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WILDLIFE LINKAGE AREAS: AN INTEGRATED APPROACH FOR CANADA LYNX

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Abstract: Conservation planning for forest carnivores now appropriately includes management considerations for habitat connectivity at a landscape scale level. We provided direction for connectivity and linkage area mapping in the Canada Lynx Conservation Assessment and Strategy, 2nd edition, August, 2000. We have drafted "lynx linkage areas" by conducting interagency meetings in the western states within the historic Canada lynx range and incorporating pertinent research. Participants in these meetings included representatives from state wildlife agencies and state departments of transportation, and federal agencies including Federal Highway Administration, Bureau of Land Management, National Park Service, USDA Forest Service, tribal governments, private conservation groups and others. One of the benefits of this approach was to receive professional input and raise the level of awareness of the importance of wildlife connectivity and linkage areas across a diverse group of managers. We viewed this approach as an ongoing process that involved incorporation of information gathered at the meetings and subsequent production of draft maps that have been sent back to participants for review. The maps represent a first effort to identify linkage areas, which can be further refined and evaluated in subsequent planning and research efforts. We will present the working maps of Canada lynx linkage areas for the Northern and Southern Rocky Mountains.

Introduction

Canada lynx were listed on March 24, 2000 (65 Federal Register 16052), as a Threatened species under the Endangered Species Act 1973 in 14 of the lower 48 states. Since this was the conclusion of an extended review of the status of lynx by U.S. Fish and Wildlife Service (FWS), there had already been an interagency team formed to produce certain reference materials and review the effects of the listing on federal actions. One of the basic products necessary to initiate program reviews was an assessment of the current research literature available on lynx biology and ecology. This publication (often referred to as the Lynx Science report) is entitled, "*Ecology and Conservation of Lynx in the United States*" (Ruggiero, et al. 2000). In addition, there was a need for a conservation strategy and management assessment of the current state of the art and how this would relate to evaluating federal management actions. This document was prepared by a group of federal interagency biologists (referred to as the Lynx Biology Team) and is entitled, "*The Canada Lynx Conservation Assessment and Strategy*" (LCAS), (Ruediger et.al. August, 2000).

To guide and coordinate federal actions regarding lynx habitat mapping and management, a Conservation Agreement was signed on February 7, 2000, by the U.S. Forest Service (USFS) and the FWS. A similar agreement exists between the Bureau of Land Management (BLM) and FWS. The National Park Service is also preparing a conservation agreement with FWS. One element of the USFS-FWS agreement is the assignment to prepare a map of lynx habitat that shows lynx linkage areas between and amongst the major blocks of lynx habitat in the western United States. The Lynx Biology Team was charged with coordinating this effort by the Interagency Lynx and Wolverine Steering Committee (LWSC), the state and federal interagency oversight team that coordinates management direction and implementation for the agencies. For a description of membership and roles of the LWSC and the Lynx Biology Team see the USFS National Carnivore website at <http://www.fs.fed.us/r1/wildlife/carnivore/>.

LCAS Guidance

The LCAS and USFS-FWS conservation agreement provides guidance to prepare the maps of lynx habitat and the lynx linkage areas. Canada lynx habitat is defined as boreal forest conditions that include vegetation of the subalpine fir zone commonly expressed as spruce-fir forests that include environmental factors such as deep, powdery snow. It is in these conditions that lynx have the advantage over other predators in seeking their primary prey, snowshoe hare.

Lynx Linkage Areas are defined as “Habitat that provides landscape connectivity between blocks of lynx habitat. Linkage areas occur both within and between geographic areas where blocks of lynx habitat are separated by intervening areas of non-lynx habitat such as basins, valleys, agricultural lands, or where lynx habitat naturally narrows between blocks. Connectivity provided by linkage areas can be degraded or severed by human infrastructure such as high-use highways, subdivisions or other developments.” (see LCAS and the letter dated April 19, 2002 signed by Kathleen McAllister, LWSC Chair, that provides clarifying language).

Methods

It was determined by the Interagency Lynx and Wolverine Steering Committee that the Lynx Biology Team would coordinate the mapping of the lynx linkage areas in the western United States. This process was initiated in 2000 by meeting with representatives from federal, state, tribal entities as well as representatives of conservation groups, organizations and private individuals. This process has lead to the maps that are presented in this paper.

Specific techniques for delineating lynx linkage areas include direct mapping by area biologists based upon their knowledge of local conditions, GIS modeling (Singleton et al. 2002), and empirical data on lynx movements where available.

Interagency meetings were held in Montana, Idaho, Colorado, and Utah to identify lynx linkage areas on July 11, 2001, November 28, 2001, January 9-10, 2002, and April 17, 2002, respectively, and two meetings were held in Wyoming on April 16 and April 18, 2002. Additional agency review and comment was conducted during the months of July and October 2002.

Objectives of the meetings were to establish mapping criteria, delineate the general location of linkage areas, and identify any impediments or barriers to movement. Participants at the meetings typically included representatives from the respective state wildlife agency, state transportation department, and state forestry department, the Federal Highway Administration, U.S. Forest Service, Bureau of Land Management, National Park Service and U.S. Fish and Wildlife Service.

Two types of linkage areas were identified: 1) those intended to connect large, disjunct blocks of mapped lynx habitat, and 2) areas that are intended to provide connectivity within mostly contiguous habitat and are at risk or in need of increased permeability.

Criteria and indicators used to identify lynx linkage areas were:

- 1) Relatively direct routes unimpeded by human developments such as towns, subdivisions, industrial areas, etc., between blocks of lynx habitat.
- 2) Expanses of undeveloped low elevation habitats such as grassland or shrub/steppe habitats which occur between forested blocks of mapped lynx habitat.
- 3) Riparian habitat across valley bottoms.
- 4) High percentage of public lands within the area, though in several cases public land was not present.
- 5) Information concerning animal crossing locations or routes based on direct observation or documented movements of radio-collared lynx.

Criteria and conditions used to identify impediments or barriers to movement were:

- 1) Four lane highways
- 2) High traffic volume highways (two or four lanes)
- 3) Highways with parallel railroad routes
- 4) Presence of numerous physical impediments (Jersey and Texas rail type barriers)
- 5) Existing plans to upgrade or improve a highway (e.g., widening, barrier installation)
- 6) Any other expected or planned developments along or nearby existing road
- 7) Human developments such as towns, subdivisions, industrial developments, etc.

The intent of the mapping efforts was to provide a general location of lynx linkage areas on a map that would lead to further refinement via resource planning actions and additional research that could eventually identify specific sites where a means of connectivity could be provided as part of lynx conservation efforts. The data provided in this report do not delineate specific linkage area boundaries identifiable on the ground, nor do they provide the exact location of crossing sites or structures. Additional field review and in some cases research are necessary to provide these data. Some exceptions to this exist, since some connectivity analyses have been completed for proposed highway upgrade projects within the reporting area.

Results

We have summarized the results of these efforts by providing maps with the lynx linkage areas (figures 1 and 2) at the landscape level for the Northern Rocky Mountains and Southern Rocky Mountains Geographic Areas. We consider these working maps that will focus further analyses and refinements pertinent to lynx and habitat connectivity in the areas indicated by the arrows on the maps when projects are anticipated or proposed nearby.

Each lynx linkage area (figures 1 and 2) indicated by an arrow on the map has not yet been evaluated for its individual value. As stated, these data indicate those areas where specific evaluation should occur to determine the value of these areas to lynx when a project is proposed.

There is field research underway (John Squires, pers. comm.) at study sites in the Yaak River drainage and Seeley Lake Valley in Montana that documents lynx movements and potential linkage areas by individually radio-collared animals. This type of research is a scientific method to specifically delineate and document actual animal use of the linkage areas. A specific example that has been identified in this manner exists on the Seeley-Swan divide on the Lolo National Forest in western Montana.

Field research also is being conducted in southern Colorado by the Colorado Division of Wildlife. Lynx movement data were used to identify known linkage areas, but extrapolation was done very cautiously since this is a reintroduced population. If the population continues to expand and additional data on movement patterns elsewhere in the state becomes available, that information can be incorporated into the map of linkage areas.

The maps (figures 1 and 2) identify focus areas for potential connectivity areas for lynx. To the best of our ability within the given time constraints and available data, we have mapped these linkage areas realizing that there may be additional linkage areas available or necessary based upon future field research.

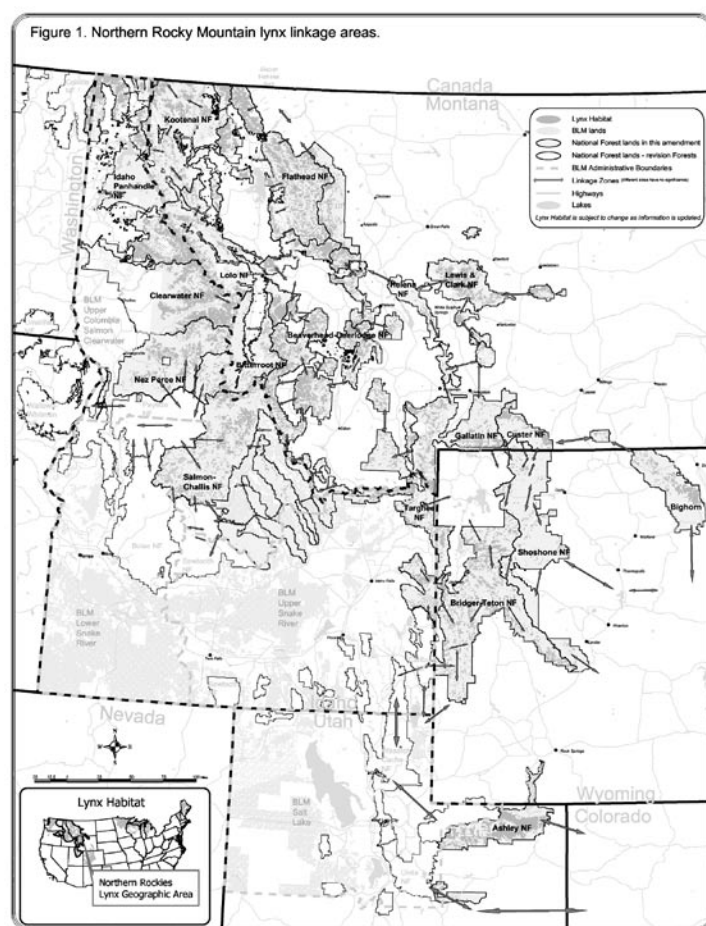


Fig. 1. Northern Rocky Mountains lynx linkage areas.

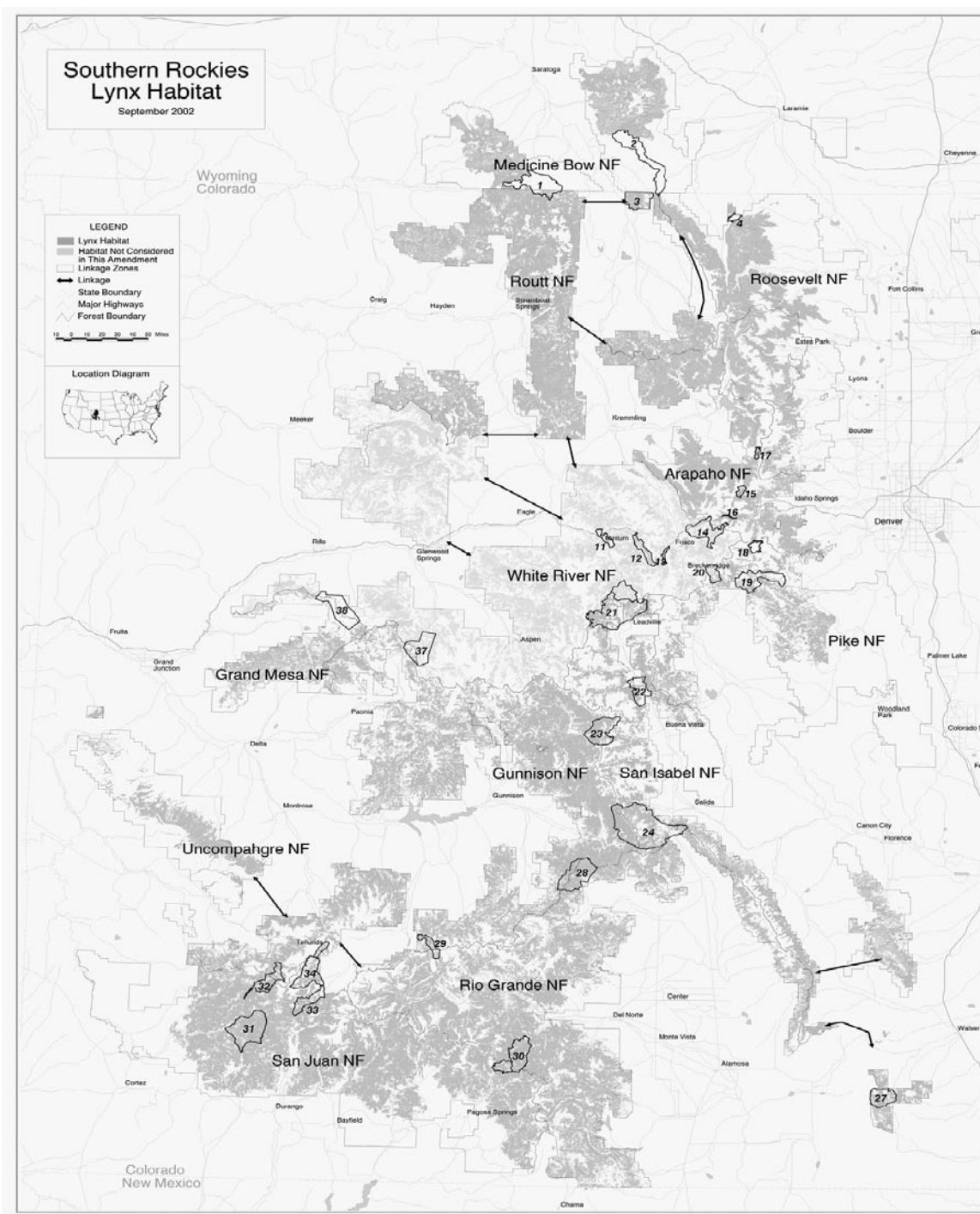


Fig. 2. Southern Rockies lynx habitat.

The maps presented should be considered the first effort to define lynx linkage areas in a working map form available for management planners. As more information becomes available on lynx and connectivity, it will be made available on the USFS National Carnivore website.

Discussion

Based on direction from the LWSC, it was determined that this assignment for producing mapped linkage areas would focus specifically on lynx. It is understood that any provision for habitat connectivity certainly benefits other wildlife species. At the same time, our purpose was to specifically strive to maintain or improve connectivity where needed to conserve lynx in the western United States.

We are also fully aware that there is little empirical science on which to base delineation of lynx linkage areas within such a large acreage of mapped lynx habitat, some of which is naturally quite fragmented. For this reason, our approach was carefully described and documented. This is a first time effort and it will be improved as more data specific to this important element of lynx conservation become available. The very limited, but specific lynx movement data that exist were incorporated into our mapped lynx linkage areas. It is important to note that at least in some cases these data indicate that lynx movements are related to landscape characteristics and not necessarily random events.

In addition, there are several important programs underway to address habitat fragmentation by government agencies as well as the private sector (Craighead, et al. 2001; Gore, et al. 2001; Servheen, et al. 2001; and others). To our knowledge, none of these efforts focus primarily on lynx as we did, but include considerations for forest carnivores as well as many other species of wildlife and aquatic organisms.

Conclusion

These maps and this report should be viewed as a significant beginning toward addressing lynx habitat linkage areas at the landscape level. These data do not depict site-specific connectivity requirements necessary for lynx habitat linkage. Ongoing efforts including research will help to refine these linkage areas, so that appropriate mitigation steps can be taken to maintain connectivity for lynx. As previously emphasized, the mapped linkage areas now bring focus to broad areas that can be evaluated for protection or mitigation that may include structural crossings as well as appropriate management on adjacent lands to maintain habitat quality for lynx and many other species of wildlife.

Biographical Sketches: James J. Claar is the carnivore program leader for the Northern Region, USDA Forest Service, in Missoula, Montana. Jim is particularly interested in the conservation biology of forest carnivores such as grizzly bears, wolves, Canada lynx, wolverine and fisher at the geographic/landscape scale levels. Habitat management coordination and wildlife linkage zone delineation are a part of his current assignment. Jim serves as the national coordinator for Canada lynx and wolverine conservation programs in the Forest Service.

Timothy Bertram is the wildlife biologist on the Northern Rockies Lynx Amendment team stationed in Missoula, MT, for the USDA Forest Service.

Robert Naney is the forest biologist on the Okanogan National Forest in Winthrop, WA, for the USDA Forest Service. He is also a member of the National Lynx Biology Team.

Nancy Warren is a wildlife biologist for the USDA Forest Service stationed in Denver, CO. She is the threatened, endangered and sensitive species program leader for the Rocky Mountain Region and a member of the National Lynx Biology Team.

William Ruediger is the ecology program leader for the USDA Forest Service stationed in Missoula, MT. For more background information see his paper in this proceedings.

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