HABITAT MAPPING AND FIELD SURVEYS FOR LYNX (*Lynx canadensis*) ON LANDS ADMINISTERED BY THE USDI - BUREAU OF LAND MANAGEMENT IN WYOMING

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10 October 2001

INTRODUCTION

In North America, the lynx (*Lynx canadensis*; common and Latin names of all species mentioned in this report are listed in Table 1) inhabits boreal and subalpine forests from Alaska to the Atlantic coast of Canada, extending southward into northern New England, the Great Lakes region, and the Central and Southern Rocky Mountains (Tumlison 1999, McKelvey et al. 2000a). Lynx range has contracted over the past several decades, especially along its southern periphery (Ruggiero et al. 2000). This contraction, along with density declines in many occupied portions of lynx range, culminated in the listing of the lynx as Threatened under the U.S. Endangered Species Act in March 2000. This has made the species a priority for natural resource managers and agencies throughout western North America.

Currently, the southern extent of lynx range in the Rocky Mountains corresponds to the Overthrust Belt/ Wyoming Range in southwestern Wyoming (McKelvey et al. 2000a; Utah Conservation Data Center, Utah Division of Wildlife Resources, unpublished data). This excludes an ongoing reintroduction effort in southern Colorado, the success of which is still in question. The status of lynx populations in the Central Rocky Mountains is rather tenuous (Aubry et al. 2000, McKelvey et al. 2000b), and there is very little scientific information specific to lynx ecology here. Thorough analyses of the limited body of existing studies suggest that lynx life history in this area is substantially different from that of lynx to the north. Among other characteristics, southern lynx appear to have larger home ranges, wider habitat breadths, greater reliance on alternative prey (especially red squirrels), more competition from generalist carnivores, and stronger dependence on late-seral conifer stands relative to their northern counterparts (Ruggiero et al. 2000).

Because of the involvement of the Endangered Species Act, lynx management is now focused on recovery of the taxon to levels that will justify de-listing. As the southernmost area of persistent lynx occupation, western Wyoming can play an important role in lynx recovery. However, achieving any specific management goal requires more basic information on lynx distribution and habitat use in this under-studied area.

OBJECTIVES

This study had 2 main objectives: (1) produce a reliable map of habitat suitability for lynx covering the entire state of Wyoming; and (2) survey for lynx on lands administered by the USDI Bureau of Land Management, using the above map to position surveys in areas of potential lynx occurrence in western Wyoming.

This document was prepared as the final report to Cooperative Agreement #KAA990027 between the Wyoming Natural Diversity Database-University of Wyoming and the USDI Bureau of Land Management-Wyoming State Office (BLM). A companion report titled "Boreal mammals on isolated mountain ranges managed by the USDI Bureau of Land Management in Wyoming" outlines the results of another study designated by this agreement.

METHODS

Habitat suitability mapping

To better understand lynx distribution in Wyoming in general, and to identify study sites on Wyoming BLM holdings that are most likely to support lynx, we produced 2 digital maps: (1) a statewide map of habitat suitability, regardless of surface ownership, and (2) a statewide map of habitat suitability on lands administered by the Wyoming BLM. Both maps are based on the statewide land cover map produced by the Wyoming Gap Analysis Project. The BLM-specific map also incorporates information from the land ownership map produced by the same effort (Merrill et al. 1996). All map manipulations described below were performed within the ArcView geographic information system (version 3.1; Environmental Systems Research Institute, Redlands, California).

The land cover map of Merrill et al. (1996) delineates polygons of unique primary and secondary land cover types across the entire state, and estimates the percent coverage of each type in each polygon, based on satellite imagery and computer classification. For some polygons, the percent coverage of primary and secondary types does not sum to 100, and an "other" (tertiary) cover type is also identified. To produce the statewide map of lynx habitat suitability, we calculated an index of habitat suitability for each polygon by first scoring the cover types 0 - 6 (worst - best) according to their suitability as lynx habitat (Table 2). These scores were assigned following a literature review of habitat associations of lynx in North America (e.g., Koehler and Aubry 1994, Ruggiero et al. 2000) and consultation with experts on Wyoming vegetation (W. Fertig and G. Jones, Wyoming Natural Diversity Database / University of Wyoming, personal communications). The habitat suitability index for each polygon was then calculated as:

$$\begin{aligned} \text{Index} = \; & (\text{Primary cover type score} * [\text{\% coverage of primary type} / 100]) + \\ & (\text{Secondary cover type score} * [\text{\% coverage of secondary type} / 100]) + \\ & (\text{Tertiary cover type score} * [\text{\% coverage of tertiary type} / 100]) \end{aligned} \tag{1}$$

The third term was not necessary for some polygons because the percent cover of the primary and secondary types summed to 100. The habitat suitability indices were attributed to the records for each polygon in the GIS data table to allow the polygons to be color-coded by index value when visually displayed.

The BLM-specific map was produced by first overlaying the statewide land cover map and the statewide land ownership map, then retaining only those polygons under BLM administration. Again, this map was visually displayed using the habitat suitability index to color-code each polygon.

To evaluate the degree to which the habitat suitability index reflected actual lynx habitat use, we compared the index values at 196 documented lynx locations in Wyoming (Biological and Conservation Database, Wyoming Natural Diversity Database / University of Wyoming) to the index values at 3 sets of randomly-placed points: (1) points located randomly throughout the state, (2) points located randomly throughout 4 areas defined by clusters of known lynx locations, and (3) points located randomly within the area currently occupied by lynx in Wyoming.

Field surveys

We examined the maps of lynx habitat suitability, described above, to identify areas on which to perform field surveys during winter 1999-2000 and 2000-2001. A survey site had to meet 3 general criteria: (1) it must be administered by the Wyoming BLM; (2) it must have a large and contiguous land surface with habitat index >5; and (3) it must be contiguous with a large, non-BLM land surface with habitat index >5. This last criteria was based on the fact that most suitable lynx habitat in Wyoming occurs at relatively high elevations on lands administered by the USDA Forest Service, and thus the probability of lynx occurrence on BLM administered lands is higher in those areas abutting suitable Forest Service holdings.

At each selected site, we performed 2 snow-tracking surveys separated by about 25 days. Each survey involved at least 1 person-day of snow-tracking, with a survey route of at least 10km. All tracks intercepted on the survey routes were identified to species and recorded on standardized data forms. Tracks of suspected lynx, wolverine, and fisher were located using a global positioning system, photographed, and measured. Potential lynx trails were categorized as either “probable” or “possible”. Probable lynx trails had stride, straddle, print dimensions, and general characteristics that matched those described for lynx by Murie (1974), Halfpenny (1986), and Forrest (1988). Possible lynx trails either (1) didn’t exactly match published dimensions, but did have general characteristics and supporting evidence suggesting lynx, or (2) matched published dimensions in stride and straddle but were too old for accurate print measurements. Observations of the abundance and distribution of both prey and competitor species were documented along each survey route, with particular attention to snowshoe hare and red squirrel occurrences.

One baited remote camera (Wildlife Pro; Forestry Suppliers Inc., Jackson, Mississippi) was placed on each site during the first snow-tracking stint and retrieved during the second. Cameras were designed to take exposures at any time of day in response to motion and infrared radiation. Each camera was secured about 75cm above the snow surface on a live tree in suitable lynx habitat, and was aimed directly at a scent pad secured at a similar height on another live tree no more than 10m away. A punctured can of tuna was placed about 2m high near this scent pad, and another scent pad was suspended from a branch about 2m high in the immediate vicinity of the camera. Scent attractant was a mixture of beaver castorum and catnip oil suspended in glycerin and propylene glycol, as described in McDaniel et al. (2000). Finally, a visual attractant consisting of a bent aluminum pie plate was suspended with monofilament line about 1m over the snow surface near the camera.

RESULTS

Habitat suitability mapping

The statewide and BLM-specific maps of habitat suitability for lynx are shown in Figures 1a and 1b, respectively, and are provided as ArcView shapefiles STATELYNX and BLMLYNX on the compact disc accompanying this report.

The value of the habitat suitability index at documented lynx locations was consistently higher than the index value at randomly placed points (Figure 2). As the placement of random points was progressively constrained to areas of historical or current lynx occupation, the index values at those points became more similar to the values at the lynx locations. This suggests that the index described in Equation 1 adequately reflects habitat suitability for lynx, and that the maps shown in Figure 1 are sufficient for guiding field surveys for lynx presence.

Field surveys

Nine areas met the criteria for study site selection (Figure 3), and field surveys were performed at each area during either winter 1999-2000 or 2000-2001. Major results of the field surveys are summarized below; more detailed discussions of each site, including photographs and maps of survey routes, are included in Appendices A - I.

Survey dates: Three sites (Pine Creek, Water Canyon, and Rock Creek) were surveyed during winter 1999-2000. Because tracking conditions were extremely poor due to low snow accumulation and infrequent fresh snowfall, we postponed surveying the majority of sites until winter 2000-2001 when we hoped conditions would be better. The remaining 6 sites were surveyed during winter 2000-2001; however, tracking conditions were as bad if not worse than during the previous year.

Survey conditions: All surveys during this project were hampered by low snow accumulation, infrequent fresh snowfall, and poor snow texture. Snow pack on most survey sites during both winters was only 50-65% of the most recent 20-year average. During each winter, much of the snow fell early in the season and was followed by a long cold spell. The temperature differential between the warm ground and cold air often created depth hoar out of the entire snow pack. Such a pack would barely support any weight (e.g., a person on skis would sink to the ground through a meter of snow), and was extremely poor at retaining details of mammal prints.

Open ridges and south-to-west facing slopes were often snow-free, especially at the lowest elevations, allowing ungulates to range across many sites and trample the tracking substrate. Wind disturbance was heavy on all sites.

Low snow cover hampered site access as well as tracking. Snow cover was often too thin and patchy to support a snow machine, but drifts prevented truck access. Sites were commonly accessed via a combination of truck, snow machine, all-terrain vehicle, and foot travel. The Grass Creek, Water Canyon, and Rock Creek sites supported especially poor survey conditions. The second tracking stint at Rock Creek was abandoned and the effort committed to other sites with higher tracking potential. Surveys on the Water Canyon site were shifted north to USDA Forest Service (Bridger-Teton National Forest) lands adjacent to the site where access and tracking conditions were better.

Observations of lynx: The camera station on the Ham's Fork site (Appendix G) captured one photo (Photo G-1, G-2) of an individual *Lynx* spp. on 21 March 2001. The coat of this animal appears to be distinctly spotted, and the ear tufts are not prominent; both of these characters suggest bobcat rather than lynx. The facial ruff is rather heavy, as is expected on lynx, but it is reasonable to expect bobcat in winter pelage to show a heavier-than-normal ruff. We concluded that this photo is most likely of a bobcat, which is supported by the fact that we documented several bobcat trails at this site during the snow-tracking portion of this study.

We recorded 2 probable and 3 possible lynx trails during this study; no wolverine or fisher trails were documented.

> ***Location:*** One possible lynx trail was documented on the Big Sandy site, and 1 probable lynx trail was documented just north of this site on USDA Forest Service (Bridger-Teton National Forest) land (Appendix D). Also, 1 possible lynx trail was documented on the Pine Creek site (Appendix H), and 1 possible and 1 probable lynx trail were documented just north of the Water Canyon site (Appendix I).
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> ***Description:*** All trails matched published dimensions of lynx stride and straddle except the possible lynx trail on the Big Sandy site. This stride and straddle of this trail were rather large, suggesting possibly a mountain lion. However, print characteristics and

behavioral observations indicated that this animal was definitely lynx-sized in both height and weight (Appendix D). The 2 other possible lynx trails were observed after snowfalls, so print measurements were impossible to make.

Habitat observations:

General: As expected, all sites were on the flanks of major mountain ranges and typically sloped upward towards USDA Forest Service lands at higher elevations. Topography was rather variable, ranging from extremely rugged (e.g., Grass Creek, Pine Creek) to gently rolling (e.g., Blucher Creek, Big Sandy).

On all sites forest cover was naturally fragmented by sagebrush-grasslands, and forest contiguity tended to increase with elevation. Sites had received varying degrees of timber extraction; in general, recent clearcuts were common and accentuated natural forest fragmentation. Lodgepole pine was the dominant forest type, and commonly formed thick "doghair" stands with a high density of small-diameter trees and very little foliage in the mid and understories. Mixed stands of Engelmann spruce and subalpine fir were encountered on all sites, but were common on only a few (e.g., Scab Creek, Ham's Fork). Structurally diverse, late-seral stands of conifers were rare. Aspen stands occurred occasionally, and large streams usually supported willow communities.

Because precipitation strongly influences vegetation composition and structure, and because most precipitation is received in winter as snow, the effects of large-scale geomorphology were rather apparent during this study. Rain-shadow sites such as Grass Creek, Lander, and possibly Rock Creek clearly received less snow than windward sites at similar elevations.

Prey species: The two primary species of lynx prey, snowshoe hare and red squirrel, were documented on every survey site. The distribution of each of these species closely matched the distribution of conifers, with snowshoe hares occasionally ranging beyond conifer stands into willow and aspen communities. Based on frequency of track encounters, each species reached its highest abundances in structurally diverse, late-seral stands of conifers. Such stands usually included a significant component of Engelmann spruce and subalpine fir. Doghair stands of lodgepole pine supported the lowest prey densities.

An initial goal of this study was to establish prey abundance monitoring routes in each survey site. This goal was abandoned for several reasons. Snow-tracking conditions were very poor during this study; furthermore, conditions were extremely variable on a 1 - 100m scale. This precluded collecting consistent and accurate estimates of track encounters on any given transect. Also, snowfall events were light, patchy, and infrequent, making it difficult to discern if tracks were made prior to or after the most recent snowfall. Such data is needed in order to convert track encounters into an index of abundance. We recommend using other methods that do not rely on snow-tracking to monitor lynx prey species. Standard call surveys would probably work best for red squirrels, and the Krebs pellet plot technique is a time-tested method to judge snowshoe hare abundance in boreal and montane forests, especially in relation to lynx.

Alternative prey species such as blue grouse, desert cottontail, and white-tailed jackrabbit were documented only infrequently, but were assumed to be present on most sites. Large herds of ungulates typically wintered on or in close proximity to the survey sites and probably serve as a reliable source of carrion. Note that the probable lynx encountered in Water Canyon (Appendix I) was scavenging an elk carcass.

Competitors: Trails of coyote, bobcat, and mountain lion were recorded on almost all sites, and all 3 species likely occupy all sites during at least part of the year. Red fox probably occupy the lower elevations of some sites even in winter. Occurrence of domestic dogs in winter likely varies directly with the amount of recreational use of any site.

Trails of generalist carnivores (especially coyotes) were common on and near roads and snow machine trails, and often followed these features for several hundred meters at a time. Off-trail excursions usually looped back to packed trails after only short distances. Packed trails almost certainly extend the range of lynx competitors in the winter and allow them to access formerly snowbound areas. Snow-free slopes and ridges may serve a similar function, but may be absent during years of more normal snowfall.

Other species: Trails of several common and expected species were recorded on the survey sites, but aside from the lynx observations discussed above we made no observations of special or unusual interest. Wolverine and fisher were not recorded during this study. American marten were recorded on 4 sites. Curiously, marten were not recorded on any of the 4 sites (Rock Creek, Ham's Fork, Pine Creek, Water Canyon) on the southern end of the Overthrust Belt/ Wyoming Range, despite the apparent abundance of suitable habitat.

Other: Timber harvesting appeared to be almost absent on the Scab Creek site, and present only in low amounts on the Rock Creek and Water Canyon sites. Recent clearcuts were a common feature on all other sites (e.g., Photo G-4). Aspen stands on all sites appeared to be composed mainly of mature individuals with very few seedlings/ saplings; additionally, many aspen stands were converting to conifer overstories. Heavy browsing of mountain shrub species, presumably by ungulates, has occurred on the Rock Creek and Ham's Fork sites and has resulted in many dead and dying shrubs (Photo G-6). The primary recreational use of the sites was snow machine travel, the intensity of which generally varied with public accessibility and snow pack. Recreational use was rather high at the Pine Creek, Blucher Creek, and Big Sandy sites, but only moderate at the Ham's Fork site and low at all others.

DISCUSSION

Habitat suitability mapping

Our results (Figure 2) indicate that the habitat suitability map (Figure 1) is sufficient to guide the placement of surveys for lynx in Wyoming, and also to summarize potential lynx distribution at spatial scales ranging from the entire state to about the county/ BLM Field Office. It is important to note that this map pertains to *potential* lynx distribution, and should not be interpreted as a definitive statement on the *actual* distribution of lynx in the state. Rather, its value lies in guiding field surveys and generating hypotheses regarding habitat quality and distribution.

We suspect the accuracy of this map becomes increasingly poor at finer scales, because the land cover map on which it is based (Merrill et al. 1996) used a 100ha minimum mapping unit. Statewide maps of land cover utilizing smaller mapping units (0.1ha) are currently planned, and applying the techniques described here to those maps would probably yield lynx habitat layers that are more accurate at finer scales. However, because lynx are highly mobile (see Ruggiero et al. 2000), such detailed maps may not be substantially more informative than the one presented here. The presence and persistence of vagile mammalian carnivores in a given landscape is probably more related to coarse-scale rather than fine-scale habitat characteristics. Changes in vegetation or prey abundance in a 1ha area probably won't substantially affect the probability of lynx presence in the surrounding landscape, because lynx respond to habitat features at a coarser scale. However, changes within a 100ha area, whether resulting from a single large action or the cumulative effects of multiple smaller actions, will likely affect the probability of lynx presence because that area more closely matches the spatial scale at which lynx use the landscape.

Future efforts at mapping habitat suitability for lynx may gain more by including geomorphologic and stand structure variables rather than increasing the spatial resolution of underlying land cover data. For example, studies of lynx habitat use suggest a preference for flat topography (Apps 2000, McKelvey et al. 2000c). Thus, incorporating a layer of topographic roughness in the mapping procedure may produce more accurate maps of habitat suitability. Also, spatial layers relating to the structural stage of conifer stands may add accuracy to a map of habitat suitability. As discussed below, lynx may prefer the relatively high densities of snowshoe hares found in the brushy environments of both early and late-seral conifer stands in the Central Rocky Mountains (Aubry et al. 2000, Buskirk et al. 2000a, Hodges 2000). Furthermore, lynx depend on the large coarse woody debris found in late-seral stands for denning (Aubry et al 2000, Squires and Laurion 2000). Thus, good lynx habitat in this area may consist of a mosaic of early- and late-seral stands. If so, and if the proper proportions and juxtapositions of stand types can be estimated, digital maps of stand structural stage could be used to further refine the habitat suitability map produced here.

Habitat observations

Although all sites supported land cover generally suitable for lynx occupation, the sites varied quite a bit in topography, snow accumulation, and degree of recreational usage. These factors are known to affect habitat quality for lynx. Lynx may prefer gentle topography over more rugged terrain (Apps 2000, McKelvey et al. 2000c). Of the 3 sites where lynx were documented during this study, 2 (Big Sandy and Water Canyon) were characterized by relatively gentle topography. The relationship with snow depth may be somewhat more complex. Extremely deep snow may be avoided due to the high energetic cost of traveling through such a medium (Apps 2000). However, because such costs are higher for generalist carnivores such as coyotes than for lynx, lynx may seek out relatively deep snow to minimize competition (Aubry et al. 2000, Buskirk et al. 2000b). Because of the consistently low snow pack encountered during this project, we cannot draw any conclusions relative to snow depth preferences from our field work.

Recreational use further complicates the relationship between lynx, other carnivores, and snow depth. Packed roads and trails are used as travel corridors by generalist carnivores, allowing them to range into formerly snowbound areas (Aubry et al. 2000, Buskirk et. al 2000b). We repeatedly observed the tracks of generalist carnivores following snow machine trails. Some carnivores traveled for several hundred meters along packed trails before exiting, and others would exit only for short (<30m) forays before returning to the packed trail. Tracks of generalist carnivores were encountered much less frequently on survey segments extending over untracked snow. Snow machine trails almost certainly extend the winter ranges of generalist carnivores in this region, probably to the detriment of lynx in the area.

Conifer forest exhibited some degree of natural fragmentation at all sites. Because natural fragmentation is an issue of vegetation *type*, as opposed to *succession*, it is more difficult to affect via management action. In contrast, forest fragmentation resulting from clearcutting was also observed on most sites, and because it is an issue of succession it is more tractable to management. Clearcutting generally does not lead to a type conversion, but rather re-sets succession in a given stand. The dense and brushy vegetation of a vigorously regenerating, early-seral conifer stand is good habitat for snowshoe hares (and hence lynx). However, although brushy early regeneration is common in the wetter forests of Canada, Montana, and Washington, it is somewhat rare in the drier forests of Wyoming and Colorado. Regenerating clearcuts here often do not support the structure or floristics conducive to high snowshoe hare production (Beauvais 2000, Buskirk et al. 2000a, Hodges 2000), and almost never provide good habitat for red squirrel, which is a very important prey species for southern lynx populations (Aubry et al. 2000). We observed very few tracks of snowshoe hare and red squirrel in recent clearcuts surveyed during this study.

Moreover, even the few clearcuts that do achieve early-seral conditions that are appropriate for hare quickly move out of this phase and into a more sterile stem exclusion phase, sometimes achieving the “doghair” configuration observed on several sites during this project. This phase persists for a long time, and holds little value for lynx because it provides minimal forage and cover for snowshoe hares and red squirrels (Buskirk et al. 2000a). Furthermore, removal of large boles during timber extraction usually results in very little coarse woody debris in these mid-seral stands, and lynx depend heavily on coarse woody debris for den sites (Aubry et al. 2000, Squires and Laurion 2000). We observed very few tracks of any species in “doghair” stands surveyed during this study.

In the Central Rocky Mountains, habitat suitability for lynx is likely highest in late-seral stands of conifers. Among other features, late-seral stands typically support multiple tree species, multiple canopy layers (including much foliage in the mid- and understories), dense patches of saplings in tree-fall gaps, large coarse woody debris, and mature trees with high cone productivity. This translates into high abundances of snowshoe hares and red squirrels, as well as abundant den structures (Beauvais 1997, Hodges 2000, Buskirk et al. 2000a). During this study, we clearly encountered the highest numbers of snowshoe hare and red squirrel tracks in structurally diverse, late-seral stands of conifers. Importantly, late-seral stands are more persistent in time than the relatively transient brushy stages of early regeneration. Over time, a timber extraction program that selectively targets late-seral stands probably decreases habitat quality of a given landscape because it eventually places most stands into the persistent and low-quality mid-seral stage.

Thus, based on current knowledge of lynx ecology in the Central Rocky Mountains and observations recorded during this study, good habitat for lynx occurs briefly in selected early-seral conifer stands, and consistently in most late-seral conifer stands (Aubry et al. 2000, Buskirk et al. 2000a, Hodges 2000). The value of such stand types is highest in landscapes with gentle topography and few packed roads and trails. Our 5 lynx observations, however, occurred in 3 separate areas that varied widely in amount of clearcutting, late-seral coverage, topographic roughness, and recreational use. The Big Sandy site (2 lynx observations) had many clearcuts, few late-seral stands, gentle topography, and many snow machine trails. The Pine Creek site (1 lynx observation) also had many packed trails, but was intermediate in both clearcutting and late-seral coverage; it also had rougher topography. The Water Canyon site (2 lynx observations) had few clearcuts, more late-seral timber, gentle topography, and few packed roads and trails. It is difficult to generalize from such limited data. At the very least, our observations suggest that lynx are capable of using a variety of landscapes in this area. However, we hypothesize that more powerful analyses of habitat use based on larger numbers of lynx observations will reveal a preference for late-seral stands on flat sites with relatively few packed trails.

Lynx on Wyoming BLM holdings

The largest amount of suitable, BLM-administered lynx habitat in the state occurs on the southern terminus of the Overthrust Belt/ Wyoming Range (Figure 1) where there is a significant BLM timber base. This area borders what is generally regarded as the best lynx habitat anywhere in the state; namely, USDA Forest Service (Bridger-Teton National Forest) holdings on the Overthrust Belt/ Wyoming Range in northern Lincoln and western Sublette counties. Relative to the rest of the state, this area supports many lynx and much lynx reproductive activity (B. Oakleaf, Wyoming Game and Fish Department, personal communication; Wyoming Natural Diversity Database, University of Wyoming, unpublished data). Also, 3 of the 5 lynx trails recorded during this study were found in this area. Therefore, it is likely that the Wyoming BLM will have the greatest affect on lynx presence and abundance in the state through management actions in this area.

Currently, the persistence of lynx in the Central Rocky Mountains may depend heavily on immigration from population centers to the north and west (McKelvey et al. 2000a, b). In other words, lynx abundance in Wyoming may be largely a result of "spillover" from other areas rather than within-state reproduction. In turn, the presence of lynx on Wyoming BLM lands may result largely from spillover of individuals from the higher elevations of the Overthrust Belt/ Wyoming Range. At first glance this might suggest that management actions on BLM lands in southwestern Wyoming can do little to affect the overall recovery of the regional lynx population. However, excluding the recent reintroduction of lynx in Colorado (the success of which is still in question), this area is the southern extent of current lynx range. Thus maintenance of lynx in this area will not only halt the range contraction seen in recent decades, but will also help establish a front from which emigrating individuals will emerge to re-colonize historic range to the south. Management actions on BLM holdings in this area can clearly contribute to these goals.

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TABLES

Table 1. Common and Latin names of species mentioned in the text.

Animals	
American marten	*Martes americana*
Beaver	*Castor canadensis*
Black bear	*Ursus americanus*
Blue grouse	*Dendrogapus obscurus*
Bobcat	*Lynx rufus*
Coyote	*Canis latrans*
Desert cottontail	*Sylvilagus audubonii*
Domestic dog	*Canis familiaris*
Elk	*Cervus elaphus*
Fisher	*Martes pennanti*
Lynx	*Lynx canadensis*
Mountain lion	*Puma concolor*
Muskrat	*Ondatra zibethica*
Red fox	*Vulpes vulpes*
Red squirrel	*Tamiasciurus hudsonicus*
Snowshoe hare	*Lepus americanus*
White-tailed jackrabbit	*Lepus townsendii*
Wolverine	*Gulo gulo*

Plants	
Aspen	*Populus tremuloides*
Douglas fir	*Pseudotsuga menziesii*
Englemann spruce	*Picea engelmannii*
Limber pine	*Pinus flexilis*
Lodgepole pine	*Pinus contorta*
Subalpine fir	*Abies lasiocarpa*
Whitebark pine	*Pinus albicaulis*
Willow	*Salix* spp.

Table 2. Lynx habitat suitability scores (0 - 6) for cover types identified by Merrill et al. (1996).

SCORE	COVER TYPES
0	Open water / human settlements / surface mining operations / irrigated crops / dry-land crops
1	Active sand dunes / black sagebrush steppe / unvegetated playa / basin exposed rock and soil / Great Basin foothills grassland / mixed grass prairie / short grass prairie / grass dominated wetland / grass dominated riparian / saltbush fans and flats
2	Bitterbrush shrub steppe / desert shrub / greasewood fans and flats / vegetated dunes
3	Basin big sagebrush / Wyoming big sagebrush / bur oak woodland / shrub dominated riparian / mesic upland shrub / xeric upland shrub
4	Mountain big sagebrush / permanent snow / alpine exposed rock and soil / forest dominated riparian
5	Limber pine woodland / ponderosa pine / juniper woodland / aspen / subalpine meadow / meadow tundra
6	Spruce-fir / Douglas fir / lodgepole pine / clearcut conifer / whitebark pine / burned conifer

FIGURES

Determining Canada Lynx (Lynx canadensis) distribution is an important management need, especially at the southern extent of the species range where it is listed as threatened under the U. S. Endangered Species Act. We describe a systematic snowtrack based sampling framework that provides reliable distribution data for Canada Lynx. We used computer simulations to evaluate protocol efficacy.Â The Garnet Range is adjacent to private lands that consist mainly of irrigated hay fields and Big Sage Brush (Artemisia tridentata) â€“ wheat grass (Agropyron spp.) cover types.Â Field test â€“ Wyoming and Salt River Ranges, Wyoming We conducted track-surveys for lynx in Wyoming during the winters of 1999-2000, 2000-2001, 20012002.