, although lynx occurrences were located only in areas adjacent to Rocky Mountain Conifer Forest. In addition, the snowshoe hare prey base appears to decline from north to south within the Cascades. There is little evidence to suggest that the silver fir/ hemlock subtype actually supports lynx.

The historical occurrence record for Oregon is significantly smaller than for Washington. McKelvey et al. (2000) documented 134 verified occurrences (78 museum specimens) in Washington, compared with 12 verified occurrences in Oregon (9 museum specimens). There are a total of 765 records from Washington plus 200 trapping records, compared with a total of 72 records from Oregon. Unlike the clustering of occurrences seen in Washington and Utah, for example, which are suggestive of resident populations, lynx occurrences in Oregon are much more scattered and include several from anomalous habitats.

<u>The Bio Team recommends the following for Washington and Oregon</u>:

1) Map vegetation using Fig. 8.20 as the outer boundary as described above.
2) Because of the uncertainty as to whether Pacific silver fir/mountain hemlock constitutes primary vegetation, do not identify these vegetation types as lynx habitat. Also, do not delineate LAUs or apply the LCAS west of the crest of the Cascades unless subalpine fir vegetation types occur in amounts and distribution great enough to establish an LAU. Lynx surveys and/or snowshoe hare information should continue to be collected through cooperative efforts of the Forest Service and the U.S. Fish and Wildlife Service.
3) On the east side of the Cascades, continue mapping with subalpine fir habitat types as primary vegetation. Identify lynx habitat and delineate LAUs using the process and criteria described above.
4) The results of the mapping will indicate whether any administrative units should be removed from Appendix A of the LCAS due to insufficient amounts or arrangement of lynx habitat.

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