Biological Assessment of the Effects of National Forest Land and Resource Management Plans and Bureau of Land Management Land Use Plans on Canada Lynx

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Executive Summary

The Canada lynx (*Lynx canadensis*) is proposed by the U.S. Fish and Wildlife Service (FWS) for listing as a threatened species under provisions of the Endangered Species Act (U.S. Fish and Wildlife Service 1998a). Informal conferencing among FWS and USDA Forest Service (FS) and USDI Bureau of Land Management (BLM) began in the fall of 1998 under the direction of an interagency Lynx Steering Committee. As a part of this effort, a Science Report (Ruggiero et al. in press 1999a) and a draft Lynx Conservation Assessment and Strategy (Ruediger et al. in press 1999) have been prepared. Using these documents and other currently available scientific and commercial information, this Biological Assessment (BA) identifies the potential effects resulting from 57 FS Land and Resource Management Plans and 56 BLM Land Use Plans (collectively referred to as Plans) within the 16 state area where lynx are proposed for listing. Five geographic areas were considered: Cascade Mountains, Northern Rocky Mountains, Southern Rocky Mountains, Great Lakes and the Northeast. The Plans are assessed as written and amended, but not including any subsequent policy direction which has not been officially incorporated into the Plans.

The BA makes a determination of effect based on the not likely/likely to adversely affect standard of the Endangered Species Act (ESA), which will serve as the basis for both

conferencing and, if the lynx is listed, for formal consultation. The definitions used for determination of adverse effects are those specified in the FWS ESA Section 7 Consultation Handbook (U.S. Fish and Wildlife Service 1998b) and Forest Service Manual 2670.5(1).

The assessment of direct, indirect, and cumulative effects of the Plans was conducted at three scales: administrative unit (local), geographic area (regional), and distinct population segment (national). The assessment used two methods, as follows:

1. A questionnaire filled out by the 93 administrative units covering 113 Plans addressed in the analysis was used to determine how well the Plans directly or indirectly incorporate an array of programmatic lynx conservation measures recommended in the Lynx Conservation Assessment and Strategy (LCAS).

2. A geographic information system (GIS) analysis using currently available data was used to characterize historical and current lynx habitat with respect to habitat connectivity and likelihood for supporting lynx conservation. Inferences were drawn about how the Plans, as well as other cumulative effects, may potentially affect these factors.

Since the conservation measures in the LCAS were designed to address specific risk factors to lynx, the basic assumption was that failure of the Plans to either directly or indirectly incorporate the programmatic conservation measures may result in adverse effects to lynx. The programmatic conservation measures were consolidated into 15 evaluation criteria against which the Plans were assessed.

The Plans showed varied success in meeting the evaluation criteria, ranging from fully meeting some to not meeting others at all (Appendix G). All Plans did not meet at least some of the criteria. Not meeting the criteria means there is a risk of adverse effects to lynx in one or more of the following categories: (1) reduction in habitat quantity or quality, (2) habitat fragmentation contributing to loss of connectivity, (3) improved access for competing carnivores, or (4) direct mortality to lynx. The effects may possibly occur to individual lynx as well as to the population as a whole.

The effects identified for individual administrative units are cumulative at the geographic area scale, affecting subpopulations over a broader geographic extent. Also, the effects at the geographic area scale accumulate to the distinct population segment scale.

While most Plans do, either directly or indirectly, incorporate some positive measures for lynx, the BA makes the following findings:

1. Within the Great Lakes geographic area, weak direction to provide denning habitat, coupled with the high percentage of the geographic area in developmental allocations (65 percent) may risk adversely affecting lynx.

2. Plans in the Great Lakes geographic area may risk adversely affecting lynx by a lack of 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 thinning.

3. 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 contributing to a risk of adversely affecting lynx by limiting the availability of foraging habitat within these areas.

4. 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. This may be contributing to the risk of adverse effects to lynx.

5. 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 illegal shooting of lynx or access by other competing carnivores. The risk of road-related adverse effects is primarily a winter season issue.

6. Plans within the Northern Rockies, Southern Rockies, and Northeast geographic areas are weak in providing guidance for new or existing recreation developments. Therefore, these activities may contribute to a risk of adverse effects to lynx.

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

8. 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. These factors may be contributing to a risk of adverse effects to lynx.

9. 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. This may contribute to a risk of adverse effects to lynx.

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

11. For all geographic areas, 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 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, Plans may risk adversely affecting lynx by potentially contributing to a reduction in the geographic range of the species.

Determination of Effect

A determination of effect is made collectively for the 113 Plans at the distinct population segment scale. One determination

for the entire distinct population segment was reasonable given that:

1. The analysis showed that some adverse effects exist on each administrative unit and in each geographic area.

2. Making a determination at the same scale at which the species is proposed for listing was reasonable from a biological standpoint.

Based on the rationale described above, the Plans in total ***may affect and are likely to adversely affect the lynx***.

Critical habitat for the Canada lynx has not been proposed to date and, therefore, a determination of effect of the existing Plans on critical habitat is not applicable.

Recommendations

The BA team recommends amending or revising the Plans to incorporate conservation measures that would reduce or eliminate the identified adverse effects to lynx. The programmatic conservation measures listed in the draft Canada Lynx Conservation Assessment and Strategy (Ruediger et al. in press 1999) should be considered in this regard, once finalized.

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I. Introduction

A. Purpose

This biological assessment (BA) documents the potential effects of existing Forest Service (FS) Land and Resource Management Plans (LRMPs), or "Forest Plans" and Bureau of Land Management (BLM) Land Use Plans (LUPs) on the Canada Lynx (*Lynx canadensis*), hereafter referred to as the lynx. LRMPs and LUPs are collectively referred to as "Plans" in this document. In a Federal Register notice on July 8, 1998, the U.S. Fish and Wildlife Service (FWS) proposed a distinct population segment of the lynx within 16 states to be listed as threatened (U.S. Fish and Wildlife Service 1998a). This BA evaluates 57 LRMPs and 56 LUPs in 13 of these states: Maine, New Hampshire, Vermont, Michigan, Wisconsin, Minnesota, Colorado, Wyoming, Utah, Montana, Idaho, Oregon and Washington. A list of these plans is in Appendix A. The process for determining which plans are included is documented in Appendix B. In the Federal Register notice, the FWS also listed Massachusetts, where there are no FS or BLM units, and Pennsylvania and New York, where FS units are geographically separated from other lynx habitats, and lynx have not been observed for several decades. Appendix B provides further information on why these units were excluded.

The Endangered Species Act (ESA) regulations at 50 CFR 402.12(a) describe the purpose of a biological assessment:

"A biological assessment shall evaluate the potential effects of the action on listed and proposed species and designated and proposed critical habitat and determine whether any such species or habitat are likely to be adversely affected by the action and is used in determining whether formal consultation or a conference is necessary."

This BA fulfills this requirement, although it does not consider possible destruction or adverse modification of critical habitat, because critical habitat has not been proposed or designated. In the July 8, 1998 Federal Register notice, the FWS explained that for a number of reasons "designation of critical habitat for the contiguous United States population of the Canada lynx is not prudent."

As this document was prepared, the FWS was in the final stages of determining whether the lynx should be listed as threatened. The ESA regulation cited above explains that a BA is often used to initiate a conference for proposed species like the lynx if an action is "likely to jeopardize" the continued existence of the species (50 CFR 402.10(a)). However, a jeopardy determination is not required to initiate a conference, since conferencing is sometimes initiated at a "may affect" level.

For listed species, "formal consultation" is required if an action "may affect listed species or critical habitat" (50 CFR 402.14). Formal consultation is a process based on ESA Section 7(a)(2) and concludes with the FWS issuance of a biological opinion. For proposed species, a conference report can be rolled over into a biological opinion if and when the species is listed (50 CFR 402.10(d)).

Conferencing among the FS, BLM and FWS has already begun, so this BA is not necessary for determining if conferencing is needed. No "jeopardy" determination for the lynx has been made or is required. Rather, the purpose of this document is to determine to what extent these 113 Plans may affect lynx, to either conclude conferencing, or to set the stage for subsequent consultation if lynx are listed. One determination is being made for all

113 Plans within the distinct population segment because no individual Plan was found to result in a different determination.

This BA will choose among the following possible determinations and outcomes:

- The Plans have no effect on the lynx. No further conferencing or consultation is necessary.
- The Plans may affect and are likely to beneficially affect the lynx. If the FWS concurs, no further conferencing or consultation is necessary.
- The Plans may affect but are not likely to adversely affect the lynx. If the FWS concurs, no further conferencing or consultation is necessary.
- The Plans may affect and are likely to adversely affect the lynx. Conferencing will be conducted at the "may affect" level, and formal consultation would be initiated if the lynx is listed prior to completion of conferencing.

How Adverse Effects are Determined

In making a determination of potential effects, this BA looks at both programmatic guidance, such as goals, objectives, standards, and guidelines, and at land management allocations, which set a framework under which anticipated on-the-ground actions may occur on FS and BLM units.

Definitions of adverse effect can be found in the FWS ESA Section 7 Consultation Handbook, p. 3-13 (U.S. Fish and Wildlife Service 1998b) and Forest Service Manual 2670.5(1).

As discussed later, FS actions are generally implemented after two levels of decisions (a programmatic Plan and a projectdecision), with consultation and preparation of a BA often occurring at both levels. The BLM planning process is similar. Plans are considered "programmatic" in that they may allow, but generally do not require, specific actions on the ground. Programmatic plans are permissive, very similar to zoning ordinances, and they generally do not mandate specific projects. The programmatic nature of Plans makes their review more difficult. Past experience has shown that many activities allowed under the Plans are never carried out for a variety of reasons, such as funding limitations and environmental or policy considerations.

While programmatic plans do not compel on-the-ground actions to be carried out, the scope of actions contemplated by the plans can nevertheless be evaluated. The plans can be evaluated by how well they foreclose potential projects with adverse effects and how well they contain measures that might mitigate adverse effects. A determination could be modified by a second determination when specific actions are actually proposed.

At the programmatic level, it is impossible to anticipate all the mitigation measures that could be applied within individual projects. Thus, it may be possible for the Plan consultation to be based on a "likely to adversely affect" determination, while mitigation measures at the project level may result in "not likely to adversely affect" determinations.

By focusing the analysis on existing Plans as written and amended, this BA does not cover any subsequent policies, strategies, or programmatic plans that have not been incorporated into LRMPs and LUPs through Plan amendments. Thus, Plan amendments such as the Northwest Forest Plan, PACFISH, and INFISH have been considered. Non-amending policies, such as individual unit lynx strategies or the Forest Service moratorium on road construction in roadless areas were not considered.

Programmatic fire management plans are generally required to allow the use of wildland fire for resource benefits. This BA viewed these fire management plans as direction which is subsequent to the Plans, and thus beyond the scope of this Assessment. If a Plan did not prohibit the use of fire to accomplish resource objectives, no further evaluation was conducted to determine if a fire management plan was actually in place. The BA team recognizes that on units without fire management plans, implementation of fire suppression policies may not be in the best interest of lynx conservation. However, these suppression policies are outside the scope of this assessment of Plans.

This BA also does not cover project decisions. Thus, if these actions adversely affect the lynx, consultation will be required if the lynx is listed. Projects will also need to follow the FS, BLM and FWS conferencing process initiated last year as part of a Lynx Conservation Strategy Action Plan (USDA Forest Service 1998) and currently being refined. Field unit biologists have been given a draft Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et al. in press 1999) to use in project design and effects determinations.

Lynx Conservation Assessment and Strategy and Science Team Report

A draft LCAS has been developed by an interagency team. That document will be used in the conferencing/consultation process to minimize or avoid adverse effects to the lynx. The LCAS is not to be construed as a recovery plan. It consists of possible actions to avoid or mitigate adverse effects to the lynx.

Wherever possible, this BA references the LCAS. The first half of the LCAS provides an overview of lynx ecology, describes habitat and population distribution, and risk factors. The second half lists programmatic and project level conservation measures. This BA was developed, in part, by comparing the management direction in existing Forest Plans to the risk factors and programmatic conservation measures in the LCAS. The BA also used a GIS analysis of land management prescriptions in the Plans to assess landscape spatial patterns and connectivity, which the LCAS identifiies as important concerns in the conservation of lynx.

Both the LCAS and this BA draw upon the resources of a Science Team comprised of expert scientists. The Science Team identified and interpreted the body of scientific knowledge appropriate for consideration in making wise management decisions regarding the lynx, and produced a report (Ruggiero et al. in press 1999a) that is referenced throughout this BA.

The Nature of Forest Service Forest Plans (LRMPs)

The FS uses a two-level staged decision making process. As described in the FS Manual:

"Planning for units of the National Forest System involves two levels of decisions. The first is the development of a Forest Plan that provides direction for all resource management programs, practices, uses, and protection measures. The second level of planning involves the analysis and implementation of management practices designed to achieve the goals and objectives of the Forest Plan. This level involves site-specific analysis to meet NEPA requirements for decision making" (FSM 1922, 53 Fed. Reg. 26807, 26809, July 15, 1988).

As required by the 1976 National Forest Management Act (NFMA), a Forest Plan provides a framework for management of an entire Forest. It sets forth goals, objectives and limitations to actions in the form of standards and guidelines, both forestwide and

on subdivisions of the Forest called "management areas." It establishes a framework for monitoring and evaluation.

Forest Plans are permissive in that they allow, but do not mandate, certain activities. Plans specify minimum resource condition goals. These are essential in achieving management goals when allowable land use activities have the potential for adversely affecting lands and resources. Plan approval does not create any on-the-ground environmental changes. Nor does it dictate that any particular site-specific action must occur. Before an action implementing one of these plans takes place, several events must transpire. First, a site-specific action (such as a timber sale or a ski-area development) must be proposed. Next, the action is subject to NEPA and NFMA analysis and public comment. Finally, the FS must approve the action. Thus, a Forest Plan is just the first level of a two-level decision making process. The FS carries out its ESA Section 7 responsibilities at both decision levels.

By establishing goals and objectives, Forest Plans provide a framework for a number of multiple use activities, including vegetation management, recreation management, grazing, hardrock mining, oil and gas leasing, watershed restoration, fish and wildlife habitat management, fire/fuels management, land exchanges and acquisitions, and a variety of special uses. Many of these activities are specifically identified in the LCAS as "risk factors" to lynx (Ruediger et al. in press 1999).

Projects that will implement a Plan will need to be consistent with its framework of goals, objectives, standards and guidelines, but can also provide additional mitigation requirements specific to the project area. This makes it inappropriate to try to tie subsequent project level determinations to the Plan determination made by this BA.

The Nature of BLM Land Use Plans (LUPs)

Public lands managed by BLM are administered under the direction of either Resource Management Plans (RMPs) or the older Management Framework Plans (MFPs), hereafter referred to as Land Use Plans (LUPs). Plan decisions generally identify how and where lands and resources will be managed or allocated for various purposes consistent with legal and regulatory requirements. The Federal Land Policy and Management Act of 1976 (FLPMA), as amended, requires that public lands be managed under the principles of multiple use and sustained yield. Such management includes a broad range of requirements for protection of resources and resource values, for effective public involvement in the planning process, and for coordination with other federal agencies, Indian tribes, and state and local governments.

Public land management decisions are made in three levels: (1) LUPs, which are often general and allow for subsequent management discretion in properly managing lands and resources; (2) Activity or program-specific plans (e.g., plans for grazing allotments, areas of critical environmental concern, off-highway vehicle management areas, etc.) and (3) Project plans (e.g., vehicle route designations in specific areas, riparian restoration in specific watersheds or wetlands, fences and exclosures, rangeland improvements, prescribed fire, etc.)

BLM Plan-level decisions generally identify types of land uses that are allowed or prohibited in specific areas within a planning or administrative unit. Decisions to allow certain land use activities to occur are made through an analysis that accounts for land and resource occurrence; resource values; and requirements of laws, executive orders, regulations and policies. Plans also allocate resources for consumptive activities such as

livestock grazing, forest products harvesting, minerals extraction, etc. Plans specify minimum resource condition goals. These are essential in achieving management goals when allowable land use activities have the potential for adversely affecting lands and resources.

Planning decisions typically include designation of administrative areas including areas of critical environmental concern, research natural areas, wilderness study areas, proposed wild and scenic rivers, and proposed natural register properties; livestock grazing allotments and authorized forage consumption limits for livestock; minimum habitat condition goals necessary to sustain or conserve various wildlife species; land disposal and acquisition areas; and management standards for the use of prescribed fire, vegetation manipulation and weed control. They also include identification of off-highway vehicle management categories (open, closed, or limited). Activity-level planning is generally necessary to determine which routes of travel in a given area will be closed or open for vehicle use within the limited management category. This would occur at the second level of BLM planning.

BLM carries out its Section 7 responsibilities under the ESA at all three levels of planning. General, or first-level plans, are essential in carrying out the two major components of Section 7: stabilizing species and their habitat by preventing adverse impacts, and conserving species and their habitats through a proactive conservation or recovery strategy.

Use of Best Available Information

As noted by the Science Team, many of the factors that determine lynx distribution and abundance are not well understood (Ruggiero and McKelvey in press 1999). This creates uncertainty about the degree to which land management activities, including those of the FS and BLM, affect lynx. For the preparation of this BA, uncertainty was addressed in several ways.

The most recent information on lynx, as contained in the Science Team report (Ruggiero et al. in press 1999a) and the LCAS (Ruediger et al. in press 1999), was used throughout the BA. Other current information representing the best scientific and commercial information was used, as available. The professional judgment of the BA team was also applied. This document received a broad review at several federal agency levels prior to finalization. Therefore, this BA is a compilation of the best knowledge available at the time it was prepared.

Geographic Areas

For analysis purposes, the Plans are grouped into five geographic areas as shown in Figure 1 and described in Appendix C. The geographic areas are identified on the basis of their uniquely different forest ecosystems, management histories, and current lynx population status. These five geographic areas are:

- Cascade Mountains
- Northern Rocky Mountains
- Southern Rocky Mountains
- Great Lakes
- Northeast

The five geographic areas correspond to those also used in the LCAS. This is a finer scale than that described in the FWS July 8, 1998, Federal Register proposed listing notice (U.S. Fish and Wildlife Service 1998a), which identified only three geographic areas, combining the Cascades with the Northern and Southern Rocky Mountains. This BA and the LCAS have separated these latter three areas due to differences in habitat types, differences in management, such as the Northwest Forest Plan, and spatial separation.

Figure 1--States, Geographic Areas, and Administrative Units Considered

Please see the website for this figure at:

http://www.fs.fed.us/r1/planning/lynx/lynx.html

B. History and Status

Administrative History of Canada Lynx Listing Events

Numerous activities preceded the Federal Register proposed listing rule published on July 8, 1998 (U.S. Fish and Wildlife Service 1998a). The following dates and actions include major events in the administrative history:

August 22, 1991: A petition to list the "North American" (Canada) lynx in the North Cascades ecosystem of Washington as an endangered species and to designate critical habitat was received by FWS from the National Audubon Society and 11 other organizations.

October 6, 1992: FWS published a notice of a 90-day finding (57 FR 46007) indicating that the petition to list the "North American" (Canada) lynx in the North Cascades did not provide substantial information.

Early 1993: The Greater Ecosystem Alliance and other organizations sued FWS over the negative 90-day finding announced on October 6, 1992 and submitted new information.

April 28, 1993: A settlement agreement was reached whereby FWS agreed to re-evaluate the negative 90-day finding announced on October 6, 1992, in light of new information that was submitted by the petitioners.

July 9, 1993: FWS published a notice (58 FR 36924) indicating that the negative 90-day finding had been revisited, but that there still was not substantial information to support the petitioned action. However, FWS announced in the notice that it believed that sufficient evidence existed to indicate that an in-depth rangewide status review for the lynx should be conducted and that FWS intended to begin this status review.

November 30, 1993: A second settlement agreement was reached. FWS agreed to complete and publish the results of a status review throughout the lower 48 States by November 14, 1994.

April 27, 1994: A petition to list the "North American" (Canada) lynx in the contiguous United States and to emergency list the southern Rocky Mountain population was received from the Biodiversity Legal Foundation and four individuals.

August 26, 1994: FWS published a notice (59 FR 44123) indicating that the administrative 90-day finding found that the petition received April 27, 1994, presented substantial information indicating the requested action for the contiguous United States population may be warranted, but there was not substantial information to indicate that an emergency listing of a southern Rocky Mountain population was warranted.

December 27, 1994: FWS published a notice (59 FR 66507) stating the 12-month finding results were that listing the Canada lynx in the contiguous United States was not warranted. The finding represented FWS's administrative finding as a result of the status review agreed to in the April 28, 1993 lawsuit settlement and the administrative 12-month finding for the petition received April 27, 1994.

January 30, 1996: The Defenders Of Wildlife and 14 other organizations and individuals sued FWS in the U.S. District Court, District of Columbia, over the not warranted petition finding that was announced in the Federal Register on December 27, 1994.

March 27, 1997: The court issued an opinion and order setting aside the not warranted finding and remanded it back to FWS for further consideration. FWS was ordered to publish a 12-month finding on the status of the lynx within 60 days.

May 27, 1997: FWS published a 12-month petition finding (62 FR 28653) that the Canada lynx population in the contiguous United States was warranted for listing under the Endangered Species Act but precluded by actions on other species of higher taxonomic status. This warranted but precluded finding automatically elevated the Canada lynx to candidate species status.

September 15, 1997: Defenders of Wildlife et al. filed suit against FWS in the U.S. District Court, District of Columbia, arguing that the FWS violated the Endangered Species Act in finding that listing the Canada lynx population in the contiguous United States was warranted but precluded (published in the Federal Register May 27, 1997).

February 11, 1998: FWS and the Plaintiffs reached a settlement that called for the FWS to publish a proposed rule to list the Canada lynx in the contiguous United States by June 30, 1998.

July 8, 1998: FWS published a proposed rule (63 FR 36993) to list the contiguous United States population of the Canada lynx as threatened. Critical habitat was not proposed because the FWS concluded that snowshoe hare and lynx denning habitat will always shift spatially and temporally across the landscape as a result of natural fire, forest maturation, seasonal and human caused changes. Canada lynx would reasonably be expected to relocate in response to lynx population levels, prey availability, and habitat conditions thereby making little use of specific areas designated as critical habitat. The lynx was proposed for listing as a distinct population segment in the lower 48 states. The test for being classified as a distinct population segment is based on two elements: discreteness and significance. Lynx in the lower 48 United States are considered discrete because the population is delineated by an international political boundary that coincides with differences in status and management. In addition, the population of lynx in the lower 48 states is considered significant because loss of this population would cause a significant reduction in the range of the species.

July 8, 1999: FWS published a notice to extend the listing deadline (64 CFR 36836) from July 8, 1999 to January 8, 2000 to allow for time to obtain and review new information in a scientific report on Canada lynx from the USDA Forest Service, Rocky Mountain Research Station.

August 1999: Science Team Report is released to the public and 30-day comment period begins on FWS proposal to list.

September 24, 1999: Comments were due on proposal to list.

January 8, 2000: FWS is scheduled to publish a final decision on listing the Canada lynx as a threatened species.

FS, BLM and other Administrative History

An interagency lynx coordination effort was initiated in March 1998, because it appeared that the lynx would be proposed for listing under ESA. The agencies participating in the project include the FS, BLM, FWS, National Park Service (NPS) and the states with responsibilities for managing lynx populations and habitat. A Lynx Steering Committee composed of all participating agencies was established to provide oversight to several teams working on specific issues related to the lynx. Two teams, the Science Team and the Biology Team, have been charged with providing a scientific basis for lynx management and a lynx conservation

strategy, respectively. These teams released their draft reports for review earlier in 1999. Publication of final reports is expected in late fall 1999.

The FS and BLM began an informal conferencing process with the FWS in September 1998 by identifying administrative units most likely to have responsibility for lynx habitat management (USDA Forest Service 1998). In January 1999, the FS and BLM assembled an interagency team to conduct this BA. This analysis considers the best scientific and commercial lynx information available, including most recent information assembled by both the Science Team and the Biology Team.

Legal Status of Canada Lynx

In May 1997, the 12-month petition finding of warranted for listing automatically elevated the Canada lynx to candidate species status. In July 1998, the Canada lynx was proposed for listing as a threatened species and regulation requires a final decision on listing within 12 months of the proposed rule. This 12-month timeline was extended by 6 months on July 8, 1999. In September 1998, the FS and BLM began informal conferencing with the FWS and are currently in that status.

The lynx is a Regional Forester designated sensitive species in FS Regions 1, 2, 4, 6 and 9. Management of sensitive species is legally addressed in NFMA, not ESA. The FS directive system prescribes direction for managing sensitive species. Forests must develop and implement management practices to ensure that species do not become threatened or endangered because of FS actions (FSH 2670.22). Additional direction states that for sensitive species, include objectives in Forest Plans to ensure viable populations throughout their geographic ranges (FSH 2672.32). Any Forest or project level decisions must not result in loss of species viability or create significant trends toward Federal listing (FSH 2670.32(4)).

The BLM Special Status Species management policy manual (6840) requires that species proposed for listing under ESA be conserved in a manner comparable to that for a listed species, with the goal of taking actions that will preclude the need to list these species, or to allow for recovery to the extent that the protection of the ESA is no longer needed.

There are 16 states in the contiguous United States where the FWS considered Canada lynx to have at one time been a resident species (U.S. Fish and Wildlife Service 1998a). As of August 1999, lynx were classified as endangered by four states (Vermont-1972, New Hampshire-1980, Michigan-1987 and Colorado-1976). Lynx are classified as threatened by Washington (1993). Utah classifies the lynx as a sensitive species. Massachusetts officially classifies them as extirpated. The official status of lynx in Pennsylvania is presumed extirpated. The lynx is classified as a species of special concern in Maine (1997). The lynx has been reclassified as a state protected species with a closed season in Wisconsin. Despite being classified as small game or furbearers, Canada lynx are fully protected from harvest in New York (1967), Minnesota (1984), Wyoming (1973), Idaho (1997) and Oregon (1997). Canada lynx trapping seasons still occurred in Montana through 1998/1999, but were severely restricted to a statewide quota of two lynx. Once the quota was reached, the state issued a notice that the season for lynx was closed for the remainder of the year. The Montana Fish, Wildlife and Parks Commission has suspended trapping during the 1999/2000 season.

Several lynx conservation plans exist or are under development. Such plans include the lynx habitat management guidelines for Washington (Washington Department of

Wildlife 1993), the Idaho State conservation effort (Roloff 1995), Washington Department of Natural Resources conservation strategy (Washington Department of Natural Resources 1996), Boise-Cascade Timber Corporation lynx habitat management plan in Washington (Whitwill and Roloff 1996), Kootenai National Forest Lynx Conservation Strategy in Montana (Kootenai National Forest 1997), and the draft strategy for the conservation and reestablishment of lynx and wolverine in the southern Rocky Mountains (Colorado Division of Wildlife et al. 1997). As of August 1999, there was no comprehensive review of these plans to determine whether the guidelines in the plans are sufficient to maintain or increase lynx populations. The degree to which these plans are or will be implemented and monitored varies.

II. Canada Lynx Life History and Habitat Relationships

The following description of the life history and habitat relationships of lynx is general and derived from other, more in-depth publications. For a more detailed description see the FWS listing proposal for Canada lynx (U.S. Fish and Wildlife Service 1998a), the report of the Interagency Canada Lynx Science Team (Ruggiero et al. in press 1999a), the draft Canada Lynx Conservation Assessment and Strategy (Ruediger et al. in press 1999), and other sources referenced in these documents.

Lynx are medium-sized cats, specialized predators that are highly dependent on snowshoe hares (*Lepus americanus*) for food. Long legs and large feet make lynx highly adapted for hunting in the soft deep snow where snowshoe hares spend the winter (Quinn and Parker 1987). Canada lynx inhabit primarily the boreal, sub-boreal, and western montane forests of North America (Koehler and Aubry 1994).

In the contiguous United States, lynx occur almost exclusively in the southern extensions of the boreal forest habitat types (McKelvey et al. in press 1999b); the Cascade Range of Washington and Oregon; the Rocky Mountains from Montana, Idaho, and Oregon south to Utah and Colorado; the western Great Lakes region; and the northeastern United States region from Maine, south to New York and Pennsylvania, and east to Massachusetts (McCord and Cardoza 1982, Quinn and Parker 1987). Lynx inhabit a mosaic between boreal forests and subalpine coniferous forest or northern hardwoods (Barbour et al. 1980, McCord and Cardoza 1982, Koehler and Aubry 1994, M. Hunter pers. comm. 1994, Colorado Division of Wildlife et al. 1997). Figure 2 displays records of known lynx occurrence within the U.S. (McKelvey et al. in press 1999b).

Ruediger et al. (in press 1999) report that some important lynx habitats in the Rocky Mountains of the western U.S. are islands of coniferous forest surrounded by shrub-steppe habitats, but the nature of lynx movements between these habitats is poorly understood. Lynx have been documented using shrub-steppe habitats that were near snowshoe hare habitats (within approximately 40 km) during jackrabbit population highs (Lewis and Wenger 1998) and when seasonally preying on Wyoming ground squirrels (Squires and Laurion in press 1999). The occasional availability of abundant alternate prey may attract lynx into these habitats, in contrast to dispersal during periods of prey scarcity as documented in the north (Poole 1997, Mech 1980). It is unknown whether these shrub-steppe habitats are critical to lynx persistence at the southern edge of their range, or whether they are only used opportunistically with no real importance (Ruediger et al. in press 1999).

McKelvey et al. (in press 1999b) found lynx locations within the contiguous U.S. to be closely associated with broadscale vegetation types. In the West, 83 percent of the locations fall within Kuchler's Rocky Mountain Conifer Forest Form. For the Great Lakes States, 88 percent of points are within Bailey's Mixed Deciduous Coniferous Forest Province. In the Northeast, Bailey's Mixed Forest-Coniferous Forest Tundra Province encompases 88 percent of the locations. In the West and the Northeast, elevation zones that encompass most of the lynx points analyzed by McKelvey et al. (in press 1999b) are higher than the average elevation in the states.

Habitat components necessary to support lynx include forests with large woody debris, such as downed logs and windfalls, to provide denning sites with security and thermal cover for kittens (McCord and Cardoza 1982,

Koehler 1990, Koehler and Brittell 1990). Stand structure appears to be of more importance than forest cover type (Mowat et al. in press 1999), and denning habitat must be available throughout the home range (Bailey 1974). Based on information from the western United States, Koehler and Brittell (1990) concluded sites selected for denning also must provide for minimal disturbance by humans and proximity to foraging habitat, with denning stands at least 1 hectare (2.47 acres) in size. Lynx seem to prefer to move through continuous forest, and particularly use ridges, saddles, and riparian areas (Koehler 1990). An increase in daily cruising radius from 2.7 km (1.7 mi) during moderate to high hare densities to 5.4 km (3.4 mi) during low hare densities has been documented (Ward and Krebs 1985).

Particularly when dispersing during periods of prey scarcity in the north, lynx are known to make long distance movements, up to 1,000 km (625 mi). Dispersing lynx have been found to cross large rivers and lakes, and to occur in agricultural areas or far south of their normal range (Poole 1997, Mech 1980).

Some degree of geographic connectivity between Canadian and southern habitats appears necessary for the persistence of southern lynx populations (McKelvey et al. in press, 1999b). Though periodic increases in lynx numbers in the contiguous United States may be accentuated by dispersal of transient animals from Canadian populations (Mech 1977, Brainerd 1985, Washington Department of Wildlife 1993), immigration pulses from the North are believed to be incapable of demographically maintaining southern lynx populations. Habitats of southern populations must support recruitment and survival (Ruggiero et al. in press 1999b).

Snowshoe hare, the primary prey for lynx, prefer forests with stands of conifers and shrub understories that provide forage, and cover to escape from predators and protection during extreme weather (Wolfe et al. 1982, Monthey 1986, Koehler and Aubry 1994). Lynx usually concentrate their foraging in areas where hare activity is high (Koehler et al. 1979, Parker 1981, Ward and Krebs 1985, Hash 1990, Weaver 1993, Koehler and Aubry 1994), and do not hunt in large, open areas with little or no cover (Koehler 1990, Koehler and Brittell 1990). Although cover is important to lynx when searching for prey (Brand et al. 1976), lynx often hunt along the edges of openings (Mowat et al. in press 1999).

The association between lynx and snowshoe hare is considered a classic predator-prey relationship (Saunders 1963, van Zyll de Jong 1966, Quinn and Parker 1987), and in much of its North American range, lynx populations are known to fluctuate with the approximate 10-year hare cycle of abundance (Elton and Nicholson 1942). Aubry et al. (in press 1999) report that lynx food habits, home range sizes, densities, and reproductive characteristics in southern boreal forests are generally comparable to those reported for northern lynx populations during times of hare scarcity. Hodges (in press 1999) concludes that many southern snowshoe hare populations are fluctuating and may be cyclic like northern hare populations. If southern hares fluctuate, lynx may be cyclic, as well (Ruggiero et al. in press 1999b).

Lynx also prey on red squirrels, especially during periods of low snowshoe hare availability (van Zyll de Jong 1966). Red squirrels, an important alternative prey in southern lynx populations (Ruggiero et al. in press 1999b), are primarily associated with the coniferous forests of northern and western North America. They are also common in eastern forests containing some mature conifers or nut-bearing hardwoods. Red squirrel densities tend to be highest in late successional, closed-canopy forest with substantial quantities of coarse woody debris,

Figure 2--Lynx Records Within Five Time Periods

Please see website for this figure at:
http://www.fs.fed.us/r1/planning/lynx/lynx.html

and lower in young stands that lack cone production (Layne 1954, Obbard 1987).

Maintenance of persistent snowshoe hare and red squirrel populations requires a landscape mixture of coniferous stands with dense understory cover along with stands of mature and old-growth forest with abundant coarse woody debris (Ruggiero et al. in press 1999b).

Lynx also prey opportunistically on other small mammals and birds, particularly when hare populations decline (Nellis et al. 1972, Brand et al. 1976, McCord and Cardoza 1982). The summer diet also shows evidence of a greater diversity of prey species (Koehler and Aubry 1994, Quinn and Parker 1987).

There has been little research on lynx diet within the southern portion of its range except in Washington (Koehler 1990). In areas characterized by patchy distribution of habitat, alternate prey could include white-tailed jackrabbit (*Lepus townsendii*), black-tailed jackrabbit (*Lepus californicus*), ground squirrels, sage grouse (*Centrocercus urophasianus*), and Columbian sharp-tailed grouse (*Tympanichus phasianellus*) (Lewis and Wenger 1998, Staples 1995, Quinn and Parker 1987).

In addition to the physical and forage components of habitat, community factors exist, such as other predators which may compete with lynx for food, interfere with lynx behavior, or kill lynx. Noting that data addressing the question are limited, Ruggiero et al. (in press 1999b) state that in the contiguous U.S., competitors, especially the coyote, likely influence lynx recruitment and survival, and that factors that facilitate movement of generalist predators into areas occupied by lynx, such as compaction of snow by snowmobiles or snowshoes/skis, should be considered a conservation risk.

Regarding human impacts to lynx, Ruggiero et al. (in press 1999b) conclude that, given current limited information, direct human impacts on lynx populations are minimal; however, trapping mortality, either intentional or incidental, poses a significant risk to the persistence of lynx in the southern portions of its range. Ruggiero et al. (in press 1999b) also state that, in general, roads do not appear to be barriers to lynx movement. Nevertheless, they state fenced roads or large interstate highways could potentially form movement barriers. Ruggiero et al. (in press 1999b) found that existing data, though sparse, do not indicate that roads are a major factor for lynx. Ruediger et al. (in press 1999) state "Though documented occurrences of lynx being killed on roads are not common, there is some recent evidence that paved roads may be a concern in lynx habitat management," citing highway development that often fails to include features that facilitate animal movement, and eight resident lynx documented as being killed on highways in Canada and Alaska.

Habitat References

The habitat descriptions and maps used in this BA in reference to lynx and lynx habitat may appear to have some inconsistency. This is due to multiple vegetation and landform classifications and descriptions that have been published for various parts of North America, which are based on different scales, and which may be appropriate for different applications (Hann et al. 1997, Demarchi 1994, Franklin and Dyrness 1973, Daubenmire and Daubenmire 1968, Kuchler 1964, Bailey 1998 and others).

The lynx habitat descriptions of forest community types in Appendix C were used to provide FS and BLM offices with more detailed information about habitats to be considered in filling out the questionnaire contained in Appendix D.

Potential habitat, as defined in this document, is based on Kuchler (1964 and 1985) potential vegetation types in the western U.S. and Bailey (1998) potential vegetation types in the Great Lakes and Northeast. Potential habitat was used as a more geographically inclusive classification than the previously discussed habitat descriptions to determine which Plans would be analyzed in the BA, and to conduct a comparison in the effects analysis section. Of the potential lynx habitat within the scope of this BA, 44 percent is on National Forest System lands, 3 percent is on BLM-administered lands, and the remainder is on lands of other ownerships. See Table 1 and Figure 3 for potential lynx habitat.

Primary areas of lynx occurrence were determined by McKelvey et al. (in press 1999b) by superimposing lynx location records over Kuchler (1964) and Bailey (1998) classifications in the three western geographic areas and the two eastern geographic areas, respectively. They characterize as primary areas of occurrence the Kuchler and Bailey classification types that contain 75 percent or more of the superimposed lynx locations. Most of the remaining locations are in close proximity to these types and well within the range of mapping error. These primary areas of occurrence are hereafter referred to in this BA as ***primary habitat***.

The BA Team acknowledges that primary habitat is not necessarily a definitive or complete representation of habitat that lynx may use or require. Basing a representation of lynx habitat on known occurrences of the species is an extrapolation, especially without extensive radio-tracking or survey data throughout the species' range. There likely are inclusions of finer scale vegetation types, non-habitat (meadows, rocky areas, etc.) or topography that lynx do not use within what we consider primary habitat. Likewise, intensive surveys or additional research could result in additional occurrence records or better understandings of how lynx use habitats that might expand or contract what we depict as primary habitat. Nevertheless, existing direction for preparing Biological Assessments (FSM 2672.42) requires the identification of habitat using the best information available. The close association of lynx occurrences with particular vegetation types represents the best scientific information currently available for identifying lynx habitat, and thus was chosen by the BA Team for this purpose. The depiction of lynx habitat in this BA is consistent with lynx habitat as defined and depicted in the LCAS.

Of the primary lynx habitat within the scope of this BA, 44 percent is on National Forest System lands, 2 percent is on BLM-administered lands, and the remainder is on other land ownerships. See Table 2 and Figure 3 for primary lynx habitat.

Primary habitat in the Great Lakes and Northeast geographic areas is displayed as large areas of continuous boreal forest (with interspersed hardwoods and bogs). This is partly the result of primary habitat being mapped using Bailey's subsections, which contains inclusions of non-habitat. In reality, the spatial pattern of primary habitat is more fragmented than depicted. This is due to these inclusions and habitat conversion resulting from agricultural and residential development, as well as forest type conversion from preferred to less desirable forest cover types for lynx (Ruediger et al. in press 1999). Inclusions of non-habitat also occur within the Kuchler vegetation types in the three western geographic areas, but not to the extent resulting from using Bailey's subsections in the Great Lakes and Northeast geographic areas.

Appendix E contains a more complete description of habitat mapping products and their uses in this BA.

Table 1--Potential lynx habitat (Kuchler and Bailey potential vegetation types).

	Cascades		No Rockies		So Rockies		Great Lakes		Northeast		Total	
	Acres (000's)	%	Acres (000's)	%	Acres (000's)	%	Acres (000's)	%	Acres (000's)	%	Acres (000's)	%
FS	12174	78	43214	71	15461	62	5635	13	1100	4	77589	44
BLM	302	2	2022	3	2304	9	0	0	0	0	4628	3
Other	3175	20	15615	26	7245	29	38165	87	28392	96	92592	53
Total	**15651**	100	**60851**	100	**25010**	100	**43800**	100	**29492**	100	**174804**	100

Table 2--Primary lynx habitat (primary areas of lynx occurrence, McKelvey et al. 1999b).

	Cascades		No Rockies		So Rockies		Great Lakes		Northeast		Total	
	Acres (000's)	%	Acres (000's)	%	Acres (000's)	%	Acres (000's)	%	Acres (000's)	%	Acres (000's)	%
FS	4112	99	23168	67	4987	76	4459	19	1097	7	37823	44
BLM	32	<1‘	1559	5	349	5	0	0	0	0	1908	2
Other	48	1	9603	28	1255	19	19324	81	15048	93	45310	54
Total	**4192**	100	**34330**	100	**6591**	100	**23783**	100	**16145**	100	**85041**	100

Figure 3--Potential Lynx Habitat and Primary Areas of Occurrence (Primary Habitat)

Please see website for this figure at:
http://www.fs.fed.us/r1/planning/lynx/
lynx.html

III. Conservation Biology Framework for Effects Assessment

Knowledge of lynx biology and ecology is limited. This constrains our ability to analyze with certainty how well Plans conserve lynx or lynx habitat. Nonetheless, we can use a framework based on metapopulation biology and landscape ecology principles to conduct portions of our analysis.

Metapopulation Biology

Populations in nature exhibit continuous variation in their distribution and spatial structure, reflecting the varying availability and connectedness of suitable habitat within the changing landscape (Hanski and Gilpin 1997). Population persistence is sensitive to spatial landscape structure, and metapopulation models have been developed to predict population dynamics in fragmented landscapes (Harrison 1991). In general, populations have a higher probability of persisting in landscapes where suitable habitat patches are large and highly connected (Stith et al. 1996). In this scenario, the population functions as a continuous demographic unit with frequent movement of individuals between patches. In contrast, populations are highly prone to extinction (non-equilibrium metapopulation) with a spatial pattern consisting of suitable habitat patches that are too small and too distant from each other to facilitate successful animal dispersal and recolonization. An example of this is the gradual loss of small boreal mammals from isolated mountain tops of the southwestern U.S. Habitat that was once connected during the Pleistocene epoch has been isolated by post-Pleistocene climatic warming (Brown 1971). Between these examples of high probability of persistence to high probability of extinction, are the spatial types of metapopulations where local populations are isolated and vulnerable to extinction but persist because they are sufficiently connected with other source patches in the landscape matrix to allow successful animal dispersal and recolonization (Harrison 1991).

The probability of persistence declines with increasing fragmentation and isolation. That does not mean that more isolated, and therefore more vulnerable, subpopulations are unimportant. Peripheral populations may contain valuable genetic, physiological or behavioral adaptations that are unique to their ecological success. Unfortunately, nothing is known about geographic variation in these adaptations for lynx in northern or southern areas (Ruggiero et al. in press 1999c).

Because suitable habitats in areas where populations act as metapopulations are spatially separated, the persistence of a metapopulation is dependent on the efficiency and success of dispersing animals in reaching isolated patches of suitable habitat. When patches are fragmented and connections between patches do not exist, recolonization becomes problematic and the metapopulation may be unable to persist, even though patches of suitable habitat remain (Meffe and Carroll 1997). Additional fragmentation and isolation of suitable habitat occurring as a result of land management activities can not only affect small isolated habitat patches supporting smaller populations but also large contiguous patches supporting higher population levels. Hanksi and Gilpin (1997) suggest that recognizing the importance of metapopulation structure will make conservation efforts more challenging, but also more likely to succeed in the long term.

Additional Ecological Considerations

Large, contiguous, well-connected areas of suitable habitat appear to be essential for the persistence of lynx populations (McKelvey et al. in press 1999a). Lynx populations are unlikely to persist in relatively small, isolated

areas of suitable habitat when opportunities for recolonization are reduced or eliminated.

Temporal factors create additional complexity for spatial metapopulation models. Densities of prey and predators change as prey habitat undergoes stand succession. There is also some evidence that southern lynx and hare populations have cyclic fluctuations which potentially changes the dynamics of local extinction and colonization (McKelvey et al. in press 1999c). In many areas of southern boreal forests, hare densities appear to be close to the lower limit required for lynx reproduction. This suggests that southern lynx habitat at this threshold is probably a mosaic of source and sink areas that shift with disturbance and succession (McKelvey et al. in press 1999c). Source habitats are those environments which produce surplus animals which must disperse in order to survive. Sink habitats do not produce enough animals to persist without immigration from source environments.

Landscape conditions have changed for lynx from historical to current times. Fire, in southern boreal forests, is a dominant natural disturbance process (along with wind, insects, and disease) maintaining the mosaic of forest successional stages providing habitat for snowshoe hare, red squirrels and lynx (Agee in press 1999). In high severity boreal fire regimes, the majority of the land base is burned by only a few large catastrophic fires. Maintaining ecosystem resiliency and sustainability for systems prone to such large disturbances requires very large spatial scales where the size of these large disturbances is small in relation to the total area (McKelvey et al. in press 1999c). The dynamic landscape mosaic (patch size, pattern, interconnectedness) associated with historical natural disturbance patterns and processes is offered as a template for a desired future landscape condition supporting lynx conservation (Ruediger et al. in press 1999, McKelvey et al. in press 1999a).

Allen and Hoekstra (1992) suggest that one of the primary causes for loss of ecosystem resiliency and sustainability is the loss of context caused by management activities. Loss of context refers to the difference between the area and planning horizon of management activities in comparison to the spatial and temporal scale of processes in natural ecosystems (McKelvey et al. in press 1999c). For example, the age class distribution and mosaic spatial pattern of forest stands produced by large scale disturbance events in natural systems are more complex and diverse when compared to results associated with conventional even-aged forest management approaches (McKelvey et al. in press 1999a).

Continued fire suppression, over time, can also alter vegetation mosaics and stand composition, and may reduce foraging habitat for hare (Ruediger et al. in press 1999). Fire exclusion may have permanently changed the dominant successional pathways and stand composition in jack pine forests of the Great Lakes geographic area. However, in western ecosystems, the removal of fire from high elevation boreal forests has not been as significant as in lower elevation warm/dry forests, such as ponderosa pine (Agee in press 1999).

Successful dispersal of juvenile lynx and the ability to move long distances in search of prey are key factors in connecting and maintaining persistence in lynx metapopulations. Lynx have been documented dispersing long distances (Mowat et al. in press 1999). Human-created developments, such as interstate highways, can interfere with dispersal and movement. High traffic volume highways (particularly fenced 4-lane interstate highways) likely impede movements and dispersal (Apps in press 1999). Eighteen of 37 mortalities of translocated lynx were attributed to vehicle collisions in an unsuccessful New York reintroduction (Brocke et al. 1990). Recent mortalities to

transplanted lynx in Colorado resulting from collisions with vehicles also highlight the risk.

It would be difficult for a lynx to travel from the Washington Cascades south to the Oregon Cascades by crossing the Columbia River. Such movements may have occurred prior to human developments such as interstate highways, railroads, residential development on both sides of the river, and hydroelectric impoundments that have widened the river. These impoundments also result in sustained large river flows throughout the year that were seasonally substantially less under pre-dam conditions.

Factors that increase risk to metapopulation persistence include the fragmentation and isolation of suitable primary habitat patches and the direct and indirect effects of human activities on habitat utilization. Characteristic of metapopulations, local extinctions are likely to occur in some patches of the overall metapopulation, and then be offset by recolonization from other source populations. Litvaitis et al. (1991) speculate that historical populations of lynx in New Hampshire and Quebec were continuous, and that immigrating lynx entered New Hampshire on a regular basis. They further presume that large-scale timber harvesting and agricultural and residential development along the St. Lawrence Seaway in southern Quebec isolated lynx populations in the Northeast geographic area. Lynx populations in New Hampshire were unable to persist without immigration of lynx from the north (Litvaitis et al. 1991).

Factors potentially influencing lynx habitat availability, habitat utilization, and connectivity are numerous. These include risk factors associated with certain timber management practices, fire management, dispersed recreation, developed recreation, backcountry roads and trail use, livestock grazing, human development, trapping, highways, land ownership patterns and ice breaking (St. Mary's River, St. Lawrence Seaway).

The analysis by McKelvey et al. (in press 1999b) of primary areas of lynx occurrence (referred to in this document as primary lynx habitat) identifies a close correlation between lynx occurrence and vegetation types. Lynx occur predominantly in ecoregions known as Laurentian Mixed Forest Province in the Great Lakes and Northeast, and Rocky Mountain Conifer Forest Form in the Cascades, Northern Rockies and Southern Rockies. These ecoregions are southern extensions of boreal forests dipping from Canada into the contiguous U.S. Most lynx occurrences outside of these ecoregions occur immediately adjacent to them, suggesting an even tighter correlation between these habitats and occurrence.

Primary lynx habitat (see Chapter II for definition) near the Canadian border but within the U.S. tends to be abundant and connected with larger areas of suitable habitat in Canada. This contrasts with the fragmented, more isolated, and smaller island patches of primary habitat found at the southern extent of the forested regions listed above. This pattern of habitat availability is reflected by the following examples: (1) well-connected habitat in the northern Washington Cascades becomes more linear and narrows in the southern Oregon Cascades, and (2) extensive blocks of primary habitat in Montana and Wyoming become more isolated as one moves south.

The spatial distribution of primary lynx habitat in the lower 48 states ranges from large areas of contiguous forests with a higher likelihood of conserving lynx, to varying degrees of naturally fragmented habitat where lynx require successful dispersal and recolonization of empty habitat patches in order to persist, and ultimately to a network of small patches that are likely too isolated for a population of lynx to persist (Figure 3).

IV. Effects Assessment

A. Methods

An assessment of the potential effects of existing Plans on the Canada lynx was conducted at three scales: administrative unit, geographic area, and distinct population segment. The assessment was based primarily on two analysis methods: an examination of individual Plans' standards and guidelines and a geographical information system (GIS) analysis based on the Plans' land management allocations and other landscape features.

1. Examination of Individual Plans

An examination of individual Plans was conducted to determine the degree to which they incorporate measures necessary to avoid adversely affecting lynx at the programmatic Plan level. The primary vehicle for this assessment was a questionnaire (Appendix D) that assessed LRMPs on 57 National Forests and 56 LUPs on 36 BLM Resource Areas, Districts, or Field Office areas, within the area in which lynx are proposed for listing (refer to Appendix B for an explanation of how these administrative units were selected). The LCAS identified risk factors that may adversely affect lynx. Where possible, the LCAS then described conservation measures, both at the programmatic and project levels, that would avoid or mitigate these adverse effects. The BA questionnaire was designed to identify whether each individual Plan incorporates the programmatic conservation measures. The Plans could achieve lynx conservation either through incorporating programmatic conservation measures specific to lynx or through other measures that indirectly conserve lynx.

The questionnaire was used for this analysis because it provided a direct method of quickly evaluating a large number of Plans and it utilized the knowledge of people who work directly with the Plans. In cases where questionnaire responses did not provide sufficient information to evaluate a Plan, the Plan for that unit was reviewed by the BA team. If the information was still uncertain, personnel on the administrative unit were contacted, and the questions were discussed in greater detail.

In addition to the questionnaire, supplemental questions were asked of BLM units for the purpose of more accurately characterizing the nature of lynx habitat on BLM-administered lands. The questions, shown at the end of Appendix D, were developed to ascertain the amount of forested lynx habitat on the units and its contiguity with similar habitats on other federal lands.

Upon return of the completed questionnaires, questions addressing related issues were grouped to form 15 evaluation criteria against which each Plan was rated. These criteria relate directly to lynx habitat needs and the risk factors and associated programmatic conservation measures considered necessary to provide adequate lynx habitat (Ruediger et al. in press 1999). The assessment examined the effects of Plans on all lynx habitat (potential, primary, and connectivity). The evaluation criteria and the questions used to develop them are displayed in Table 3. Table 3 also shows whether the activities associated with the criteria are most likely to occur within developmental or nondevelopmental land allocations in the Plans as described in Appendix F.

Some portions of the questionnaire required narrative responses (e.g., questions 36-39, 43), and these were not used in developing the evaluation criteria. Narrative responses were used to further interpret how an individual

.

Table 3--Evaluation Criteria

Evaluation Criteria	Question Nos.	Allocation[1/]
1. DENNING HABITAT: Plan contains either specific or incidental direction that results in providing denning habitat.	7, 8, 14a, 14b	D/N
2. FORAGING HABITAT: Plan contains either specific or incidental direction that results in providing foraging habitat.	7, 8, 17, 18	D/N
3. HABITAT CONVERSIONS: Plan prohibits habitat conversions that would reduce habitat suitability for lynx.	10, 11	D
4. THINNING: Plan provides direction for integrating lynx habitat needs in stand thinning projects.	15, 16a, 16b	D
5. FIRE MANAGEMENT: Plan incorporates fire management direction that helps maintain or improve lynx habitat.	17, 18a, 18b	D/N
6. LANDSCAPE PATTERNS: Plan direction either directly or indirectly results in landscape vegetation patterns that maintain or improve lynx habitat suitability.	9, 12, 13, 14c	D/N
7. FOREST ROADS: Plan contains direction pertaining to roads that helps promote lynx conservation.	23a, 23b, 24	D
8. DEVELOPED RECREATION: Plan contains direction that mitigates the effects of developed recreation on lynx and lynx habitat.	25a, 25b, 26a, 26b	D
9. NON-WINTER DISPERSED RECREATION: Plan contains direction that mitigates the effects of non-winter dispersed recreation on lynx and lynx habitat.	27, 29	D/N
10. WINTER DISPERSED RECREATION: Plan contains direction that mitigates the effects of winter dispersed recreation on lynx and lynx habitat.	27, 28a, 28b, 30a, 30b	D/N
11. MINERALS AND ENERGY: Plan contains direction that mitigates the effects of minerals and energy development on lynx and lynx habitat.	31	D/N
12. CONNECTIVITY: Plan contains direction that mitigates potential barriers to lynx movement and maintains habitat connectivity. Riparian management and other connectivity issues are considered.	32, 33	D/N
13. LAND ADJUSTMENTS: Plan contains direction that maintains or improves lynx habitat during land tenure adjustments.	34, 35	D/N
14. COORDINATION: Plan contains specific direction for coordinating issues that may affect lynx with nearby units and other agencies.	40, 41	D/N
15. MONITORING: Plan contains direction for monitoring lynx and snowshoe hare or their habitats.	42a, 42b	D/N

[1/] The Allocation column in Table 3 identifies whether a given criterion is most likely to occur in nondevelopmental land allocations (N) (management prescriptions 1, 2, and 3 in Appendix F) or developmental land allocations (D) , (all other management prescriptions) or both (D/N). These are general guidelines and site-specific exceptions may occur.

administrative unit's Plan did or did not conserve lynx.

For each Plan assessed, one of the following ratings was assigned for each evaluation criterion and displayed in a matrix (Appendix G). The guidelines in Appendix G explain how the ratings were assigned.

F The Plan fully meets the criterion; near certainty the criterion is met.
S The Plan substantially meets the criterion; highly probable the criterion is met.
M The Plan marginally meets the criterion; criterion may or may not be met.
N The Plan does not meet the criterion; criterion not met at all or is unlikely met.
U Unknown if the criterion is met; inadequate information to assess.
NA The criterion is not applicable on the administrative unit.

FS and BLM administrative units were grouped in the matrix into five geographic areas. A summary of the ratings for each criterion was then presented narratively within each geographic area, and the resulting potential effects to lynx or their habitats were described. Those criteria for which the risk of adverse effects was found to be significant within a geographic area were identified (e.g., a preponderance of N and M ratings which could result in effects which are not discountable, beneficial, or insignificant as defined by U.S. Fish and Wildlife Service 1998), and the effects carried forward as part of the rationale for the determination of effect. If it was not explicitly stated in the narrative that the effects carried forward to the determination of effect, then the effects were found to be discountable or insignificant for that criterion. The ratings for those criteria found to be presenting a risk of adverse affects to lynx were summarized in tabular form for each geographic area and for the entire distinct population segment (Tables 4-9). These summaries are only a general information display of the ratings in the larger matrix (Appendix G) and not a quantitative assessment of effects. These tabular summaries are not quantitative assessments because the amount of lynx habitat differs among administrative units and because the relevance of some evaluation criteria varies among geographic areas depending on the risk factors most important for each area.

2. GIS Analysis

GIS analysis was conducted to provide a spatial representation of habitat connectivity and a comparative assessment (relative to supporting lynx conservation) of historical landscapes versus managed landscapes under the programmatic direction of current Plans. Based on this comparison, the BA team reached some conclusions regarding the potential effects of these Plans on large scale lynx habitat issues at the distinct population segment level and across each of the five geographic areas. This GIS analysis is not a population viability assessment (PVA). McKelvey et al. (1999c) state that we cannot build even the simplest deterministic models needed for a formal PVA given the scarcity and uncertainty of data on lynx vital rates.

The concepts of connectivity and metapopulation dynamics are useful tools in understanding how species persist at a landscape scale. Because of limited research on lynx in the conterminous U.S., little is known about the importance of these concepts to lynx ecology. Addressing the issues of connectivity and metapopulation dynamics tends to be speculative and conceptual because of the uncertainty of the science. The practical challenges of conducting research at the scale of large geographic areas tend to limit research efforts.

Despite these limitations, the BA team examined these spatial issues based on concepts described in Chapter III Conservation Biology Framework for Effects Assessment and insights drawn from the Science Report (Ruggiero et al. in press 1999).

A key component of this GIS assessment is a map delineating potential habitat and primary areas of lynx occurrence (primary habitat). Primary habitat is based on lynx occurrence data from McKelvey et al. (in press 1999b).

Another interim product for this Assessment categorized land allocations (and associated activities) in the Plans into eight broad management prescriptions. Much of this information was already assembled for some geographic areas covered by this BA, but in other areas some crosswalk of planning codes and mapping was necessary. The descriptions of management prescriptions are contained in Appendix F.

GIS analyses did not consider adjacent Canadian habitats. Depictions of habitat connectivity and likelihood for supporting lynx conservation could differ along the U.S./Canadian border if adjoining Canadian habitats were included. The addition of adjacent Canadian habitat would increase the area with moderate or higher likelihoods for supporting lynx conservation (e.g., the Purcell Range in Montana and British Columbia).

HIstorical Lynx Habitat Distribution and Likelihood for Supporting Lynx Conservation

As discussed in Chapter III, McKelvey et al. (1999) suggest that lynx populations in relatively small, isolated patches of suitable habitat are unlikely to persist when opportunities for recolonization are reduced or eliminated. The BA team utilized 1800 km^2 (695 mi^2) of nearly continuous suitable habitat as a break point for describing polygons with a higher likelihood for supporting lynx conservation. The 1800 km^2 (695 mi^2) size is based on Koehler's (1990) study area of this size in north central Washington which supports a population of approximately 25 lynx. Koehler's study area consisted of extensive subalpine forest (primarily Engelmann spruce, subalpine fir, lodgepole pine, and Douglas-fir) with minor inclusions of meadows and alpine non-habitat. The estimated density of lynx in this area was about one lynx per 50 km^2. Because we feel that the Okanogan population represents a likely minimum viable population, we are using 1800 km^2 (695 mi^2) of nearly continuous habitat as a break point for polygons that may be able to support lynx in the short term without dispersal.

The Lynx Science Team (Ruggiero et al. in press 1999b) suggests that an area of at least 1250 km^2 of contiguous suitable habitat may be necessary for a population of 25 lynx to persist in the short-term, but recognizes that the actual conservation area would need to be considerably larger. The Lynx Science Team derives the 1250 km^2 by simply multiplying the number of animals (25) times the density of one lynx per 50 km^2. The BA Team chose to use the larger more conservative size for GIS analysis because it is based on the actual study area size upon which density estimates were drawn, and addresses the qualifying comment by the Lynx Science Team that the actual conservation area would need to be considerably larger.

The following assumptions were used to develop Figure 4: Historical Lynx Habitat Distribution and Likelihood for Supporting Lynx Conservation. 1/

1. Primary lynx habitat is more tightly correlated with records of lynx occurrence and likely lynx habitat preference when compared to more general habitat descriptions (i.e., potential lynx habitat).

2. Large areas of primary habitat at least 1800 km2 (695 mi2) in size are likely more capable of supporting self-sustaining lynx populations without immigration when compared to smaller areas. Therefore, these larger areas contribute to a higher likelihood of lynx persistence when compared to smaller areas.

3. Contiguous patches of primary habitat are preferred over scattered patches.

4. If scattered, larger patches that are closer together are preferred over smaller patches further apart.

5. While all habitat patches in a metapopulation structure over time can play a role in conserving lynx and maintaining the broadest lynx geographic range, source habitats are critically important in conserving lynx.

6. In the long term, portions of large contiguous habitat patches are more likely to provide source environments which, combined with short dispersal distances, support higher likelihoods of conserving lynx populations.

Utilizing these assumptions to assess historical landscape capability, contiguous areas of primary habitat at least 1800 km^2 (695 mi^2) in size were presumed to have a higher likelihood for supporting lynx conservation. In considering contiguity of primary habitat**,** the BA team used GIS to determine distances between patches of primary habitat within broader areas of potential lynx habitat. Patches of primary habitat within 10 km (6.25 mi) of each other that in the aggregate totalled at least 1800 km^2 (695 mi^2) were presumed to have a moderate likelihood for supporting lynx conservation. The 10 km (6.25 mi) distance was selected based on Lynx Science Team data that suggested this distance is within the error margin for lynx occurrence locations and within a normal home range travel distance or short range exploratory lynx movement (McKelvey et al. in press 1999b). The category of lower likelihood for supporting lynx conservation in Figure 4 refers to small patches of primary habitat farther than 10 km (6.25 mi) from each other, or that do not aggregate to at least 1800 km^2 in size. While less likely to maintain lynx occurrence, these smaller areas may function to support a metapopulation.

Lynx Habitat Distribution with Current Plan Direction and Likelihood for Supporting Lynx Conservation

The BA team then attempted to depict the likelihood of supporting lynx conservation when management prescriptions, based on programmatic allocations, overlay the natural distribution of primary habitat as displayed in Figure 5 - Lynx Habitat Distribution with Current Plan Direction and Likelihood for Supporting Lynx Conservation. We examined current land allocations in lynx primary habitat and compared them to landscape capabilities to provide areas of at least 1800 km^2 (695 mi^2) of contiguous suitable habitat. Additional assumptions include the following: 1/

1. Land management prescriptions 1 and 2 (wilderness, designated roadless, National Parks, and FWS Refuges) pose fewer conservation risks to lynx and were therefore considered to have a higher likelihood of supporting lynx conservation when compared to land management prescriptions 3 through 8 (see Appendix F, Table 3, and text following these

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1/ The assumptions used in the analysis of likelihood of supporting lynx conservation were based on limited scientific information. The 1800 km^2 (695 mi^2) size rule for contiguous habitat and the 10 km (6.25 mi) rule for distance between habitat patches are two examples. Changes in these assumptions could result in considerable changes in the areas depicted on the maps. Additional research would help clarify the accuracy of these values.

Because of these limitations, the results of this analysis should be viewed as general indicators of potential to conserve lynx across large landscapes rather than site-specifically accurate predictors of lynx occurrence. In some instances, lands identified as having a higher likelihood of lynx conservation may not now be supporting lynx, whereas lands in the lower likelihood category may in some cases be supporting resident lynx.

assumptions). In general, direction in management prescriptions 1 and 2 emphasizes maintaining natural disturbance patterns and processes.

2. Land management prescription 3, that primarily has a natural disturbance emphasis, but which also may allow limited commodity removal, posed additional categories of conservation risk. Therefore management prescription 3 was considered moderately capable of supporting lynx conservation when compared with management prescriptions 1 and 2 (see Appendix F and Table 3). Management prescription 3 activities are similar, but generally of lesser intensity, when compared to management prescriptions 4 through 8.

3. Land management prescriptions 4 through 8 were assumed to provide lower potential for supporting lynx conservation (see Appendix F and Table 3). More intensive land management is associated with management prescriptions 4 through 8 when compared to management prescriptions 1 through 3, in combination with the absence of management direction emphasizing natural disturbance processes and patterns. Therefore, the degree of risk is assumed to be greater.

Considerations leading to the assumptions used to assess current Plan direction and likelihood of supporting lynx conservation include the following:

Examination of individual Plans indicates that some programmatic conservation measures believed necessary to avoid or mitigate risk of adverse effects to lynx may not be applied in all management prescriptions 1 through 8. However, in comparison to management prescriptions 1 and 2, management prescriptions 3 through 8 pose the risk of adverse effects in four additional key criteria: habitat conversions, thinning, road management, and developed recreation (Table 3).

Conservation risks associated with the remaining evaluation criteria could occur in all management prescriptions 1 through 8. In general, however, lands associated with management prescriptions 4 through 8, and to a lesser extent management prescription 3, are more accessible to the risk of adverse effects. Therefore, conservation risks are often of a lesser magnitude and intensity in management prescriptions 1 and 2.

An additional consideration in evaluating conservation risk deals with overall management direction. As previously mentioned, the dynamic landscape mosaic associated with historical natural disturbance patterns and processes is offered as a template for a desired future landscape condition supporting lynx conservation (Ruediger et al. in press 1999, McKelvey et al. in press 1999a). Maintaining natural disturbance processes and patterns is considered a critical factor for maintaining ecological resiliency and sustainability in boreal ecosystems where lynx reside (McKelvey et al. in press 1999a). Management prescriptions that contained direction emphasizing maintaining natural ecological patterns and processes (management prescriptions 1 through 3) were considered to pose less conservation risks than dissimilar management direction provided in management prescriptions 4 through 8.

Based on these considerations and assumptions, areas were grouped into four broad categories of likelihood (higher, moderate to higher, moderate, and lower) for supporting lynx conservation. Contiguous areas of primary habitat within management prescriptions 1 and 2 that are 1800 km^2 (695 mi^2) or larger were considered to have a higher likelihood of supporting lynx conservation. Contiguous areas of primary habitat within management prescriptions 1, 2, and 3 that are 1800 km^2(695 mi^2) or

larger were considered to have a 'moderate to higher' likelihood. Areas within management prescriptions 1, 2, and 3 having smaller blocks of primary habitat within 10 km (6.25 mi) of each other, that aggregate to meet the 1800 km^2 (695 mi^2) size were presumed to have a moderate likelihood. Areas that either had primary habitat within management prescriptions 1, 2, and 3 that did not aggregate within 10 km (6.25 mi) to meet the 1800 km^2 (695 mi^2) size, or had a management prescription other than 1, 2, or 3, fell into the lower likelihood category. The results are discussed in part B of this chapter and displayed in Figure 5 - Lynx Habitat Distribution with Current Plan Direction and Likelihood for Supporting Lynx Conservation.

All management prescriptions 1 through 8 could contribute to increased effectiveness of supporting lynx conservation with incorporation of programmatic and project level conservation measures designed to mitigate known risk factors. For developmental allocations, active management (tree harvesting, prescribed fire) may be needed to maintain or restore desired vegetation characteristics for lynx due to human-induced limitations on natural ecological processes within these management prescriptions.

Connectivity

Chapter III discusses the concept of connectivity as it applies to lynx management. Concern about connectivity generally lies in two areas: 1) spatial distribution of habitat components (eg. the Southern Rockies geographic area may be disconnected from lynx habitats further to the north due to intervening deserts in Wyoming and Utah), and 2) impediments to connectivity such as high traffic volume highway corridors and shipping channels, along with the cumulative effects of development adjoining these corridors.

For assessing connectivity relative to habitat components required by lynx, the BA team relied upon several broad assumptions. While there is little scientific information regarding these assumptions, and lynx have been documented travelling through a broad range of habitats, the BA team felt the assumptions were reasonable for displaying a coarse representation of habitat distribution potentially affecting connectivity within and between geographic areas.

1. The overriding assumption is that connectivity is more assured in habitats where lynx are known to reside and have a competitive advantage (such as primary habitat), compared to reduced assurance in more open habitats (such as shrub-steppe and grassland) due to increased vulnerability and lack of typical prey base.

Additional assumptions used for illustrative purposes include the following:

2. Habitat connectivity is more assured in large, contiguous blocks of primary habitat. Connectivity becomes less assured when departing from this condition.

3. Habitat connectivity is more assured in primary habitat within management prescriptions 1, 2 and 3 (due to reduced conservation risks), compared to primary habitat outside these management prescriptions.

4. Connectivity is more assured in primary habitat than within potential habitat.

5. Connectivity is more assured in potential habitat than in other forest types (such as ponderosa pine in the West, or aspen in the East).

6. Connectivity is more assured in other forest types than in non-forest types (such

Figure 4--Historical Lynx Habitat Distribution and Likelihood for Supporting Lynx Conservation

Please see website for this figure at:
http://www.fs.fed.us/r1/planning/lynx/lynx.html

Figure 5--Lynx Habitat Distribution with Current Plan Direction and Likelihood for Supporting Lynx Conservation

Please see website for this figure at:
http://www.fs.fed.us/r1/planning/lynx/lynx.html

as shrub-steppe, grassland).

7. Habitat connectivity is more assured as areas of habitat are closer to each other. The BA team chose to limit dispersal/connectivity consideration to 40 km (25 mi) based on the mean dispersal distance identified by the Lynx Science Team (McKelvey et al. in press 1999b).

Based on these assumptions, an illustration of connectivity potential related to habitat distribution was portrayed across the distinct population segment in Figure 6 - Connectivity Potential.

Potential connectivity concerns related to high traffic volume highway corridors, shipping channels, and associated development (Ruediger et al. in press 1999) are displayed in Figure 7. Figure 8 highlights potential concerns at the regional level and focuses on the cumulative impacts in the Southern Rocky Mountains resulting from Interstate Highway 70 and ski area/recreation development.

Cumulative Effects

Cumulative effects were addressed in several ways and integrated throughout the effects analysis. The GIS-based analysis of ownerships, such as National Parks, state lands, tribal lands, and private lands were considered. The questionnaire-based analysis of administrative units considered the effects of Plans on individual units and aggregated these effects to look at effects for each geographic area and for the lynx distinct population segment overall. The administrative unit, geographic area, and distinct population segment assessments each considered all the known risk factors believed to potentially affect lynx and that are reasonably foreseeable to occur under existing Plans and on other land ownerships.

Rationale for Determination of Effects

The effects identified through the combined questionnaire and GIS-based analyses were used to form the rationale for a determination of effect of existing Plans on the distinct population segment of lynx proposed for listing (Chapter V). The assumptions carried consistently throughout the analysis were that:

1. Certain risk factors have been identified for lynx.

2. Conservation measures have been developed to avoid or mitigate these risk factors, where possible, at the programmatic and project levels.

3. Plans can be assessed to determine whether they directly or indirectly incorporate the programmatic conservation measures.

4. Adverse effects to lynx are likely when the programmatic conservation measures are not incorporated in Plans.

It was also assumed that a determination of likely to adversely affect for Plans is appropriate when an adverse effect could occur either to individual lynx or to the population as a whole. In other words, if it was determined that a Plan may adversely affect either an individual lynx or some population segment through failure to include any one of the programmatic conservation measures, then the Plan overall is likely to adversely affect lynx.

This BA makes one determination of effect for the distinct population segment of lynx proposed for Federal listing. Making multiple determinations of effect for individual administrative units or geographic areas was considered. However, one determination for the entire distinct

population segment seemed reasonable given that:

1. The analysis showed that there is a risk of some adverse effects on each administrative unit and in each geographic area.

2. Making a determination at the same scale at which the species is proposed for listing was reasonable from a biological standpoint.

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Figure 6--Connectivity Potential

Please see website for this figure at:
http://www.fs.fed.us/r1/planning/lynx/lynx.html

Figure 7--Potential National Connectivity Concerns

Please see website for this figure at:
http://www.fs.fed.us/r1/planning/lynx/lynx.html

Figure 8--Example of a Potential Regional Connectivity Concern

Please see website for this figure at:
http://www.fs.fed.us/r1/planning/lynx/lynx.html

B. Analysis of Direct, Indirect and Cumulative Effects

1. Effects at the National Forest and BLM Unit Scale

A total of 57 LRMPs and 56 LUPs was assessed for the 15 evaluation criteria previously described. The results of this analysis are displayed in the matrix in Appendix G, and the reader is referred there for details of the effects at the administrative unit scale. The Plans showed varying success in meeting the criteria, ranging from fully meeting (F) some criteria to not meeting others at all (N). All Plans in every geographic area failed to meet one or more of the criteria. Nine LRMPs and 26 LUPs did not meet a majority of the criteria. Although a determination of effect was not made for each individual Plan, all Plans could allow at least some actions to occur at the programmatic level that would risk having adverse effects to lynx or lynx habitat. Additional effects may occur at the project level, but these are beyond the scope of this BA.

In general, LRMPs tended to meet more of the criteria than LUPs, but that was not universally the case. BLM lands tend to be at the margins of forested lynx habitat, representing only 2 percent of the primary habitat, and in many cases the evaluation criteria pertaining to silvicultural activities did not apply to BLM units. BLM lands may be particularly important with respect to maintaining connectivity and providing alternate prey species during times of snowshoe hare scarcity.

At the administrative unit scale, the result of Plans not meeting certain evaluation criteria means that some of the programmatic conservation measures believed necessary to avoid or mitigate adverse effects to lynx may not be applied on those units. The effects of this are likely to include the following:

1. Habitat may be eliminated or reduced in quality.

2. Habitat may be fragmented and connectivity reduced, resulting in isolated habitats, lowered productivity or potential range reduction for lynx.

3. Competing carnivores may have easier access to lynx habitat, resulting in increased competition for food resources or social competition for space.

4. Risk of direct mortality to lynx from predators, including humans, may be increased.

These effects are likely to impact individual lynx, as well as lynx subpopulations. The matrix in Appendix G provides a visual depiction of where these effects are likely to occur.

2. Effects at the Geographic Area Scale

The effects identified at the administrative unit scale accumulate upwards to the geographic area scale. The following discussion summarizes these effects for each geographic area, and the reader is again referred to Appendix G for further details. Some additional effects unique to this scale are also presented. Conclusory statements about effects are based on the questionnaire results, personal knowledge of BA team members, and other available information.

a. Cascades Geographic Area

The Cascades geographic area includes ten National Forests and five BLM District Offices (see Appendix A). The net area covered by these units is 20,543,780 acres, of which 4,144,000 acres (20 percent) are

identified as primary lynx habitat. National Forest System lands comprise 99 percent of the primary habitat in the geographic area. BLM lands comprise less than one percent of the primary habitat, and the remaining 1 percent is in other ownerships (Figure 9). BLM lands comprise the western fringes of lynx habitat at lower elevations. All NF and BLM Plans within this area were amended by the Northwest Forest Plan and/or PACFISH, and we evaluated these Plans as amended

Risk Factors

The LCAS identifies the following risk factors to lynx in this geographic area:

- Timber management that converts cover type to less desirable tree species, and precommercial thinning that reduces habitat suitability for snowshoe hares
- Fire exclusion that changes the vegetation mosaic maintained by natural disturbance processes
- Roads and winter recreation trails that facilitate access to historical lynx habitat by competitors
- Incidental trapping
- Predation
- Being hit by vehicles
- Obstructions to movements such as highways, dams, and urban growth

Spatial Patterns in Primary Lynx Habitat

The distribution of primary habitat follows the north/south axis of the Cascades Range (Figure 3). Primary habitat is widest, largest and most contiguous at the Washington/British Columbia boundary and becomes more linear and narrow in the southern Oregon Cascades. As a result, a larger and more persistent population than in the remainder of the geographic area is possible in the northern Washington Cascades (Figures 4 and 5).

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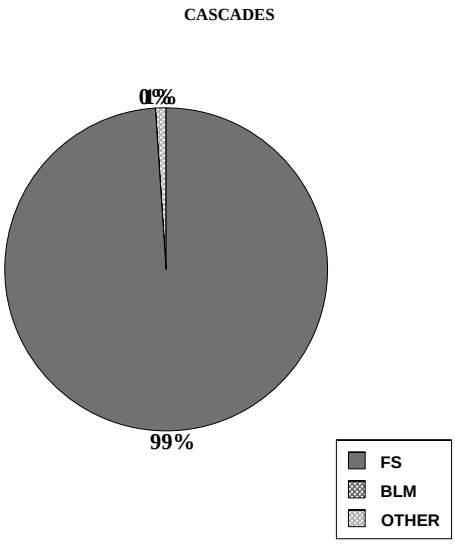
Figure 9--Land ownership of primary habitat in the Cascades geographic area.



Likelihood for Supporting Lynx Conservation

The northern Washington Cascades (centered around the Pasayten Wilderness) has a combination of factors associated with the highest likelihood for supporting lynx conservation in the Cascades geographic area (see Methods section and Figure 5). These factors include primary habitat that is contiguous, occurring in large patches at least 1800 km^2 (695 mi^2) in size, and with management direction emphasizing natural ecological processes (management prescriptions 1 and 2, Appendix F).

The northern half of the Oregon Cascades provides 'moderate to high' levels for supporting lynx conservation, although the narrow shape and smaller size of this area would suggest a smaller population size is possible when compared to the spatial pattern of primary habitat in the northern Washington Cascades.

Most smaller patches of primary habitat with a management direction emphasizing natural ecological processes in the Cascades geographic area are within a distance of 10 km (6.25 mi) from each other, and in the aggregate provide moderate levels of support for lynx conservation throughout much of the Cascades geographic area (Figure 5). Areas with a lower potential for supporting lynx conservation under current management direction constitute a small percentage of this geographic area and generally occur along the periphery of primary habitat.

In summary, Plan direction continues to support lynx conservation in much of the Cascades and provides a foundation for a connected network of primary habitat along the length of the Cascades. However, compared to historical times, the Plans have contributed to a reduction of the total area in which natural ecological processes are emphasized.

Landscape Connectivity

Direct linkage with broader expanses of Canadian habitat facilitate dispersal to and from Canadian source populations, a key factor for lynx persistence. Historically, lynx dispersal may have occurred between the Washington Cascades and the Oregon Cascades, between the northern Washington Cascades and the Northern Rocky Mountains (Okanogan Highlands, Kettle Range), and between the southern Oregon Cascades and the Northern Rocky Mountains (through portions of the Ochoco, Wallowa-Whitman, Umatilla, and Malheur National Forests) (Figure 6).

Factors Potentially Affecting Lynx Movements

Lynx movement between the Washington Cascades and the Oregon Cascades across the Columbia River seems unlikely given the presence of Interstate Highway 84, a two-lane highway, railroads, residential development, and hydroelectric impoundments that have widened the river. Movement between the northern and southern Washington Cascades may now be impeded by high volume traffic along Interstate Highway 90, ski resorts and residential development. Plan direction has allowed ski resort development along the Interstate Highway 90 corridor. Potential lynx movement between the Oregon Cascades and the Northern Rockies may be impeded by the cumulative effects of north-south Highway 97, and residential and agricultural development along the east face of the Cascades. Impediments to lynx movements connecting the Oregon Cascades with the Washington Cascades or the Rocky Mountains increase the area's vulnerability and suggest that the capacity to maintain a persistent metapopulation has been reduced (Figure 7).

In summary, there are more impediments in the current environment that may affect

lynx movements than historically existed. A strength for the region is that federal lands are generally continuous along the length of the Cascades in comparison to the fragmented ownership patterns in other geographic areas. This factor increases the area's capacity to support lynx conservation (Figures 5 and 6).

Effects Within Nondevelopmental Land Allocations

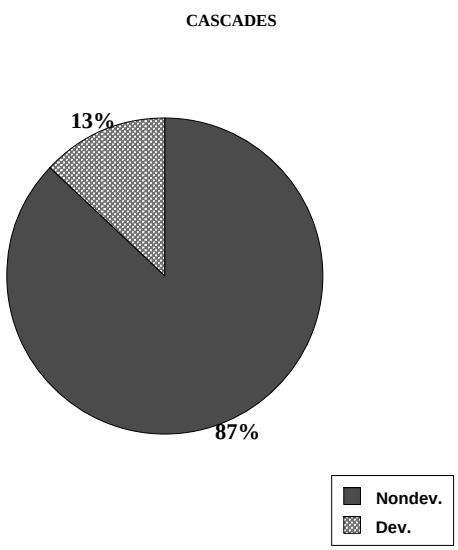
Approximately 3,577,440 acres (87 percent) of the primary lynx habitat on FS and BLM lands in this area is designated as nondevelopmental land allocations (management prescriptions 1, 2 and 3--wilderness, roadless, late successional reserves, etc., see Appendix F) where natural disturbance processes may predominate (Figure 10). Table 3 identifies which of the 15 evaluation criteria are most applicable within the nondevelopmental land allocations.

Eight of ten LRMPs and three of five LUPs allow, but do not mandate, the use of wildland fire for resource benefits within these allocations. Fire could assume a significant role in creating a natural mosaic of vegetation communities and age classes across the landscape under existing Plan direction. Other natural processes such as insects, disease, and wind storms will contribute to the maintenance of this mosaic. Lynx foraging habitat is likely to be maintained at a level somewhat less than would be provided under natural disturbance regimes. Denning habitat, consisting of old growth forests and concentrations of downed logs resulting from disturbance events, will likely be maintained at or above levels that occurred historically. The differences from historical conditions are due to continued fire suppression, which results in fire being allowed to play its natural role in only a portion of these land allocations. Some human activities potentially affecting lynx, such as timber harvest, road construction, recreation developments, and motorized dispersed recreation, are generally not expected to occur within nondevelopmental land allocations, and therefore will not adversely affect lynx there. Other activities, such as grazing and mining, may occur but are likely to occur less extensively than in developmental allocations. Winter dispersed recreation activities, such as snowshoeing and skiing, may result in packed trails that could facilitate movement of competitors and predators into lynx habitat. All of the Plans allow these forms of non-mechanized human travel, although the roadless character of these lands constrains winter use to some extent.

Effects Within Developmental Land Allocations

The Plans provide the opportunity to maintain lynx habitat through vegetation manipulation and other land management activities within the developmental land allocations (management prescriptions 4-8, see Appendix F). Conversely, potential impacts to lynx or their habitats may result from a number of human activities. The Plans were examined to determine how well they meet 15 evaluation criteria with respect to maintaining lynx habitat and mitigating potential human impacts (refer to Methods section for details). The results of this review are displayed for each administrative unit in Appendix G. A geographic area summary of the findings for each criterion follows below. Criteria which were found to present a risk of adverse effects to lynx were carried forward as part of the rationale for the determination of effect in Chapter V. Criteria which are not identified as carrying forward were found to present a discountable or insignificant risk of adverse effects (see U.S. Fish and Wildlife Service 1998b, p. 3-13 for definitions).

Figure 10--Proportion of developmental and nondevelopmental allocations in the Cascades geographic area.



Denning habitat--The Northwest Forest Plan emphasizes restoring and maintaining late successional forests within an interconnected mosaic throughout the area. This old growth network is more than adequate to provide for lynx denning needs, and all Plans within this geographic area were judged fully satisfactory in providing denning habitat. No adverse effects to lynx denning habitat are expected from the Plans.

Foraging habitat--Vegetation management within the 13 percent of the geographic area where active management is allowed can potentially supplement foraging habitat created by natural disturbances on the remaining 87 percent of the area. These activities also have the potential to eliminate foraging habitat. Given the extent of the nondevelopmental land allocations where natural processes are in operation, and the probability that some forage will be produced within developmental allocations, all Plans were judged to substantially meet the criterion for providing foraging habitat. Lynx are not expected to be significantly affected by a shortage of foraging habitat in the geographic area, but some vegetation management activities which site-specifically reduce foraging opportunities could affect individual lynx (see thinning discussion below).

Habitat conversions--One LUP contains direction that substantially prohibits vegetation type conversions that could be adverse to lynx. Three LRMPs and three LUPs contain language that marginally precludes vegetation type conversions, while seven LRMPs and one LUP contained no direction that precludes such activity. While most Plans did not specifically prohibit type conversions, it is unlikely that conversions will commonly occur within this geographic area because vegetation management activities are allowed on only 13 percent of the area. The low percentage of the area allocated to forest management activities suggests that

habitat loss due to type conversions is unlikely to be significant within the geographic area.

Thinning--Seven LRMPs and two LUPs include direction that would marginally integrate lynx habitat needs with timber stand thinning projects, while two LRMPs and three LUPs contain no such direction. Thinning has the potential to adversely affect lynx in this geographic area, but with only 13 percent of the area available for vegetation management, and at any given time a fraction of this in an age class where thinning might be considered, the overall effects of thinning in the geographic area are minimal. There is likely adequate foraging habitat available to sustain a lynx population regardless of thinning because natural disturbance processes could potentially create some foraging habitat within the portion of the area (87 percent) that is in nondevelopmental allocations. However, there is a risk that individual lynx could be adversely affected on a site-specific basis by reduction of habitat quality within their home ranges. These potential effects to individual lynx carry forward as part of the rationale for the determination of effects.

Fire management--Two LRMPs contain wildfire suppression direction that helps to substantially maintain or improve lynx habitat; five LRMPs and two LUPs contain direction that marginally does so; and three LRMPs and three LUPs contain no such direction. Wildland fire management direction within developmental land allocations weakly maintains lynx habitat. This represents only 13 percent of the geographic area, and fire management direction on the remaining 87 percent (nondevelopmental allocations) allows for the maintenance of lynx habitat. Overall, fire suppression strategies within Plans for the geographic area seem adequate to preclude adverse effects to lynx. Implementation of strategies allowed by the Plans is unknown and beyond the scope of this analysis.

Landscape patterns--All LRMPs and LUPs within the geographic area were judged to fully meet the criterion of providing landscape vegetation patterns that maintain lynx habitat. This is a result of the amount of the area in nondevelopment land allocations where natural disturbance processes predominate, as well as Northwest Forest Plan, PACFISH, and INFISH direction that establish riparian corridors throughout the entire area. No adverse effects to lynx were identified as a result of Plan direction pertaining to landscape patterns.

Forest roads--One LRMP and one LUP provide direction pertaining to roads that helps to fully promote lynx recovery; eight LRMPs and three LUPs contain direction that substantially does so; and one LRMP and one LUP contain direction that marginally does so. Strong road management direction in the Plans results primarily from Northwest Forest Plan and PACFISH direction. Road management direction within the geographic area appears adequate to avoid adverse effects to lynx.

Developed recreation--Five LRMPs provide marginal direction for mitigating the potential effects of developed recreation on lynx, while five LRMPs and five LUPs provide no direction. Major recreation developments such as large ski areas or resorts are moderately common in the geographic area. The potential effects of these developments on individual lynx include loss of suitable habitat on a site-specific basis as well as impeding lynx movements. The significance of these effects to the population is likely to be low to moderate at the present time due to the moderate level of such developments and the relatively large blocks of contiguous habitat available to lynx within the area. Overall, this criterion was judged to not be affecting lynx within the geographic area under current Plans.

Non-winter dispersed recreation--Eight LRMPs and three LUPs contain direction that substantially mitigates the effects of non-winter dispersed recreation on lynx. One LRMP contains direction that marginally mitigates these effects, while one LRMP and two LUPs contain no direction for mitigation. This mitigation relates to mechanized off-road vehicles rather than to foot travel. Due to topography, vegetation characteristics, and the low susceptibility of lynx to displacement by humans (Ruggiero et al. in press 1999b), this activity presents a low risk of adverse effects to lynx with the exception of disturbance near denning sites (Ruediger et al. in press 1999). Denning habitat is abundant and widely distributed in the geographic area. Therefore, no adverse effects from non-winter dispersed recreation could be identified.

Winter dispersed recreation--One LRMP and two LUPs contain direction that substantially mitigates the effects of winter dispersed recreation on lynx. Eight LRMPs marginally mitigate these effects, while one LRMP and three LUPs do not mitigate the effects. Where mitigation is directed, it generally applies to mechanized over-snow vehicles rather than to foot travel. Only one Plan contains direction to partially restrict snowshoeing and skiing in lynx habitat. The effects of these activities potentially includes providing packed trails for other carnivores to more easily enter lynx habitat and either compete with lynx for food resources or prey on lynx. Winter dispersed recreation may be contributing to a risk of adverse effects to lynx in this geographic area and is carried forward as part of the rationale for the determination of effect.

Minerals and energy development--Nine LRMPs contain direction that would marginally mitigate the effects of mineral and energy development on lynx, while one LRMP and five LUPs contain no such direction. These activities are not widespread within the geographic area and are subject to long-standing laws and regulations. Where they do occur, specific mitigation is normally developed at the project analysis level rather than at the programmatic level of land management plans. Considering these factors, these activities may be a low risk to lynx within the geographic area, and Plan direction was found to present no adverse effects to lynx.

Habitat connectivity--All ten LRMPs and five LUPs within the geographic area were judged to contain direction that substantially maintains lynx habitat connectivity within the administrative unit scale. This direction is contained in Northwest Forest Plan, PACFISH, and INFISH amendments to the Plans. Direction in existing Plans for riparian management was not found to present a risk to lynx habitat connectivity. Direction for avoiding or mitigating movement barriers across highways is generally lacking in the Plans. This responsibility should properly be shared between the land management agencies and highway administration authorities. Most highways predate the Plans and are part of the baseline condition. Future highway construction and reconstruction have the potential to adversely affect lynx if not mitigated, and mitigation is anticipated at the project level. Current Plan direction was not found to be adversely affecting lynx in the geographic area.

Land tenure adjustments--Nine LRMPs and three LUPs contain direction that marginally maintains or improves lynx habitat through land tenure adjustments. One LRMP and two LUPs contain no direction. Land tenure adjustments within lynx habitat are infrequent in the geographic area, and their mitigation is generally provided at the project analysis level. Current Plan direction for land tenure adjustments does not appear to present a risk of adverse effects to lynx within the geographic area.

Management coordination--All ten LRMPs and four LUPs contain substantial direction for coordinating issues that may affect lynx with nearby administrative units or other agencies. One LUP contains marginal direction. This direction is provided through amendments to the Plans resulting from the Northwest Forest Plan, PACFISH, and INFISH. No adverse effects were identified as a result of Plans providing inadequate direction for coordination.

Monitoring--One LRMP contains full direction for monitoring of lynx, snowshoe hares, or their habitats. Nine LRMPs and two LUPs contain marginal monitoring direction, while three LUPs contain no direction. While failure to monitor does not directly cause adverse effects, it does result in any adverse effects being difficult to identify and assess. This criterion is carried forward as part of the rationale for the determination of effect.

In summary, NF units account for the majority of primary lynx habitat in the Cascade Mountains geographic area; 4,112,000 acres or 99 percent. BLM units account for less than one percent of primary lynx habitat in the Cascades. Table 4 summarizes the ratings for the three evaluation criteria for which Plan direction was found to present a risk of adverse affects to lynx. Those criteria are**: *thinning, winter dispersed recreation, and monitoring***. These findings of likely adverse effects are carried forward as part of the rationale contributing to the determination of effect in Chapter V. The ratings for all 15 criteria are presented in Appendix G.

Additional Considerations, Including Cumulative Effects

Overall conditions for lynx with respect to Plan direction appear to be better in this geographic area than any other in the Nation. This is largely due to Plan amendments directed by the Northwest Forest Plan, PACFISH, and INFISH. The Cascades are not without a potential risk of adverse effects, however. Certain types of winter recreation, and particular types of vegetation management (i.e., thinning) within the portions of the area where such activities may still occur, have the potential to adversely affect lynx by introducing competitors, eliminating habitat, and restricting movements.

Table 4--Summary ratings for the three criteria contributing to a risk of adverse effects to lynx in the Cascade Mountains geographic area.

	FS (99% of Primary Habitat)		BLM (<1% of Primary Habitat)	
Ratings[1/]	**Number**	**Percent**	**Number**	**Percent**
F	1	3	0	-
S	1	3	2	13
M	25	83	4	27
N	2	7	9	60
U	1	3	0	-
NA	0	-	0	-
Total	30	100	15	100

[1/] The methods section of this chapter describes how evaluation criteria were developed and what the individual rating codes represent.

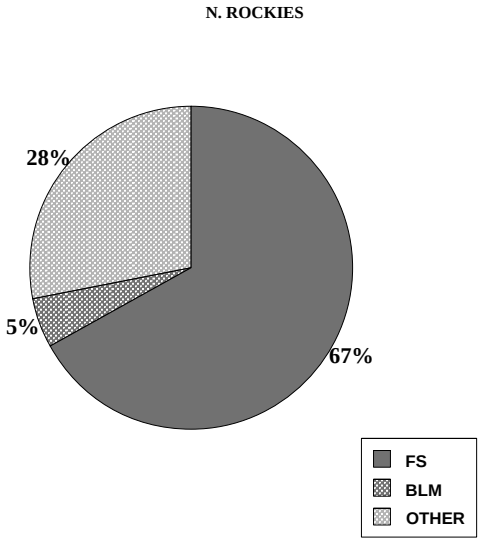
This geographic area is narrow and linear, making it vulnerable to dissection by the several existing east-west crossing highways and associated development. Highways, dams, railroads, and other developments within the Columbia River Gorge have likely eliminated what may have been historical movements between the Washington and Oregon Cascades. The north-south Highway 97 and residential and agricultural development along the east face of the Cascades impedes the possibility of a connection with the Northern Rocky Mountains through habitats in central Oregon. Timber management on private corporate and tribal lands may also cumulatively affect lynx in this geographic area. Washington lynx habitat is connected with Canadian habitats to the north, and maintenance of this connection may be crucial to lynx persistence in the area.

b. <u>Northern Rockies Geographic Area</u>

The Northern Rockies geographic area includes 31 National Forests and 29 BLM administrative units (8 Resource Areas, one District Office, and 20 Field Offices, see Appendix A). One Resource Area (Idaho Falls) contains two planning units, while one Resource Area (Challis) and one Field Office (Salt Lake) each contain three planning units, resulting in a total of 41 LUPs assessed. The net area covered by these units is 126,243,610 acres, of which 24,727,000 acres (20 percent) are identified as primary lynx habitat. National Forest System lands comprise 67 percent of the primary habitat in the geographic area, BLM lands make up 5 percent, and the remaining 28 percent is in other ownerships (Figure 11).

Several Forest Plans within the geographic area have been amended by INFISH or PACFISH decisions. This analysis considers these Plans as amended. Much of the BLM lands, and some of the NF lands, especially in the southern portions of the geographic area, are in shrub-steppe habitats that may be important primarily for connectivity between patches of coniferous habitat or for foraging on alternate prey during times of snowshoe hare scarcity.

Figure 11--Land ownership of primary habitat in the Northern Rocky Mountains geographic area.



Risk Factors

The LCAS identifies the following risk factors to lynx in this geographic area:

- Timber harvest and precommercial thinning that reduce denning or foraging habitat or converts habitat to less desirable tree species
- Fire exclusion that changes the vegetation mosaic maintained by natural disturbance processes
- Grazing by domestic livestock that reduces forage for lynx prey
- Roads and winter recreation trails that facilitate access to historical lynx habitat by competitors
- Legal (in Montana) and incidental trapping and shooting
- Predation
- Being hit by vehicles
- Obstructions to lynx movements such as highways and private land development

Spatial Patterns in Primary Lynx Habitat

The Northern Rockies geographic area has the largest amount of primary habitat on federal lands of any geographic area (Figure 3). It contains a variety of spatial patterns from large connected patches along the continental divide to isolated patches such as the Bighorn Mountains in Wyoming. Since most primary habitat occurs on FS and BLM lands, federal agencies have a key role in conservation efforts. The large amount of primary habitat on federal lands in this geographic area also suggests that it may contain the highest number of lynx on federal lands in any geographic area.

Likelihood for Supporting Lynx Conservation

The Northern Rockies geographic area has three large areas with the combination of factors providing the highest likelihood for supporting lynx conservation including: Glacier National Park and surrounding NFs, Yellowstone National Park and surrounding NFs, and the Bitterroot Mountains in Idaho and Montana. The Northern Rockies geographic area not only has the most areas with high potential, but also the largest (Figure 5).

Areas in the category of moderate to high levels for supporting lynx conservation (contiguous primary habitat in management prescriptions 1, 2, and 3 meeting the 1800 km^2 (695 mi^2) minimum size) adjoin and provide additional acreage to the three large areas previously described. When smaller patches of primary habitat (with management direction emphasizing natural ecological processes) within 10 km (6.25 mi) are considered, most of the primary habitat in the geographic area aggregates into large patches with moderate potential for supporting lynx conservation (Figure 5). The isolated areas outside of these large patches would represent areas with the lowest potential for supporting lynx conservation, although they may form a metapopulation with nearby primary habitat patches. Successful dispersal is necessary to maintain resident animals.

In summary, the amount and distribution of primary habitat in the Northern Rockies geographic area under federal land management suggest that this area may be the most important stronghold maintaining persistent lynx populations in the contiguous U.S. Current management direction provides three large areas with high potential to support lynx conservation, but this represents a reduction from historical availability (Figures 4 and 5).

Landscape Connectivity

Direct linkage with Canadian habitats contributes to increased persistence in the northern portion of this geographic area. The

Northern Rockies may facilitate movements linking the Northern Rockies with the Cascades and Southern Rockies geographic areas. Potential landscape linkages in this geographic area are: corridors linking the Yellowstone Ecosystem with central Idaho and northern Montana, forested corridors that may facilitate movements from central Idaho to the Blue Mountains and west toward the Oregon Cascades, forested corridors from Idaho and Wyoming to the Wasatch and Uinta Ranges in Utah, and forested habitats that may facilitate movements between the Northern Rockies and the northern Cascades in Washington. Animals moving across these areas would encounter shrub-steppe environments, and connectivity is assumed to become less assured as lynx depart from primary habitat or forested conditions (see Methods Section and Figure 6).

Factors Potentially Affecting Lynx Movements

Highways and private land development, especially along road corridors in mountain valleys, may fragment habitat and impede movement by lynx (Ruediger et al. in press 1999). The LCAS identified that the following roads could impede lynx movement. Interstate Highways 90 and 15 and Highway 93 could discourage lynx movement in Idaho and Montana. Also in Montana, Highways 2 and 83 could impede movements. In Idaho, Highway 12 and State Highways 55 and 75 intersect lynx habitat. In Utah, I-80 may impede movement between the Uinta and Wasatch Ranges. In Oregon and Washington, I-84 may discourage lynx movement in the Blue Mountains. In Wyoming, Highways 14, 26, and 189, and high volume traffic in Yellowstone National Park may impede movements (Ruediger et al. in press 1999).

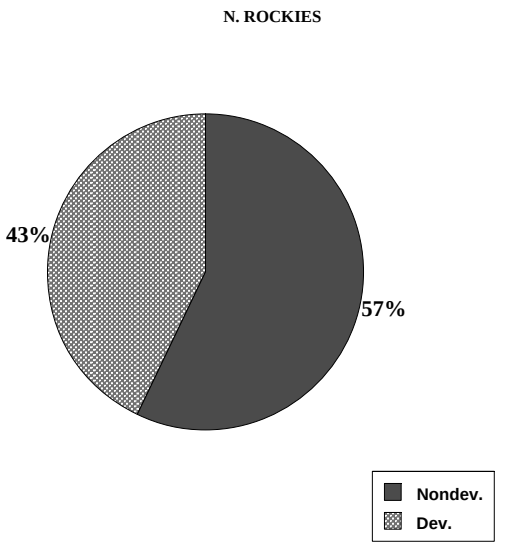
In summary, while the Northern Rocky Mountains geographic area has the largest amount of available primary habitat on federal lands of any geographic area, a number of highways, and development along these highways, cumulatively may impede lynx movements within and between geographic areas (Figure 7).

Effects Within Nondevelopmental Land Allocations

Approximately 14,094,390 acres (57 percent) of the primary lynx habitat on FS and BLM lands in this area is designated as nondevelopmental land allocations (management prescriptions 1, 2 and 3 -- wilderness, etc., see Appendix F) where natural disturbance processes may predominate (Figure 12). Table 3 identifies which of the 15 evaluation criteria are most applicable within the nondevelopmental land allocations.

Twenty-six of the 31 LRMPs and nine of the 41 LUPs allow, but do not mandate, the use of wildland fire for resource benefits (WFRB) within these allocations. The lower proportion of BLM units that allow WFRB is not significant to lynx since only a small percent of the habitat within the geographic area is administered by BLM. These BLM lands are generally at lower elevations and often consist of shrublands. It appears that fire could assume a significant role in creating a natural mosaic of vegetation communities and age classes across the landscape within the geographic area under existing Plan direction. Other natural processes such as insects, disease, and wind storms will contribute to the maintenance of this mosaic. Lynx foraging habitat is likely to be maintained at a level somewhat less than would be provided under natural disturbance regimes. Denning habitat, consisting of old growth forests and concentrations of downed logs resulting from disturbance events, will likely be maintained at or above levels that occurred historically. The differences from historical conditions are due to continued fire suppression, which results in fire being allowed to play its natural role in only a

Figure 12--Proportion of developmental and nondevelopmental allocations in the Northern Rockies geographic area.



portion of these land allocations. Some human activities potentially affecting lynx, such as timber harvest, road construction, recreation developments, and motorized dispersed recreation, are generally not expected to occur within nondevelopmental land allocations, and therefore will not adversely affect lynx there. Other activities, such as grazing and mining, may occur but are likely to occur less extensively than in developmental allocations. Winter dispersed recreation activities, such as snowshoeing and skiing, may result in packed trails that could facilitate movement of competitors and predators into lynx habitat. All of the Plans allow these forms of non-mechanized human travel, although the roadless character of these lands constrains winter use to some extent.

Effects Within Developmental Land Allocations

The Plans provide the opportunity to maintain lynx habitat through vegetation manipulation and other land management activities within the developmental land allocations (management prescriptions 4-8, see Appendix F). Conversely, potential impacts to lynx or their habitats may result from a number of human activities. The Plans were examined to determine how well they meet 15 evaluation criteria with respect to maintaining lynx habitat and mitigating potential human impacts (refer to Methods section for details). The results of this review are displayed for each administrative unit in Appendix G. A geographic area summary of the findings for each criterion follows below. Criteria for which Plans were found to present a risk of adverse effects to lynx were carried forward as part of the rationale for the determination of effect in Chapter V. Criteria which are not identified as carrying forward were found to present a discountable or insignificant risk of adverse effects (see U.S. Fish and Wildlife Service 1998b, p. 3-13 for definitions).

Denning habitat--Denning habitat is fully maintained in 15 LRMPs, substantially maintained in 11 LRMPs and three LUPs, marginally maintained in two LRMPs and five LUPs, not maintained in three LRMPs and 13 LUPs, and not applicable in 14 LUPs due to insufficient forest coverage. On much of the geographic area, especially the southern and eastern portions, BLM lands may have low potential to provide denning habitat due to inherent climatic and vegetational limitations. The NF lands overall are doing a good job of maintaining denning habitat due to old growth direction contained in the Plans. Denning habitat is likely not limiting to lynx within the geographic area. No adverse effects to lynx denning habitat are expected from the Plans.

Foraging habitat--Foraging habitat is substantially maintained in 12 LRMPs, marginally maintained in 18 LRMPs and ten LUPs, not maintained in one LRMP and 11 LUPs, and not applicable in 14 LUPs due to insufficient forest coverage. On much of the geographic area, especially the southern and eastern portions, BLM lands may have low potential to provide snowshoe hare foraging habitat due to inherent climatic and vegetational limitations, but may provide habitat for foraging on alternate prey species such as jackrabbits. BLM lands also provide the potential for connectivity between patches of coniferous habitat. Based on questionnaire results, the ability of the Plans to provide foraging habitat may be a limiting factor to lynx in the geographic area. This criterion is carried forward as part of the rationale for the determination of effects.

Habitat conversions--Vegetation type conversions that could reduce habitat suitability for lynx are fully precluded in one LRMP and four LUPs, substantially precluded in one LUP, marginally precluded in 12 LRMPs and six LUPs, not precluded in 18 LRMPs and 14 LUPs, and are not applicable in ten LUPs. Type conversions, as from lower valued species (e.g., lodgepole pine) to higher valued species (e.g., western larch) have often occurred during silvicultural treatments within this geographic area. This practice has the potential to affect lynx foraging habitat over large acreages. Type conversion in the shrub-steppe habitat type could reduce potential for foraging on alternate prey as well as movement by lynx. Given the weak emphasis in Plans on avoiding this practice and the fact it could potentially occur on a large percentage of the geographic area (43 percent in developmental allocations), there is a risk that lynx could be adversely affected. This criterion is carried forward as part of the rationale for the determination of effects.

Thinning--One LUP includes direction that would substantially integrate lynx habitat needs with timber stand thinning projects, four LRMPs and two LUPs contain direction that would marginally achieve this objective, 27 LRMPs and 17 LUPs contain no such direction, and the criterion is not applicable for 15 LUPs. With 43 percent of the geographic area in developmental allocations, precommercial thinning is a common practice on commercial forest lands. The Plans are generally weak in providing compatible direction for thinning within lynx habitat, and this activity may risk adversely affecting lynx within the geographic area. This criterion is carried forward as part of the rationale for the determination of effects.

Fire management--Within developmental land allocations, 23 LRMPs and 21 LUPs direct aggressive wildfire suppression that would limit the creation of lynx foraging habitat through natural ecological processes. Seven LRMPs and seven LUPs direct a limited suppression approach that may help maintain foraging habitat. The fire management strategy could not be determined for one LRMP and four LUPs. The objective of aggressive fire suppression where resource values are at risk is understandable, but nevertheless may be contributing to a risk of adverse effects to lynx within the geographic

area by reducing the creation of foraging habitat through natural disturbance processes. This criterion is carried forward as part of the rationale for the determination of effects.

Landscape patterns--Two LRMPs contain full direction to provide landscape vegetation patterns that would maintain lynx foraging and denning habitats; three LRMPs provide substantial direction; 19 LRMPs and 11 LUPs provide marginal direction; seven LRMPs and 13 LUPs provide no such direction; and the criterion is not applicable within 11 LUPs. While this generally weak direction is of concern, the Northern Rockies are less fragmented than some others due to natural landscape patterns, inherent productivity of vegetation in much of the area, and the fact that a relatively small proportion of the area is in non-federal ownership compared to most other geographic areas. PACFISH and INFISH direction on some NFs in the geographic area may help maintain landscape patterns to a degree. Stronger direction in the Plans is desirable, but current direction is likely not limiting to lynx populations or adversely affecting individual lynx at this time.

Forest roads--Five LRMPs provide direction pertaining to roads that fully helps promote lynx recovery; nine LRMPs provide substantial direction; ten LRMPs and 15 LUPs provide marginal direction; seven LRMPs and 15 LUPs provide no direction; and the criterion is not applicable in four LUPs. Road management direction is strongest in portions of the geographic area that emphasize management for grizzly bears and elk. While displacement by humans does not appear to be a major factor in lynx ecology (Ruggiero et al. in press 1999b), human access via roads may increase the mortality risk to lynx from incidental trapping or illegal shooting, as well as competition from other carnivores. Road-related risks are primarily a winter season issue. The issue is a concern on the portions of the geographic area (refer to Appendix G) with weak or no road management direction and could be contributing to a risk of adverse effects to lynx in these areas. This criterion is carried forward as part of the rationale for the determination of effects.

Developed recreation--Two LRMPs provide direction that substantially mitigates the potential effects of developed recreation on lynx; three LRMPs and three LUPs provide marginal direction; 25 LRMPs and 28 LUPs provide no direction; and the criterion is not applicable in four LUPs. Large recreation developments are present in moderate numbers on NF lands within this geographic area. Where they occur, they may eliminate habitat and pose a threat to lynx movements. Although mitigation can be developed at the project level, most developments were constructed before lynx became a conservation issue. Since most existing Plans are weak in guidance for new or existing recreation developments, these activities may contribute to a risk of adverse affects to lynx in this geographic area. This criterion is carried forward as part of the rationale for the determination of effects.

Non-winter dispersed recreation--One LRMP contains direction that fully mitigates the effects of non-winter dispersed recreation on lynx; 13 LRMPs and nine LUPs substantially mitigate these effects; nine LRMPs and six LUPs marginally mitigate the effects; and seven LRMPs and 18 LUPs contain no mitigation. Where it occurs, mitigation relates to mechanized off-road vehicles rather than to foot travel. Non-winter dispersed recreation at current levels may not have an adverse effect on lynx within the geographic area since lynx do not appear to be highly susceptible to displacement by humans (Ruggiero et al. in press 1999b). The exception may be near denning sites (Ruediger et al. in press 1999). Plans generally provide for adequate and widely distributed denning habitat in the geographic area. Therefore, no adverse effects from non-

winter dispersed recreation could be identified.

Winter dispersed recreation--Three LRMPs and three LUPs contain direction that substantially mitigates the effects of winter dispersed recreation on lynx; 15 LRMPs and nine LUPs contain direction that marginally mitigates these effects; and 12 LRMPs and 21 LUPs contain no direction. Where mitigation occurs, it relates primarily to mechanized over-snow vehicles. Very few Plans contain any limitation on winter foot travel by snowshoes or skis. Both mechanized and non-mechanized winter recreation may contribute to a risk of adverse effects on lynx where they are allowed within the geographic area by providing packed trails for other carnivores to more easily enter lynx habitat and either compete with lynx for food resources or prey on lynx. This criterion is carried forward as part of the rationale for the determination of effects.

Minerals and energy development--Four LRMPs and one LUP contain direction that would substantially mitigate the effects of minerals and energy development on lynx; 14 LRMPs and four LUPs marginally mitigate these effects; and 12 LRMPs and 30 LUPs contain no mitigation. These activities are relatively common in the Northern Rockies. Specific mitigation for such activities is often developed at the project level. The overall weakness of the Plans with respect to these activities does not necessarily mean that adverse effects to lynx will occur. Some adverse effects may occur at the project level, but these are beyond the scope of this analysis. No evidence was found to indicate that Plan direction may be contributing to adverse effects to lynx.

Habitat connectivity--Ten LRMPs contain direction that substantially mitigates the effects of movement barriers or maintains lynx habitat connectivity at the administrative unit scale. Thirteen LRMPs and 12 LUPs contain direction that marginally addresses these issues, and eight LRMPs and 23 LUPs contain no direction. Connectivity is an important concern in this geographic area, especially in the southern and eastern portions where landscapes are more naturally fragmented. Riparian corridors required by INFISH and PACFISH assist with connectivity on those NFs where this direction applies. Other portions of the geographic area contain weaker riparian direction. The weakness of the Plans in addressing connectivity issues in the remaining portions of the geographic area potentially contributes to a risk of adverse effects on lynx. This criterion is carried forward as part of the rationale for the determination of effects.

Land tenure adjustments--One LUP contains direction that would fully maintain or improve lynx habitat through land tenure adjustments; one LRMP and one LUP contain substantial direction; 12 LRMPs and 15 LUPs contain marginal direction; and 18 LRMPs and 18 LUPs contain no such direction. Although direction contained in the Plans is weak, land adjustments are limited in scope and low in number, and are therefore not likely to present an impact to lynx habitat at a programmatic level within the geographic area. Effects on lynx would normally be assessed at the project level and mitigated appropriately. Some adverse effects may occur at the project level but these are beyond the scope of this analysis. No evidence was found to indicate that Plan direction may be contributing to adverse effects to lynx.

Management coordination--Four LRMPs and one LUP contain substantial direction for coordinating issues that may affect lynx with nearby administrative units or other agencies; 18 LRMPs and 13 LUPs contain marginal direction; and nine LRMPs and 21 LUPs contain no direction. Management coordination is important in this geographic area for maintaining connectivity with Canada to the north, the Southern Rockies to the

south, and the Cascades to the west. The overall weakness of Plans in directing coordination may contribute to a risk of adverse effects on lynx. This criterion is carried forward as part of the rationale for the determination of effects.

Monitoring--One LRMP contains full direction for monitoring of lynx, snowshoe hares, or their habitats; one LRMP contains substantial direction; 12 LRMPs and one LUP contain marginal direction; and 17 LRMPs and 34 LUPs contain no direction. While failure to monitor does not directly cause adverse effects, it does result in any adverse effects being difficult to identify and assess. This criterion is carried forward as part of the rationale for the determination of effect.

In summary, NF units account for the majority of primary lynx habitat in the Northern Rockies geographic area; 23,168, 000 acres or 67 percent. BLM units account for 1,559,000 acres or 5 percent of primary lynx habitat in the Northern Rocky Mountains. Table 5 summarizes the ratings for the 10 evaluation criteria for which Plan direction in the Northern Rocky Mountains was found to present a risk of adverse affects to lynx. Those criteria are**:** ***foraging habitat, habitat conversion, thinning, fire management, forest roads, developed recreation, winter dispersed recreation, habitat connectivity, management coordination, and monitoring***.

These findings of likely adverse effects are carried forward as part of the rationale contributing to the determination of effect in Chapter V. The ratings for all 15 criteria are presented in Appendix G.

Additional Considerations, Including Cumulative Effects

This geographic area likely has the strongest current lynx population in the lower 48 states. Relatively high quality habitat, in large blocks, well connected within the geographic area and with Canada, are some of the probable reasons. Silvicultural and fire management practices allowed by the Plans within the developmental land allocations of the area have the potential to adversely affect lynx. Similarly, management practices on state, corporate private, and small private lands may present a risk to lynx persistence in the long term. The presence of major

Table 5--Summary ratings for the ten criteria contributing to a risk of adverse effects to lynx in the Northern Rocky Mountains geographic area.

	FS (67% of Primary Habitat)		BLM (5% of Primary Habitat)	
Ratings[1/]	**Number**	**Percent**	**Number**	**Percent**
F	9	3	4	1
S	51	16	8	2
M	135	44	94	27
N	113	36	192	55
U	2	1	4	1
NA	0	0	48	14
Total	310	100	350	100

[1/] The methods section of this chapter describes how evaluation criteria were developed and what the individual rating codes represent.

highways through the area, several large reservoirs, and residential/urban development pose movement obstacles to lynx. On the positive side, management instituted for other species, such as grizzly bear and inland fisheries management programs, affords protection for some key elements of lynx habitat, such as human access limitations and riparian corridors. The two large National Parks within the area (Glacier and Yellowstone) provide large secure blocks of habitat. This geographic area is particularly important as a conduit for maintaining connectivity with several other areas of lynx habitat, namely Canada, the southern Cascades, and the Southern Rockies.

c. Southern Rockies Geographic Area

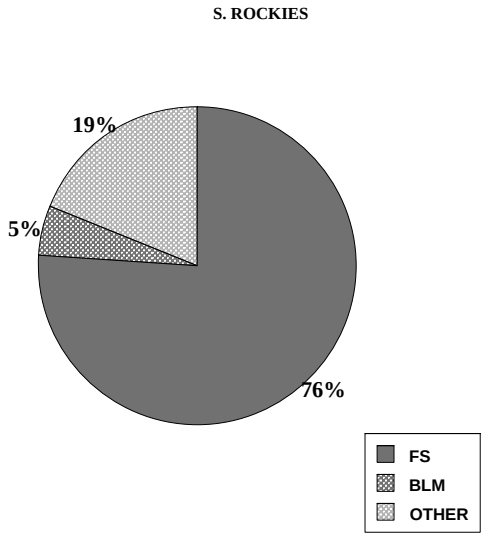
The Southern Rockies geographic area includes eight National Forests and ten BLM administrative units (seven Resource Areas and three Field Offices, see Appendix A). The net area covered by these units is 35,166,320 acres, of which 5,336,000 acres (15 percent) are identified as primary lynx habitat. National Forest System lands comprise 76 percent of the primary habitat in the geographic area, BLM lands make up 5 percent, and the remaining 19 percent is in other ownerships (Figure 13). Much of the BLM lands, and some of the NF lands, are in shrub-steppe habitats that may be important primarily for connectivity between patches of coniferous habitat or for foraging on alternate prey during times of snowshoe hare scarcity.

Risk Factors

The LCAS identifies the following risk factors to lynx in this geographic area:

- Fire exclusion, which changes the vegetation mosaic maintained by natural disturbance processes
- Grazing by domestic livestock, which reduces forage for lynx prey
- Roads and winter recreation trails that facilitate access to historical lynx habitat by competitors
- Incidental trapping (except in Colorado where trapping is illegal) and shooting
- Predation
- Being hit by vehicles

Figure 13--Land ownership of primary habitat in the Southern Rocky Mountains geographic area.



- Habitat conversion, fragmentation, and obstruction to movements resulting from large recreation (ski area) developments, urban sprawl, and highway construction

Spatial Patterns in Primary Lynx Habitat

Forested primary habitat in the Southern Rockies geographic area occurs below the extensive high elevation alpine environment, and above the shrub-steppe lower valleys (Figure 3). When combined with the spatial arrangement of mountain ranges in the Southern Rockies, a naturally fragmented distribution pattern of primary habitat is created. Metapopulation dynamics are typical for this type of fragmented spatial distribution. Natural patterns of fragmentation increase the value of existing landscape connections and increase an area's vulnerability to additional fragmentation (Hanski and Gilpin 1997).

Likelihood for Supporting Lynx Conservation

There are no large primary habitat patches in the Southern Rockies geographic area meeting the criteria with high likelihood for supporting lynx conservation, primarily reflecting the natural fragmentation occurring in the area. There are polygons of primary habitat (with management direction emphasizing natural ecological processes) that are within 10 km (6.25 mi) distance that meet the criteria with moderate potential for supporting lynx conservation (Figures 4 and 5).

Landscape Connectivity

The Southern Rockies geographic area represents the southern-most extension of the lynx geographic range. Arid desert environments (such as the Red Desert in southern Wyoming, the Green River and Colorado River canyons in Utah) separate the Southern Rockies from the nearest potential source population in the Northern Rockies geographic area.

Hostile desert habitats present imposing conditions for lynx movements when compared to movement through forest or even shrub-steppe environments. Habitats may have been more connected during the Pleistocene epoch, but now are isolated to higher mountain elevations by post-Pleistocene climatic warming (Brown 1971), leading to the possibility that any naturally occurring lynx in the Southern Rockies may represent a relict population.

Factors Potentially Affecting Lynx Movements

Human development in the Southern Rockies geographic area may have reduced the ability of lynx to colonize suitable habitat within Colorado, or to reach the state from potential source populations in Wyoming. For example, Interstate Highway 70 west of Denver passes through primary lynx habitat. Adjacent to the highway are numerous ski areas, their supporting businesses, and residential developments. The areas surrounding the ski developments often cater to additional recreational activities such as snowmobiling and cross country skiing. Cumulatively, these actions may contribute to increased metapopulation vulnerability through fragmenting habitat and weakening landscape connections (Figure 8).

In summary, the Southern Rockies geographic area has a naturally fragmented spatial pattern of primary habitat. The capability to maintain a metapopulation there depends on successful dispersal between habitat fragments, and potentially between geographic areas. Increased fragmentation and isolation has occurred due to cumulative impacts from highways and residential and recreational development often tied to ski areas developed on NF lands. The capacity to support lynx conservation in this area has

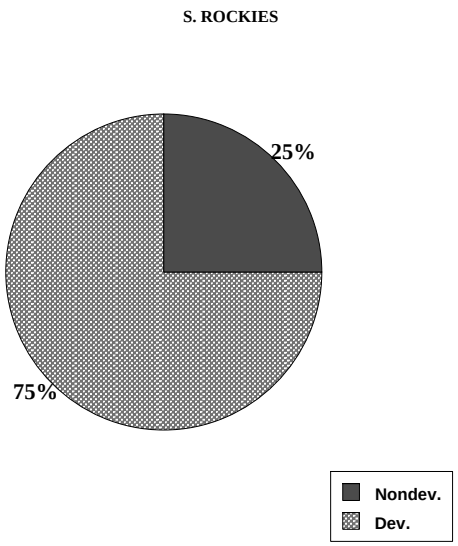
been reduced by these activities (Figures 6 and 8).

Effects Within Nondevelopmental Land Allocations

Approximately 1,357,480 acres (25 percent) of the primary lynx habitat on FS and BLM lands in this area are designated as nondevelopmental land allocations (management prescriptions 1, 2 and 3 -- wilderness, roadless, etc., see Appendix F) where natural disturbance processes may predominate (Figure 14). Table 3 identifies which of the 15 evaluation criteria are most applicable within the nondevelopmental land allocations.

All eight of the LRMPs and six of ten LUPs allow, but do not mandate, the use of wildland fire for resource benefits within these allocations. Fire could assume a significant role in creating a natural mosaic of vegetation communities and age classes across the landscape under existing Plan direction. Other natural processes such as insects, disease, and wind storms will contribute to the maintenance of this mosaic. Lynx foraging habitat is likely to be maintained at a level somewhat less than would be provided under natural disturbance regimes. Denning habitat, consisting of old growth forests and concentrations of downed logs resulting from disturbance events, will likely be maintained at or above levels that occurred historically. The differences from historical conditions are due to continued fire suppression, which results in fire being allowed to play its natural role in only a portion of these land allocations. Some human activities potentially affecting lynx, such as timber harvest, road construction, recreation developments, and motorized dispersed recreation, are generally not expected to occur within nondevelopmental land allocations, and therefore will not adversely affect lynx there.

Figure 14--Proportion of developmental and nondevelopmental allocations in the Southern Rockies geographic area.



Other activities, such as grazing and mining, may occur but are likely to occur less extensively than in developmental allocations. Winter dispersed recreation activities, such as snowshoeing and skiing, may result in packed trails that could facilitate movement of competitors and predators into lynx habitat. All of the Plans allow these forms of non-mechanized human travel, although the roadless character of these lands constrains winter use to some extent

Effects Within Developmental Land Allocations

The Plans provide the opportunity to maintain lynx habitat through vegetation manipulation and other land management activities within the developmental land allocations (management prescriptions 4-8, see Appendix F). Conversely, potential impacts to lynx or their habitats may result from a number of human activities. The Plans were examined to determine how well they meet 15 evaluation criteria for maintaining lynx habitat and mitigating potential human impacts (refer to Methods section for details). The results of this review are displayed for each administrative unit in Appendix G. A geographic area summary of the findings for each criterion follows below. Criteria which were found to potentially present a risk of adverse effects to lynx were carried forward as part of the rationale for the determination of effect in Chapter V. Criteria which are not identified as carrying forward were found to present a discountable or insignificant risk of adverse effects (see U.S. Fish and Wildlife Service 1998b, p. 3-13 for definitions).

Denning habitat--Denning habitat is fully maintained in two LRMPs; substantially maintained in five LRMPs and one LUP; marginally maintained in one LRMP and four LUPs; and not maintained in five LUPs. The small percentage of the geographic area in BLM lands may have low potential to provide denning habitat due to inherent climatic and vegetational limitations. The NF lands overall are doing an acceptable job of maintaining denning habitat due to old growth direction contained in the Plans. Denning habitat is likely not limiting to lynx within the geographic area. No adverse effects to lynx denning habitat are expected from the Plans.

Foraging habitat--Foraging habitat is substantially maintained in one LRMP; marginally maintained in seven LRMPs and four LUPs; and not maintained in six LUPs. The small percentage of the geographic area in BLM lands may have low potential to provide habitat for foraging on snowshoe hare due to inherent climatic and vegetational limitations, but may provide habitat for foraging on alternate prey species such as jackrabbits. BLM lands also provide the potential for connectivity between patches of coniferous habitat. Based on the questionnaire results summarized above, the ability of the Plans to provide foraging habitat may be a limiting factor to lynx in the geographic area. This criterion is carried forward as part of the rationale for the determination of effects.

Habitat conversions--Vegetation type conversions that could reduce habitat suitability for lynx are fully precluded in four LUPs, marginally precluded in three LRMPs and three LUPs, and are not precluded in five LRMPs and three LUPs. This practice has the potential to affect lynx foraging habitat over large acreages. Type conversion in the shrub-steppe habitat could reduce potential for foraging on alternate prey as well as movement by lynx. Given the weak emphasis in Plans on avoiding this practice and the fact it could potentially occur on a large percentage of the geographic area (75 percent in developmental allocations), there is a risk that lynx could be adversely affected. This criterion is carried forward as part of the rationale for the determination of effects.

Thinning--Five LRMPs and two LUPs include direction that would marginally integrate lynx habitat needs with thinning projects, while three LRMPs contain no direction, and the criterion is not applicable to eight LUPs. With 75 percent of the geographic area in developmental allocations, precommercial thinning has the potential to occur over a broad area. The Plans are generally weak in providing compatible direction for thinning within lynx habitat, and this activity may risk adversely affecting lynx within the geographic area. This criterion is carried forward as part of the rationale for the determination of effects.

Fire management--Six LRMPs and nine LUPs direct aggressive wildfire suppression, which would limit the creation of lynx foraging habitat through natural ecological processes. Two LRMPs and one LUP direct a limited suppression approach that may help maintain foraging habitat. The objective of aggressive fire suppression where resource values are at risk is understandable, but nevertheless may be contributing to a risk of adverse effects to lynx within the geographic area by reducing the creation of foraging habitat through natural disturbance processes. This criterion is carried forward as part of the rationale for the determination of effects.

Landscape patterns--One LRMP contains substantial direction for providing landscape vegetation patterns that would maintain lynx foraging and denning habitats; seven LRMPs and one LUP provide marginal direction; and nine LUPs provide no direction. This generally weak direction is of concern in a geographic area where habitats tend to be naturally fragmented, and could be contributing to a risk of adverse effects on lynx. This criterion is carried forward as part of the rationale for the determination of effect.

Forest roads--One LRMP provides direction pertaining to roads that fully helps promote lynx recovery; three LRMPs and one LUP provide substantial direction; four LRMPs and four LUPs provide marginal direction; and five LUPs provide no direction. While displacement by humans does not appear to be a major factor in lynx ecology (Ruggiero et al. in press 1999b), human access via roads may increase the mortality risk to lynx from trapping (except in Colorado where trapping is prohibited) or shooting, as well as competition from other carnivores. Road-related risks are primarily a winter season issue. The issue is of concern on the portions of the geographic area (refer to Appendix G) with weak or no road management direction and could be contributing to a risk of adverse effects to lynx on these units. This criterion is carried forward as part of the rationale for the determination of effect.

Developed recreation--Three LRMPs provide direction that marginally mitigates the potential effects of developed recreation on lynx, while five LRMPs and ten LUPs provide no such direction. Major recreation developments are uncommon on BLM lands but present in significant numbers on NF lands within this geographic area. Because of the number and size of recreational developments, coupled with the often linear nature of the habitat, these developments pose a threat to lynx in the area. Although mitigation can be developed at the project level, the prominence of this type of activity within the Southern Rocky Mountains suggests that it would also be advantageous to address it programmatically at the Plan level. Since most existing Plans are weak with respect to guidance for developed recreation, these activities may risk adversely affecting lynx in this geographic area. This criterion is carried forward as part of the rationale for the determination of effect.

Non-winter dispersed recreation--One LRMP contains direction that fully mitigates the effects of non-winter dispersed recreation on lynx; two LRMPs and one LUP substantially mitigate these effects; three

LRMPs and one LUP marginally mitigate the effects; and two LRMPs and eight LUPs contain no mitigation. The mitigation relates to mechanized off-road vehicles rather than to foot travel. Non-winter dispersed recreation may not be an adverse effect on lynx within the geographic area because lynx do not appear to be highly susceptible to displacement by humans (Ruggiero et al. in press 1999b). Plans generally provide for adequate and widely distributed denning habitat in the geographic area. Therefore, no adverse effects from non-winter dispersed recreation could be identified.

Winter dispersed recreation--Three LRMPs contains direction that substantially mitigates the effects of winter dispersed recreation on lynx; two LRMPs contain direction that marginally mitigates these effects; and three LRMPs and ten LUPs contain no such direction. The mitigation relates to mechanized over-snow vehicles only. No Plans limit winter foot travel by snowshoes or skis. These activities may potentially contribute to a risk of adverse effects on lynx within the geographic area. This criterion is carried forward as part of the rationale for the determination of effect.

Minerals and energy development--Four LRMPs contain direction that would substantially mitigate the effects of minerals and energy development on lynx; two LRMPs and two LUPs marginally mitigate these effects; and two LRMPs and eight LUPs contain no mitigation. These activities are relatively common in the southern Rockies geographic area. Specific mitigation for such activities is often developed at the project level. The overall weakness of the Plans with respect to these activities does not necessarily mean that adverse effects to lynx will occur. Some adverse effects may occur at the project level, but these are beyond the scope of this analysis. No evidence was found to indicate that Plan direction may be contributing to a risk of adverse effects to lynx.

Habitat connectivity--Two LRMPs contain direction that substantially mitigates the effects of movement barriers or maintains lynx habitat connectivity at the administrative unit scale. Two LRMPs contain direction that marginally addresses these issues, while four LRMPs and ten LUPs contain no such direction. Connectivity is a major concern in this geographic area due to the naturally fragmented landscape and the relatively high level of human developments. Highways, ski areas, and other developments may be locally affecting lynx movements (refer to Figure 9 for an example.) Weak riparian guidance in some portions of the geographic area may contribute to connectivity concerns. The overall weakness of the Plans in addressing connectivity issues potentially contributes to a risk of adverse effects to lynx. This criterion is carried forward as part of the rationale for the determination of effect.

Land tenure adjustments--Five LRMPs and two LUPs contain direction that would marginally maintain or improve lynx habitat through land tenure adjustments, while three LRMPs and eight LUPs contain no direction. Although direction contained in the Plans is weak, land adjustments are limited in scope and relatively low in number, and are therefore not likely to present an impact to lynx habitat at a programmatic level within the geographic area. Effects on lynx would normally be assessed at the project level and mitigated appropriately. Some adverse effects may occur at the project level, for example the exchange of federal lands at the base of ski areas for private commercial or residential development. These project level effects are beyond the scope of this analysis. No evidence was found to indicate that Plan direction may be contributing to adverse effects to lynx.

Management coordination--Four LRMPs and one LUP contain marginal direction for coordinating issues that may affect lynx with nearby administrative units or other agencies,

while four LRMPs and eight LUPs contain no direction. Management coordination may be especially important in this geographic area of mixed ownerships and naturally fragmented landscapes. The weakness of Plans in this regard may contribute to a risk of adverse effects on lynx. This criterion carries forward as part of the rationale for the determination of effects.

Monitoring--One LRMP contains substantial direction for monitoring of lynx, snowshoe hares, or their habitats; two LRMPs contain marginal direction; and five LRMPs and ten LUPs contain no direction. While failure to monitor does not directly cause adverse effects, it does result in any adverse effects being difficult to identify and assess. This criterion is carried forward as part of the rationale for the determination of effect.

In summary, NF units account for the majority of primary lynx habitat in the Southern Rocky Mountains geographic area; 4,987,000 acres or 76 percent. BLM units account for 349,000 acres or 5 percent of primary lynx habitat in the Southern Rocky Mountains. Table 6 summarizes the ratings for the 11 evaluation criteria for which Plan direction was found to present a risk of adverse affects to lynx. Those criteria are: ***foraging habitat, habitat conversions, thinning, fire management, landscape patterns, forest roads, developed recreation, winter dispersed recreation, habitat connectivity, management coordination, and monitoring***. These findings of likely adverse effects are carried forward as part of the rationale contributing to the determination of effect in Chapter V. The ratings for all 15 criteria are presented in Appendix G.

Additional Considerations, Including Cumulative Effects

Climatic and geomorphic factors play a key role in determining lynx habitat in this geographic area. The drier climate makes habitat generally less productive than most other geographic areas. The habitat here also consists of a naturally fragmented landscape composed of timbered mountain ranges capped by rock and tundra, and separated by shrub-dominated valleys. FS and BLM lands tend to be located within these two types of habitat, respectively. The Southern Rockies may not be connected to lynx habitats farther to the north due to the intervening Red Desert in Wyoming and the Green River and Colorado deserts of Utah and western

Table 6--Summary ratings for the eleven criteria contributing to a risk of risk of adverse effects to lynx in the Southern Rocky Mountains geographic area.

	FS (76% of Primary Habitat)		BLM (5% of Primary Habitat)	
Ratings[1/]	**Number**	**Percent**	**Number**	**Percent**
F	3	3	0	-
S	11	11	4	4
M	52	54	18	16
N	31	32	60	53
U	0	-	1	1
NA	0	-	30	26
Total	97	100	113	100

[1/] The methods section of this chapter describes how evaluation criteria were developed and what the individual rating codes represent.

Colorado (Ruediger et al. in press 1999). Maintenance of regional-scale habitat connectivity is, therefore, perhaps more important to lynx conservation in this geographic area than any other. Generally, the Plans are weak in providing for this need.

Recreational developments, vegetation management, and grazing practices may contribute to loss of connectivity on federal lands. Additional cumulative effects include management practices on private lands and numerous highways and other human developments. High winter dispersed recreation use may also present a risk of adverse effects in this geographic area in terms of facilitating movement of lynx competitors and predators.

d. Great Lakes Geographic Area

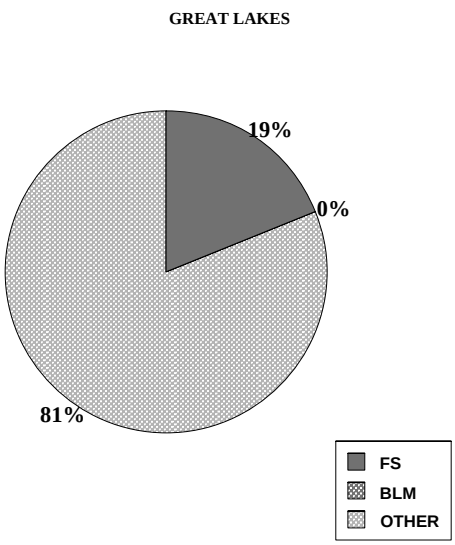
The Great Lakes geographic area includes six National Forests and no BLM administrative units (see Appendix A). The net acreage covered by these units is 6,148,000 acres, of which 4,459,000 acres (72 percent) are identified as primary lynx habitat. National Forest System lands comprise 19 percent of the primary habitat in the geographic area, and the remaining 81 percent is in other ownerships (Figure 15).

Risk Factors

The Interim LCAS identifies the following risk factors to lynx in this geographic area:

- Timber management that converts cover type from conifer to hardwoods, reducing habitat quality for prey species, reducing mature forests needed for denning, and making habitat more favorable for competitors
- Fire exclusion that changes the vegetation mosaic maintained by natural disturbance processes
- Roads and winter recreation trails that facilitate access to historical lynx habitat by competitors
- Incidental trapping and shooting
- Predation

Figure 15--Land ownership of primary habitat in the Great Lakes geographic area.



- Being hit by vehicles
- Obstructions to movements such as highways, agricultural lands, and ice-breaking associated with the St. Mary's River shipping corridor
- Habitat conversion through agricultural and urban development

Spatial Patterns in Primary Lynx Habitat

Primary habitat in the Great Lakes geographic area is displayed as a continuous expanse of boreal forest (with interspersed hardwoods and bogs) surrounding Lake Superior in northern Minnesota, Wisconsin, and the upper peninsula of Michigan (Figure 4). This is partly the result of primary habitat being broadly mapped as a Bailey's subsection, which contains inclusions of non-habitat. In reality, with the exception of the area in and around Boundary Waters Canoe Area Wilderness, primary habitat is more fragmented than depicted. This is due to these non-habitat inclusions and habitat conversion resulting from agricultural and residential development, as well as forest type conversion from preferred to less desirable forest cover types (Ruediger et al. in press 1999). In addition, scattered primary habitat occurs in central Wisconsin and the lower peninsula of Michigan.

The six NFs in this geographic area are not contiguous. Most primary habitat occurs on non-federal lands surrounding the National Forests, ensuring that state, county and private lands will have an important influence on lynx conservation efforts.

Likelihood for Supporting Lynx Conservation

Boundary Waters Canoe Area Wilderness on the Superior NF has the combination of factors with the highest potential for supporting lynx conservation in the Great Lakes geographic area (see Methods section). This area is strategically located along the Canadian border to facilitate lynx movements. Quetico Provincial Park, Ontario, adjoins the Boundary Waters area and functionally enlarges the size of this conservation area (Figure 6). Smaller primary habitat patches within 10 km (6.25 mi) of each other, with management direction emphasizing natural ecological processes, adjoin the Boundary Waters area and provide moderate potential for supporting lynx conservation (Figure 6).

The western portion of the Ottawa NF contains enough smaller primary habitat patches within 10 km (6.25 mi) of each other, that aggregate to meet the 1800 km^2 (695 mi^2) criteria, to warrant consideration as an area with potential to support lynx conservation. However, current Plan direction within these primary habitat patches is not oriented towards lynx conservation.

Remaining patches of federal land are either too small or too isolated to likely support lynx conservation without coordinating efforts with the surrounding private and other non-federal landowners. Maintaining connectivity between areas with potentially higher likelihood for supporting lynx conservation on the Ottawa and Superior NFs may be a key to future conservation efforts in this geographic area.

In summary, Plan direction supports high potential for lynx conservation in the Boundary Waters area, but also contains management direction dissimilar to natural ecological processes in much of the remaining Great Lakes geographic area. There is sufficient federal land in primary habitat on the Ottawa NF with higher potential to support lynx conservation, but current management direction is not oriented towards lynx habitat management (Figures 5 and 6).

Landscape Connectivity

Boreal habitat in the Great Lakes geographic area is connected in northern

Minnesota with extensive similar habitats in Canada. Frequent lynx movements have been documented between northern Minnesota and Canada (Ruediger et al. in press 1999). The closest connection between Canadian source populations and upper Michigan occurs along the St Mary's River linking Lake Superior and Lake Huron. Dispersal is more likely to occur during winter when lynx could cross the frozen river. Historically, the expanse of primary habitat within the Great Lakes geographic area was more continuous than current conditions, and it provided stronger landscape connections.

Factors Potentially Affecting Lynx Movements

Movement capability between Canadian source populations and the Great Lakes geographic area is likely strongest along the adjoining Boundary Waters/Quetico Provincial Park area. Lynx movements across the St. Mary's River are currently impeded by the extended Great Lakes shipping season which maintains an open river channel during winter (Ruediger et al. in press 1999) (Figure 8).

Habitat connectivity within the geographic area has been reduced by the following factors: conversion from forest to agricultural lands in northern Wisconsin and central and eastern upper Michigan, and the extensive network of highways (Ruediger et al. in press 1999). Maintaining connectivity between the larger patches of primary habitat on the Ottawa and Superior NFs may be dependent on compatible management on the intervening non-federal lands (Figure 7).

In summary, there are additional impediments affecting lynx movements, and potential breaks in landscape connections within the region, and between upper Michigan and Canada, compared to the historical condition. A strong link with Canadian source populations remains in northern Minnesota, coincident with this area having the highest capability to support lynx conservation. Federal lands are isolated by private, county, and state lands; therefore, connectivity will be strongly influenced by actions on non-federal lands.

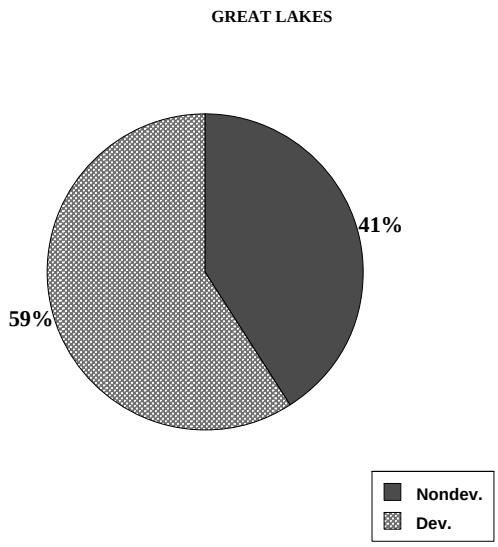
Effects Within Nondevelopmental Land Allocations

Approximately 1,828,000 acres (41 percent) of the primary lynx habitat on FS lands in this area are designated as nondevelopmental land allocations (management prescriptions 1, 2 and 3 -- wilderness, roadless, etc., see Appendix F) where natural disturbance processes may predominate (Figure 16). Table 3 identifies which of the 15 evaluation criteria are most applicable within the nondevelopmental land allocations

Only one of six LRMPs allows the use of wildland fire for resource benefits within these allocations, and therefore, fire is unlikely to fully assume its natural role in creating a mosaic of vegetation communities and age classes across the landscape. Escaped fires and other natural processes such as insects and wind storms likely will maintain this mosaic to some degree. Lynx foraging habitat is likely to be maintained at a level somewhat less than would be provided under natural disturbance regimes. Denning habitat will be maintained at a somewhat higher level than occurred historically due to forest succession toward old growth and concentrations of downed logs created by disturbance events.

The differences from historical conditions are due to strong fire suppression direction in the Plans, resulting in fire not being allowed to play its natural role in the ecosystems. Some human activities potentially affecting lynx, such as timber harvest, road construction, recreation developments, and motorized dispersed recreation, are generally not expected to occur within nondevelopmental land allocations, and therefore will not

Figure 16--Proportion of developmental and nondevelopmental allocations in the Great Lakes geographic area.



adversely affect lynx there. Other activities, such as grazing and mining, may occur but are likely to occur less extensively than in developmental allocations. Winter dispersed recreation activities, such as snowshoeing and skiing, may result in packed trails that could facilitate movement of competitors and predators into lynx habitat. All of the Plans allow these forms of non-mechanized human travel, although the roadless character of these lands limits winter use to some extent.

Effects Within Developmental Land Allocations

The Plans provide the opportunity to maintain lynx habitat through vegetation manipulation and other land management activities within the developmental land allocations (management prescriptions 4-8, see Appendix F). Conversely, potential impacts to lynx or their habitats may result from a number of human activities. The Plans were examined to determine how well they meet the 15 evaluation criteria with respect to maintaining lynx habitat and mitigating potential human impacts (refer to Methods section for details). The results of this review are displayed for each administrative unit in Appendix G. A geographic area summary of the findings for each criterion follows below. Criteria which were found to potentially present a risk of adverse effect to lynx were carried forward as part of the rationale for the determination of effect in Chapter V. Criteria which are not identified as carrying forward were found to present a discountable or insignificant risk of adverse effects (see U.S. Fish and Wildlife Service 1998b, p. 3-13 for definitions).

Denning habitat--Denning habitat is substantially maintained on the one NF with the largest component of wilderness and is marginally maintained on the remaining five NFs as a result of weak old growth management direction. The lack of additional direction to provide denning habitat coupled

with the high percentage of the geographic area in developmental allocations (65 percent) may result in a risk of adverse effects to lynx within this geographic area. This criterion is carried forward as part of the rationale for the determination of effect.

Foraging habitat--Foraging habitat is marginally maintained on all six NFs. Historical timber harvest practices converted forests to less suitable types on a broad scale, and practices prescribed in the Plans tend to perpetuate this condition over much of the geographic area. While sufficient foraging habitat exists to support a snowshoe hare population, it may not be adequate to support an expanding lynx population, especially in light of competition from other carnivores. The preponderance of aspen and birch in the geographic area is also not conducive to high populations of red squirrels as an alternate prey species. Weak Plan direction to provide conditions suitable for lynx foraging may risk adversely affecting the species in the geographic area. This criterion is carried forward as part of the rationale for the determination of effect.

Habitat conversions--Vegetation type conversions that could reduce habitat suitability for lynx are not precluded by LRMP direction on five NFs and are marginally precluded on the remaining one. This activity potentially reduces foraging habitat for lynx; however, much of the lynx habitat in the area was historically converted to less desirable seral types. Direction to restore historical vegetation patterns, either actively through management or passively through succession, would be beneficial to lynx if it existed in the Plans. Given the current vegetation conditions in the geographic area, type conversions from more desirable to less desirable habitats is not an issue in this geographic area. No adverse effects resulting from this practice were identified.

Thinning--Two LRMPs include direction that would marginally integrate lynx habitat needs with timber stand thinning projects; three LRMPs contain no direction; and thinning is not applicable on one NF. Overall, thinning does not appear to be as large an issue in this geographic area as in most others. This is mainly due to the preponderance of seral aspen and birch stands resulting from historical type conversions. Thinning could become an important factor in the future if coniferous forests were restored to their historical levels. At this time, Plan direction regarding thinning does not appear to present a risk of adverse effects to lynx in the geographic area.

Fire management--Five of the six LRMPs direct aggressive wildfire suppression, which would limit the creation of lynx foraging habitat through natural ecological processes. The remaining LRMP contains flexibility to base fire management decisions on an area-specific basis, thus marginally meeting this criterion. Restoration of fire to the ecosystems would become a more important factor if historical forest composition and structure were restored. Under current conditions, fire management direction in the Plans does not appear to be presenting a risk of adverse effects to lynx.

Landscape patterns--All six LRMPs provide direction that marginally results in landscape vegetation patterns that would maintain lynx foraging and denning habitats. This weak direction is typically in the form of guidance for timber harvest unit sizes, shapes, and spacing, and old growth distribution requirements. Weak direction to maintain vegetation patterns suitable for lynx habitat may be contributing to a risk of adverse effects to lynx in the area. This criterion is carried forward as part of the rationale for the determination of effect.

Forest roads--Three LRMPs provide direction pertaining to roads that substantially

helps promote lynx recovery, while the other three LRMPs contain marginal direction. Although displacement by humans does not appear to be a major factor in lynx ecology (Ruggiero et al. in press 1999b), human access via roads may increase the mortality risk to lynx from incidental trapping or shooting, as well as increased competition from other carnivores. Road-related effects are primarily a winter season concern. This criterion is carried forward as part of the rationale for the determination of effect.

Developed recreation--None of the six LRMPs provides direction that mitigates the potential effects of developed recreation on lynx. However, major recreation developments such as large ski areas or resorts are not common in this geographic area. Effects to lynx from existing Plan direction regarding recreation developments are judged to be insignificant in the geographic area.

Non-winter dispersed recreation--One LRMP contains direction that substantially mitigates the effects of non-winter dispersed recreation on lynx; two LRMPs marginally mitigate; and three LRMPs contain no mitigation. The mitigation relates to mechanized off-road vehicles rather than to foot travel. This activity presents a low risk of adverse effects to lynx within the geographic area due to season of use and the tolerance of lynx to human disturbance (Ruggiero et al. in press 1999b). The exception may be near denning sites (Ruediger et al. in press 1999). Availability of denning habitat is an issue in the geographic area. However, since no existing denning sites are presently known in the area, no adverse effects from Plan direction regarding non-winter dispersed recreation could be identified.

Winter dispersed recreation--Two LRMPs contain direction that substantially mitigates the effects of winter dispersed recreation on lynx. This mitigation relates to mechanized over-snow vehicles rather than to foot travel, but should help to limit the effects of competitors travelling on packed trails within lynx habitat in winter on these units. The remaining four LRMPs contain no measures to help mitigate these effects. Both mechanized and non-mechanized winter recreation may locally risk adversely affecting lynx in this geographic area. This criterion is carried forward as part of the rationale for the determination of effect.

Minerals and energy development--One LRMP contains direction that would mitigate the effects of minerals and energy development on lynx. The remaining LRMPs contain no such direction. These activities are not common on federal lands in the geographic area, but where they do occur, specific mitigation is generally developed at the project level. These activities are judged to be a low risk of adversely affecting lynx within the geographic area.

Habitat connectivity--Three LRMPs contain direction that marginally mitigates the effects of movement barriers or maintains lynx habitat connectivity at the administrative unit scale. The remaining three LRMPs contain no direction. Maintenance of connectivity is especially important in this geographic area due to fragmented habitats and the non-contiguous nature of federal lands. Riparian guidance in the Plans is adequate from a connectivity standpoint in this geographic area. Poor habitat connectivity resulting from fragmented land ownerships, and movement barriers such as highways, may risk adversely affecting lynx in this geographic area. This criterion is carried forward as part of the rationale for the determination of effect.

Land tenure adjustments--One LRMP contains substantial direction that would maintain or improve lynx habitat through land tenure adjustments. Three LRMPs contain marginal direction, and two LRMPs contain no direction. Although direction contained in the Plans is weak, land adjustments are limited

in scope and low in number, and are therefore not likely to present an impact to lynx habitat at a programmatic level within the geographic area. Effects on lynx would normally be assessed at the project level and mitigated appropriately. Some adverse effects could occur at the project level but these are beyond the scope of this analysis. No evidence was found to indicate that Plan direction may be contributing to a risk of adverse effects to lynx.

Management coordination--Two LRMPs contain marginal direction for coordinating issues that may affect lynx with nearby administrative units or other agencies. The remaining LRMPs contain no direction. Coordination with adjacent landowners is critical in the fragmented habitats within this geographic area, and inadequate direction for doing so could risk adversely affecting lynx. This criterion is carried forward as part of the rationale for the determination of effect.

Monitoring--Three LRMPs contain marginal direction for monitoring of lynx, snowshoe hares, or their habitats, while the remaining three LRMPs contain no such direction. While failure to monitor does not directly cause adverse effects, it does result in any adverse effects being difficult to identify and assess. This criterion is carried forward as part of the rationale for the determination of effect.

In summary, NF units account for all the federally-managed primary lynx habitat in the Great Lakes geographic area; 4,459,000 acres or 19 percent. BLM units account for none of primary lynx habitat in the Great Lakes. Table 7 summarizes the ratings for the eight evaluation criteria for which Plan direction was found to present a risk of adverse affects to lynx. Those criteria are: ***denning habitat, foraging habitat, landscape patterns, forest roads, winter dispersed recreation, habitat connectivity, management coordination, and monitoring***. These findings of likely adverse effects are carried forward as part of the rationale contributing to the determination of effect in Chapter V. The ratings for all 15 criteria are presented in Appendix G.

Additional Considerations, Including Cumulative Effects

This geographic area consists of six non-contiguous NFs surrounded by private lands and other non-federal ownerships. NF lands are a minor percentage of the total geographic area but may be a significant proportion of the lands capable of supporting lynx. It is

Table 7--Summary ratings for the eight criteria contributing to a risk of adverse effects to lynx in the Great Lakes geographic area.

	FS (19% of Primary Habitat)		BLM (0% of Primary Habitat)	
Ratings[1/]	**Number**	**Percent**	**Number**	**Percent**
F	0	-	0	-
S	6	13	0	-
M	28	58	0	-
N	14	29	0	-
U	0	-	0	-
NA	0	-	0	-
Total	48	100	0	-

1/ The methods section of this chapter describes how evaluation criteria were developed and what the individual rating codes represent.

unlikely that a persistent lynx population could be maintained on the NF lands alone. However, this likelihood could be increased by instituting compatible management on the interspersed non-federal lands and by maintaining connectivity between the NFs and with lynx habitat in Canada.

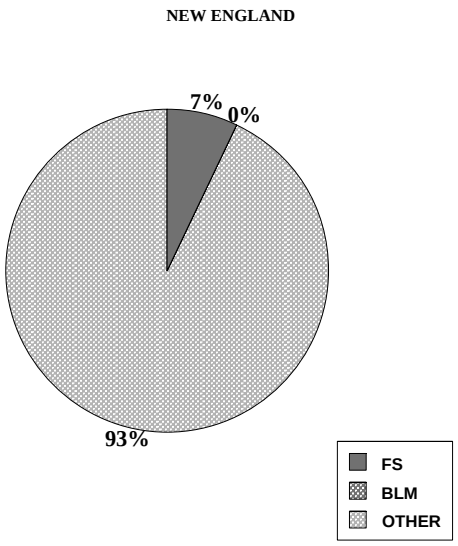
Provisions for habitat connectivity are presently weak in the LRMPs and virtually non-existent in surrounding non-federal lands. Likewise, connectivity with Canada is tenuous in parts of the geographic area due to barriers such as the St. Mary's River (which no longer freezes at historical intervals due to ice-breaking activities), agricultural development, urban growth, and highways.

Highways may pose an important direct mortality threat to lynx in this geographic area as well as impeding movements. Within the NFs, appropriate direction for vegetation management that would provide the needed coniferous foraging and denning habitat within an interconnected mosaic across the landscape may be a limiting habitat factor. Recovery of habitats from historical widespread logging and type conversions has not occurred. Human influences resulting in mortality risk from incidental trapping or shooting, highway collisions, and facilitation of movement of competitors on packed winter recreation trails and plowed roads could also limit lynx recovery in the area.

e. Northeast Geographic Area

The Northeast geographic area includes two NFs and no BLM administrative units (see Appendix A). The net area covered by these units is 1,096,454 acres, all of which are identified as primary lynx habitat. National Forest System lands comprise 7 percent of the primary habitat in the geographic area, and the remaining 93 percent is in other ownerships (Figure 17).

Figure 17--Land ownership of primary habitat in the Northeast geographic area.



Risk Factors

The LCAS identifies the following risk factors to lynx in this geographic area:

- Timber management that converts cover type or reduces foraging habitat
- Roads and winter recreation trails that facilitate access to historical lynx habitat by competitors
- Incidental trapping and shooting
- Predation
- Being hit by vehicles
- Obstructions to movements such as highways, agricultural lands, and the St. Lawrence River shipping lane
- Habitat conversion through agricultural and urban development

Spatial Patterns in Primary Lynx Habitat

Most primary habitat in the Northeast geographic area occurs on state and private lands (Figure 3). Primary habitat on the Green Mountain and White Mountain NFs generally occur at the higher elevations of their respective mountain ranges. A population of lynx in the Northeast geographic area is unlikely to persist on NF lands alone.

Primary habitat in the Northeast geographic area is displayed as large patches of continuous boreal forest (with interspersed hardwoods and bogs) (Figure 3). This is partly the result of primary habitat being broadly mapped as a Bailey's subsection, which contains inclusions of non-habitat. In reality, the spatial pattern of primary habitat is more fragmented than depicted. This is due to these non-habitat inclusions and habitat conversion resulting from agricultural and residential development, as well as forest type conversion from preferred to less desirable forest cover types (Ruediger et al. in press 1999).

Likelihood for Supporting Lynx Conservation

There are no federal lands in the Northeast geographic area meeting the criteria for providing high likelihood for supporting lynx conservation. The Green Mountain NF does not appear to have a sufficient landbase size to meet the 1800 km^2 (695 mi^2) area criteria associated with high support levels. The White Mountain NF has sufficient primary habitat to potentially meet the minimum size criteria, but current management direction is not oriented specifically toward lynx. Most polygons of primary habitat are within 10 km (6.25 mi) of each other (Figure 5).

In summary, Plan direction calls for a large amount of the landscape to be managed in a manner dissimilar to natural ecological processes. Considering the large proportion of private and state lands in the Northeast, NFs contain some of the best opportunities to provide for lynx conservation, but whether lynx persist on, or recolonize, federal lands will likely hinge on landscape connectivity on non-federal lands supporting lynx movements (Figures 4 and 5).

Landscape Connectivity

Historically, primary habitat in the Northeast was connected with more extensive primary habitat and lynx source populations in Quebec and New Brunswick (Litvaitis et al. 1991). Linkage with Canadian source populations is a key factor supporting lynx conservation. Patches of isolated primary habitat were embedded within a forest matrix supporting lynx movements.

Factors Potentially Affecting Lynx Movements

Primary habitat within the Northeast geographic area has been increasingly

fragmented and isolated by a combination of factors including: an extensive network of paved roads with high volume traffic, conversion of forest lands to agricultural lands, urban growth, and extensive residential development. For example, a lynx moving 96 km (60 mi) from the White Mountain NF to the Green Mountain NF would have to cross Interstate Highways 89, 91 and 93 (Figures 6 and 7).

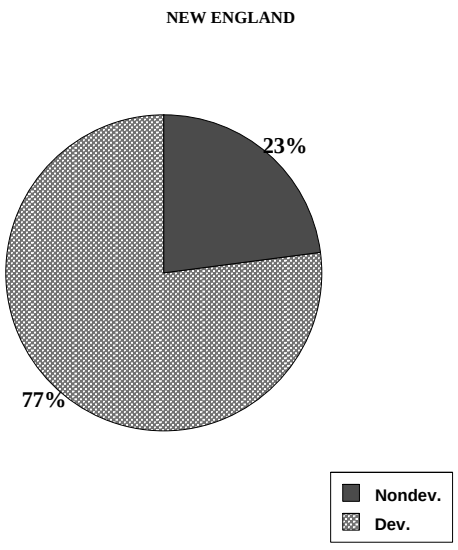
Connectivity with Canadian source populations has been adversely affected by habitat conversion on either side of the St. Lawrence Seaway, combined with the use of ice-breakers which preclude the formation of ice bridges across the Seaway (Litvaitis et al. 1991).

In summary, the likelihood of supporting lynx conservation in the Northeast geographic area is low. Actions on NF lands are potentially important for providing areas with a higher potential to support lynx conservation, but activities on non-federal lands will be critical to maintaining a population of lynx in this region (Figure 5).

Effects Within Nondevelopmental Land Allocations

Approximately 244,000 acres (23 percent) of the primary lynx habitat on FS lands in this area are designated as nondevelopmental land allocations (management prescriptions 1, 2 and 3 --wilderness, roadless, etc., see Appendix F) where natural disturbance processes may predominate (Figure 18). Table 3 identifies which of the 15 evaluation criteria are most applicable within the nondevelopmental land allocations. Neither LRMP allows the use of wildland fire for resource benefits within these allocations, and therefore, fire is unlikely to fully assume its natural role in creating a mosaic of vegetation communities and age classes across the landscape. Escaped fires and other natural processes such as insects, disease, and wind

Figure 18--Proportion of developmental and nondevelopmental allocations in the Northeast geographic area.



storms likely will maintain this mosaic to some degree. Lynx foraging habitat is likely to be maintained at a level somewhat less than would be provided under natural disturbance regimes. Denning habitat will be maintained at a somewhat higher level than occurred historically due to forest succession toward old growth and concentrations of downed logs created by disturbance events. The differences from historical conditions are due to strong fire suppression direction in the Plans, resulting in fire not being allowed to play its natural role in the ecosystems. Some human activities potentially affecting lynx, such as timber harvest, road construction, recreation developments, and motorized dispersed recreation, are generally not expected to occur within nondevelopmental land allocations, and therefore will not adversely affect lynx there. Other activities, such as grazing and mining, may occur but are likely to occur less extensively than in developmental allocations. Winter dispersed recreation activities, such as snowshoeing and skiing, may result in packed trails that could facilitate movement of competitors and predators into lynx habitat. All of the Plans allow these forms of non-mechanized human travel, although the roadless character of these lands constrains winter use to some extent.

Effects Within Developmental Land Allocations

The Plans provide the opportunity to maintain lynx habitat through vegetation manipulation and other land management activities within the developmental land allocations (management prescriptions 4-8, see Appendix F). Conversely, potential impacts to lynx or their habitats may result from a number of human activities. The Plans were examined to determine how well they meet 15 evaluation criteria for maintaining lynx habitat and mitigating potential human impacts (refer to Methods section for details). The results of this review are displayed for each administrative unit in Appendix G. A geographic area summary of the findings for each criterion follows below. Criteria which were found to potentially present a risk of adverse effects to lynx were carried forward as part of the rationale for the determination of effect in Chapter V. Criteria which are not identified as carrying forward were found to present a discountable or insignificant risk of adverse effects (see U.S. Fish and Wildlife Service 1998b, p. 3-13 for definitions).

Denning habitat--Denning habitat is fully maintained on one of the two NFs through a comprehensive old growth retention strategy. Denning habitat is marginally maintained on the other NF as a result of less explicit old growth retention guidelines. Overall, denning habitat may be adequately maintained on NF lands within the geographic area considering both developmental and nondevelopment management allocations. The Plans are judged to not be contributing to adverse effects to lynx with respect to denning habitat.

Foraging habitat--Foraging habitat is marginally maintained on both NFs through vegetation manipulation activities and natural disturbances. There is a risk that lynx may be adversely affected on these Forests by an inadequate strategy and direction to provide needed foraging habitat for lynx. This criterion is carried forward as part of the rationale for the determination of effect.

Habitat conversions--Vegetation type conversions that could reduce habitat suitability for lynx are not precluded by LRMP direction on one NF and are marginally precluded on the other NF. This activity may potentially reduce foraging habitat for lynx, and thus contribute to a risk of adverse effects. This criterion is carried forward as part of the rationale for the determination of effect.

Thinning--Neither LRMP includes direction to programmatically integrate lynx habitat needs with timber stand thinning projects. Thus this activity may potentially contribute to

a risk of adverse effects to lynx by reducing foraging habitat. This criterion is carried forward as part of the rationale for the determination of effect.

Fire management--Both LRMPs direct aggressive wildfire suppression programs that would limit the creation of lynx foraging habitat through natural ecological processes. This aggressive strategy, while understandable in a highly developed area, may be contributing to a risk of adverse effects on lynx habitat. This criterion is carried forward as part of the rationale for the determination of effect.

Landscape patterns--One LRMP contains little or no direction to provide landscape vegetation patterns that would maintain lynx foraging and denning habitats. The other LRMP provides substantial direction for maintaining such patterns. Providing an appropriate mosaic of habitats across the landscape is a critical issue within the geographic area due to fragmented land ownerships and resultant habitat fragmentation. Federal lands may be contributing to a risk of adverse effects to lynx on at least one of the NFs in the geographic area. This criterion is carried forward as part of the rationale for the determination of effect.

Forest roads--One LRMP provides direction pertaining to roads that marginally helps promote lynx recovery, while the other LRMP contains no direction. While displacement by humans does not appear to be a major factor in lynx ecology (Ruggiero et al. in press 1999b), unlimited human access via roads may increase the mortality risk to lynx from incidental trapping or shooting, as well as competition from other carnivores. Road-related effects are primarily a winter season issue. This criterion is carried forward as part of the rationale for the determination of effect.

Developed recreation--One LRMP provides direction that marginally mitigates the potential effects of developed recreation on lynx, while the other LRMP contains no such direction. Large recreation developments are moderately abundant on federal and other land ownerships within the geographic area. Given the fragmented nature of habitat in the Northeast area, further fragmentation and habitat loss due to recreation developments could contribute to a risk of adverse effects to lynx at the individual and subpopulation levels. Due to the weak guidance in the Plans with respect to developed recreation, this criterion is carried forward as part of the rationale for the determination of effect.

Non-winter dispersed recreation--Both LRMPs contain direction that was judged to fully mitigate the effects of non-winter dispersed recreation on lynx. This mitigation relates to mechanized off-road vehicles rather than to foot travel. Non-winter dispersed recreation may not be presenting a risk of adverse effects on lynx within the geographic area because lynx do not appear to be highly susceptible to displacement by humans (Ruggiero et al. in press 1999b). The exception may be near denning sites (Ruediger et al. in press 1999). Plan direction appears adequate to address this issue, and no adverse effects are anticipated.

Winter dispersed recreation--Both LRMPs contain direction that was judged to substantially mitigate the effects of winter dispersed recreation on lynx. This mitigation relates to mechanized over-snow vehicles rather than to foot travel, but should help to limit the effects of competitors travelling on packed trails within lynx habitat in winter on these units. Non-mechanized winter recreation may locally risk adversely affecting lynx in this geographic area. This criterion is carried forward as part of the rationale for the determination of effect.

Minerals and energy development--Neither LRMP contains direction that would mitigate the effects of minerals and energy

development on lynx. These activities are not common on federal lands, but where they do occur, mitigation is generally developed at the project level. These activities present a low risk of adversely affecting lynx within the geographic area.

Habitat connectivity--Neither LRMP contains direction that mitigates the effects of movement barriers or maintains lynx habitat connectivity at the administrative unit scale. Habitat connectivity is a critical issue in this geographic area due to fragmented land ownerships and habitats. Weak riparian management direction contributes to connectivity concerns in this geographic area. Fragmented habitats and movement barriers such as highways may also risk adversely affecting lynx in the Northeast. This criterion is carried forward as part of the rationale for the determination of effect.

Land tenure adjustments--Neither LRMP contains direction that would maintain or improve lynx habitat through land tenure adjustments. Mitigation for land adjustments is generally provided at the project analysis level. Although direction contained in the Plans is weak, land adjustments are limited in scope and low in number, and therefore are not likely to present an impact to lynx habitat at a programmatic level within the geographic area. Effects on lynx would normally be assessed at the project level and mitigated appropriately. Some adverse effects may occur at the project level but these are beyond the scope of this analysis. No evidence was found to indicate that Plan direction may be contributing to adverse effects to lynx.

Management coordination--Neither LRMP contains specific direction for coordinating issues that may affect lynx with nearby administrative units or other agencies. Coordination with adjacent landowners is critical in the fragmented habitats within this geographic area, and inadequate direction for doing so could risk adversely affecting lynx. This criterion is carried forward as part of the rationale for the determination of effect.

Monitoring--Both LRMPs contain substantial direction for monitoring of lynx, snowshoe hares, or their habitats, and no adverse effects relative to monitoring are anticipated.

In summary, NF units account for the majority of primary lynx habitat in the Northeast geographic area; 1,096,454 acres or 7 percent. BLM units account for none of primary lynx habitat in Northeast. Table 8 summarizes the ratings for the ten evaluation criteria for which Plan direction was found to present a risk of adverse affects to lynx. Those criteria are: ***foraging habitat, habitat conversion, thinning, fire management, landscape patterns, forest roads, developed recreation, winter dispersed recreation, habitat connectivity, and management coordination***. These findings of likely adverse effects are carried forward as part of the rationale contributing to the determination of effect in Chapter V. The ratings for all 15 criteria are presented in Appendix G.

Additional Considerations, Including Cumulative Effects

This geographic area consists of two non-contiguous NFs surrounded by private lands and other non-federal ownerships. NF lands are a minor percentage of the total geographic area. These factors likely make it impossible to maintain a persistent lynx population on the NF lands alone. Management that is compatible with lynx habitat needs would be necessary on much of the interspersed non-federal lands to achieve lynx recovery, yet there is presently little, if any, direction for such management. Connectivity between patches of suitable lynx habitat at the landscape scale would be essential for a persistent lynx population. Provisions for habitat connectivity are weak in the two LRMPs and virtually non-existent in

surrounding non-federal lands. Likewise, it appears connectivity with lynx habitats and populations in Canada may be crucial to lynx survival in this geographic area; however, this connectivity is tenuous due to barriers such as the St. Lawrence Seaway, agricultural development, urban growth, and highways. Highways pose an important direct mortality threat to lynx in this geographic area. Eighteen of 37 mortalities of translocated lynx were attributed to vehicle collisions in an unsuccessful New York reintroduction (Brocke et al. 1990). Within the National Forests in this geographic area, appropriate direction for vegetation management that would provide the needed foraging and denning habitat within an interconnected mosaic across the landscape seems to be a limiting habitat factor. High human populations, with the associated mortality risk from incidental trapping or shooting resulting from a largely uncontrolled road system, could also limit lynx recovery in the area.

Table 8--Summary ratings for the ten criteria contributing to a risk of adverse effects to lynx in the Northeast geographic area.

	FS (7% of Primary Habitat)		BLM (0% of Primary Habitat)	
Ratings[1/]	**Number**	**Percent**	**Number**	**Percent**
F	0	-	0	-
S	3	15	0	-
M	8	40	0	-
N	9	45	0	-
U	0	-	0	-
NA	0	-	0	-
Total	20	100	0	-

[1/] The methods section of this chapter describes how evaluation criteria were developed and what the individual rating codes represent.

3. Effects at the Distinct Population Segment Scale

Similar to the accumulation of administrative unit scale effects, the effects identified at the geographic area scale accumulate upward to the broader scale of the distinct population segment (16 state historical range of lynx). The following section summarizes these effects and presents additional effects that are operational only at this scale.

Large Scale Landscape Analysis

Maintaining demographic links between the distinct population segment and Canadian source populations is critical to lynx conservation in the conterminous U.S.

Neither the Great Lakes geographic area nor the Northeast geographic area link with any of the other previously described geographic areas in the conterminous U.S. Potential breaks in the linkage between the Northeast geographic area and Canadian source populations, combined with the patchwork of land ownerships, suggest that the likelihood of supporting lynx conservation in the Northeast geographic area is low. The Great Lakes geographic area maintains landscape connections with potential Canadian source populations in northern Minnesota. This geographic area also has a patchwork of land ownerships and, without compatible management for lynx on non-federal lands, the likelihood increases that the geographic range may shrink towards the core Boundary Waters area.

The Southern Rockies geographic area is the most distant geographic area from Canadian source populations. Hostile desert environments separating the geographic area from the Northern Rockies combine with urban, rural, and recreational development and highway impacts to further isolate and fragment landscape connections in this geographic area. Maintaining a persistent population will be challenging in this area and dependent on maintaining landscape linkages primarily within the geographic area itself.

The Cascades geographic area has a spatial distribution of primary habitat that extends down the length of the Cascades Range. The largest population of lynx would occur in the North Cascades, coinciding with the widest distribution of primary habitat and strongest connection with Canada. As the distribution of habitat narrows in southern Oregon, population levels can be expected to be lower. In comparison to historical times, there are additional impediments to lynx movements. The Oregon Cascades is vulnerable to breaks in connectivity from potential source populations in the Washington Cascades and the Northern Rockies. As a result, the capability of the landscape to support lynx conservation has been reduced in the Oregon Cascades.

The Northern Rockies geographic area encompasses the broadest and most abundant distribution of primary habitat under federal land management of any region and contains three large areas with contiguous primary habitat. The Northern Rockies are connected with Canada and provide the closest potential links to the Cascades and Southern Rockies geographic areas within the distinct population segment. All of these factors combine to highlight the geographic area's importance as a stronghold for supporting lynx conservation in the western U.S.

For all geographic areas, 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 known risk factors to lynx (Figures 5 and 6). The Plans have continued this trend. The Plans have also continued the process of fragmenting habitat and reducing its quality and quantity. Consequently, Plans may risk

adversely affecting lynx by potentially contributing to a reduction in the geographic range of the species.

Summary Effects from Individual Plans

The effects of the individual Plans with respect to the 15 evaluation criteria are shown in Appendix G and have previously been summarized by geographic area in Tables 4 through 8. These results are summarized for the entire distinct population segment in Table 9.

NF lands account for almost half of the total primary lynx habitat in the U.S.; 37,823,000 acres or 44 percent. BLM lands account for 1,908,000 acres or 2 percent of the total primary lynx habitat. Table 9 summarizes the ratings associated with all evaluation criteria across all geographic areas where Plan direction was found to present a risk of adverse affects to lynx. Those evaluation criteria are displayed by geographic area in Table 9 as contributing to the determination of effect. Individual Plan ratings for all 15 criteria are displayed in Appendix G.

Table 9--Summary of ratings for all criteria contributing to a risk of adverse effects to lynx within the distinct population segment.

	FS (44% of Primary Habitat)		BLM (2% of Primary Habitat)	
Ratings[1/]	**Number**	**Percent**	**Number**	**Percent**
F	11	2	4	1
S	71	15	11	2
M	229	49	107	24
N	158	33	255	57
U	3	1	5	1
NA	0	0	63	14
Total	472	100	445	100

[1/] Chapter IV. Effects Assessment - A. Methods 2. Examination of Individual Plans describes how evaluation criteria were developed and what the individual rating codes represent.

V. Determination of Effect

This determination of effect applies to the 57 existing National Forest Land and Resource Management Plans and 56 existing BLM Land Use Plans, collectively, which were assessed within the distinct population segment of Canada lynx proposed by the U.S. Fish and Wildlife Service (1998a) for listing as a threatened species.

It is the conclusion of this BA that these Plans ***may affect, and are likely to adversely affect,*** the subject population of Canada lynx. This conclusion is based upon the following rationale:

1. Within the Great Lakes geographic area, weak direction to provide denning habitat, coupled with the high percentage of the geographic area in developmental allocations (65 percent) may risk adversely affecting lynx.

2. Plans in the Great Lakes geographic area may risk adversely affecting lynx by a lack of 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 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.

3. 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 contributing to a risk of adversely affecting lynx by limiting the availability of foraging habitat within these areas.

4. 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. This may be contributing to the risk of adverse effects to lynx.

5. 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 effects is primarily a winter season issue.

6. Plans within the Northern Rockies, Southern Rockies, and Northeast geographic areas are weak in providing guidance for new or existing recreation developments. Therefore, these activities may contribute to a risk of adverse effects to lynx.

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

8. 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. These factors may be contributing to a risk of adverse effects to lynx.

9. 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. This may contribute to a risk of adverse effects to lynx.

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

11. For all geographic areas, forest management has resulted in a reduction of the area in which natural ecological processes were historically allowed to operate, 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, Plans may risk adversely affecting lynx by potentially contributing to a reduction in the geographic range of the species.

The evaluation criteria contributing to the determination of *likely to adversely affect* are summarized by geographic area in Table 10. Critical habitat for the Canada lynx has not been proposed to date and, therefore, a determination of effect of the existing Plans on critical habitat is not applicable.

Table 10--Evaluation criteria contributing to a determination of likely to adversely affect the lynx.

Criterion	Cascades	N. Rockies	S. Rockies	Great Lakes	Northeast
denning habitat				X	
foraging habitat		X	X	X	X
habitat conversion		X	X		X
thinning	X	X	X		X
fire management		X	X		X
landscape patterns			X	X	X
forest roads		X	X	X	X
developed recreation		X	X		X
non-winter dispersed rec					
winter dispersed rec	X	X	X	X	X
minerals and energy					
habitat connectivity		X	X	X	X
land tenure adjustments					
mgmt. coordination		X	X	X	X
monitoring	X	X	X	X	

VI. Recommendations

Forest Service Manual 2672.42 requires that BAs documenting adverse effects include recommendations for avoiding or minimizing those effects. The draft Canada Lynx Conservation Assessment and Strategy (Ruediger et al. in press 1999) was developed to provide conservation measures that, if implemented, would avoid or minimize adverse effects to lynx.

Bureau of Land Management Manual 6840 specifies that any species proposed for listing be conserved in a manner comparable to that for a listed species. Thus, this policy requires that the lynx be conserved. In this context, conservation means taking affirmative measures to restore and protect lynx through land management decisions so that it recovers to the extent that the protective provisions of the ESA are no longer necessary to ensure its survival and persistence throughout its normal range.

Therefore, the BA team recommends the 57 LRMPs and 56 LUPs listed in Appendix A be amended or revised to incorporate conservation measures that would reduce or eliminate the identified possible adverse effects to lynx. The programmatic conservation measures listed in the draft Canada Lynx Conservation Assessment and Strategy (Ruediger et al. in press 1999) should be considered in this regard, once finalized.

VII. The Authors

J. Randal Hickenbottom (*Initial Team Leader)* was the Endangered Species Program Manager for the Intermountain Region of the Forest Service, Ogden, UT. Midway through this project, he transferred to his current position as District Ranger on the South Platte Ranger District in Morrison, Colorado. In his 20 years with the Forest Service, he has worked as a wildlife biologist on three National Forests in Oregon and Arizona and previously served as the Threatened and Endangered Species Program Assistant Manager for the Pacific Northwest Region. He received his B.S. degree in Natural Resources, with an emphasis in wildlife ecology, from the University of Arizona. Besides this Biological Assessment, Randy has also served on the Forest Service EIS team for the Spotted Owl, the interagency EIS team for the Northwest Forest Plan, the Terrestrial Science Team for the Interior Columbia Basin Ecosystem Management Project, and the Biological Assessment Team to evaluate effects of Forest Service and BLM plans on bull trout.

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Jeff Aardahl is a Wildlife Biologist in the Washington, D.C. office of the Bureau of Land Management. His primary responsibilities include special status species management, conservation planning, and developing program priorities. He began his career with the Bureau of Land Management in the California Desert in 1974 and has worked as a field biologist, environmental coordinator, and resources staff supervisor. From 1989 to 1995 he was a resources management division chief with the National Park Service in Death Valley National Park. He transferred to the Washington Office in 1997. He holds a B.S. degree in Wildlife Management from Humboldt State University, California.

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Lynn Jackson is a Forest Planner on the Chippewa National Forest, Cass Lake, MN in the Eastern Region of the USDA Forest Service. Her primary responsibilities include strategic Forest Plan development, site level implementation and forestwide monitoring on the 666,000 acre Forest. She holds a B.S. degree in Forestry from the University of Minnesota, and an MBA in Finance from the University of South Dakota. Since beginning her career with the Forest Service in 1990, she has been responsible for completing 18 Plan amendments, co-leading the Forest Plan Revision process, preparing the Forest Plan annual monitoring and evaluation reports and providing oversight to the GIS program on the Chippewa.

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John Rupe is a Forest Planner on the Black Hills National Forest, Custer, SD in the Rocky Mountain Region of the USDA Forest Service. He was the team leader for the recently completed Black Hills Forest Plan Revision, the fourth Forest planning effort he has been involved with in his 22 year career with the Forest Service. He holds a B.S. degree in Civil Engineering from the University of Idaho and a M.S. degree in Transportation Planning from the University of California, Berkeley.

VIII. Contributors and Contacts

Questionnaire Respondents

CASCADE MOUNTAINS geographic area

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Okanogan NF, Jan Flatten, Bob Naney
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Mt. Hood NF, Bill Otani, Denise Pengeroth
Deschutes NF, Rick Newton
Willamette NF, Ken Byford, Neal Forrester
Umpqua NF, Cindy Barkhurst
Rogue River NF, Jim Goode
Winema NF, Brent Frazier
Eugene DO, Eric Greenquist
Medford DO, Matt Broyles
Roseburg DO, C. Foster, R. Espinosa
Salem DO, Jim Irving, Wayne Logan
Spokane DO, Joyce Whitney,

NORTHERN ROCKY MOUNTAINS geographic area

Ochoco NF, Dave Zalunerdo
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Wallowa-Whitman NF, Tim Schommer
Umatilla NF, Ed Pugh, Lyle Jensen, and Charles Gobar
Colville NF, James McGowan
Idaho Panhandle NF, Anthony Matthews, and Bob Ralphs
Clearwater NF, Dan Davis
Nez Perce NF, Dick Artley, Steve Blair
Lolo NF, Mike Hillis, Beverly Yelczyn
Kootenai NF, Wayne Johnson
Flathead NF, Tom Wittinger
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Caribou NF, Scott Feltis
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Buffalo FO, Larry Gerard
Casper FO, George Soehn
Rawlins FO, Larry Apple
Butte DO, Headwaters RA, Bill Dean
Dillon FO, Jim Roscoe
Great Falls FO, Thomas (Tad) Day
Cottonwood RA, Chief Joseph MFP, Craig Johnson
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Idaho Falls RA Medicine Lodge PU, Jeff Gardetto
Malad RA, James Kumm
Shoshone RA-Bennett Timmerman and Sun Valley PUs, Gary Wright
Snake River RA, Upper Snake River RA, Paul Makela
Lemhi RA, Loren D. Anderson
Challis RA - Challis PU, Jerry Gregson
Challis RA - Mackay PU, Jerry Gregson
Challis RA - Ellis/Pahsimeroi PU, Jerry Gregson

Lower Snake River DO, Cascades RA, Jack LaRocco
Missoula FO, Dave McCleerey
Two Rivers,John Day and Brothers/LaPine RA, Jan Hanf, Scott Cooke
Lander FO, Connie Breckenridge, Tom Rinkes, Sue Oberlie
Pinedale FO, Frederick Roberts
Cody FO, Dennis Saville
Worland FO,Grass Creek RA, Tim Stephens
Kemmerer RA, Vernon Phinney
Green River RA, Jim Dunder
Wasatch Front, Kirk Gardner
Randolph Grazing MFP, Kirk Gardner
Box Elder RMP, Kirk Gardner
Vernal FO, Steve Madsen

SOUTHERN ROCKY MOUNTAINS geographic area

Arapaho-Roosevelt NF, Dennis Lowry
Medicine Bow NF, Tom Cartwright
Routt NF, Tom Cartwright
San Juan NF, Thurman Wilson, Rick Metzger
Rio Grande NF, Thurman Wilson, Rick Metzger
White River NF, Julie Grode
Grand Mesa, Uncompagre and Gunnison NF, Tom Holland
Pike-San Isabel NF, Nancy Ryke, Cindy Rivera
Royal Gorge RA, Erik Brekke
San Luis Valley RA, Jill Lucero
Kremmling RA, Chuck Cesar
Little Snake FO, Mike Albee
White River RA, Ed Hollowed
Grand Junction FO, Ron Lambeth
Glenwood Springs RA, Leonard Coleman
Gunnison RA, Joe Capodice
San Juan/San Miguel RA, Hilary Donoghue-Countess
Uncompahgre Basin RA, Jim Ferguson

GREAT LAKES geographic area

Chippewa NF, Al Williamson
Superior NF, Ed Lindquist, Duane Lula
Chequamegon NF, Norm Weiland
Nicolet NF, Norm Weiland
Hiawatha NF, Leighlan Prout
Ottawa NF, Bob Brenner, Bob Evans, Bob Johnson, Jerry Edde

NORTHEAST geographic area

Green Mtn NF, Clayton Grove
White Mountain NF, Marc Whisler

Units where questionnaires were completed and returned, but not used in the BA

Huron-Manistee NF, Kenneth Rex Ennis, James DiMaio
Finger Lakes NF, Clayton Grove
Allegheny NF, Brad Nelson
Manti-la-Sal NF, Rod Player
Fremont NF, Steve Egeline
Siskiyou NF, Lee Webb
Milwaukee FO, Sylvia Jordan
Jarbridge RMP, Jim Klott
Idaho Falls FO, Big Desert MFP, Joe Lowe
Havre FO, West HiLine RMP, Jody Peters
Malta FO, John Grensten
Lakeview DO, Klamath Falls RA, Steve Hayner
Elko FO, Roy Price

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X. Appendicies

APPENDIX A - Administrative Units Analyzed
APPENDIX B - Process for Determining Which Plans Are Covered by This Biological Assessment
APPENDIX C - Lynx Habitat Descriptions for the Five geographic areas
APPENDIX D - Blank Questionnaire, including Supplemental Questions for BLM
APPENDIX E - Description of Habitat Mapping Products and Their Uses
APPENDIX F - Forest Land and Resource Management Plans Management Area Emphasis
APPENDIX G- Rating Guidance and Evaluation Matrix

CASCADE MOUNTAINS GEOGRAPHIC AREA			
Administrative Unit	**Management Plan**	**Date of Plan**	**States**
Mt. Baker-Snoqualmie NF	LRMP Mt. Baker-Snoqualmie NF	1990	WA
Okanogan NF	LRMP Okanogan NF	1989	WA
Wenatchee NF	LRMP Wenatchee NF	1990	WA
Gifford Pinchot NF	LRMP Gifford Pinchot NF	1990	WA
Mt. Hood NF	LRMP Mt. Hood NF	1990	OR
Deschutes NF	LRMP Deschutes NF	1990	OR
Willamette NF	LRMP Willamette NF	1990	OR
Umpqua NF	LRMP Umpqua NF	1990	OR
Rogue River NF	LRMP Rogue River NF	1990	OR,CA
Winema NF	LRMP Winema NF	1990	OR
Eugene BLM District	Eugene District RMP	1994	OR
Medford BLM District	Medford District RMP	1995	OR
Roseburg BLM District	Roseburg District RMP	1995	OR
Salem BLM District	Salem District RMP	1995	OR
Spokane BLM District	Spokane District RMP	1987	WA
NORTHERN ROCKY MOUNTAINS GEOGRAPHIC AREA			
Administrative Unit	**Management Plan**	**Date of Plan**	**States**
Ochoco NF	LRMP Ochoco NF	1989	OR
Malheur NF	LRMP Malheur NF	1990	OR
Wallowa-Whitman NF	LRMP Wallowa-Whitman NF	1990	ID,OR, WA
Umatilla NF	LRMP Umatilla NF	1990	OR,WA
Colville NF	LRMP Colville NF	1988	WA
Idaho Panhandle NF	Idaho Panhandle Forest Plan	1987	ID,WA
Clearwater NF	Clearwater Forest Plan	1987	ID
Nez Perce NF	Nez Perce Forest Plan	1987	ID

Lolo NF	Lolo Forest Plan	1986	MT
Kootenai NF	Kootenai Forest Plan	1987	MT,ID
Flathead NF	Flathead Forest Plan	1985	MT
Lewis and Clark NF	Lewis and Clark Forest Plan	1986	MT
Helena NF	Helena Forest Plan	1986	MT
Bitterroot NF	Bitterroot Forest Plan	1987	MT,ID
Beaverhead-Deerlodge NF	Beaverhead Forest Plan Deerlodge Forest Plan	1986 1987	MT
Gallatin NF	Gallatin Forest Plan	1987	MT
Custer NF	Custer Forest Plan	1986	MT,SD
Payette NF	Payette NF LRMP	1988	ID
Boise NF	LRMP Boise NF	1990	ID
Sawtooth NF	LRMP Sawtooth NF	1987	ID,UT
Salmon Challis NF	LRMP Challis NF LRMP Salmon NF	1987 1986	ID
Targhee NF	LMP Targhee NF	1986	ID,WY
Caribou NF	LRMP Caribou NF	1985	ID,WY
Wasatch-Cache NF	Wasatch-Cache NF LRMP	1986	ID,UT, WY
Uinta NF	LRMP Uinta NF	1984	UT
Ashley NF	Ashley NF Forest Plan	1986	UT,WY
Bridger-Teton NF	Bridger Teton NF LRMP	1989	WY
Shoshone NF	LRMP Shoshone NF	1986	WY
Bighorn NF	LRMP Bighorn NF	1985	WY
Burns BLM District	Three Rivers RMP	1992	OR
Baker BLM Field Area	Baker MFP / Malheur MFP	1989/1982	OR
Buffalo BLM Field Area	Buffalo RMP	1985	WY
Casper BLM Field Area	Platte River RMP	1985	WY
Rawlins BLM District	Great Divide MFP	1990	WY
Butte BLM District	Headwaters Resource Area RMP	1983	MT
Dillon BLM Field Area	Dillon RA MFP	1979	MT
Great Falls BLM Field Office	West HiLine RMP	1992	MT

Coeur d'alene BLM District	Chief Joseph MFP Emerald Empire Res Area MFP	1981 1981	ID
Upper Snake River District Idaho Falls Resource Area Idaho Falls Resource Area Idaho Falls Resource Area Idaho Falls Resource Area Upper Snake River District Upper Snake River District Snake River Resource Area	Pocatello RMP Big Lost MFP/MacKay MFP Little Lost Birch Creek MFP Medicine Lodge RMP Malad RMP Shoshone RA-Bennett Timmerman and Sun Valley RMPs Cassia RMP	1988 1983/1984 1981 1985 1981 1981 1984	ID
Salmon BLM Field Area Challis Resource Area	Lemhi RMP Challis MFP Mackay MFP Ellis/Pahsimeroi MFP	1987 1979 1984 1982	ID
Lower Snake River District	Cascades RMP	1988	ID
Missoula BLM Field Area	Garnet RMP	1988	MT
Prineville BLM Field Area	Two Rivers RMP/John Day & Brothers RMP/La Pine RMP	1986/1985/ 1989	OR
Malheur BLM Field Office			OR
Lander BLM Field Area	Lander RMP	1987	WY
Pinedale BLM Field Area	Pinedale RMP	1987	WY
Cody BLM Field Area	Cody RMP	1990	WY
Worland BLM Field Area	Grass Creek RMP	1998	WY
Kemmerer BLM Field Area	Kemmerer RMP	1986	WY
Rock Springs Field Area	Green River RMP	1997	WY
Salt Lake City BLM Field Area	Wasatch - Pony Express RMP Randolph MFP Box Elder RMP	1990 1980 1985	UT
Vernal BLM Field Area	Book Cliffs RMP/ Diamond Mountain RMP	1984/ 1994	UT

SOUTHERN ROCKY MOUNTAINS GEOGRAPHIC AREA

Administrative Unit	**Management Plan**	**Date of Plan**	**States**
Arapaho-Roosevelt NF	Arapaho-Roosevelt Revised Forest Plan	1998	CO
Medicine Bow-Routt NF	Routt Revised Forest Plan Medicine Bow Forest Plan	1998 1985	CO, WY

San Juan-Rio Grande NF	Rio Grande Revised Forest Plan San Juan Forest Plan	1997 1992	CO
White River NF	White River Forest Plan as amended	1990	CO
Grand Mesa, Uncompagre and Gunnison NF	GMUG Forest Plan	1991	CO
Pike-San Isabel NF	Pike-San Isabel Forest Plan	1985	CO
Canyon City BLM District	Royal Gorge RMP San Luis Valley RMP	1995	CO
Craig BLM District	Kremmling RMP Little Snake RMP White River RMP	1999 1989 1996	CO
Grand Junction BLM District	Grand Junction RMP Glenwood Springs RMP	1987 1988	CO
Montrose BLM District	Gunnison RMP San Juan/San Miguel RMP Uncompahgre Basin RMP	1993 1985 1989	CO
GREAT LAKES GEOGRAPHIC AREA			
Administrative Unit	**Management Plan**	**Date of Plan**	**States**
Chippewa NF	LRMP Chippewa NF	1986	MN
Superior NF	LRMP Superior NF	1986	MN
Chequamegon-Nicolet NF	LRMP Chequamegon NF LRMP Nicolet NF	1986 1986	WI
Hiawatha NF	LRMP Hiawatha NF	1986	MI
Ottawa NF	LRMP Ottawa NF	1986	MI
NORTHEAST GEOGRAPHIC AREAS			
Administrative Unit	**Management Plan**	**Date of Plan**	**States**
Green Mtn-Finger Lakes NF	LRMP As Amended, Green Mountain NF	1993	VT
White Mountain NF	LRMP White Mountain NF	1986	ME,NH

Following is an explanation of the process for determining which Forest Service (FS) Forest Plans and Bureau of Land Management (BLM) Land Use Plans (LUPs) are covered by this Biological Assessment.

First, all FS and BLM administrative units were eliminated from consideration if they were outside the 16 states listed in the July 8, 1998. Federal Register notice from the FWS (U.S. Fish and Wildlife Service 1998a).

Second, all units within the 16 states were considered if they were listed in a September 4, 1998, memorandum to Forest Supervisors and BLM Districts about the conferencing process which had begun (USDA Forest Service 1998).

Third, additional units were added within the 16 states if they were in suitable habitat as depicted by potential habitat (Figure 3 in the BA) or if there was new information about lynx sightings in close proximity to the unit.

Next, the following units were dropped after discussions with FWS representatives and Regional biologists. No further conferencing or consultation for the lynx should be required for these units.

Forest Service Units Eliminated From Assessment

Huron-Manistee (Michigan), Allegheny (Pennsylvania) and Finger Lakes (New York): In Pennsylvania, lynx were likely extirpated in the early 1900s. In addition, there have been no recorded occurences of lynx on or near the Huron Manistee, Allegheny and Finger Lakes National Forests in the past four decades.

There are significant barriers to movement if a metapopulation were to be established on these National Forests. Those barriers between the Forests and the closest lynx population in Canada include conversion of habitat travel corridors to urban and agricultural uses, interstate and 4-lane divide highways, and open water during winter months on major rivers used for shipping. There are no plans or discussions of using these Forests for lynx reintroduction. It is highly unlikely that a reintroduction would successfully establish a viable population.

Manti-La Sal (Utah): The Manti-La Sal National Forest is at the extreme southern range of the area possibly considered in this BA. Habitat is marginally suitable and decreases in quality and availability as one moves southward. It is very unlikely that viable historic populations have ever been supported by this area. The habitat is highly fragmented, and there is widespread occurrence of competing predators such as coyotes, bobcats and red foxes.

Siskiyou (Oregon), Fremont (Oregon): These National Forests are at the extreme southern range of the Cascades. Habitat is marginally suitable and decreases in quality and availability as one moves southward.

Blm Units Eliminated From Assessment

Eastern States, Milwaukee Field Office: This unit consists of multiple islands less than two acres each. Use of these islands by lynx is unlikely.

Lewistown, Miles City, Billings, Havre, and Malta (Montana): These units are sparsely covered with suitable habitat and are far from other suitable habitats.

Jarbridge Resource Area (Idaho): This unit is also sparsely covered with suitable habitat and is far from other suitable habitat.

Elko (Nevada): This unit is also sparsely covered with suitable habitat and is far from other suitable habitat.

Cascade Mountains Geographic Area

Geographic Extent

The vegetation and land forms in the Cascade Mountains of Washington and Oregon have been described by Hann et al. (1997), Demarchi (1994), Franklin and Dyrness (1973) and Daubenmire and Daubenmire (1968) among others. Demarchi (1994) used climatic processes to describe ecodivisions, which are then subdivided into ecoprovinces.

The Washington and Oregon lynx range falls into the semi-arid steppe highlands and the humid maritime highlands ecodivisions. The Pacific Northwest Coast and Mountains ecoprovince incorporates the west side of the Cascades in Washington and Oregon. The Thompson-Okanogan Highlands, Columbia Plateau and Northern Rocky Mountain Forest ecoprovinces make up the east side of the Cascades and the portion of the northern Rocky Mountains of eastern Washington and Oregon.

The Pacific Northwest Coast and Mountains ecoprovince of the United States and Canada is influenced in winter by oceanic low pressure systems which provide mild, moist conditions over the area. The majority of the ecoprovince is temperate rainforest but Engelmann spruce, subalpine fir, black spruce, and boreal white spruce forests occur along the eastern valleys and into the interior.

The climate of the Thompson-Okanogan Highlands is generally drier as air moving across from the ocean loses most of its moisture on the west side of the Cascades. In winter, cold dense Arctic air may occur since there is no barrier once it reaches the plateaus of interior British Columbia. At the upper elevations of the plateau and on the upper and middle slopes of the mountain ranges, Engelmann spruce and subalpine fir are present.

The Columbia Plateau climate is moderated by the surrounding mountains. The mountains protect this area from all but the severe outbreaks of Arctic air in winter. The vegetation on the higher mountains, above the Douglas-fir and grand fir montane forests, is dominated by Engelmann spruce, subalpine fir, grand fir and lodgepole pine.

The Northern Rocky Mountain Forest ecoprovince is characterized by vegetation from big sagebrush/ grassland communities at lower elevations to Engelmann spruce, lodgepole pine and subalpine fir forests at higher elevations (Demarchi 1994).

Lynx Habitat Components

Koehler (1990) conducted research on lynx in northcentral Washington. The study area had been modified very little by forest management during the period when the research took place. Approximately 80 percent of the study area was coniferous forest, ten percent open parks, seven percent bogs, wet meadows and water, and the remainder exposed rock. It was largely unroaded and the vegetation had been structured by wildfire (Eby 1984). Large wildfires occurred in 1901, 1930 and 1970 and several smaller fires burned throughout the area. Most fires were ignited by lightning (Brittell et al. 1989).

Kilgore and Heinselman (1990) provided an overview of fire regimes across North America. On the west slopes of the Cascades, the pre-settlement fire regime seems to have been mostly large-scale but very long-interval

(150 to 500 years) crown fires or severe ground fires. East of the crest, the dominant fire regimes were probably frequent light surface fires in lower elevation ponderosa pine forests, and long-interval crown fires or severe surface fires at the higher elevations.

Primary lynx habitats in Washington and Oregon are dominated by Engelmann spruce, subalpine fir and lodgepole pine. Secondary habitats contain western larch, Douglas-fir, Pacific silver fir, western redcedar/mountain hemlock and the upper elevations of ponderosa pine forests (Koehler 1990).

The elevations of occupied lynx habitats vary depending on moisture patterns and temperatures. On the east side of the Cascade Mountains and the portion of the Northern Rocky Mountains in Washington and Oregon, the average elevations where the subalpine fir plant associations occur are generally above 4,000 feet (above 5000 feet in Oregon) (Williams and Lillybridge 1983, Williams et al. 1995, Johnson and Clausnitzer 1992, Lillybridge et al. 1995). In some cold air drainages, subalpine fir associations may occur below 4,000 feet (Williams and Lillybridge 1983). These vegetation types generally occur in areas with heavy winter snow falls. Subalpine fir communities are not as well represented on the west side of the Cascades where mountain hemlock replaces subalpine fir at upper elevations. On the Mount Baker-Snoqualmie National Forest only approximately one percent of the forest is occupied by the subalpine fir association (Henderson et al. 1992).

In boreal forest habitats, lynx are generally found in areas of low topographic relief (Koehler and Aubry 1994). The subalpine fir plant associations east of the Cascade Mountains and in the northern Rocky Mountains of eastern Oregon and Washington are generally on slopes averaging less than 30 percent and many of the associations are on slopes averaging less than 20 percent (Williams and Lillybridge 1983, Williams et al. 1995, Lillybridge et al. 1995, Johnson and Simon 1987, Johnson and Clausnitzer 1992). On the west side of the Cascade Mountains on the Mount Baker-Snoqualmie National Forest the mean slope measurement for the subalpine fir associations were greater than 30 percent (Henderson et al. 1992).

Northern Rocky Mountain Geographic Area

Geographic Extent

The Northern Rocky Mountain Geographic Area encompasses northern to central Idaho, western Montana, eastern Washington, northeastern Oregon, northwestern Utah, and western Wyoming. Landforms, climate, and vegetation across this large area are complex and highly variable.

Within the current post-glacial period, climate has been relatively stable for the past 1700-2000 years in this area (Mack et al. 1983). Across the Northern Rocky Mountain Geographic Management Area, there are strong north-south and east-west gradients in climate. The northwestern portions have a cool temperate, maritime-influenced climate, while the eastern and southern portions have a cold continental climate (McNab and Avers 1994). As a result, vegetation varies from moist, dense conifer forests, to less productive forests with greater interspersion of grasslands and shrublands. Koehler and Aubry (1994) suggest that there is a general pattern of decreasing habitat suitability for lynx with decreasing latitude in the Rocky Mountains.

The Northern Rocky Mountain Geographic Management Area falls within the Shining Mountains, Northern Rocky Mountain Forest, Utah Rocky Mountain, and Wyoming Basins Ecoprovinces as described by Demarchi (1994). The extent of each of these Ecoprovinces is as follows:

Shining Mountains Ecoprovince--

This Ecoprovince extends from Southern Canada into the northern United States. It includes the Columbia Mountains, Selkirk Mountains of northern Idaho and eastern Washington, Southern Rocky Mountain Trench, Rocky Mountains of Alberta and Montana, the Belt formation in Montana, and the mountains of the Idaho panhandle.

Northern Rocky Mountain Forest Ecoprovince--

The Blue Mountains of Oregon, Idaho Batholith of central Idaho, Bitterroot Mountains of Montana and eastern Idaho, and mountains of Wyoming are included in this Ecoprovince.

Utah Rocky Mountain Ecoprovince--

This area consists of two dominant mountain ranges, the Uinta and Wasatch Mountains, and smaller ranges to the south.

Wyoming Basins Ecoprovince--

This Ecoprovince is composed of a series of high-elevation basins and low ridges, and also includes the Bighorn Mountain Range.

Lynx Habitat Components

Historically, fire has been a dominant influence in the northern Rocky Mountains (Barrett et al. 1997, Gruell 1983). Forest fires maintained mosaics that provided ideal snowshoe hare and lynx habitat (Koehler 1990). Avalanche, insects, and pathogens have also been important agents of natural disturbance, creating finer-grained patterns of vegetation.

Fire regimes in the Northern Rocky Mountains are extremely complex, reflecting great variation in climate, topography, vegetation, and productivity (Kilgore and Heinselman 1990). In general, the two dominant regimes in pre-settlement times were:

1. long-interval (100 to 300 years) crown fires in continuous forests of lodgepole pine, spruce, and subalpine fir, often with smaller acreages subjected to low-intensity surface fires in the intervals between crown fires; and

2. short-interval (5 to 60 years) low to moderate-intensity surface fires in lower elevation ponderosa pine, Douglas-fir, aspen, and adjacent parklands and lodgepole pine forests. In the intermountain areas, frequent fires (6 to 15 years) restricted the distribution of juniper woodland to shallow, rocky soils and rough topography in many portions, while fire frequency in sagebrush-scrub communities was 30 to 70 years.

In the higher latitudes of northern Montana and Idaho, lynx habitat generally occurs above 4,000 feet (Koehler and Brittell 1990). Lynx habitat is found above 5,000 feet in elevation in eastern Oregon (Johnson and Clausnitzer 1992), and above 6,500 feet in Wyoming.

Shining Mountains Ecoprovince--
(northwestern Montana, northern Idaho, and northeastern Washington)

The landforms of this Ecoprovince have been strongly influenced by glaciation, with several advances of continental glaciers during the Pleistocene period. The higher mountains not over-ridden by continental glaciers have been subjected to intense glaciation by alpine glaciers.

Grasslands and ponderosa pine occur at the lowest elevations. Dominant vegetation includes interior western redcedar and western hemlock habitat types on lower to middle slopes in wetter localities and in the northern portion of the Rocky Mountain Trench; interior Douglas-fir on the lower slopes of the southern portion of the Rocky Mountain Trench; subalpine fir, Engelmann spruce, and grand fir habitat types on the middle slopes of

all mountains; and whitebark pine, alpine larch, and dry alpine tundra on mountain summits (Pfister et al. 1977).

Habitats in which lynx have been studied in the Northern Rockies are characterized as moderate, rolling mountainous terrain. Typical lynx habitat occurs within the subalpine fir, Engelmann spruce, western redcedar, western hemlock and grand fir habitat types, on which current vegetation is dominated by lodgepole pine, Douglas-fir, subalpine fir, and/or Engelmann spruce (Brainerd 1985, Koehler et al. 1979). In addition, the numerous peatlands which are located along the valley bottoms yield additional diversity and are important habitat components for the lynx.

On portions of the Idaho Panhandle National Forest in northern Idaho and northeastern Washington, the lower limit of lynx habitat types is found near 3,000 feet. This is closely correlated with the cooler/moist habitat types which are typical within this landscape. Lynx have been frequently documented at elevations ranging from 3,000 feet to near the upper treeline. Although lynx sightings or observational information show a bias to road and trail locations, they strongly suggest that lynx make use of the lower elevation western redcedar and hemlock forest within the landscape. This is perhaps unique to this region.

The subalpine fir and Engelmann spruce dominated forest generally occurs above 4,500 feet, depending on slope, aspect and other associated climatic factors. On northern aspects and in cool air drainages, the subalpine fir and spruce dominated communities extend to lower elevations. The western redcedar and hemlock dominated communities are found below the transitional zone with subalpine fir and spruce communities, and often extend to and encompass the valley bottoms. Western redcedar and hemlock communities are highly productive habitat for both snowshoe hare and lynx at either end of the successional spectrum.

Northern Rocky Mountain Forest Ecoprovince--(central Idaho, eastern Oregon and western Utah)

Landforms are primarily of volcanic and sedimentary origin. Dominant plant communities are big sagebrush and bluebunch wheatgrass at lower elevations; Douglas-fir, grand fir, and ponderosa pine forests at middle elevations; Engelmann spruce, lodgepole pine and subalpine fir on upper mountain slopes; and alpine communities on the highest mountains within the eastern portion of the Ecoprovince.

In central Idaho, lodgepole pine community types and habitat types are not widespread but do commonly appear on more gentle terrain, toe-slopes and valley bottoms wherever the species can dominate the site (Steele et al. 1981). Such stands usually grade into subalpine fir or Douglas-fir habitat types on adjacent steeper or higher slopes. After disturbances such as fire, these lodgepole pine communities often provide good quality lynx foraging habitat for several decades.

The subalpine fir series occurs at upper elevations throughout most of central Idaho (Steele et al. 1981). Large stands of fire-induced lodgepole pine commonly dominate much of this series and, especially when interspersed with unburned islands of subalpine fir, often provide very good quality lynx habitat. Undergrowth is variable and ranges from tall shrub layers of blue huckleberry and menziesia to low, depauperate layers of grouse whortleberry or heartleaf arnica. Thus, the quality of lynx foraging habitat (i.e., snowshoe hare habitat) often varies greatly by habitat type. Engelmann spruce stands commonly occur along streams and valley bottoms where cool air drainage allows them to extend into the

adjacent, lower elevation Douglas-fir communities. Habitat types within the series often occur on very wet sites and on steep northerly aspects where snow accumulates (Steele et al. 1981). Though a minor series, Engelmann spruce habitat types commonly provide good lynx travel corridors and denning habitat.

Douglas-fir habitat types occur over the broadest range of environmental conditions of any conifer in central Idaho (Steele et al. 1981). Douglas-fir communities often extend from lower to upper timberline, especially in the drier mountain ranges. The types of most importance to lynx include those where lodgepole pine is a seral species and those which abut shrub-steppe communities. Within central Idaho, many habitat types within the Douglas-fir series are too dry and/or depauperate to provide good lynx foraging habitat.

Atypical lynx habitats in central and southern Idaho, Wyoming, southeast Montana, and eastern Oregon occur in the shrub-steppe communities where populations of alternate prey such as whitetail jackrabbits are found. These atypical habitats often provide connectivity between adjacent mountains ranges. Along the Continental Divide, they may also provide an important north-south link between large areas of typical habitats.

Portions of the Ochoco and Malheur National Forests in Oregon provide connectivity/dispersal habitat for movement between the Northern Rocky Mountains and the Oregon Cascades.

Utah Rocky Mountains Ecoprovince--

Records of lynx are limited to the Uinta mountain range. Shrub-steppe dominates at the lower elevations; quaking aspen dominates over much of the landscape on mountain slopes, with conifer forest (Douglas-fir, ponderosa pine, Engelmann spruce, white fir, subalpine fir, and lodgepole pine) at the higher elevations; and alpine tundra communities occur on the highest mountain summits. The Uinta Mountains may be important in providing connectivity between lynx populations in the Northern and Southern Rocky Mountain Geographic Areas.

Wyoming Basins Ecoprovince--

Dominant vegetation includes shrub-steppe in the basins; pinyon pine, juniper, ponderosa pine, and Douglas-fir forests on mountain slopes; with Engelmann spruce and lodgepole pine at the higher elevations.

Southern Rocky Mountain Geographic Area

Geographic Extent

The Southern Rocky Mountain Geographic Area (SRMGA) encompasses south-central Wyoming, western Colorado, and north-central New Mexico.

Some evidence exists that over the last 15,000 to 20,000 years, valley glaciers from the Pleistocene period retreated to their cirques, isolating species in the process (Fitzgerald et al. 1994). More recently, over the last 4,000 to 6,500 years, a period of warmer and drier weather allowed for a number of southwestern species to occupy areas previously inhospitable (Armstrong 1972). The southern Rocky Mountains have a strong influence on the continental climate in central Wyoming, western Colorado, and north-central New Mexico. Other factors that moderate climate are latitude, elevation, exposure, local topography, and location with respect to storms and prevailing winds (Fitzgerald et al. 1994).

The Southern Rocky Mountain Geographic Area encompasses the Northern Rocky Mountain Forest, Central Rocky Mountain Basins, Colorado Rocky Mountain, and New Mexico Rocky Mountain Ecoprovinces (Demarchi 1994).

Northern Rocky Mountain Forest Ecoprovince--

As described previously for the Northern Rocky Mountain Geographic Area, this Ecoprovince encompasses the Blue Mountains of Oregon, Idaho Batholith of central Idaho, Bitterroot Mountains of eastern Idaho and Montana, and mountains of Wyoming. Only a small portion in Wyoming falls within the SRMGA.

Landforms are primarily of volcanic and sedimentary origin. Plant communities of big sagebrush and bluebunch wheatgrass dominate the lower elevations while Douglas-fir, grand fir, and Ponderosa pine forests occur on mid elevation areas. Engelmann spruce, lodgepole pine and subalpine fir dominate the upper mountain slopes with alpine tundra communities occurring on the highest mountains within the eastern portion of the Ecoprovince (McKee 1972).

Central Rocky Mountain Basin Ecoprovince--

Large river basins like the Green, Uinta, and Paradox, and mountain ranges like the Roan, Uncompaghre, White River, northern Colorado plateaus, and Grand Mesa provide the backbone for this Ecoprovince (Mitchell 1993). Low elevation plant communities are dominated by big sagebrush, needle-and-thread grass, bluebunch wheatgrass, and western wheatgrass. Dense shrub communities of big sagebrush, rabbitbrush and winterfat cover the higher elevations, while Rocky Mountain juniper is isolated to shallow soil upland sites. Ponderosa pine, Douglas-fir, and quaking aspen forests typically dominate the low mountain ridges (USDA Soil Conservation Service 1981).

Colorado Rocky Mountain Ecoprovince--

Very high mountains divided by wide high elevation "parks" characterize this Ecoprovince. Most of the mountain summits are the result of mountain glaciers during the Pleistocene period. Big sagebrush, rabbitbrush, needlegrass, and wheatgrass dominate the low elevation plant communities. As elevation increases Ponderosa pine, Douglas-fir, junegrass and Arizona fescue dominate the landscape. Mid-elevation sites are forested with quaking aspen, lodgepole pine and Engelmann spruce. The high elevation summits are typically bare rock and rolling alpine tundra. Grasslands and mountain meadows can be found throughout all the mountain areas (Mitchell 1993).

New Mexico Rocky Mountains Ecoprovince--

High, rolling plateaus with isolated mountains and steeply scarped mesas dominate this Ecoprovince (USDA Soil Conservation Service 1981). Indian ricegrass, blue grama, dropseed, prickly pear, four-winged saltbrush, winterfat and rabbitbrush dominate the low elevation plant communities, which transition as elevation increases into pinyon-juniper and big sagebrush. Douglas-fir and ponderosa pine are found on the higher more sheltered areas, with Engelmann spruce and subalpine fir forests occupying the highest summits (Brown 1982, Pase and Brown 1982).

Lynx Habitat Components

Fire regimes are extremely complex, reflecting great variation in climate, topography, vegetation, and productivity. In general, two dominant fire regimes exist. One regime has a long time interval (100 to 300 years) between crown fires in the contiguous forests of lodgepole pine, spruce, and subalpine fir. Often smaller acreages are subjected to low-intensity surface fires during the intervals between the crown fires. The other fire regime occurs over a shorter time-period with surface fires of low to moderate-intensity returning every 5 to 60 years in the low elevation forests of ponderosa pine, Douglas-fir, aspen, adjacent parklands and in some forests of lodgepole pine. In the intermountain areas, frequent fires intervals (6

to 15 years) help maintain the juniper woodlands on the shallow, rough topography, rock soils, while lowland sagebrush-shrub communities experience fires every 30 to 70 years (Kilgore and Heinselman 1990).

Lynx habitats in south-central Wyoming, western Colorado, and north-central New Mexico are typically dominated by mature Engelmann spruce and subalpine fir (Weaver 1993) with lodgepole pine, quaking aspen, bristlecone pine, and Douglas-fir. Colorado blue spruce and willow species, dominate many of the riparian and meadow complexes (Apps 1988 pers. comm., Dolbeer and Clark 1975), with the low foothill shrubland communities linking the more stable spruce-fir lynx habitats with the dynamic lodgepole pine and quaking aspen forests.

Engelmann spruce and subalpine fir forests can occupy the subalpine zone as either a single species or can occur in combination, providing some of the most "stable" lynx habitats. Subalpine zone elevations generally range from 9,000 to 11,500 feet.

The upper and lower montane zones are comprised of lodgepole pine and aspen with Engelmann spruce, subalpine fir and Douglas-fir (Andrews et al. 1992). In the north-central part of the Geographic Area, lodgepole pine dominates the upper montane zone (Crane 1982; Thompson pers. comm.). Typically these forests are dense, uniform and often depauperate of any forest floor shrub components (Andrews et al. 1992). They are often found between the Engelmann spruce and subalpine fir forests of the subalpine zone and the Douglas-fir and Ponderosa pine forests (Front Range) of the lower montane zone. Elevations typically range from 6,500 to 11,500 feet, but can commonly occur between 7,500 and 10,500 feet (Andrews et al. 1992). Aspen and lodgepole pine stands are typically found on sites where disturbance events like fire, insects or logging have occurred. These forest stands tend to be "less stable" because of frequent fire return intervals, high stand densities tend to promote insect outbreaks, and generally there location on the landscape makes them easily accessible for man's intervention.

Sagebrush, foothill shrublands and pinyon-juniper woodlands provide the link between the Northern Rocky Mountain and the Southern Rocky Mountain Geographic Management Areas. The western slope of Colorado is dominated by Gambel's oak, big sagebrush (North Park and Gunnison Basin), mountain sagebrush, pinyon-pine and juniper provide important habitat connective links throughout the Southern Rocky Mountain Geographic Management Area. These habitats can generally be found between 4,000 and 9,500 feet and often occur as vegetation stringers, or parks within the Engelmann spruce-subalpine fir forests. Many of these areas occur as large expanses, such as the Red Desert in southeastern Wyoming, Yampa Plateau of northeastern Utah, and Danforth Hills and Vermillion Bluffs of northeastern Colorado. Generally, these vegetation types occur on land managed by the Bureau of Land Management or are contained within private ownership.

Great Lakes Geographic Area

Geographic Extent

The Great Lakes Geographic Area encompasses northeastern and north-central Minnesota, northern Wisconsin, and the upper peninsula and northern portions of Michigan. This area largely falls within the western portions of the Laurentian Mixed Forest Province *(USDA, 1994)*. Most of this province has low relief with rolling hills occurring in many areas. Glacial features such as lakes, poorly drained depressions, morainic hills, drumlins, eskers, and outwash plains are typical of the area. Elevations range from sea level to 2,400 feet. Climate in the area produces moderately long and somewhat

severe winters where snowfall remains on the ground all winter. The forest vegetation of this ecoprovince is transitional between the boreal forests of the north and the broadleaf deciduous forests to the south. Forested stands vary from mixtures of conifers (pine, spruce, fir, cedar) and hardwoods (birch, maple, beech, basswood) to pure stands of conifer or hardwood species *(Bailey, 1995)*.

That portion of the Laurentian Mixed Forest Province that comprises the Great Lakes Geographic Area is composed of several ecological subdivisions, or Sections, as described by McNab and Avers (1994). The Sections included are the Northern Great Lakes, Southern Superior Uplands, Western Superior, Northern Superior Uplands, Northern Minnesota and Ontario, and Northern Minnesota Drift and Lake Plains.

Northern Great Lakes Section (212H)--

This Section extends across the northern one-third of the "mitten" portion of Michigan, the eastern half of the Michigan upper peninsula and northeastern Wisconsin. The potential natural vegetation types, according to Kuchler, occurring on this Section include northern hardwoods forest, northern hardwood-fir forest, Great Lakes pine forest, conifer bog, and elm-ash forest.

Southern Superior Uplands Section (212J)--

This Section covers most of the northern half of Wisconsin and the western half of the upper peninsula of Michigan. Potential natural vegetation types occurring on this Section include maple-beech-birch forest, aspen-birch forest, and spruce-fir forest.

Western Superior Section (212K)--

This Section includes portions of northwestern Wisconsin and east-central Minnesota. Potential natural vegetation types occurring on this Section include Great Lakes pine forest, Great Lakes spruce-fir forest, and maple-basswood forest.

Northern Superior Uplands Section (212L)-

The Northern Superior Uplands encompass the "arrowhead" region of northeastern Minnesota. Potential natural vegetation types occurring on this Section include Great Lakes pine forest and Great Lakes spruce-fir forest.

Northern Minnesota and Ontario Section (212M)--

This Section occurs along the U.S.-Canada border in north-central Minnesota. Potential natural vegetation types occurring here include conifer bog, Great Lakes spruce-fir forest, and Great Lakes pine forest.

Northern Minnesota Drift and Lake Plains Section (212N)--

This Section extends across much of north-central Minnesota south of the Northern Minnesota and Ontario Section. Potential natural vegetation types occurring here include Great Lakes pine forest, Great Lakes spruce-fir forest, and conifer bog.

Lynx Habitat Components

Lynx habitat within the Great Lakes Geographic Area resides within the ecotone between boreal and mixed deciduous forests and is primarily associated with Great Lakes spruce-fir forest, Great Lakes pine forest, conifer bog, and northern hardwood-fir forest communities. These forest ecosystems may contain large areas of jack, red, or white pine; aspen-birch; red, white, or black spruce; white cedar; tamarack; black ash, northern hardwoods, or other forest types.

In addition to climatic and topographic influences, a variety of disturbance factors created and maintained forest composition and successional patterns which provided landscape mosaics of suitable lynx habitat. These disturbance factors included fire, insects, and wind.

Pre-settlement forests in this area had three distinct fire regimes:

1. Jack pine and spruce-fir forest with very large (sometimes >250,000 acres) stand-replacement crown fires or severe surface fires, every 50 to 100 years in the west and 80 to 250 years in the east;

2. Red pine and white pine forests with combinations of moderate intensity surface fires at 20 to 40 year intervals, with more intense crown fires at 150 to 300 year intervals, and

3. Mixed aspen-birch-conifer forests with high-intensity surface or crown fires (Kilgore and Heinselman 1990).

Larger blowdowns, due to windshear and tornadoes, occurred infrequently but often caused extensive, localized disturbance. Insect infestations, such as those caused by spruce budworm, contributed to large areas of tree mortality and may have led to fires.

These catastrophic events created diverse, early successional forests which provided habitats preferred by snowshoe hare and thus important foraging areas for lynx. The less intense, more frequent ground fires were an important factor in maintaining the conifer component throughout much of this area. Smaller, localized wind events and insect infestations likely created concentrations of downed logs which can provide suitable denning habitat for lynx.

An additional important habitat component in this geographic area is the presence of conifer bogs or lowland conifer forests. These forest communities are extremely important snowshoe hare habitats and serve as refugia for hare during low points in their cycle (Jaako Poyry Consulting, 1992).

New England Geographic Area

Geographic Extent

The New England Geographic Area encompasses western Maine, the western half of New Hampshire, the eastern half of Vermont, the northeastern portion of New York, small portions in northwestern Massachusetts, and the very northeast corner of Pennsylvania. This area largely falls within the Adirondack-New England Mixed Forest - Coniferous Forest - Alpine Meadow Province *(USDA, 1994)*. This province is composed of subdued glaciated mountains and maturely dissected plateaus of mountainous topography. Any glacially broadened valleys have glacial outwash deposits and contain numerous swamps and lakes. Elevations range from 500 to 4,000 feet with a few isolated peaks higher than 5,000 feet. The climate in the area is characterized by warm summers. Winters can be severely cold, but less so near the ocean. Average annual snowfall is more than 100 inches. The forest vegetation of this ecoprovince is transitional between the boreal forests of the north and the deciduous forests to the south. Growth form and species are similar to those found to the north, but red spruce tends to replaces white spruce. Vertical vegetational zonation is present. Valleys contain a hardwood forest with the principal tree species being sugar maple, yellow birch and beech with a mixture of hemlock. Low mountain slopes support a mixed forest of spruce, fir, maple, beech and birch. Above the mixed-forest zone lie pure stands of balsam fir and red spruce. Alpine meadows exist above timberline. *(Bailey, 1995)*.

The Adirondack-New England Mixed Forest - Coniferous Forest - Alpine Meadow Province is composed of several ecological subdivisions, or Sections, as described by McNab and Avers (1994). These included the White Mountains Section, the New England Piedmont Section, the Green, Taconic, Berkshire Mountains Section, the Adirondack

Highlands Section, and the Catskill Mountains Section.

White Mountains Section (M212A)--

This Section extends across the western one-half of Maine from north to south and the northeastern corners of New Hampshire and Vermont. The potential natural vegetation types, according to Kuchler, occurring on this Section include northern hardwoods forest, northern hardwood-spruce forest, and northeastern spruce-fir forest.

New England Piedmont Section(M212B)--

This Section covers much of the western half of New Hampshire, the northeastern one-third of Vermont, and small portions of north-central Massachusetts. Potential natural vegetation types occurring on this Section include northern hardwood forest and northern hardwood-spruce forest.

Green, Taconic, Berkshire Mountains Section (M212C)--

This Section covers most of the remainder of Vermont with the exception of the northwestern corner. It also reaches into western Massachusetts and east-central New York. Potential natural vegetation types occurring on this Section include northern hardwoods forest, northern hardwood-spruce forest, and northeastern spruce-fir forest.

Adirondack Highlands Section (M212D)--

This Section covers the Adirondack Mountains in northern New York. Potential natural vegetation types occurring on this Section include northern hardwood-spruce forest and northeastern spruce-fir forest.

Catskill Mountains Section (M212E)--

This Section occurs in southeastern New York and extends to the Pennsylvania border. Potential natural vegetation types occurring here include northern hardwood forest and northern hardwood-spruce forest.

Lynx Habitat Components

Lynx habitat within the New England Geographic Area existed in a mostly contiguous block of forest in the ecotone between the boreal and deciduous forest, and is primarily associated with northeastern spruce-fir forest and northern hardwood-spruce forest communities. The primary tree species associated with these habitats include red spruce, and balsam fir, interspersed with northern hardwoods such as sugar maple, yellow birch, and American beech (U.S. Fish and Wildlife Service, 1998). These forest communities exist on the higher elevations of the region from the lower mountain slopes to the mountain tops or timberline.

Beyond climatic and topographic influences, the primary disturbance factors which created and maintained forest composition and successional patterns in this Geographic Area were wind, insects, disease, and fire.

Large blowdown disturbances resulting from hurricane winds and other severe wind events contributed significantly to the early successional forest patterns in this region. Higher elevation forests are often characterized by an even-aged, wind-throw phenomenon known as fir-waves. Insect and disease disturbances resulting from a variety of agents including spruce budworm, spruce beetle, beech bark disease, and sugar maple defoliators were also important factors effecting forest landscape patterns (McNab and Avers, 1994).

Montane forests in this Geographic Area lack significant fire regimes. Fire was a more frequent disturbance in southern New England and becomes increasingly infrequent on more northern inland sites (McNab and Avers, 1994). Kilgore and Heinselman (1990) provided an overview of fire regimes across North America. The typical fire regime for this part of the country was infrequent surface

fires in the dormant season in the hardwood forests, and slightly more frequent but long-interval fires in some conifer forests.

These catastrophic events created diverse, early successional forests which provided habitats preferred by snowshoe hare and thus important foraging areas for lynx. Red spruce and balsam fir are important components in snowshoe hare habitat. Smaller, localized wind events, disease outbreaks, and insect infestations likely created concentrations of downed logs which can provide suitable denning habitat for lynx.

APPENDIX D--Questionnaire - Canada Lynx Management Direction In Land And Resource Management Plans on USFS And BLM Administrative Units

Instructions and Assumptions

1. The following Questions pertain **only** to the written management direction contained in approved National Forest Land and Resource Management Plans (LRMP) or Bureau of Land Management Land Use Plans (LUP). The purpose is to assess how implementation of LRMPs and LUPs **as written** affect Canada lynx and lynx habitat. The information will be used in Section 7 consultation with the U.S. Fish and Wildlife Service. If policies or conservation strategies exist, but have not been incorporated into your Plan, they should not be used to answer the questions. The questions do not apply to site-specific project-level or activity plans, which require their own, individual, Section 7 consultation.

2. Please answer ALL questions. If a question does not apply, write 'na'.

3. We are seeking a professional approximation, not a GIS analysis.

4. For each question where you answer that your Plan contains direction, please disclose which page numbers in your Plan you referenced to answer the question.

5. We are looking for specific direction of intent to manage for lynx or the kind of conditions required by lynx. Broad statements of intent such as "At the time a species is listed as threatened or endangered, appropriate action will be taken" are too general to count as meeting the intent of managing or maintaining lynx.

6. Questions apply to areas 'within existing or potential lynx habitat' unless otherwise noted (see # 7 below).

7. Lynx habitat descriptions by geographic area are attached. Please use better local information, if available, but identify how geographic descriptions have been 'fine-tuned.'

8. A glossary of terms is attached and should be referenced to answer questions.

9. Your answers will be tallied with answers from approximately 100+ other units to arrive at a determination of effects of existing Plans on lynx and lynx habitat.

GENERAL INFORMATION

1. Name of Administrative Unit covered by your current LRMP or LUP _____
2. Name of person(s) completing questionnaire _____
3. Telephone number, and email address for #2, above: (____)_____, _____.
4. Are there records (kills, visual sightings, tracks, hair, scats, etc.) of Canada lynx on your admin. unit or within 25 miles of your administrative unit over the past 10 years? Y___ N___
5. If not, are there historic (>10 years ago) records (as above) of lynx presence on or within 25 miles of your unit? Y___ N___
6. Based on the best information you have, has there been a decline in lynx numbers on your unit in the last twenty years? Y___ N___

QUESTIONAIRRE GLOSSARY

Atypical Habitats - Habitat adjacent to or between areas of lynx habitat, where lynx are not typically found, except during periods of prey scarcity. In the western U.S., lynx have been documented in habitats such as shrub-steppe (sagebrush), juniper, and ponderosa pine which are not normally associated with snowshoe hares. Atypical habitats within approximately 70 km of areas inhabited by snowshoe hare may be used as part of the home range. Atypical habitats between areas of lynx habitat is used by lynx for dispersal at the southern edge of its range. White-tailed jackrabbit, black-tailed jackrabbit, sage and Columbian sharp-tailed grouse, and beaver could be important prey for lynx in atypical habitat.

Connectivity - The arrangement of habitats that allow organisms and ecological processes to move across the landscape. In the case of lynx, the habitat linkages that allow long distance movements to find food, cover, and mates. Lynx appear to show a reluctance to cross large openings, preferring to travel in continuous forest, particularly in areas such as ridges, saddles, and riparian areas.

Denning Habitat - Habitat used during parturition and rearing of young lynx until they are mobile. Often includes mature Engelmann spruce/subalpine fir forests with lodgepole pine in western ecosystems. Large amounts of coarse woody debris are present for use as escape and thermal cover by kittens.

Forage Habitat/Snowshoe Hare Habitat - Lynx forage habitat is where prey (snowshoe hare) is present and available to lynx. Snowshoe hare densities and overwinter survival are the highest where understory stem densities, especially conifers, are >5000 stems/acre and extend above average snow depths. These conditions can occur, usually within 15 to 20 years, as a result of fire or cutting over large expanses. Such conditions can also occur within other structural conditions as canopy is eliminated, such as in mature vegetation. Older forests with a substantial amount of understory shrubs and young conifers can provide snowshoe hare habitat. In many areas shushes hares are present in various vegetation structures, at varying densities, as long as cover (both winter and summer) and forage are present.

Lynx Management Unit - An area that approximates the size of a female lynx home range (the area used by an individual either during the entire calendar year or seasonally, in its normal activities of foraging, mating, and rearing of young.) The size of LMUs should generally be 15-25 square miles in contiguous habitat (such as 5th or 6th code HUCs in parts of west), and likely should be larger in less contiguous or poorer quality or naturally fragmented habitat.

STRATEGIES AND MEASURES

Vegetation Management

Lynx habitat components requirements

7.

a. Does your LRMP or LUP contain specific direction to provide for lynx denning and foraging habitat? Y___ N___ LRMP or LUP pp._____

b. Is this direction applied to all areas where lynx currently occur and may have historically occurred? Y___ N___ LRMP or LUP pp._____

8. Does your LRMP or LUP contain other direction, not specific to lynx, that would result in maintaining lynx habitat components (denning and foraging habitats) within lands capable of producing lynx habitat? Y___ N___ LRMP or LUP pp._____

9.

a. Have areas for lynx management (e.g., lynx management units-LMUs) been delineated on your unit? Y___ N___ LRMP or LUP pp._____

b. Are LMUs delineated in all areas where lynx currently occur and may have historically occurred? Y___ N___ LRMP or LUP pp._____

10. Does your LRMP or LUP allow changes in tree species composition or covertype which could reduce habitat suitability for lynx (e.g.,. emphasizing selection for less desirable western larch in stands with a preferred component of lodgepole, or mixed conifer stands converted to red pine or monotypic hardwoods)? Y___ N___ LRMP or LUP pp._____

11. Within atypical habitat, does your LRMP or LUP allow habitat conversion to a less desirable species or covertype which could reduce habitat suitability for lynx prey species (e.g.,. sagebrush conversion to crested wheatgrass)? Y___ N___ LRMP or LUP pp._____

Lynx habitat spatial size and distribution requirements

12. Does your LRMP or LUP address the need to provide a distribution of lynx habitat components across the planning unit (LMU, 5th or 6th code HUC, etc) to provide suitable lynx habitat? Y___ N___ LRMP or LUP pp._____

13.

a. Does your LRMP or LUP include direction to simulate natural disturbance patterns and sizes when designing vegetation treatments?

Completely_____ Partially_____ Not at all_____ LRMP or LUP pp._____

b. What direction does your LRMP or LUP contain for:

Average stand size? (narrative) LRMP or LUP pp._____

Age and size class distribution on subunits of your administrative unit? (narrative)

LRMP or LUP pp. _____

Shape of timber harvest units? (narrative) LRMP or LUP pp._____

Adjacency of temporary openings or even-aged harvest units (eg. minimum separation between stands, minimum height requirement for stands adjacent to proposed harvest)? (narrative)

LRMP or LUP pp._____

c. As a result of the direction in the plan, what is the desired or probable landscape? (narrative)

LRMP or LUP pp._____

14.

a. Does your LRMP or LUP contain direction for retention of late-successional forest communities? Y___ N___ LRMP or LUP pp._____

b. If yes, over what percent of the forested area in lynx habitat? _____%

LRMP or LUP pp._____

c. What are the distribution requirements for late-successional forest (by land area or plant association)?

LRMP or LUP pp._____

Silvicultural Practices

15. Snowshoe hare foraging habitat is necessary for lynx. It may be necessary to create or provide forage for snowshoe hare. Would there be a conflict with any LRMP or LUP direction if thinning is delayed in commodity emphasis management areas in order to maintain forage or produce it quickly? Y___ N___ LRMP or LUP pp._____

16.

a. When you thin, does your LRMP or LUP include direction that provides for snowshoe hare habitat (eg. leave islands, higher stem density, retaining deciduous shrub densities, etc.)

Completely_____ Partially_____ Not at all_____ LRMP or LUP pp._____

b. Does your LRMP or LUP contain direction that will maintain at least 15% of those stands with >5000 stems per acre in an unthinned condition? Y___ N___ LRMP or LUP pp._____

Fire

17. Does your LRMP or LUP allow the use of wildland fire for resource benefits (sometimes referred to as "let burn policy ", prescribed natural fire, etc.) in non-developed land management allocations (wilderness, roadless, etc.)? Y___ N___ LRMP or LUP pp._____

18.

a. Within lynx habitat, identify which of the following fire management categories are prescribed in your LRMP or LUP and the approximate percentage of habitat to which each applies:

Full suppression_____ Limited suppression_____ No suppression_____

LRMP or LUP pp._____

b. Within atypical lynx habitat, identify which of the following fire management categories are prescribed in your LRMP or LUP and the approximate percentage of habitat to which each applies:

Full suppression_____ Limited suppression_____ No suppression_____

LRMP or LUP pp._____

Grazing

19.

a. Does your LRMP or LUP allow livestock grazing in forested lynx habitat (including clearcuts and burns)? Y___ N___ LRMP or LUP pp._____

b. What is the highest range utilization standard that your LRMP or LUP allows in forested lynx habitat? %_____ LRMP or LUP pp._____

20. If you allow grazing in aspen stands, does your LRMP or LUP provide direction or prescription to maintain a diversity of age and height classes, particularly in the 5 - 15 foot height category? Y____ N____ LRMP or LUP pp._____

21. Do you have riparian guidelines in your LRMP or LUP that provide for a diverse vegetative community and age class and structure sufficient to provide cover and forage for lynx prey species?

Completely_____ Partially_____ Not at all_____ LRMP or LUP pp._____

22. Within atypical habitat, are there management standards in your LRMP or LUP that realistically result in at least 60% of the naturally occurring plant communities being maintained in a healthy mid- to late-seral condition? Y___ N___ LRMP or LUP pp._____

Roads

23.

a. If your LRMP or LUP contains open road density standards, what percent of your unit (within lynx habitat) has standards at the following levels? .
≤ 2 miles/sq mi _____% 2 - 3 miles/sq mi _____% No Stds. Exist_____

b. Over what area is road density calculated?

LRMP or LUP pp._____

24. Do you have winter road closure restrictions in your LRMP or LUP that may benefit lynx?
Y___ N___ LRMP or LUP pp._____

Recreation

25.

a. Does your LRMP or LUP include standards that address potential impacts to lynx or lynx habitat from highly developed recreation sites,(such as ski areas and large resorts)?

Completely_____ Partially_____ Not at all_____ LRMP or LUP pp._____

b. Does your LRMP or LUP include standards that address potential impacts of large ski areas or resort developments on the habitat of lynx prey species (snowshoe hare)?

Completely_____ Partially_____ Not at all_____ LRMP or LUP pp._____

26.

a. Does your LRMP or LUP provide direction for expansion of developed recreation facilities?
Y___ N___ LRMP or LUP pp._____

b. If yes, does it contain direction to mitigate potential impacts to lynx or lynx habitat?
Y___ N___ LRMP or LUP pp._____

27. Does your LRMP and LUP include standards that serve to mitigate potential impacts to lynx denning from yearround dispersed recreation?
Completely_____ Partially_____ Not at all_____ LRMP or LUP pp._____

28.

a. Does your LRMP or LUP allow use of snowmobiles and other over-snow vehicles off designated routes or outside designated areas? Y___ N___ Estimate the amount of lynx habitat where such use is allowed. _____% LRMP or LUP pp._____

b. Does your LRMP or LUP allow use of snowshoes and cross-country skiing off designated routes or outside designated areas? Y___ N___ Estimate the amount of lynx habitat where such use is allowed. _____% LRMP or LUP pp._____

29. Does your LRMP or LUP allow use of all-terrain vehicles off designated routes or outside designated areas? Y___ N___ Estimate the amount of lynx habitat where such use is allowed. _____% LRMP or LUP pp._____

30.

a. Does your LRMP or LUP promote or allow for a net increase of designated snowmobile routes or play areas from the current situation? Y___ N___ LRMP or LUP pp._____

b. If yes, what percent of lynx habitat could be affected by this increase? _____%
LRMP or LUP pp._____

Minerals And Energy

31. Does your LRMP or LUP include standards that serve to mitigate potential impacts to lynx or lynx habitat from minerals, oil or gas development and management?
    Completely_____ Partially_____ Not at all_____ LRMP or LUP pp._____

Connectivity

32. Does your LRMP or LUP provide direction for maintaining connectivity at the watershed or lynx management unit level? Y_____ N_____ LRMP or LUP pp._____

33. Does your LRMP or LUP include mitigation measures that facilitates lynx movements across highways (e.g.,. overpasses, underpasses, reduced speed, etc.)? Y___ N___
    LRMP or LUP pp._____

Land Tenure Adjustments

34. Does your LRMP or LUP identify parcels for land tenure adjustments (e.g.,. acquisitions, land exchanges and conservation easements) which would either directly or indirectly benefit lynx habitat conservation? Y___ N___ LRMP or LUP pp._____

35. Does your LRMP or LUP identify parcels for land tenure adjustments which would dispose of lynx habitat? Y_____ N_____ LRMP or LUP pp._____

Other

36. Does your LRMP or LUP include any additional measures not mentioned in this questionnaire that directly or indirectly assist in lynx conservation?
    Y____ N_____ If so, what are they? LRMP or LUP pp._____

37. Is there any other direction in the plan that prevents or discourages lynx conservation?
    Y____ N_____ If so, what are they? LRMP or LUP pp._____

38. In what ways may implementing your LRMP or LUP be negatively impacting lynx?

39. What factors other than Plan implementation have directly or indirectly contributed to lynx decline on your unit (please provide sources)?

40. Does your LRMP or LUP provide direction for coordinating with nearby units or other land management agencies on shared issues potentially affecting lynx (e.g., ensuring habitat connectivity between units)? Y_____ N____ LRMP or LUP pp._____

41. For National Forest and BLM units adjacent to Canada, does your LRMP or LUP provide direction for coordinating with the appropriate Canadian agencies on issues affecting lynx (e.g., ensuring habitat connectivity). Y_____ N_____ LRMP or LUP pp._____

42. Does your LRMP or LUP contain any direction for monitoring:

    a. lynx/lynx habitat? Y____ N____ LRMP or LUP pp._____

    b. prey/prey habitat? Y____ N____ LRMP or LUP pp._____

43. Additional Comments?

Thank you for your assistance in answering the questionnaire!

Supplemental questions for BLM

1. Do you have Spruce/Alpine Fir or Lodgepole Pine forest on your unit?

   If so, about how many acres?

2. Do you have Douglas Fir forest on your unit?

   If so, about how many acres?

3. Are these forest types contiguous with similar forest on other public lands?

4. If you do not have these forest types, do they occur within 25 miles of your units?

Lynx habitat descriptions and maps used for completing the BA evolved as we progressed with the project. We referenced three distinct lynx habitats during the course of this assessment:

1. Habitat descriptions used to complete the questionnaires.

2. Potential habitat map used to determine which FS and BLM units should be analyzed and to conduct portions of the effects analysis.

3. Primary habitat map, also used to conduct portions of the effects analysis.

Habitat 1

Early on, we cast a wide net for data gathering purposes using ecological descriptions covering large, contiguous blocks of land rather than habitat types which delineate smaller units within those contiguous blocks. We used the Lynx Habitat Descriptions for the Five Geographic Areas prepared by the Lynx Biology Team (Appendix C) to give BA questionnaire respondents baseline habitat information. These descriptions were changed in the later drafts of the LCAS, but since we used the original descriptions to obtain information for the BA, they were retained for this report. We gathered questionnaire data from more administrative units than we actually analyzed in this document (Appendix B).

Habitat 2

Next, we created a potential habitat map that was used to determine which units should be included in the BA. This also served as a basis for conducting portions of the effects analysis. We began with habitat classified at a finer scale than the descriptions enclosed in the questionnaires. We started with Kuchler potential vegetation types that were capable of supporting lynx and lynx prey, and we limited consideration to the 16 states in the Federal Register proposed listing. This map was used for discussions with the FWS in deciding which of our original pool of administrative units would be carried through the BA analysis. In the Great Lakes and Northeast regions, local experts remapped Kuchler's potential habitat using Bailey's broadscale ecological units at the subsection level. The subsection level incorporates such factors as climate, snow depth, vegetation, and landform. After this exercise, all habitat in Pennsylvania was deleted even though Pennsylvania was one of the 16 states listed in the Federal Register notice. It is believed that in Pennsylvania, lynx were extirpated in the early 1900s.

The map representing final habitat decisions after discussions between the FWS and the local administrative units is called potential habitat (Figure 3). The Science Team maps entitled Western Lynx Points within Broad Scale Vegetation Classes, Great Lakes Lynx Points within Broad Scale Vegetation Classes and Northeastern Lynx Points within Broadscale Vegetation Classes (McKelvey et al. in press 1999b) depict similar habitat with the following exceptions: (1) habitat outside of the 16 States in the FWS listing is included in the Science Team map and not included in the BA potential habitat map, and (2) In the Great Lakes region, the Science Team map follows the boundary of the Laurentian Mixed Forest province of Bailey's ecological hierarchy. The potential habitat map incorporates local knowledge and maps selected subsection boundaries that are nested within the Laurentian Mixed Forest Province. In the Northeast, The Science Team map follows the boundaries of the Adirondack-New England Mixed Forest, a mountainous version of the Laurentian Mixed

Forest Province. The potential habitat map incorporates local knowledge by mapping selected subsections within that mountainous province and adds another subsection in Maine that is outside of the Adirondack-New England Mixed Forest, but still within the Laurentian Mixed Forest Province.

Specific differences between the Science Team maps and the BA potential habitat map are:

1. Habitat is mapped in California, Arizona, New Mexico, South Dakota, Nebraska, Massachusetts, Pennsylvania and West Virginia on the Science Team maps but not on the potential habitat map. The Science Team's assignment was to collect information about lynx occurrence within the lower 48 states. The BA team's assignment was to analyze those FS and BLM units that were believed to play a role in lynx conservation. It is assumed that FS and BLM units in those states do not. There was no need for the BA team to map and consider isolated patches of lynx habitat in those states.

2. Habitat in and around the Siskiyou and Fremont NFs in Oregon, Manti-La Sal NF in Utah, Huron- Manistee NF in Michigan, Allegheny NF in Pennsylvania, Finger Lakes NF in New York, Elko NV BLM Office and all habitat in Nevada, Jarbridge Resource Area in Idaho, Lewistown, Miles City, Billings, Havre, and Malta BLM offices in Montana and those areas covered by the Eastern States Milwaukee Field office of the BLM is eliminated from the potential habitat map. Small isolated polygons of habitat in Idaho, Utah, Wyoming, Montana, and New York were also deleted from the BA potential habitat map. These changes occurred because the administrative units were located in areas where lynx are believed to have been extirpated for many decades, or units that are located at the extreme southern range of the area being considered by the BA and habitat is marginal at best, or because the habitat patches are isolated and there are significant barriers to lynx movement and use of those patches.

Habitat 3

Finally, we developed a primary habitat map (Figure 3: Primary Areas of Lynx Occurrence), based on polygons from the Primary Types maps created by the Science Team. The Science Team maps were created using Kuchler (1964) broadscale vegetation classes in the west and Bailey (1998) broadscale vegetation classes (province level) in the east, selected elevations (except in the Great Lakes) and recorded lynx observances. The primary habitat map varies from the Science Team Primary Types maps by including only that Primary Type habitat located within potential habitat described earlier.

The following table identifies lynx habitat mapping products, sources and brief descriptions of data used to create the products, products available for that habitat and how we used the products.

Table E-1--Habitat mapping products and uses.

A. Lynx Habitat-Broad Scale Description		
Source (Brief Description)	*Products*	*Uses*
Geographic Area Descriptions created by the Lynx Biological Team. Western US: Demarchi Eastern US: Bailey Sections	Appendix C: Lynx Habitat Descriptions for the Five Geographic Areas	To determine which administrative units should complete the BA questionnaire and to give questionnaire respondents baseline habitat information
B. Potential Lynx Habitat		
Source (Brief Description)	*Products*	*Uses*
Kuchler potential vegetation for western states Western US: Types 3,4,12,14,15,18,20,21,52 Baileys Ecological Subsections for eastern states within Province 212-Laurentian Mixed Forest	Figure 3. Potential Lynx Habitat Table 1. Potential lynx habitat	Basis for discussions between FWS, USFS and BLM to determine which units should be included in the BA analysis. (Decision also considered 16 states identified in the Federal Register proposed listing). To conduct a portion of the effects analysis.
C. Primary Lynx Habitat		
Source (Brief Description)	*Products*	*Uses*
McKelvey et al. in press 1999b - Lynx Science Team This is an integration of broadscale ecological units, selected elevations and recorded lynx observations. Western US: primary habitat is derived using Kuchler potential vegetation types, selected elevations and recorded lynx observations. Eastern US: primary habitat is derived using Bailey's ecological subsections, selected elevations in northeast region only and recorded lynx observations.	Figure 3. Primary Areas of Lynx Occurrence Table 2 . Primary lynx habitat	To conduct a portion of the effects analysis. (Note: Mapping for the Cascades, Northern Rockies and Southern Rockies is at a finer scale than mapping for the Great Lakes and New England areas. The Great Lakes and New England area map units contain inclusions of non-suitable habitat within the units.)

Code	Description	Interpretation
1	Ecological processes operate relatively free from human influence. Diversity resulting from natural succession and disturbances predominates, non-native vegetation rare. Few, if any facilities, travel non-motorized.	Manage designated and proposed wilderness to achieve natural ecosystems and meet high quality wilderness objectives.
2	Conservation of representative or rare ecological settings or components. Insuring overall sustainability of larger landscapes. Influences of humans sometimes evident, generally nonintensive. Areas often formally designated. Travel generally non-motorized.	Manage administratively or congressionally designated areas according to their designation. (Wild and Scenic Rivers, RNA, etc.)
3	Ecological values in balance with human use. Predominantly natural appearing landscape, but management tools can be used to restore or maintain relatively natural patterns. Some evidence of human activity. Restrictions on motorized travel.	Natural forces and processes play a dominant role in vegetation and landscape changes. Wildlife, fish, water quality are primary, but range, timber, mineral and other activities are typically allowed.
4	Ecological values are managed to provide human recreational use, but are maintained well within levels necessary to maintain overall ecological integrity. Consumptive resource uses occur but not emphasized. Motorized transportation common.	Manage for concentrated recreation use and development. Effects are evident and long term. Areas are typically small in scale.
5	Primarily forested ecosystems managed to meet a variety of ecological and human needs. Often, display high levels of investment, use, activity, density of facilities and evidence of vegetative manipulation activities. Motorized transportation common.	Intensive management of vegetative species to meet resource objectives. Maintain ecosystem health and sustainability while providing favorable conditions for commodity and non-commodity outputs.
6	Primarily grass and shrub lands managed to meet a variety of ecological and human needs. Often display high levels of investment, use, activity, density of facilities and evidence of vegetative manipulation activities. Motorized transportation common.	Intensive management of range vegetative species to meet resource objectives. Maintain ecosystem health and sustainability while providing favorable conditions for commodity and non-commodity outputs.
7	Public lands intermingles with private. Often residential lands. Ecosystem management objectives tempered by other landowner uses. Human activities have altered natural appearances. Resource use not planned on a sustainable basis. Motorized transportation common.	Manage fed lands that are significantly influenced by private lands to protect ecosystems and promote cooperation and meet management objectives.
8	Ecological conditions (including processes) generally permanently altered by human activities. Ecological values protected where they affect human occupancy. Areas generally small. Activities generally commercial. Motorized transportation common.	Manage for concentrated mining, special use, or administrative site use and development. Effects are evident and long term. Areas are typically small in scale.

Guidelines for Developing Evaluation Matrix from Lynx Questionnaires

Each applicable administrative unit will be rated on each of the 17 effects criteria in the matrix. The possible responses are:

F= fully meets the criterion; near certainty that the criterion is met
S= substantially meets the criterion; highly probable that the criterion is met
M= marginally meets the criterion; criterion may or may not be met
N= does not meet the criterion; criterion not met at all, or unlikely it is met
U= unknown if the criterion is met; inadequate information to assess
NA= the criterion is not applicable on the administrative unit

The responses are based primarily on the referenced questions in the questionnaire. However, any narrative statements provided by the administrative units will also be used. When the questionnaire does not provide a conclusive answer, the unit's Plan will be reviewed for further information. If an answer still cannot be determined, the contact person on the unit will be phoned for more information. All the above information sources will be used to arrive at a final response to each criterion through the professional interpretation of members of the BA team.

The following is guidance for how an initial response is derived from the questionnaire for each criterion. As noted above, other factors are considered in arriving at the final response.

General--
If an administrative unit does not address a particular criterion (i.e., no response), then the response to that criterion is **U**. If a criterion is not applicable to an administrative unit, then the response is **NA**.

Criterion 1--
If the answer to questions 7 or to question 8 is Y, and question 14 indicates at least 10% old growth is well distributed, then the response is **F**. If the answer to questions 7 and 8 is N, and question 14 indicates minimal and poorly distributed old growth, then the response is **N**. Anything in between these responses indicates partially meeting the criterion, and the answer is either **S** or **M** depending on the amount and distribution of old growth provided.

Criterion 2--
If the answer to questions 7 or to question 8 is Y, question 18 indicates <50% full suppression, and the unit has a significant vegetation manipulation program, then the response is **F**. If the answer to questions 7 and 8 is N, question 18 indicates >50% full suppression, and the unit has a minimal vegetation manipulation program, then the response is **N**. Anything in between these responses indicates partially meeting the criterion, and the answer is either **S** or **M** depending on the reviewer's judgement of the amount of forage habitat provided.

Criterion 3--
If the answer to questions 9 and 10 is N, then the response is **F**. If the answer to questions 9 and 10 is Y, then the response is **N**. If questions 9 and 10 have differing answers, then the response is **S** or **M**, depending on interpretation of the relative amounts of habitat and atypical habitat present on the unit. Note: In practice these questions proved difficult for the units to consistently understand and interpret. Therefore, units consistently received an M rating (may or may not meet the criterion) if their response was N, unless further corroborating information was available.

Criterion 4--
If the answer to question 15 is N and the answer to question 16a is either not at all, partially, or completely, then the response is either **M**, **S**, or **F**, respectively. If the answer to question 15 is Y and the answer to question 16a is either not at all, partially, or completely, then the response is either **N**, **M**, or **S**, respectively. Question 16b was not used in the responses because the referenced information was not used in the final version of the LCAS.

Criterion 5--
If the answer to question 17 is Y, and the answers to questions 18a and b include ≥50% in the no suppression or limited suppression categories, then the response is **Y**. If the answer to question 17 is N, and the answers to questions 18a and b include <50% in the no suppression or limited suppression categories, then the response is **N**. Any other combination of answers results in either an **M** or **S** response depending on the reviewer's judgement of how well the unit meets the criterion.

Criterion 6--
This criterion requires interpretation of several questions to derive a response. If the answer to questions 12 and 13a is Y, then the response is probably **F**. If the answer to questions 12 and 13a is N, then the response is probably **N**. If questions 12 and 13a have differing answers, the response is either **M** or **S**. However, each of these responses must consider the answers to questions 13b, 13c, and 14c in deriving the final response.

Criterion 7--
If the answer to question 23 is No Standards Exist and the answer to question 24 is N, then the response is **N**. If the answer to question 23 is No Standards Exist and the answer to question 24 is Y, then the response is **M**. If the answer to question 23 shows that open road density standards in the ≤2 miles/sq mi range exist, then the response is **F**, **S**, or **M** depending on the percent of the unit with the standard. The percent of the unit with a 2-3 miles/sq mi standard was used to influence the rating in borderline cases.

Criterion 8--
If the answer to questions 25a and 25b is Not At All, then the response is **N**. If the answer to questions 25a and 25b is Partially, then the response is **M**. If the answer to questions 25a and 25b is Completely and the answer to question 26 is Y, then the response is **S** or **F**, depending on site specific conditions.

Criterion 9--
If the answer to question 27 is Not At All and extensive ORV use off designated trails is indicated in question 29, then the response is **N**. If the answer to question 27 is Partially, the response is either **M** or **S**, depending on the amount of ORV use off designated trails indicated in question 29. If there is low ORV use, then the response is **F** or **S**, depending on amount of use.

Criterion 10--
If the answer to question 27 is Not At All and extensive snowmobile use off designated trails is indicated in question 28a, then the response is **N**. If question 28a indicates more than half the area is open to snowmobile use off designated trails, then he response is **M**. If question 28a indicates less than half the area is open to snowmobile use off designated trails, then he response is **S**. If question 28 indicates no snowmobile use off designated trails and question and question 28b indicates other winter dispersed recreation use is occurring, then the response is **S**.

Criterion 11--
If the answer to question 31 is None or no plan direction was found for oil and gas leasing or minerals, the response is **N**. If the answer to question 31 is partially or generic plan direction for minerals or oil and gas leasing was found, the response is **M**. If answer to question 31 is partially or specific

wildlife guidelines or withdrawals were found in plan direction, the response is **S**. If the answer to question 31 is Completely or oil and gas or minerals S&Gs or objectives pertaining to lynx were found, the response is **F**.

Criterion 12--
No unit responded Y to question 33, so no unit received an **F** under this criterion. If the answer to question 32 was N or no plan direction was found for within or between unit connectivity, the response is **N**. If the answer to question 32 was Y or plan direction was found for portions of the forest or for one species with somewhat similar requirements, then the response is **M.** If the answer to question 32 was Y or plan direction was found for connectivity for several species or habitats appropriate for lynx, the response is **S**. Plan language relative to grazing and riparian management was reviewed with respect to connectivity concerns. The above responses were adjusted up or down based on BA team judgement on how well the Plans addressed these concerns.

Criterion 13--
If the answer to question 34 is Y and the answer to question 35 is N and lynx were mentioned as a rationale for land adjustments, then the response is **F**. If the answer to question 34 is Y and the answer to question 35 is N and sensitive/special status species were mentioned as a rationale for land adjustments, then the response is **S**. If the answer to question 34 is Y and the answer to question 35 is Y or N and wildlife was mentioned as a rationale for land adjustments, then the response is **M.** If the answer to question 34 is N and the answer to question 35 is Y or N, then the response is **N**.

Criterion 14--
No unit (where applicable) identified direction for coordinating with Canada. These units could not receive a response of **F**. If the answer to question 40 is Y and the answer to question 41 is N (where applicable) or specific direction was found in the plan for coordination with adjacent units and agencies, then the response is **S**. If the answer to question 40 is Y and the answer to question 41 is N (where applicable) or generic direction was found in the plan for coordination with adjacent units and agencies, then the response is **M**. If (where applicable) the answers are both N and no plan direction for coordination was found, then the response is **N**. For units where only question 40 is applicable no units identified coordination needs for lynx and no response of **F** is possible. For units where only question 40 is applicable, the answer was Y, or specific direction for coordination with adjacent units was found in the plan, the response is **S**. For units where only question 40 is applicable, the answer was Y, or generic direction for coordination with adjacent units was found in the plan, the response is **M**. For units where only question 40 is applicable, the answer was N, or no direction for coordination with adjacent units was found in the plan, the response is **N**.

Criterion 15--
If the answer to question 42a. is Y and the answer to 42b. is Y, or measurable plan direction was found for this monitoring, then the response is **F**. If the answer to question 42a. is Y and the answer to 42b. is N (or vice versa), and measurable plan direction was found for either category of monitoring, then the response is **S**. If the answer to question 42a. is Y and the answer to 42b. is N (or vice versa), and generic plan direction was found for either category of monitoring, then the response is **M**. If the answer is N, for 42a. and 42b., or no plan direction was found, then the response is **N**.

Answers to questions not specifically mentioned above may be used in further interpretations or in narrative sections of the BA.