LYNX

A STUDY OF SIX SITES IN WESTERN WYOMING

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LYNX STATUS

The Canada lynx (*Lynx Canadensis*) was listed as a threatened species under the provisions of the Endangered Species Act in March of 2000. In the listing, the U.S. Fish and Wildlife Service concluded that the factor threatening the lynx in the contiguous U.S. is the inadequacy of existing regulatory mechanisms, especially the lack of guidance for conservation of lynx in the National Forest Land and Resource Management Plans and the BLM Land Use Plans.

Conservation of this species is further complicated by lack of knowledge of lynx morphology, as well as the very low population densities found within the listing area. The findings of the forest carnivore conservation assessment published by the USDA in 1994 entitled, *The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx and Wolverine in the Western United States* (Ruggiero et al.1994b) stated, "Major information gaps exist for these forest carnivores."(Lyon et al.1994,p.137). Regarding lynx in the western United States, the Assessment read,"…there is a need for the most basic information on habitat relationships, at any spatial or temporal scale and at any level of measurement. Virtually any new data on habitat relationships involving lynx in the western conterminous 48 states would be a substantive increase in knowledge "(Ruggiero et al.1994a,p.142). The Assessment also found the state of knowledge was equally inadequate for all other aspects of lynx ecology in the western United States. In preparation for the proposed lynx listing, the USDA, in 1999, released the most complete and up-to-date compilation of lynx knowledge to date, *Ecology and Conservation of Lynx in the United States* (1999) hereafter called the Science Report. In it, Ruggiero states "Knowledge of lynx ecology in the United States has not improved substantially since publication of the Forest Carnivore Conservation Assessment in 1994: there have been no new research findings published on lynx ecology in the United States."

The Science Report also stated "Understanding the ecology of lynx in Wyoming is critical to conservation planning because these animals represent the southernmost known population.

Although a considerable amount is known about lynx ecology in northwestern Canada and Alaska, the Science Report cautions that the applicability of this information to ecosystems in the western United States is unknown, and potential ecotypic variation in lynx populations warns against the application of this information in the western United States (southern) portion of the lynx 's range (Ruggiero et al.1994a).

Lynx habitat in the higher latitudes (northern Canada and Alaska) is composed primarily of large expanses of homogeneous taiga. There, lynx reach their greatest densities, with populations undergoing large 10-year cycles in delayed synchrony with snowshoe hare populations.. In contrast, lynx habitat in the contiguous United States is extremely heterogeneous, with large variations in site conditions, fire regimes and forest types over short distances. The inherently fragmented nature of lynx habitat in the southern portions of it range contribute to divergent influences from climate, natural and man-caused disturbance regimes, forest successional pathways, prey abundance and competition. (Ruggiero et al. 1999)

In general, it has been found that demographic characteristics of lynx in the contiguous United States, such as low densities, low pregnancy rates, small litter sizes and high kitten mortality, as well as large home range sizes, are similar to those reported during the low phase of the snowshoe hare cycle in the more northern latitudes (Koehler 1990, Apps 2000, Ruggiero et al. 1999).

While lynx populations in the southern portion of it range have always been much lower density that in the taiga, southern populations seem to have declined rapidly over the last 30 years. One trapper from Pinedale, Wyoming stated of his experiences trapping lynx in the Wyoming Range during the winter of 1972-1973 "They were easy to trap. Once we found a track, we had a cat the next weekend,". That winter, he trapped 13 lynx, mainly from one drainage in the northern end of the Wyoming Range. Tom Laurion, lynx researcher for the Wyoming Game and Fish Department, commented that in his experience lynx are getting harder and harder to find with each passing year. Bob Oakleaf, nongame coordinator for the Wyoming Game and Fish Department said recently "Every ecological change that's happened in the last 30 years has to be considered detrimental to the lynx."

This population decline makes gathering the site-specific knowledge necessary for species recovery, all the more difficult to obtain and all the more urgent.

RISK FACTORS AFFECTING LYNX VIABILITY

The *Canada Lynx Conservation Assessment Strategy* (Ruediger et al, 2000) identified potential risk factors for lynx in the contiguous United States. These include programs, practices and activities that may influence lynx or lynx habitat.

I. Factors Affecting Lynx Productivity
- A. Timber Management
- B. Wildland Fire Management
- C. Recreation
- D. Forest / Backcountry Roads and Trails
- E. Livestock Grazing
- F. Other Human Developments (Oil and Gas Leases, Mines, Reservoirs, Agriculture)

II. Factors Affecting Lynx Mortality
- A. Trapping (legal and non-target)
- B. Predator Control
- C. Incidental or Illegal Shooting
- D. Competition and Predation as Influenced by Human Activities
- E. Highways (vehicular collisions)

III. Factors Affecting Lynx Movements
- A. Highways, Railroads and Utility Corridors
- B. Land Ownership Pattern
- C. Ski Areas and Large Resorts

IV. Other Large-Scale Risk Factors
- A. Fragmentation and Degradation of Lynx Refugia
- B. Lynx Movement and Dispersal Across Shrub-Steppe Habitats

C. Habitat Degradation by Non-native Invasive Plant Species

In the later sections describing the observations at each study site, we will discuss the principal risk factors that are present on each site.

STUDY PROTOCOL

The study consisted of 2 tracking sessions on each site separated by 40 days. The first session consisted of 2 person-days of tracking and the establishment of 1 baited remote-camera station, followed in approximately 40 days by the second session of 2 person-days of tracking and retrieval of the camera station. Data was recorded for all confirmed or possible tracks of Canada lynx, wolverine (*Gulo gulo*), and fisher (*Martes pennanti*) as well as general weather conditions, tracking quality, date and amount of most recent snowfall, snow-tracking route, general habitat suitability relative to Canada lynx and other forest carnivores and prey species. In addition general information was noted on other forest carnivores as well as relative abundance of prey species.

The study protocol did not utilize a specific transect method, but rather used skis or if suitable, snowmachines to cover as much of the suitable Canada lynx habitat in each study site as possible. The camera site was placed within good habitat areas that displayed relatively high prey densities.

STUDY SITES

The 6 study sites were chosen using suitable Canada lynx habitat forest types, historic lynx populations and other factors overlaid on BLM administered lands.

1) Hams Fork – Kemmerer FO, southern Wyoming Range
2) Scab Creek – Pinedale FO, west slope central Wind River Range
3) Big Sandy – Rock Springs FO, west slope central Wind River Range
4) Blucher Creek – Rock Springs FO, west slope southern Wind River Range
5) Lander – Lander FO, east slope southern Wind River Range
6) Grass Creek – Worland FO, east slope Absaroka Range

The study sites covered the whole range of habitat conditions from Site #2, Scab Creek, a Wilderness Study Area that has been administratively protected for many years and is in excellent condition with a diverse forest structure, excellent temporal stability and good prey base, to Site #3, Big Sandy and Site #4 Blucher Creek which is in poor condition having been heavily impacted by timber management. These two sites (#3 and #4) had predominately a monoculture of doghair lodgepole pine, and except for a few uncut areas or in regenerating stands that had not self-pruned above 2-3' had a very limited prey base. Other sites were in-between these two extremes.

SNOW TRACKING QUALITY

The snow pack this year was unusually poor for tracking as well as travel. All of the areas studied were generally around 50-65% of the 20-year average. Much of the snow fell early in the season followed by a long, cold spell. The vast temperature differential between the warm ground and below normal air temperatures created depth hoar out of the entire snow pack. For instance, in the deepest snow found, in the higher elevations of site #2 Scab Creek, the snow pack was between 32 and 40", from December through February, a person on skis would sink to within only a few inches of the ground. This lack of resistance to penetration, large crystal size and lack of internal cohesion made finding clear prints rare. In order to judge the depth a typical lynx would sink in such conditions, a 5 lbs. weight was dropped from 6" onto the handle of a ski pole with a basket 5" in diameter. While the 5" diameter basket is larger than a lynx foot it gave a general indication of how far a lynx would sink. Depending on conditions it generally sank between 1 to 2', sometimes it would sink to within a few inches of the ground.

OBSERVATIONS

SITE #1 - HAMS FORK

This site, located approximately 20 miles north of Kemmerer, Wyoming in the Kemmerer Field Office, ranged in elevation from about 7,600' to 9,275' on South Fork Mountain. The Hams Fork site lies at the southern terminus of the Wyoming Range where the main spine of the range, Commissary Ridge subsides into the surrounding shrub-steppe. Much of this site was composed of stringers off of the more contiguous forested lands to the north managed by the Forest Service. Much of the site was in very good condition. With the exception of three large clearcuts at the head of Boney Canyon, little vegetative manipulations were evident. Much of the upper elevation areas as well as the east face of South Fork Mountain has a diverse forest structure with mature and old growth spruce/fir and small scale gaps from downed trees. This large woody debris combined with brush in the gaps provided excellent lynx denning habitat, as well as outstanding snowshoe hare and red squirrel habitat. Two areas in this site had apparent hare densities equal to those found on the home range of the collared male lynx in the northern end of the range. Many other areas also had significant hare and squirrel densities.

This photo, taken from the camera station located at N42 04.722 W110 34.339 on the ridge of South Fork Mountain exhibited some of the highest hare densities:

Large woody debris in the northern portion of the site:

On the east face of South Fork Mountain there were also significant hare and squirrel densities. This photo taken shortly after a snowfall, at the crown of a newly downed spruce shows extensive hare utilization:

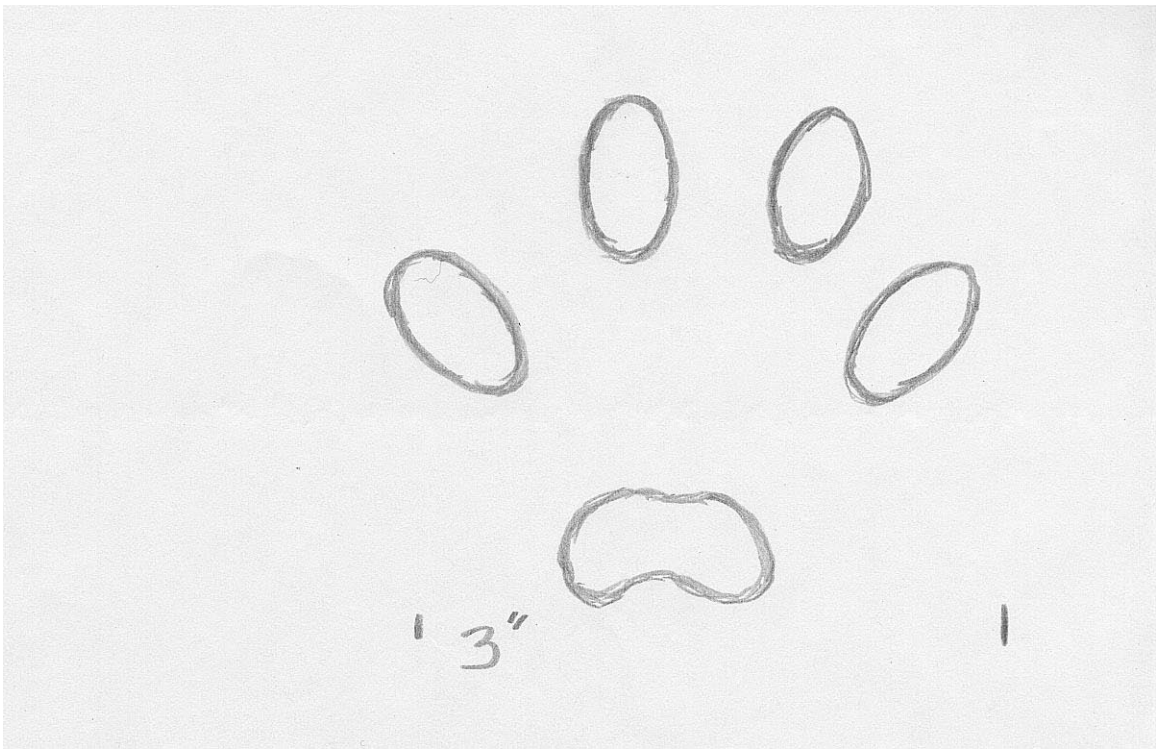
The largest concentration of bobcat tracks were in a strip of spruce/fir along the head of Boney Canyon, pictured below. This strip left at the bottom a string of clearcuts on the eastern flank of Boney Canyon also exhibited high hare and squirrel densities. The canyon also serves as easy access from the lower elevations as there was a significant amount of travel up and down the canyon. Unfortunately the locations of these timber harvests eliminated a significant foraging area. For future timber activities, a thorough winter survey of the planning area would alert land managers of site specific characteristics and considerations, and would thereby reduce impacts to forest carnivores and their prey.

Of concern to the maintenance of productive hare habitat, is the widespread observation of excessively browsed brush and tree species. Many areas exhibited a significant number of saplings 3-6' tall that had developed 'medusa heads' and subsequently died. These sapling had grown up fairly undisturbed but then had their new growth repeated browsed to the stem for 3-5 years, creating a spiky ball at the top of the stem. Due to snow

accumulation, the condition of lower growing brush was not always able to be seen. The photos below show typical characteristics of excessive browsing found on the site. Excessive ungulate browsing reduces summer food for hare as well as contributes to long-term changes in forest structure. These impacts could be caused by over-population of deer and elk exacerbated by over-grazing by domestic livestock. In this site, as well as all the other sites studied, all the aspen stands were in poor condition. Very little regeneration was present and most of the stands were being taken over by conifers.

Bobcat tracks were by far the most common predator detected, followed by coyotes. No wolverine, fisher or marten tracks were seen. While the lack of fisher is not surprising, finding no marten tracks in this survey or in the surveys conducted by Dr. Gary Beauvais in other sites in the Wyoming Range is something that should be looked into. Only one set of mountain lion tracks were seen in this site.

The only possible lynx track found, Lynx track Set #1, on this site was seen approximately 600' from the first camera station. Only one print was found on a short section of firm windslab. The tracks in either direction, had been covered by drifting snow. Unfortunately no photo was obtained for this track. Below is a sketch of the print. While the total print size is similar to a mountain lion, the much smaller interdigital pad as well as the fact that print impression was less than ¼" would suggest lynx. Note that due to the firmness of the windslab, no impression was made by the foot hair causing smaller track width than would be normal in snow.



A second camera station was set up at N42 5.42 W110 35.43. Film will be collected from this station in June 2001.

PRINCIPAL RISK FACTORS:

I A. Timber Management – While much of the site has had little recent timber management, there are a number of clearcuts in Boney Canyon as well as the Forest Service lands to the north and east of Boney Canyon. This area provides the main habitat corridor between the site and the more extensive habitat base to the north. This area has high densities of prey species and in general good forest structure. Careful study of this area should be done before further timber activities are conducted in this area

I E. Livestock Grazing – While the condition of surface vegetation could not be determined, the evidence pointing to excessive grazing/browsing impacts should be studied more thoroughly to assess effects.

II A., B. and C. Trapping, Predator Control, Shooting – While direct impacts to lynx will be difficult to document, there are probably numerous instances of unreported, illegal take throughout the Wyoming Range.

II D. Competition and Predation as Influenced by Human Activities – This site is particularly vulnerable to interspecific competition due to the naturally fragmented nature of the forest structure and the open ridges sloping down to the lower elevations. These ridges receive strong winds, preventing deep snow accumulation and allowing bobcats, coyotes and mountain lions access to many parts of this site.

SITE #2 - SCAB CREEK

This site located 10 miles east-northeast from Boulder, Wyoming, ranges in elevation from 8,000 to 9,600'. It borders on the east and north with the Bridger Wilderness and has had BLM Wilderness Study Area designation for some time. The biodiversity and range of forest structure was by far the greatest of any of the sites studied. The western face of the site was generally very steep with many rock outcrops.

The lower to mid elevation areas of this western face are excellent mountain lion habitat and three separate sets of lion tracks were observed. Bobcats were also numerous on this site, with a total of 5 separate sets found, 4 in the low to mid elevation areas and one in the higher elevations. 3 sets of marten tracks were found in the mid to higher elevations. No lynx tracks were found. Coyote tracks were observed only on the lowest elevations of this site in the ungulate winter range areas.

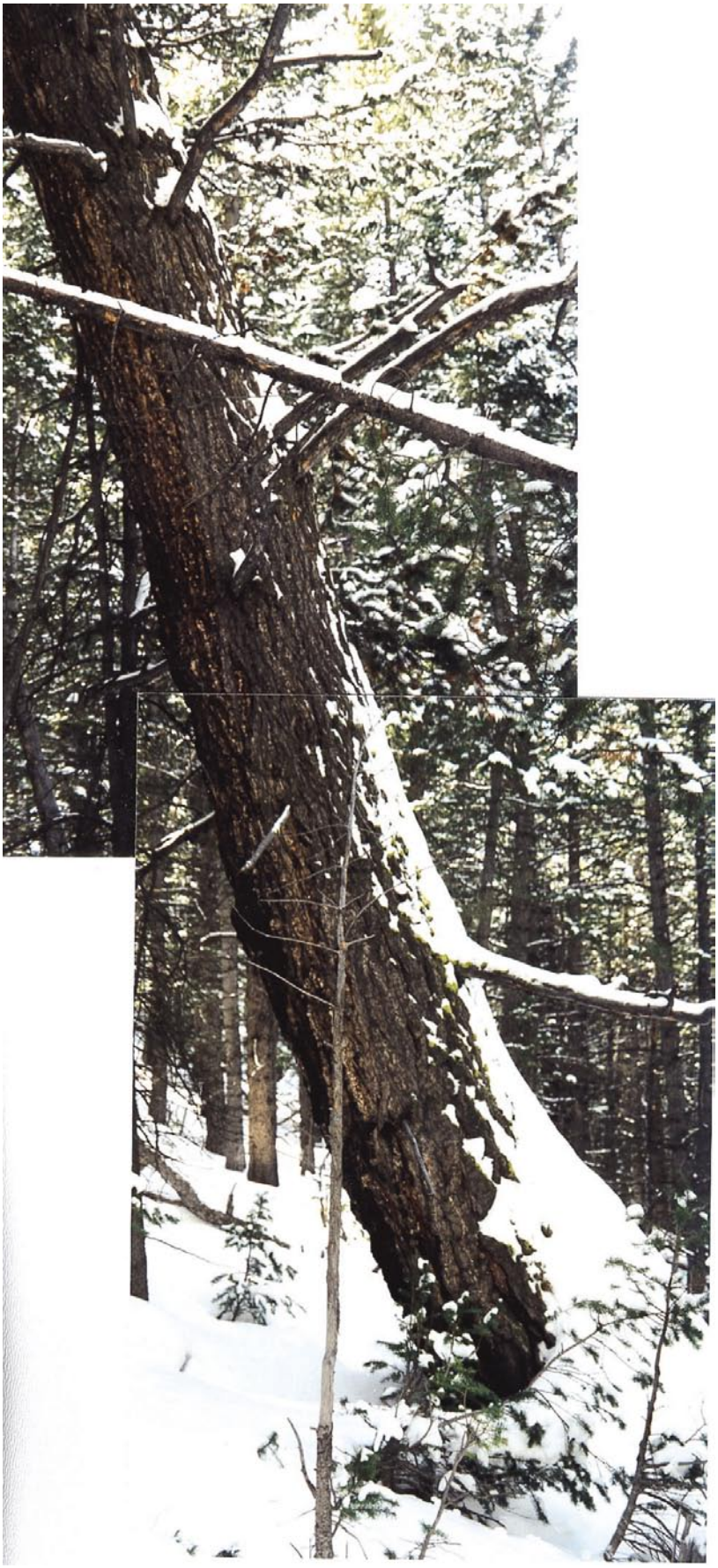
This site received fewer miles of surveys than other sites due to no motorized access, large elevation changes and very difficult snow conditions for travel. No evidence of winter human use was noted due to the difficulty of winter access. The area to the west of the site is a state elk feedground and protected from human intrusion during the winter months, with the rest of the area accessed only with permission through private property.

Due to the long-term protections in place on this site, natural disturbance regimes predominate. A wide variety of forest types and structures were found, ranging from open aspen stands, and young lodgepole to old-growth spruce/fir. This site exhibited the highest densities of red squirrels of any of the sites. Densities were highest in the old-growth areas where piles of torn apart cones often reached a foot or more above the snow and large areas were covered with the remains of chewed cones (further discussion of the importance of red squirrel populations to lynx in its southern range will be dealt with in a later section). The natural disturbance regimes in the old-growth areas created small gaps with lots of woody debris from the downed tree or trees as well as dense understory. This forest structure contained the highest densities of both red squirrels as well as snowshoe hare. While apparent hare densities were somewhat less than areas of regenerating stands, the large numbers of squirrels must be considered in the equation. This gap-phase old-growth forest structure is also the most temporally stable of forest structures, which in turn provides protection to resident species from stochastic events and other detrimental influences. This gap-phase structure gave this site a much broader range of habitat and structure than other sites, this broader range led to a more diverse biotic community. Such a diverse biotic community is inherently more stable.

A camera site was set up at UTM 0622104 4733369. Upon return to the site at the end of the second session no photos had been taken so the station was reset with a different camera, which will be picked up in June, 2001.

The picture below is a representative shot from the site, such varied aged stands were common. Due to the lack of disturbance, these stands had a much higher ratio of spruce/fir to lodgepole than other sites. Areas such as these were almost exclusively spruce/fir, which are much slower to self-prune than lodgepole and hence created denser horizontal cover. A greater range of species was found in these areas than in stands predominantly of lodgepole.

Significant areas of the site had trees such as this one, which was 5 ½’ DBH.



In the higher elevation areas with more wind disturbance, the frequent stand structure was similar to this picture, small, dense stands of spruce/fir surrounding and interspersed among mature and old growth spruce/fir. This stand structure provided excellent cover for prey and was used extensively by hare and squirrels.

PRINCIPAL RISK FACTORS:

I E. Livestock Grazing – While the condition of surface vegetation could not be determined, grazing/browsing impacts should be studied more thoroughly to assess effects.

II A., B. and C. Trapping, Predator Control, Shooting – While direct impacts to lynx will be difficult to document, there are probably numerous instances of unreported, illegal take throughout the western Wyoming.

II D. Competition and Predation as Influenced by Human Activities – This site has significant numbers of mountain lion as well as bobcat, which may be affected by a lack of other predators. More information on these relationships is needed.

SITE #3 – BIG SANDY

This site, located 24 miles east south-east of Boulder, Wyoming ranges in elevation from 8,000 to 9,200'. The general topography at this site was fairly flat to rolling, with the only significant slopes at the far western portion off of Muddy Ridge. This site has a significant percentage of its area under past or present timber projects. As this site had such prevalent disturbance over the last 50 years, lodgepole was the primary tree species, accounting for approximately 75%, with aspen stands approximately 15% of the area. Much of the site was doghair lodgepole between 30 and 45 years old. In many of these stands the average DBH was 4-5", average height was 35', with self-pruning of all but the top 3-4' of branches. These type of stands offer little potential for timber production and provide little, if any, habitat for wildlife species. While traveling through these type of stands one could go for a mile without seeing a track of any kind. More discussion of lodgepole and its structural and temporal relation to lynx habitat and their prey, will be held in a later section.

Due to its considerable timber harvests, this site exhibited an extensive network of roads. This site is due south of the Continental Divide Snowmobile Trail which runs along the south end of the range. All roads within the site, shown on the 7.5 minute USGS maps, are used extensively in the winter by snowmobiles. Many of the unmapped roads, as well as open areas, are also used extensively. Coyote tracks were frequently encountered on snowmobile trails throughout this area. This corroborates the findings of the Science Report regarding the entry of lynx competitors (coyotes, in this instance) via human-induced snow compaction into areas that, due to snow depth, they would normally be excluded.

Camera station placement was difficult due to lack of prey abundance anywhere on the site. No significant pockets of snowshoe hare or red squirrels were found. The camera station was set up at N43 36.369 W109 18.631. No photos where taken by the camera.

No lion tracks were found even though the southern portions of the site were not far from ungulate winter range areas. Tracks of 1 bobcat were found on the eastern portion of the site. Coyote tracks were common on most of the snowmobile trails. No marten tracks were found on the site, but 3 sets of marten tracks were found on Forest Service lands not far from the site. In general the Forest Service lands exhibited less recent timber harvest activities than the BLM lands and the doghair lodgepole stands on Forest Service lands tended to be a little older than those on the BLM administered lands.

Two sets of possible lynx tracks were found, both within 1.25 miles of each other, presumably by the same individual. One from the first session December 28, 2000 and the other from the second session February 18, 2001. Track measurements and site details are listed in the appendix. Lynx Track Set #2 was found ¼ mile east of the camera station walking down hill parallel to and on a logging road. Tracks were made before the previous snowfall, so only stride and straddle could be determined exactly, close approximation of track measurements were also taken. Photos from these tracks did not develop. This set of tracks was followed for approximately 1,500' to try to find further evidence but no clearer tracks or other evidence was found. The line of travel was basically straight through a strip of aspen along the edge of the stand of lodgepole where the camera station was set up, no sign of hunting was found. The picture below was taken at the end of this stand. While the trail measurements fit well with commonly accepted

lynx characteristic, the poor snow quality and 2” of newer snow on top preclude a certain identification.

Lynx Track Set #3 was found 1.25 miles south south-west of Lynx Track Set #2 in an area between two recent clear-cuts. This set of tracks was more recent when found (estimated within 24-hours) than Lynx Track Set #2 and more details were available. Even in protected areas with little loose snow, only subtle toe or interdigital pad details were seen (see right photo on page 19), as would be expected for a mid-winter lynx print. All mountain lion tracks found on any of the sites displayed clear, distinct and deep toe and interdigital pad impressions even a few days after the tracks had been made. The individual frequently walked under immovable objects which would have been more difficult for a mountain lion. This trail was followed for approximately 1,500’. For the most part the individual had been following a creek bed that had not been logged, up to a low ridge. Tracks were found late in the day, so some of the pictures were taken the first day, but there was not time to do a thorough recording of the trail and the site was

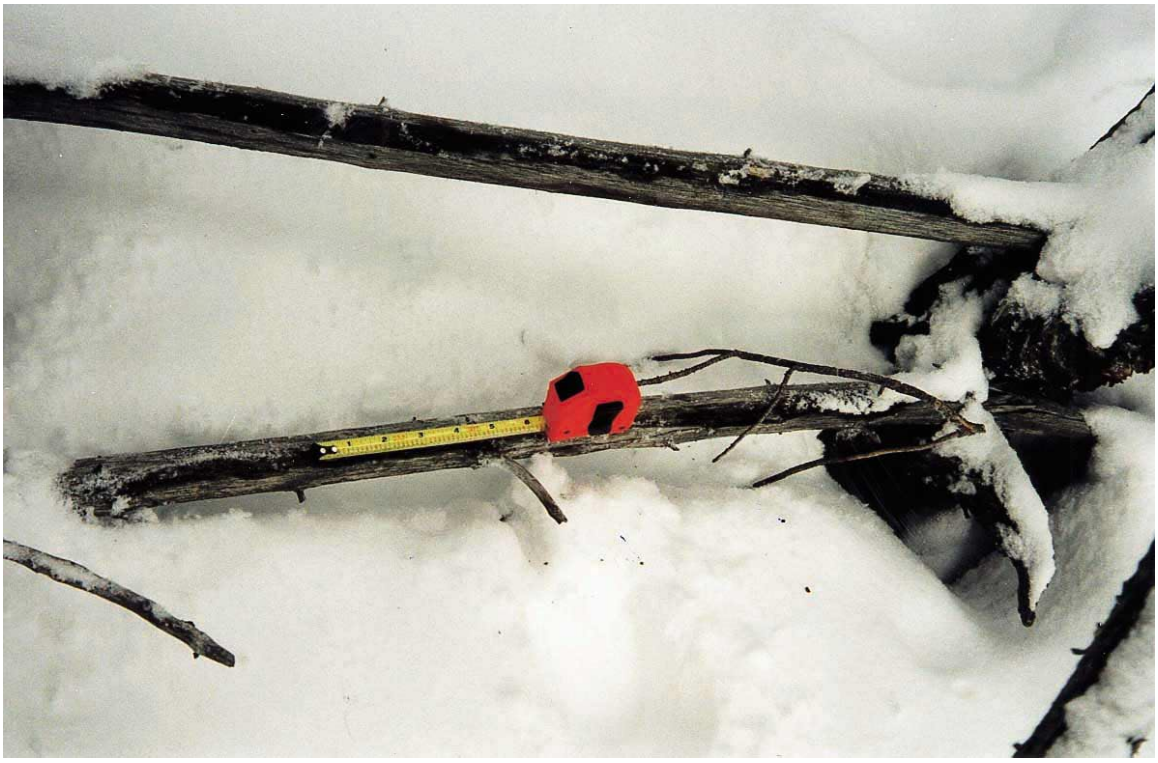
returned to the next morning for a more complete documentation. During the night 2” of snow fell. Picture below is at the top of the clear-cut, tracks coming from left.

The following two pictures are of the same two tracks, one from directly above (left) to show track measurements, and the other with a horizontal view showing that the individual easily walked under a thick branch only 15' above the track surface (not snow surface).

This picture is a typical representation of the trail.

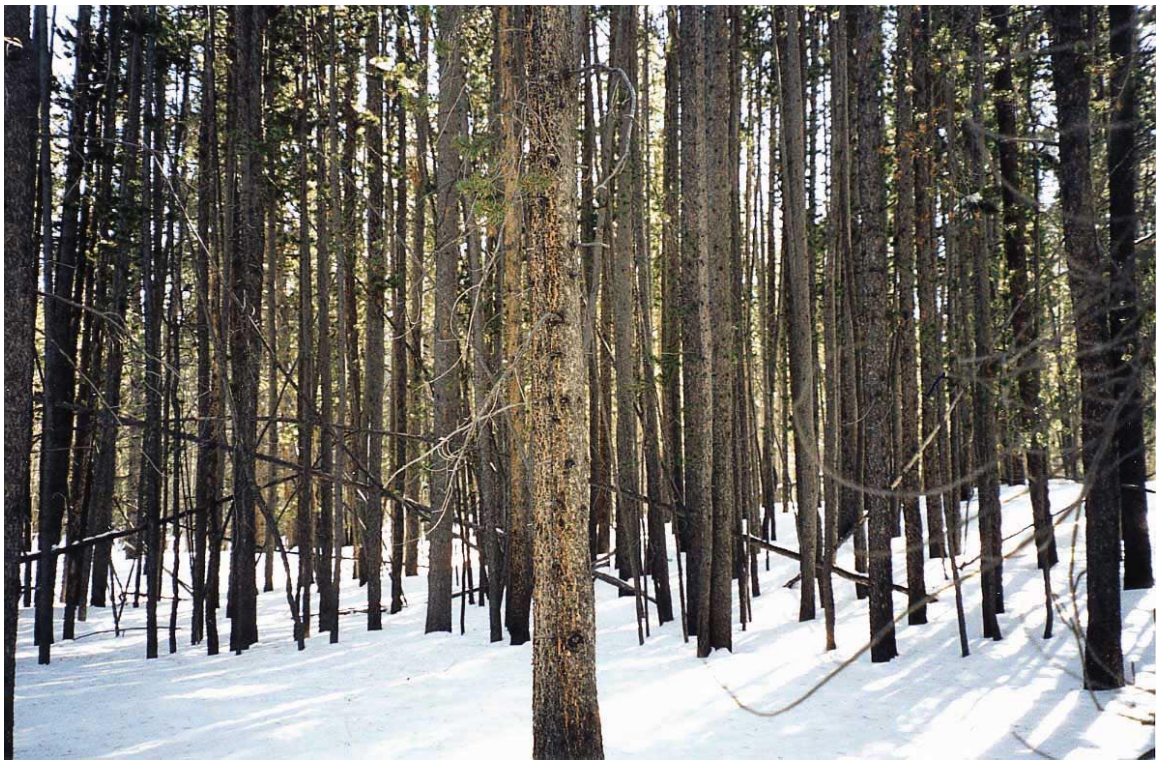
Approaching a small patch of cover used by hare, the individual walked along this downed tree (top) and then jumped down and walked through the branches of the downed tree where there was evidence of hare use (bottom left and right).

Continuing west the individual walked along these downed saplings. If it had been a full sized mountain lion (>140 lbs.) the smaller one (top) would have broken under the weight.



Typical tracks in deeper snow.

The following three pictures are representative of the site. The top picture is looking north from the tracks, middle is a clear-cut 1,500' north of the tracks, and bottom is clear-cuts and snowmobile usage 1/2 mile north of track site.



PRINCIPAL RISK FACTORS:

I A. Timber Management – Cumulative impacts from timber removal on this site are high. Nearly the entire site is in early successional stages, either too recent to provide cover and food for snowshoe hare or already self-pruned well above snowline. No mature stands are available to provide habitat for red squirrels, resulting in neither of the 2 primary prey resources being significantly available. No further timber harvest activities should be conducted in this area and efforts should be made at habitat restoration. Within the study site is also a section of State land which had recently been clear-cut. There are areas within the site that are marked for firewood cutting as well.

I E. Livestock Grazing – While the condition of surface vegetation could not be determined, the evidence pointing to excessive grazing/browsing impacts should be studied more thoroughly to assess effects.

II A., B. and C. Trapping, Predator Control, Shooting – While direct impacts to lynx will be difficult to document, there are probably numerous instances of unreported, illegal take throughout the western Wyoming.

II D. Competition and Predation as Influenced by Human Activities – This site shows significant evidence of the presence of coyotes due to snow compaction from the wide-spread use of snowmobiles. Bobcats also used these packed surfaces to access areas that normally would require large expenditures of energy.

III B. Land Ownership Patterns – While most of the area is BLM or Forest Service lands, the state section in the middle of the site requires coordination with the State on management issues.

IV A. Fragmentation and Degradation of Lynx Refugia – This risk factor must be considered as much of the southern portion of the Wind River Range outside of designated Wilderness areas have similar impacts.

SITE #4 – BLUCHER CREEK

This site, located 37 miles east south-east of Boulder, Wyoming ranges in elevation from 8,000 to 8,640'. The general topography at this site was fairly flat to rolling, with the only significant slopes along the Sweetwater River gorge. This site has a significant percentage of its area under past or present timber projects. Due to the prevalent disturbance over the last 50 years, lodgepole was the primary tree species, accounting for approximately 75%, with mature aspen stands, with little to no regeneration, in approximately 15% of the area. Much of the site was doghair lodgepole between 30 and 45 years old. In many of these stands the average DBH was 4-5", average height was 35', with self-pruning of all but the top 3-4' of branches. These type of stands provide little, if any, habitat for wildlife species. While traveling through these type of stands one could go for a mile without seeing a track of any kind. More discussion of lodgepole and its structural and temporal relation to lynx habitat and their prey, will be held in a later section.

Due to its history of timber harvests as well as grazing activities, this site exhibited an extensive network of roads. The Continental Divide Snowmobile Trail runs through the length of the site and heavy snowmobile use was found throughout the area. All roads within the site, shown on the 7.5 minute USGS maps, are used extensively in the winter by snowmobiles. Many of the unmapped roads, as well as open areas, are also used extensively. Coyote tracks were frequently encountered on snowmobile trails throughout this area. This corroborates the findings of the Science Report regarding the entry of lynx competitors (coyotes, in this instance) via human-induced snow compaction into areas that, due to snow depth, they would normally be excluded.

Camera station placement was difficult due to lack of prey abundance anywhere on the site. No significant pockets of snowshoe hare or red squirrels were found. The camera station was set up at N42 33.640 W109 07.485. Only one photograph of a moose was taken by the camera.

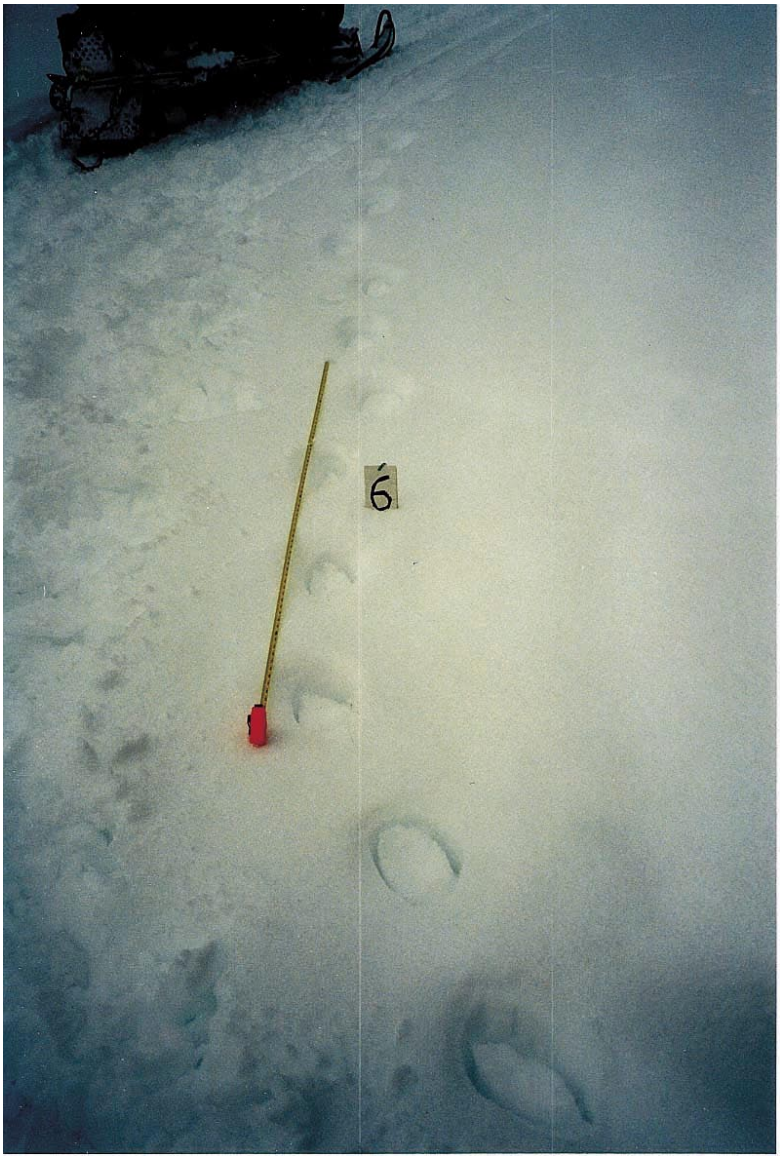
Lion tracks were found along Blucher Creek and the southern section of the Sweetwater River. Tracks of 2 bobcats were found on the western portion and southern portions of the site. Coyote tracks were common on most of the snowmobile trails. Two sets of marten tracks were found in a mature stand of lodgepole-spruce-fir near Blucher Creek.

Two sets of possible lynx tracks were found. Track measurements and site details are listed in the appendix. Lynx Track Set #4 was found on Forest Service land about halfway between the Big Sandy site and Blucher Creek site. No photos of this track set developed. While trail measurements fit well within the accepted range for lynx, due to snow conditions a certain identification could not be made. This set of tracks was followed for approximately 300' to try to find further evidence but no clearer tracks or other evidence was found.

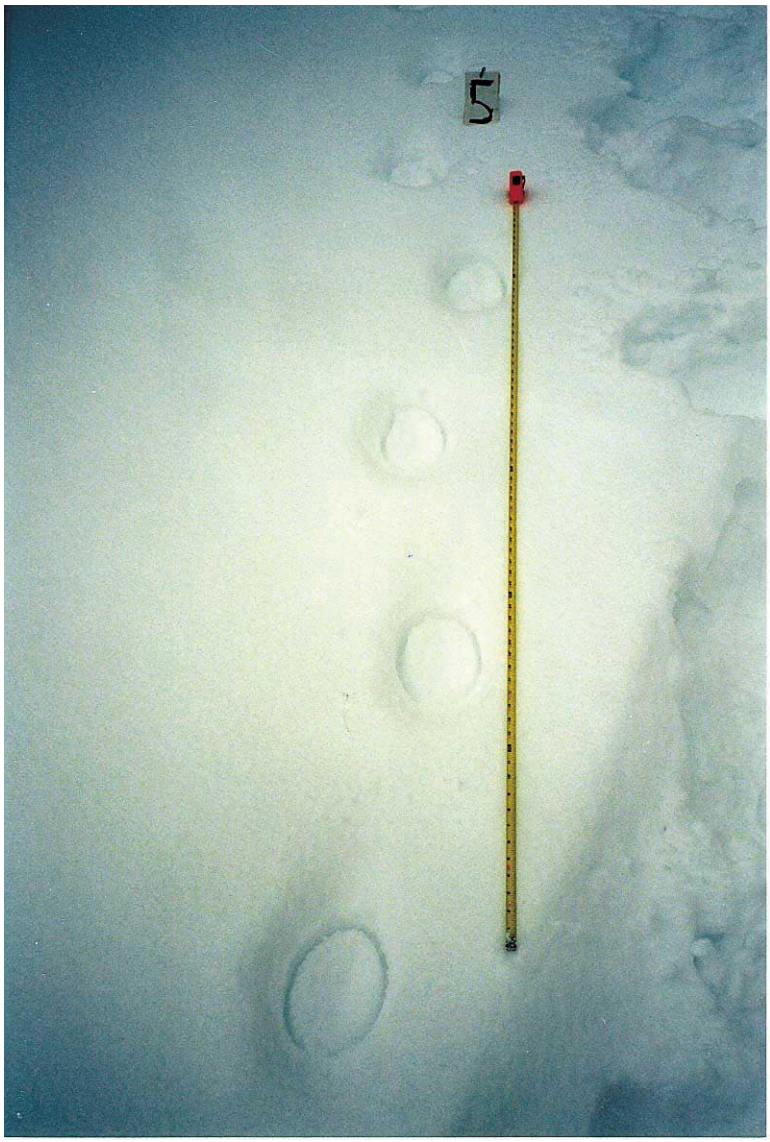
Lynx Track Set #5 was found following a small tributary of the Sweetwater River as it crossed the main access road into Sweetwater Gap and the upper Sweetwater

Campground. The tracks were made just before the previous night's snowfall of 2", this covered small details of the prints but track outlines were clear. On some of the photos, a pencil was used to highlight the edges of each track to provide contrast for the pictures. The tape measure in each photo is 6'. The individual was following the willow thickets along the creek bed.

The photo below left, shows tracks as they exit the willows and cross the road. Direction of travel is from bottom to top. On right a closer detail of the same set of tracks.



Tracks as they exit willows, left overview, right detail. Direction of travel is top to bottom.



Tracks through willows, direction of travel top to bottom.

The tracks were followed up stream (opposite direction of travel) for approximately 1,200' to where the individual had climbed down from walking on the top rail of a buck and rail fence for approximately 900' from the stand at the other end of the clearing.

PRINCIPAL RISK FACTORS:

I A. Timber Management – Cumulative impacts from timber removal on this site are high. Nearly the entire site is in early successional stages, either too recent to provide cover and food for snowshoe hare or already self-pruned well above snowline. Few mature stands are available to provide habitat for red squirrels, resulting in neither of the 2 primary prey resources being significantly available. No further timber harvest activities should be conducted in this area and efforts should be made at habitat restoration.

I E. Livestock Grazing – While the condition of surface vegetation could not be determined, the evidence pointing to excessive grazing/browsing impacts should be studied more thoroughly to assess effects.

II A., B. and C. Trapping, Predator Control, Shooting – While direct impacts to lynx will be difficult to document, there are probably numerous instances of unreported, illegal take throughout the western Wyoming.

II D. Competition and Predation as Influenced by Human Activities – This site shows significant evidence of the presence of coyotes due to snow compaction from the wide-spread use of snowmobiles. Bobcats also used these packed surfaces to access areas that normally would require large expenditures of energy. Much of this site is a snowmobile 'play area' and snowmobile trails were widespread throughout the study area and up into Forest Service land.

IV A. Fragmentation and Degradation of Lynx Refugia – This risk factor must be considered as much of the southern portion of the Wind River Range outside of designated Wilderness areas have similar impacts.

SITE #5 – LANDER

This site, located 10 miles west of Lander, Wyoming, ranges in elevation from 6,800' near the bottom of North Fork Canyon to 10,400' near the top of Cyclone Pass. The general topography at this site was moderately sloping, the main slope of the site was a continuous, smooth, raised block. This site has a significant percentage of its area under past or present timber projects. Due to the prevalent disturbance over the last 50 –100 years, lodgepole is the primary tree species, accounting for approximately 95% of the mid elevation stands (Band #2). The lower elevations (Band #1) are approximately 40% lodgepole , 40% spruce/fir and 20% mature aspen stands. As observed at other sites, the aspen stands showed little to no evidence of reproduction and a significant percentage of the members of most stands were dead or dying. The higher elevations (Band #3) were a mix of spruce/fir and limber/whitebark pine, with increasing densities of the pine species in the highest elevations. Primary prey species were not found in high densities anywhere on this site, but the areas with the greatest densities relative to this site where in the lower elevation band of spruce/fir before its transition to lodgepole, Band #1 and Band #3. In Band #1, red squirrels as well as snowshoe hare, were found in the remnants of mature spruce/fir. The next band higher, Band #2, the lodgepole band was similar to the lodgepole stands on other sites with doghair lodgepole between 30 and 45 years old. In many of these stands the average DBH was 4-5", average height was 35', with self-pruning of all but the top 3-4' of branches. These types of stands provide little, if any, habitat for wildlife species and rarely were any tracks observed in this elevation range. Above the lodgepole band, into the mix of spruce/fir and limber/whitebark pine, Band #3, primary prey species became more abundant. The camera station was setup at UTM 0666052 4740127 and 2 sets of marten tracks were found in this area. No target species were photographed by the camera.

With the exception of these remnant stands of mature and old-growth spruce/fir in the lower elevations, the stands in the other bands of the site were all of similar age. This site

was characterized by a strong homogeneity in topography, stand types and ages within each elevation band.

This site has the second lowest road densities of the 6 sites studied and very little evidence of winter recreational usage was observed. The area is protected during the winter months from most snowmobile usage due to the winter range and feed grounds closures located adjacent to the east side of the site. This limits legal access to the area mainly from the road from Sinks Canyon to Shoshone Lake which is rather difficult to snowmobile on.

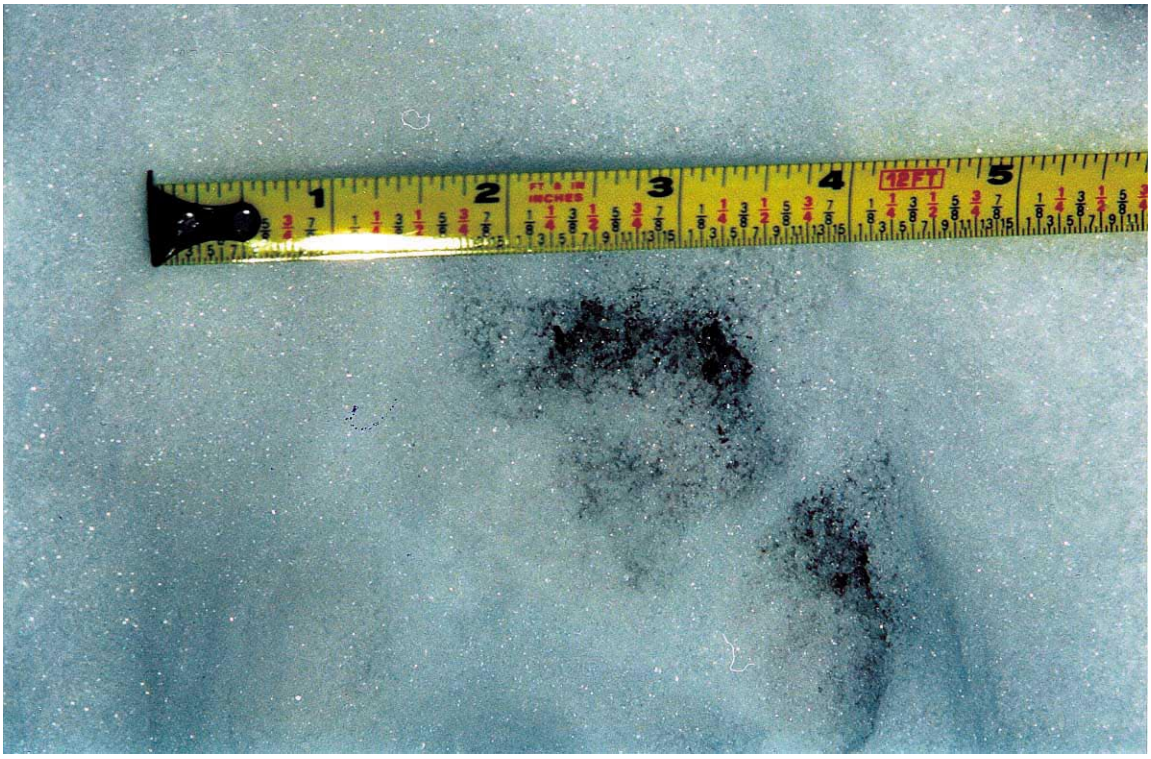
Lion and bobcat tracks were found throughout the lower elevations of the site and the adjoining winter range areas. Coyote tracks were also seen in these lower elevation areas.

Due to the rain shadow effect from the spine of the Continental Divide, this site generally had less snow accumulation than the other 4 sites discussed previously. The maximum snow depth at 10,400' was about that of the other sites at 8,500-9,000'.

No lynx tracks were observed at this site.

The picture below is representative of the mid to lower elevation bands.

One of the many large mountain lion tracks found in the lower elevation areas.



Mature spruce/fir stands in the lower elevation band. Note snow depth at this elevation of 9,000'. Finding most of the remaining mature spruce/fir stands on the site marked for cutting, we inquired with Bob Oakleaf of the Wyoming Game and Fish Department and were told that the sales were canceled due to complaints from residents along the road into Lander about dust from the logging trucks.

PRINCIPAL RISK FACTORS:

I A. Timber Management – Cumulative impacts from timber removal on this site are high. Much site is in early to mid successional stages, the lodgepole stands are already self-pruned well above snowline creating no usable habitat in the middle band of the site. Few mature stands are available to provide habitat for red squirrels, resulting in neither of the 2 primary prey resources being significantly available. A thorough, best science-based analysis of any further timber harvest activities should be conducted in this area and efforts should be made at habitat restoration.

I E. Livestock Grazing – While the condition of surface vegetation could not be determined, the evidence pointing to excessive grazing/browsing impacts should be studied more thoroughly to assess effects.

II A., B. and C. Trapping, Predator Control, Shooting – While direct impacts to lynx will be difficult to document, there are probably numerous instances of unreported, illegal take throughout western Wyoming.

IV A. Fragmentation and Degradation of Lynx Refugia – This risk factor must be considered as much of the southern portion of the Wind River Range outside of designated Wilderness areas have similar impacts.

SITE #6 – GRASS CREEK

This site, located 22 miles south of Meeteetse, Wyoming ranges in elevation from 7,200 to 10,010’ at the top of Castle Rocks. The general topography at this site was fairly steep

with V cut drainages, in most areas, with the far south-western areas near Castle Rocks having quite dramatic relief with 2 or 3 cliff bands between the creek bed and the ridgelines. This site was, by far, the driest of the six sites studied. Snow depth was zero on south and south-west slopes and on other aspects up to 9,000' had a maximum of approximately 12" of snow. Grass Creek which is the major drainage of the area collecting runoff from an area of approximately 175 sq. miles shows few signs of major spring runoff and judging from the channel structure peak flows are rather small. Due to the low snow depth and the snowless south and south-west facing slopes, ungulate tracks were found in most parts of the site. Also lynx competitors such as bobcats, mountain lions and coyotes could easily access all parts of the site. This lack of snow depth eliminates the competitive advantage lynx have over these other predators in areas that receive sufficient snow accumulations. The site is naturally highly fragmented, with no large blocks of contiguous stands.

While not as heavily utilized as the Big Sandy and Blucher Creek sites, this site has a significant percentage of its area under past or present timber projects. Much of the forested portions of the site were spruce/fir with lodgepole in the higher elevations bordering the Shoshone National Forest. The aspen stands were similar to those of other sites, mature trees with little to no regeneration. In an exclosure constructed 7 years ago which divided a small aspen stand near Grass Creek, dense regeneration was present, while outside the exclosure no new growth was evident. Tree lichen was fairly heavy in most of the spruce/fir stands.

Camera station placement was difficult due to lack of prey abundance anywhere on the site. No significant pockets of snowshoe hare or red squirrels were found. The camera station was set up at UTM 0661317 4857113. No photos of target species were taken camera. Due to camera malfunction the station was only up for about 3 weeks. No additional camera station was set up due to the lack of probable lynx habitat.

Lion tracks were found along South Fork Cottonwood. Coyote tracks were common. No marten tracks were observed.

The site had low overall prey densities, few snowshoe hare, red squirrels, or other common prey species. Even in habitat similar to those that supported significant prey populations on other sites, few if any, significant prey populations were found on this site.

Picture below is from the camera station.

PRINCIPAL RISK FACTORS:

I A. Timber Management – Cumulative impacts from timber removal on this site are moderate to high. Many parts of the site are in early successional stages. Few mature stands are available to provide habitat for red squirrels.

I E. Livestock Grazing – While the condition of surface vegetation could not be determined, the evidence pointing to excessive grazing/browsing impacts should be studied more thoroughly to assess effects. The much of the lower to mid elevation areas have year-long ungulate usage along with livestock grazing in summer and fall.

II A., B. and C. Trapping, Predator Control, Shooting – While direct impacts to lynx will be difficult to document, there are probably numerous instances of unreported, illegal take throughout the range of lynx in Wyoming..

RECOMMENDED CHANGES FOR FUTURE STUDIES

1) Site Selection: Add a layer for average snow depth to eliminate areas of low snow accumulation to the GIS site analysis.

2) Castor Scent: Most of the carpet pads used for holding the beaver castor/catnip mixture were completely odorless when picked up at the end of each session. To maximize the effectiveness of the castor/catnip lure a standard coffee can could be

used to put a pool of the mixture in the bottom of the can with openings cut in the upper 2/3 of the can with a wick suspended from the top of the can into the supply of mixture at the bottom of the can. This would create a large surface area for evaporation and an adequate supply of mixture for the entire session.

3) Bait: Tuna in oil was used as bait for this study. When collecting materials from the camera station at the end of the 2nd session most tuna cans had been carefully emptied by birds or, if the holes were too small, still full but having provided little odor to attract the target species. A more effective solution would be similar to the coffee cans mentioned above with the possible addition of ½ can of blood mixture. In this case the lid of the coffee can would need to be reinforced to prevent opening.

GENERAL DISCUSSIONS

Even though our knowledge of lynx in the contiguous United States is unsatisfactory and in great need of improvement, the primary compilations of lynx research:

1) *Ecology and Conservation of Lynx in the United States* USDA 1999

2) *The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx and Wolverine in the Western United States* Ruggiero et al.1994

3) *Canada Lynx Conservation Assessment and Strategy* USDA 2000

4) *Biological Assessment of the Effects of National Forest Land and Resource Management Plans and Bureau of Land Management Land Use Plans on Canada Lynx* USFWS 1999

give land managers a thorough understanding of the 'state of the art' of lynx conservation. It is vital to lynx conservation and the fulfillment of ESA requirements placed upon the agencies involved, that all those involved with the design, approval and implementation of projects on federal lands have an up-to-date and thorough knowledge of the range of issues discussed in the above sources.

During discussions with agency personnel during this lynx survey, it was found that there was a general lack of knowledge of many of the issues discussed in these basic sources.

It is recommended that agencies hold annual courses to train land managers in lynx management issues and keep them informed of the latest findings and developments.

A brief discussion of a few points important to lynx conservation in the contiguous United States follow:

POPULATION MODELS:

An understanding of population models relative to lynx is extremely important for successful project planning, especially in Wyoming, the southern terminus of U.S. lynx populations. It is generally felt that lynx in the contiguous United States exists in

metapopulations. Metapopulation dynamics are discussed in the Science Report as follows:

Fragmented forest cover types, high vagility of lynx, and linkages in population dynamics suggest that lynx in the contiguous United States are arranged as metapopulations. Metapopulation stability depends on not only habitat quality but also dispersal rates between habitat islands. Models indicate that dispersal rates between habitat islands should sharply decrease as the islands become smaller and more distant and the risks associated with crossing between islands increase. Southern lynx populations may fluctuate, which affects both rates of extinction and colonization of habitat islands. Synchronous population fluctuations can decrease the viability of metapopulations. Southern habitat islands probably are source-sink mosaics that shift with disturbance and succession.

Given the low densities of lynx in these southern habitats, many of these habitat islands will contain relatively few individuals and may collectively function as metapopulations. Alternatively, many of these habitat islands may function as separate, isolated populations unto themselves, rendering each isolated population highly vulnerable to extirpation.

For population at equilibrium (birth rates = death rates), small changes in habitat quality can produce a sink (birth rates <death rates). Sink environments do not produce enough animals to sustain themselves and, in the absence of immigration from source areas, populations living in sink areas go extinct (Pulliam 1988).

An important inference from this model is that when the rate of local extinction equals that of colonization, all islands are unoccupied and the entire metapopulation goes extinct. For most of the islands in metapopulation to be occupied at given time, the colonization rate must greatly exceed that of local extinction. If subpopulations on islands are extinction-prone, then a stable metapopulation requires a high rate of dispersal between the islands.

Demographic stochasticity in a very small population can be viewed as being similar to series of coin flips: if heads the population decreases by one, if tails, it increases by one. If population size = 3, then HHH would cause extinction, as would HHTHH. In very small populations, random events leading to extinction are likely and extinction rates are high.

If a landscape provides small habitat islands, then the system will only be stable if it functions as a metapopulation. Very small isolated populations are subject to a variety of risks and are prone to extinction. For metapopulation to persist, rates of colonization must greatly exceed rates of extinction. Colonization rates, in turn, are driven by the number of colonizers produced by the islands and the probability of successful dispersal between islands. Because metapopulations depend both on population size within and dispersals between islands, they can easily be destabilized. If, for instance, adult mortality were increased so that populations on the islands were generally below carrying capacity, even if these populations appeared stable, dispersal would be greatly reduced: there would be fewer potential dispersers and more of these would likely remain on their natal islands.

Similarly, maintaining populations on the islands at carrying capacity, but reducing between-island dispersal, would also potentially destabilize the metapopulation. We emphasize the dangers associated with ignoring either local habitat quality or regional connectivity.

Our uncertainty about the ecology of lynx, combined with the obviously complex interactions of cycling populations over an expansive assumed metapopulation structure, make the lynx-prey-vegetation system a complex ecological problem. Several recent conceptual developments, like source-sink and metapopulation theories, clearly have major implications for lynx populations in the contiguous United States; but without more empirical data and modeling efforts, we can only guess at what those are. We know remarkably little about the current status and numbers of lynx in the contiguous United States (Chapter 8). However, what little we know indicates that the subpopulations are not large. Until we better determine the current location and sizes of lynx sub-populations, it is unwise to assume that these populations can be reduced or further isolated without sharply increasing the risk of their individual and collective extinction. *Science Report Chapter 2*

MANAGEMENT EFFECTS:

The *Science Report* states that habitat alteration is considered the primary cause of the present species decline, extirpation or extinction. A thorough analysis of pre and post-settlement disturbance regimes, both spatially and temporally is needed to successfully manage for the conservation of sensitive forest carnivore species.

A large percentage of the forest area surveyed exhibited significant anthropogenic disturbance, creating a much higher ratio of early and mid seral to late seral stages, than probably would have been found in pre-settlement conditions. In much of the forested areas of Wyoming, lodgepole pine is the first tree species to be established following major disturbance. These early to mid seral lodgepole forests are highly temporally unstable, having only a 10-20 year period from when they become useful for prey species to when they self prune above snow height and become worthless for prey habitat. When these lodgepole stands are then cut, the area is again returned to another cycle of lodgepole. This vastly increased overall percentage of lodgepole stands compared to the more stable spruce/fir stands in the forest;

1) creates large areas of unsuitable habitat for 10-15 years after disturbance and then again from the onset of self pruning above snowline until the lodgepole is replaced by spruce/fir

2) creates rapidly changing habitat conditions for both predator and prey species

3) hinders spruce/fir regeneration

The following from the *Science Report* discusses management considerations:

For the boreal forest, there are several general principles that must be addressed in landscape management plans if harvesting or fire disturbance is to be incorporated:

1) The habitat will be a product of the cumulative effect of all disturbances.

2) The substitution of logging for fire, for example, is only meaningful if fire can be successfully removed from the environment, and even then, logging will not totally mimic fire as a disturbance process because of roading and coarse woody debris differences.

3) Typical models used for fire history studies suggest that fire selected a range of stand ages to burn. Harvesting only the oldest ages will decrease the average stand age of the landscape and will remove the complex boreal stand structure that may be critical for lynx denning. Young and old stands need to be part of any landscape disturbance plan.

4) Size and juxtaposition of stands is critical. Most fires are small. Most of the landscape, however, is affected by larger fire patches, with unburned areas inside the fire perimeter (stringers, islands, fire skips).

Science Report Chapter 3

HABITAT FRAGMENTATION:

Human-caused fragmentation of the already patchy and heterogeneous lynx habitat in much of the listing area is of primary concern in conservation efforts.

The *Science Report* details the effects of fragmentation as follows:

Habitat fragmentation tends to facilitate competition by generalist predators, of which the most likely beneficiary is the coyote. Other potential interference competitors with lynx include cougars and bobcats. Of these three carnivores, all are more widespread and more abundant within the southern distribution of the lynx than 50 years ago.

Fragmentation tends to reduce habitat area and to isolate patches of native vegetation (especially in late seral stages) from each other, both of which can lead to local species extirpations (Wilcox 1980; Wilcox and Murphy 1985). Moreover, the loss of some species in this way can lead to multiple extinctions through community-level secondary effects (Wilcox and Murphy 1985).

Finally, as clearly stated by Wilcox and Murphy (1985:884), “That current ecological theory is inadequate for resolving many of the details should not detract from what is obvious and accepted by most ecologists: habitat fragmentation is the most serious threat to biological diversity and is the primary cause of the present extinction crisis.” Direct habitat effects of fragmentation of most concern in lynx conservation are:

(1) Reduction of area and patch size of late-successional forest and of optimal snowshoe hare habitat.

(2) Creation of openings that facilitate access by potentially competing carnivores.

(3) Increased densities of edges between early successional and other forest types.

(4) Changes in the amounts and structural complexity of seral forest stands within landscapes.

Although landscape-level studies have not determined how fragmentation affects lynx ecology and population persistence (Koehler and Aubry 1994), rare species associated with wilderness, such as the lynx, generally are considered most susceptible to fragmentation (Bright 1993). Likewise, habitat specialists with large individual spatial needs, including the lynx (Quinn and Parker 1987;O 'Donoghue et al.1998), are likely to be impacted by habitat fragmentation (Andrén 1994).

Fragmentation of habitats occupied by lynx (including increased openings, higher road densities, exurban residential development, and wider use of snowmobiles and devices that compact snow in areas with deep, soft snow) is a plausible mechanism for the questionable conservation status of the lynx in the contiguous United States.

Science Report Chapter 4

IMPORTANCE OF RED SQUIRRELS TO LYNX IN THE CONTIGUOUS UNITED STATES:

Little research has been done on the importance of red squirrels in the diet of lynx, but what has been done points to a greater reliance on red squirrel by lynx in the listing area. This is a very important area were even one or two studies would greatly improve lynx management.

Throughout the survey area red squirrel densities were positively correlated mature and old growth spruce/fir stands and were absent from all predominantly lodgepole stands regardless of age. These observations further support the need to manage for more mature and old-growth stands as well as spruce/fir, expressed by the authors of the *Science Report*.

The *Science Report* discusses what is known regarding the importance of red squirrels as follows:

In the southwest Yukon, red squirrels were the most important alternative prey for lynx during years of low abundance of hares. Red squirrels became increasingly important (20-44% biomass) during the years of lowest hare density compared to almost no use (0-4% biomass) during years of high hare densities (O 'Donoghue et al.1998b).

Similarly, during years of hare scarcity, use of carrion, red squirrel, ruffed grouse, and other birds increased in central Alberta (Brand et al.1976), and in southwestern NWT, red squirrels and birds were found more frequently (K.Poole, unpublished data). Red squirrels in particular appear to be an important alternative food source for lynx throughout the North during periods of low hare abundance. Koehler (1990) reported red squirrels in 24 percent of lynx diets in northcentral Washington. Staples (1995) reported that red squirrels were the second most important food source for lynx during his study in Alaska. O'Donoghue (1997) found red squirrels were the main alternate prey of lynx during periods of hare low abundance. Although a diet of red squirrels alone may not be adequate to ensure lynx reproduction and survival of kittens (Koehler 1990), the species appears to be the most important alternate prey throughout the range of the lynx (Brand et al. 1976, O'Donoghue et al. 1998, Apps 2000). Lynx appear to capture red squirrels opportunistically when hares are abundant, and to actively hunt red squirrels when hares are scarce (O'Donoghue 1997). Red squirrels are primarily associated with the coniferous

forests of northern and western North America, but are also common in eastern forests containing some mature conifers or nut-bearing hardwoods. Red squirrel densities tend to be highest in older, closed-canopy forests with substantial quantities of coarse woody debris, and lower in young stands that lack cone production (Layne 1954, Obbard 1987, Klenner and Krebs 1991). Population densities are highest (250-400/km 2 or 96-154 /mi 2) in spruce forests, lower (100-200/km 2 or 38-77/mi 2) in mixed conifers and mixed conifer/hardwoods, and lowest (25-100/km 2 or 10-38/mi 2) in pines and hardwoods (Obbard 1987).

For red squirrels, consideration should be given to the landscape pattern (amount and arrangement) of mature coniferous forests, snags, and down logs. Snowshoe hares inhabit both early and later successional forests. Mature and late successional forests may provide more stable habitat for a longer period (Buskirk et al. 2000).

Science Report Chapter 9

LYNX PREY, FOREST STRUCTURE AND TEMPORAL STABILITY:

The graph below brings to light an interesting and important point in management for lynx prey species. While much of the Forest Service lynx prey research has focused on prolonging the suitability of regenerating lodgepole stands for snowshoe hare, little attention has been put on the stand structure that may prove to be the most important to long-term lynx survival, the gap-phase old-growth structure. This study shows that

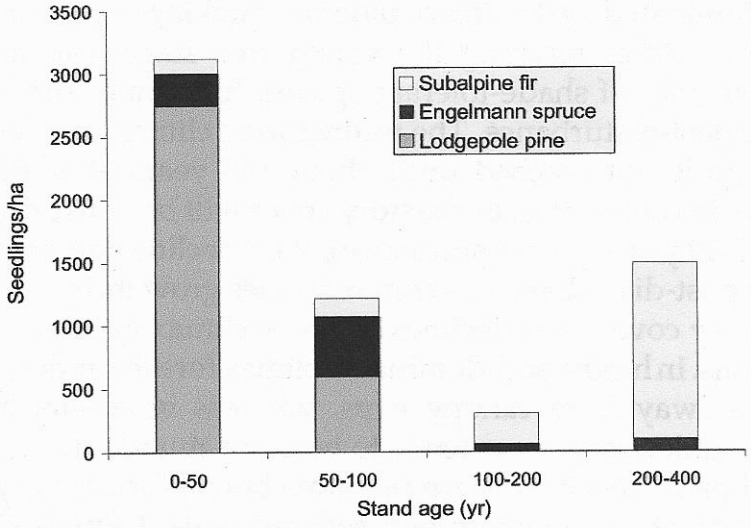


Figure 1—Densities (no./ha) of conifer seedling (< 4 cm dbh) stems in relation to stand age after fire in the Pasayten Wilderness, Washington. Data are from Fahnestock (1976).

seedling density decreases with stand age until the stand reaches the gap-phase structure and then seedling density increases again to almost 50% of the original lodgepole density. This gap-phase structure creates ideal conditions for red squirrels at the same time as high quality habitat for snowshoe hare. This study also clearly shows the transition from lodgepole to the climax spruce/fir.

The Science Report discusses the need to understand forest successional trajectories and their influence on prey densities:

We caution against uncritical application of ecological understandings derived from the North to southern lynx *and we emphasize the potential importance of late-successional forests as habitat for hares, red squirrels, and lynx in the southern part of the range of the lynx.* (emphasis added)

Mills and Henderson (unpubl.data) found hares relatively abundant in old-growth forest in northwestern Montana, and Beauvais (1997) found track densities of hares to be positively correlated with variables indicative of late-seral stages in northern Wyoming.

Two years of snow tracking in a range of stands from young to old growth in northern Wyoming (Beauvais 1997) showed that snowshoe hare tracks were negatively correlated with indices typical of highly fragmented landscapes, such as density of clear-cut edge, and positively correlated with indices such as percent of forest cover and percent of spruce-fir cover.

Understanding red squirrel abundances in the context of succession is also important given the role of squirrels as alternative prey for lynx (O 'Donoghue et al.1998b, Chapters 9,13). Because squirrels eat primarily conifer seeds, in the West their abundance over successional time is linked to cone-producing ages, usually mature (Smith 1970, Obbard 1987) or older (Kemp and Keith 1970,Rusch and Reeder 1978), conifers. Thus, late-successional forest provides habitat within which two prey species important to lynx occur sympatrically and are relatively abundant.

We question the generalization that the best way to provide habitat for lynx prey, including hares, is to create early-successional forest. (emphasis added) On mesic sites, the highest hare densities are generally found in sapling-stage forests after disturbance, but squirrels are absent from these sites. We believe the data, though sparse, also suggest that old gap-phase forests provide a combination of high numbers of squirrels and moderate densities of hares on many sites. Additionally, site moisture appears to be an important correlate of shrub and sapling densities in the early stages following disturbance and, in dry areas of the West where post-disturbance regeneration is erratic, gap-phase old-growth forests may provide relatively higher densities of small-diameter woody stems compared to earlier stages of succession on the same sites.

In areas where boreal forests are highly fragmented, older forests may be an important stabilizing element. Because small areas of boreal forest can be highly altered by single disturbance events, such as fire, hare dynamics associated with post-disturbance conditions will be transient. Older forests are temporally stable, will produce hares in lower but more reliable numbers, and provide squirrels as alternative prey.

The relationship between forest succession and prey abundance is an area of utmost importance to southern lynx conservation. We believe that a well-designed, geographically extensive study to further examine these relationships should be given the highest priority for research. Failure to carefully consider successional trajectories and their structural habitat correlates on a regional and site-specific basis can produce the opposite of intended results, especially with regard to the habitat needs of snowshoe hares. (emphasis added)

Science Report Chapter 14

One of the primary causes for the loss of ecosystem resiliency (i.e., loss of sustainable character) is loss of context resulting from management activities (Allen and Hoekstra 1992). By this, the authors mean a disparity between the spatial and temporal scales of critical ecosystem processes in the natural system, and the area and planning horizon of management activities.

In natural systems, the age distribution of forest stands varies dramatically from that produced under most forest management models. In natural landscapes, stand age distributions produced by large-scale stochastic events, such as forest fires, are more complex than those that result from deterministic, even-aged models of forest management. In most boreal forest systems, the constant-probability stochastic process model (here- after referred to as the negative exponential model) results in a distribution of stand ages that approximates a negative exponential curve (Fi .15.1a). For boreal forests with long fire-return intervals, this model approximates natural stand-age distributions, or at least one that is much closer to natural conditions than the truncated distribution produced by even-aged cutting practices (Fig.15.1c; see also Chapter 3). By maintaining old-growth forests in the landscape, the negative exponential model also retains mature forests, the most temporally stable element on the landscape.

Older forests provide a stabilizing influence that is likely to increase ecosystem resiliency. Resulting landscapes have greater levels of complexity and diversity because all age classes are maintained within the landscape.

In all of the applications of lynx management, however, we recommend the following:

1) Use natural disturbance patterns, in terms of size, frequency, intensity, and stochasticity for guidance concerning the design and management of landscapes.

2) Engage in spatially explicit landscape planning within very large management areas. Lynx metapopulation dynamics operate at regional scales.

3) Manage for landscapes that contain a continuum of age classes, including both very young and very old forest. Not only is this reflected in patterns that result from fire and other natural disturbances, but it represents a prudent conservation policy in the face of uncertainty. In this regard, be especially cautious with older forests and carefully consider the replacement time for each forest type and forest element. A large-diameter log may take hundreds of years to decay; a small clearing can be created in a few weeks.

4) Provide for a variety of regeneration conditions; some areas should be dense and some more open. Treatments that depend on natural regeneration will be more likely to produce these patterns than will planting. Leave individual trees and variable-sized groups of residual elements if natural disturbance processes suggest these structures are appropriate.

5) Practice adaptive management and consider every action on the landscape to be an experiment. Monitor the efficacy of management actions and adapt strategies if desired conditions are not being achieved.

CONCLUSIONS

Management of lynx under the ESA is made difficult due to our lack of understanding of many of the complexities of lynx ecology in general, and an even greater lack of landscape or site specific information, to base management decisions on in Wyoming forests. Furthermore, lynx, historically or at present, use most of the forests in western Wyoming, affecting a majority of proposed projects. The perceived rapid decline of populations further adds urgency to the need to develop a more complete body of knowledge to be successful in restoring lynx populations.

The authors of the Lynx Science Report began their document with a brief discussion of the political crisis caused by the decline and listing of the spotted owl in the forests of the northwest and noted the similarities between the two situations, as well as the situation with other forest carnivores such as the wolverine and fisher. Little tangible progress has been made in the protection of lynx and other forest carnivore species of concern in the years preceding or following the listing of lynx in March, 2000. There is an urgent need for a greater administrative priority to accomplish the lynx research outlined in the Science Report and implementation of the Canada Lynx Conservation Assessment and Strategy.

TRACK OBSERVATION FORM – LYNX TRACK SET #1

Species Observed: Possible Lynx

Date: 2/7/2001 Time: 2:30 P.M. Observers: Jonathan Ratner

Location: Hams Fork Site Lynx track Set #1

UTM or Long/Lat: N42 4.738 W110 34.424 Elevation: 9,360' Aspect: Flat

Habitat: Opening in Spruce/Fir forest near area of highest hare and squirrel densities, 300' from camera station.

Topography: Flat ridgetop, with steep drop on either side.

Tracking Surface: Firm windslab

Notes: Only one print was found on a small area of windslab that was not covered with new snow. No pictures were obtained. Drawing of track on next page.

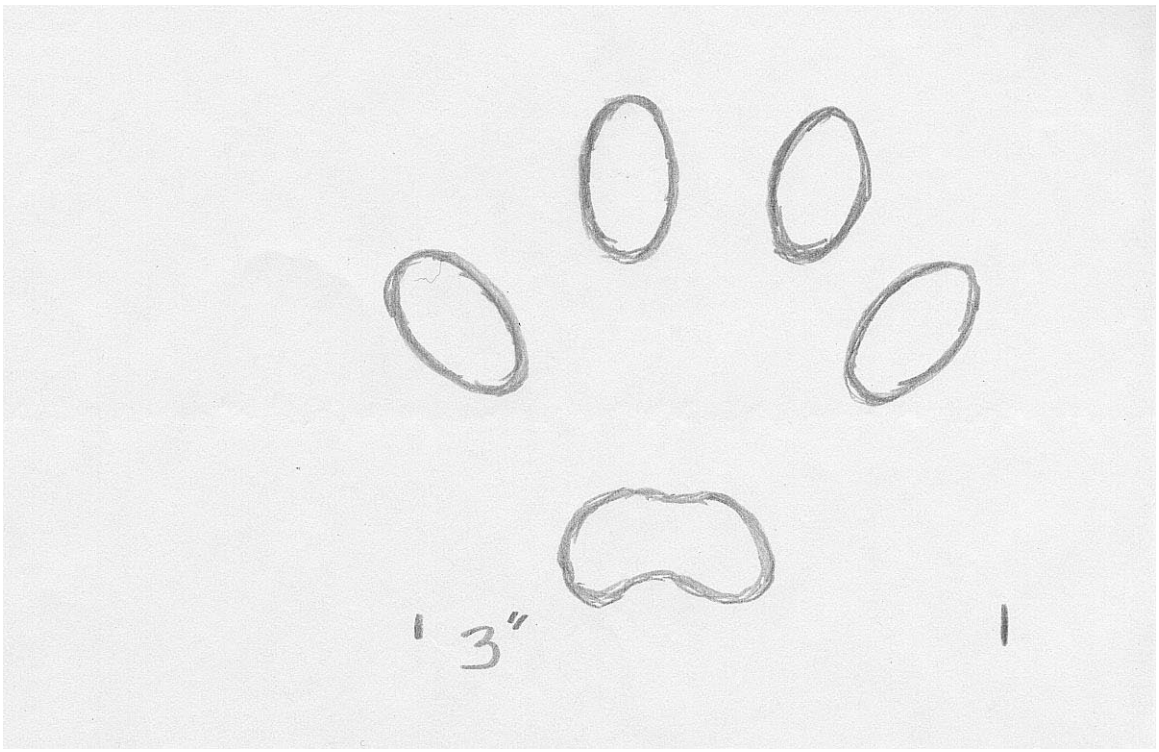
Trail Measurements:

Stride										
Straddle										
Trough										

Track Measurements:

Width										
Length										

Comments: While one track is insufficient for positive identification, total size and interdgital pad size were good.


3"

TRACK OBSERVATION FORM – LYNX TRACK SET #2

Species Observed: Possible Lynx

Date: 12/28/2000 Time: 11:28 am Observers: Jonathan Ratner

Location: Big Sandy Site

UTM or Long/Lat: N42 36.458 W 109 18.692 Elevation: 8,874' Aspect: ESE

Habitat: Aspen/Doghair 35 year old lodgepole, recent clearcuts

Topography: Rolling

Tracking Surface: Surface hoar – light old snow with 2" of newer snow on top of tracks.

Notes: Tracks are walking downhill on packed snowmachine trail so stride is long, no sinking, made before previous snow 12/24/2000. No print details – only stride straddle, foot hair drag and approximate print size. No photos were obtained.

Trail Measurements:

Stride	42	41 ¾	40 ¾	42	43	44	46	44	45	45
Straddle	8 ¾	9	8 ¾	8 ¾	9	9	8 ¾	9	9	8 ¾
Trough	8 ¾	9	9	8 ¾	9	9 ½	9	9	9	9

Track Measurements:

Width	4	4	4	4	4	4	4	4	4	4
Length	4	4	4	4	4	4	4	4	4	4

Comments:

Clear disturbance of snow from foot hair around each track observed on the snowmobile trail.

TRACK OBSERVATION FORM - LYNX TRACK SET #3

Species Observed: Possible Lynx

Date: 12/30/2000 Time: 3:59 P.M. Observers: Jonathan Ratner

Location: Forest Service land between the Big Sandy and Blucher Creek sites

UTM or Long/Lat: N42 38.075 W109 13.557 Elevation: 9260' Aspect: Flat

Habitat: Opening in aspen spruce/fir and lodgepole mix

Topography: gently rolling

Tracking Surface: 8 day old snow, wind modified, on top of depth hoar, little resistance to penetration. Not tracks were found on the snowmobile trail due to subsequent traffic. Track measurements were from unpacked surfaces and due to snowpack of primarily depth hoar, the individual sunk more deeply and thus moved more slowly that would be expected.

Notes: Tracks looked to be about 2 days old

Trail Measurements:

Stride	24 ½	25 ½	25	25	26	26 ½	24	25	25	26
Straddle	7	7	7	7	7	7	7	6 ½	7	7
Trough	9	10	8 ½	9	10	8 ½	7	8	8	8

Track Measurements:

Width	4	4	4	4 ¼	4	3 ¾	4	3 ¾	3 ¾	3 ¾
Length	3 ½	3 ½	3 ½	3 ¼	3 ¼	3 ½	3 ½	3 ½	3 ½	3 ½

Comments:

TRACK OBSERVATION FORM - LYNX TRACK SET #4

Species Observed: Lynx

Date: 2/18/2001 Time: 4:53 P.M. Observers: Jonathan Ratner

Location: Big Sandy Site

UTM or Long/Lat: 0639220 4716678 Elevation: 8,400' Aspect: SE

Habitat: 35 year old doghair lodgepole, aspen, clearcuts

Topography: Rolling

Tracking Surface: Pure hoar, no resistance to penetration

Notes: Trail went through tight brush and low branches and walked on small fallen trees and branches, some of which would not support 150 lbs.

This track set was found near sunset so I was only able to gather info for about 15 minutes, when I returned the next morning about 2" of new snow had fallen.

Trail Measurements:

Stride	35	37	39	34	41	37	40	35	36	37
Straddle	8 ½	8	8	8 ½	8 ½	8	8 ½	9	8 ½	8 ½
Trough	10	10	9	9	10	10	10	10	10	10

Track Measurements:

Width	3 ¾	3 ¾	3 ¾	4	4	3 ¾	3 ¾	3 ¾	3 ¾	3 ¾
Length	3 ¾	3 ¾	3 ¾	4	3 ¾	3 ¾	3 ¾	4	3 ¾	3 ¾

Comments:

TRACK OBSERVATION FORM - LYNX TRACK SET #5

Species Observed: Lynx

Date: 2/20/2001 Time: 2:30 P.M. Observers: Jonathan Ratner

Location: Blucher Creek Site along road to Sweetwater Gap

UTM or Long/Lat: 06585529 4713155 Elevation: 8,371' Aspect: SSE

Habitat: Willow creek bottom, opening between stringers

Topography: gently rolling

Tracking Surface: snowpack of depth hoar with 2" on new snow on top of tracks

Notes: Individual walked on rails of buck and rail fence for 300'

Trail Measurements:

Stride	40	41	39	40	40	40	40	38	39	37
Straddle	8	8	10	8 ½	8	8	8 ½	7	8	7
Trough										

Track Measurements:

Width	4	4	4	4	4	4	4	4	4	4
Length	4	4	4	4	4	4	4	4	4	4

Comments: