

## Canada Lynx SSA Expert Elicitation Workshop – Notes

Bloomington, Minnesota - October 13-15, 2015

### U.S. Fish and Wildlife Service

*Note to Reviewers:* These notes were taken by the U.S. Fish and Wildlife Service (Service) during a Canada lynx (*Lynx canadensis*) Expert Elicitation Workshop the Service convened to inform its species status assessment (SSA) for the Contiguous U.S. Distinct Population Segment (DPS) of lynx. The lynx DPS was designated as threatened under the Endangered Species Act (ESA) in 2000 due to the inadequacy, at that time, of existing regulatory mechanisms, particularly those governing management of federal lands. The SSA will rely on the best available information to evaluate the current status of, and the nature and magnitude of potential threats to, lynx populations and habitats within the DPS, and it will provide the scientific basis for determinations the Service is required to make in accordance with the ESA. The Service convened this workshop to elicit and capture the knowledge, professional judgments, and opinions of lynx experts to inform the SSA, particularly with regard to aspects of lynx population ecology for which we lack sound empirical data and which are not otherwise captured in the existing scientific literature or other sources of available information.

These notes were reviewed, and in some cases amended with notes taken separately, by other members of the Lynx SSA Team in attendance. The notes were then sent to workshop experts and other participants for their reviews. Annotations in these final notes, in the form of strikethrough and colored text, indicate where experts edited or clarified the notes pertaining to their presentations or responses during the workshop.

The Service has prepared and disseminated to workshop participants a Workshop Report summarizing the proceedings and providing the Service's analysis and assessment of the information gathered at the workshop. These final notes constitute Appendix 3 of the Workshop Report. Presentations and some of the other materials referenced in these notes are also appendices of the Workshop Report, and they are available on the Service's Region 6 Canada lynx web page under Species Status Assessment at: <http://www.fws.gov/mountain-prairie/es/canadaLynx.php>, as are other materials referenced here that are not appendices to the Workshop Report.

**Workshop Attendees** - See Workshop Report, Appendix 2.

#### **Day 1**

##### **Introductory Presentations by USFWS**

Welcome and introduction from Jodi Bush, Field Supervisor of the Service's Montana Ecological Services Field Office. Thanks to everyone for joining us for this important meeting. As you know, we are here to assess the current condition and future viability of lynx in the contiguous U.S. distinct population segment (DPS). This workshop is intended to inform the Species Status Assessment (SSA) that we've

undertaken for the DPS, which will inform future decisions we need to make under the ESA, including recovery planning. However, this workshop is just about the science and best professional judgments of the experts; we will not be discussing ESA policies or making decisions about the listing status of the DPS or future recovery goals or criteria, etc.

Goals/objectives/background – See Jim Zelenak Overview slides (this presentation and all others from the workshop are included in Appendix 5 of the Workshop Report and available at <http://www.fws.gov/mountain-prairie/es/canadaLynx.php>). Where data are lacking, elicit expert opinion on the status, threats, and future viability of the lynx DPS. Complete a SSA for lynx – will be the scientific underpinning for decisions on lynx in the future. SSA will inform recovery planning and 5-year review. Provided overview of listing history. Six areas within the range of the listed DPS currently or recently (GYA) support lynx populations.

Covered FACA/APA concerns given the information from the handout (attendees were given the handout “Using Expert Meetings for SSA” whitepaper) prior to and again at the workshop. Clarified to the participants that all info from the workshop is subject to FOIA. Meeting is not to make policy decisions (e.g., whether there should be multiple DPSs), develop recovery goals or objectives, determine the “right” answer or seek consensus. Rather it is to document range of knowledge and opinion regarding current status and likely future conditions for lynx in the Lower 48 states.

SSA framework overview covered – SSA fact sheet provided to attendees (Appendix 1 of Workshop Report).

Conceptual model handouts provided – in draft form, will be used for elicitation process this week, looking for feedback from the experts.

Overview of the expert elicitation process – we will be eliciting expert judgment/opinion on areas of uncertainty concerning lynx. We will use modified Delphi approach to elicitation – involves eliciting individual input from the experts. Will explore what information/data/reasoning is influencing expert opinion on a particular question. There will be opportunity for reconsideration after discussion. We are not seeking consensus answers to questions asked. We hope to raise the level of lynx related knowledge of the group as we progress through the workshop.

Overview Presentations: (See also the presentation files from presenters)

Historic and Current Distribution of Lynx in the Contiguous US – Kevin McKelvey

- Issues w/ lynx distribution – frequently confused w/ bobcats, a problem for relatively rare species like lynx, which can cause misidentification to corrupt the data without proper screening of occurrence records.
- Provided examples of potential error rates when a similar species (bobcat) is much more abundant; even with relatively high (90%) identification success, only a few misidentified bobcats can cause significant error in lynx “observations.”

- Described need to rely on “verified records” to screen out poor data/misidentification.
- Lynx periodically move south in pulses/waves (irruptions) from Canada. Some lynx end up in places that may support them over time; others end up temporarily in places where they cannot persist. How to determine which places support permanent populations vs those that only have lynx temporarily during or after pulses?
- Largest pulses of lynx seem to be ~1960, 1970, 1980, and lesser pulses in recent decades.
- Evidence of historical populations in WA, ID, MT, MN, ME, MI, NH based on persistence over time and/or evidence of reproduction, habitat, etc.
- No current populations in NH, NY, VT, MI, WI. May be a small population in Greater Yellowstone Area (southwest MT/northwest WY).
- No evidence that lynx were widespread across contiguous U.S. historically.
- Nearly all areas of suitable habitat (with adequate snow resources) seem to be occupied in the lower 48 states. There are a few exceptions.
- The historic data are in the form of recorded occurrences, which allows for inference about past distribution but not abundance.
- Historic records are both finite and often unreliable.
- Group discussion following this presentation brought up the fact that IUCN is updating their Red List evaluation of lynx, to be released in November, which will include their estimate of distribution and trends (Vashon).
- It was asked why lynx appear unable to establish/maintain populations in most of Idaho, given seemingly viable habitat and many historic records. Presenter indicated there is no clear answer based on the evidence in the record.

#### Lynx Regulatory Environment 2000-2015 – Scott Jackson

- Pre listing, there was very little regulation on Forest Service lands specifically for lynx.
- Pre listing, interagency lynx steering committee, science team and bioteam were formed to direct compilation of the Lynx Science Report, Lynx Conservation Assessment and Strategy (LCAS, 2000), Biological Assessment of 1999, all to guide conservation and land use management on Federal lands.
- Listed due to inadequacy of existing regulatory mechanisms.
- FWS Biological Opinion in 2000 directed USFS to revise 113 forest plans and develop Conservation Agreements to guide management and lynx conservation until forest plans were revised. Some units are still operating under Agreements, though most national forests with lynx or potential lynx habitat have formally amended their Forest Plans.
- Post listing, Conservation Agreements between USFWS, USFS, BLM – “likely to adversely affect” projects would no longer occur. BLM and USFS began updating land use plans to align w/ LCAS (2000) standards and guidelines. LCAS was revised in 2013.
- LCAS (2000) principles: identified 17 risk factors and measures to reduce these risks, guidance on how to map Lynx Analysis Units (LAUs), forest management prescriptions to benefit lynx.

- Revised LCAS (2013) – new science, core area emphasis, anthropogenic influences (2 tiers) instead of “risk factors”, fewer conservation measures (vs. “standards and guidelines” from 2000 LCAS). Secondary/ peripheral habitat combined into “non-core” areas in the revised LCAS.
- Focus of regulations has been on Federal land, primarily in the West. There are other issues on private lands and unique regulatory issues in Maine (Maine Forest Practices Act of 1989).
- LCAS (2013) identified greatest potential influences from climate change, forest fragmentation, wildland fire management, and vegetation management (timber harvest/mgmt. and silvicultural treatments).
- Areas of greatest uncertainty = large scale, high intensity fires in the West, wide scale insect outbreaks, changes in silviculture that may or may not benefit hares and lynx.
- Amount of lynx habitat in Federal ownership varies among 6 units from 98% in the Cascades to 1% in the Northeast.
- A question regarding landownership was raised - do we have a breakdown of land-ownership for each of the 6 geographic areas? JZ – we have broken each critical habitat unit by ownership, but we did not designate CH in Colorado/S. Rockies, though ownership info there is also probably readily available.

#### Lynx Genetics Considerations – Michael Schwartz

- Reviewed all published papers on lynx genetic studies in N. America; summary that global results for measure of genetic variation (17 populations) shows high genetic mixing, some sub-structuring over distance, but ample gene flow continent wide.
- N. Rockies provide some gene flow restriction, as well as an invisible barrier to gene flow in eastern Canada south of James Bay/Hudson’s Bay that may be related to snowfall. Other than these, there are unlikely to be barriers to genetic interchange throughout much of the lynx range in boreal forest.
- River systems can influence genetic sub-structuring.
- Some genetic drift within the smallest populations; some genetic substructure in populations in eastern Canada and south of the St. Lawrence, island populations (Newfoundland and Cape Breton); however, there is evidence that there is interchange of lynx between each generation in eastern Canadian populations.
- Some evidence that we are seeing gene flow out of Canada into US lynx populations during population surges.
- Discussed levels of genetic sub-structuring of lynx in MT – river valley and highway may be causing sub-structuring.
- Hybridization w/ bobcats does occur – studies have shown hybrids in MN, and Maine, no hybridization in west detected so far. Very low numbers. Does not seem to be a major issue nor is there evidence that hybridization is increasing despite significant increases in bobcat numbers.
- Genomic studies can increase power and look for genes under selection.

- Recommended conservation goal for lynx should be to conserve genetic diversity currently represented in the 6 populations in the lower 48 states. Recognize that this variation at the edge of the range may be of value to future populations, especially as related to changing climate.

#### Lynx Distribution, Status, and Management in Southern Canada – Jeff Bowman

- Each province has its own management program for lynx, each with its own harvest (trapping) policies and strategies.
- British Columbia, Alberta, Saskatchewan, Manitoba – trapping numbers show peaks in 60's, 70's and 80's. Smaller peaks in lynx numbers trapped since then. Eastern provinces show higher peaks in lynx trapped in 1990, 2000 than the western provinces.
- Peaks in lynx numbers lag behind hare peaks by one year. Peaks occur roughly every 10 years. *[Note to presenter - please clarify if this statement is correct or if the lynx peaks in the east followed lynx peaks in the west by one year].*
- Potential range contraction in eastern Ontario from 1960's to 2010, southern boundary moving north. Genetic study also supports trailing range-edge effect.
- New Brunswick and Nova Scotia have listed lynx as endangered provincially; these two provinces have high numbers of bobcats, probable correlation. Other provinces status seems secure (COSEWIC review).
- Data show large peaks of hares/lynx in 1960, 1970, 1980; cycles since then are dampened, may be a future trend?
- Noted recent genetic studies show some genetic differences (unique alleles) south of the St. Lawrence, but differences are not large.
- Lynx range contraction in southern Ontario because of changes in forest practices, increase in tolerant hardwoods. Seeing less genetic heterozygosity (allele richness) at the range margin.
- "Invisible" genetic barrier south of Hudson's Bay likely related to winter snow. Effect will likely increase in the future with climate change. May be habitat "imprinting" (snow conditions) between east and west Canadian populations.
- Nova Scotia and New Brunswick have largest bobcat populations in Canada.
- There was a question: Why are forests changing in Southern Ontario? It is likely a combination of things - the movement towards management of small scale disturbances, increased control of fire and other disturbances, less wide-scale logging than in the past, now more natural hardwood forests than in previous years. Management not caribou driven (caribou are farther north).

#### Introduction and Discussion of Lynx Conceptual Models – Jonathan Cummings

- Presented the 4 draft conceptual models to the experts (see handouts).
- Simplified viability model, and one each for resiliency, redundancy, and representation.

- We will be seeking expert input on the models this week, will inform elicitation

## **Day 2**

### Overview Presentations (continued):

#### 7 Ways a Warming Climate can kill the Boreal Forest – Lee Frelich

- Boreal forest may disappear from Minnesota by end of century.
- Temperate tree species are invading boreal forests at local and regional scales, mixed ecotone spreading; deer herbivory may temporarily slow hardwood invasion of conifer stands.
- Higher summer temperatures in northern MN (5 to 12 degree F increases projected by 2100).
- Prairie-forest border may move north by 150-300 miles by 2100.
- Some authors project a 300 mile northward movement of boreal forest continent wide by end of the century.
- Severe drought 8 of last 10 years.
- High emissions scenario – no paper birch in US.
- Aspen, fir, spruce will be reduced to absent in US.
- Insect outbreaks will increase with climate change.
- Small triangle of boreal forest in northeast MN (Arrowhead region) likely to hang on to end of the century because of higher elevation of area and lake-effect snow. This is not the entire arrowhead region, just a small proportion of it that is of relatively higher elevation.
- Discussed 7 ways in which boreal forest will be converted to temperate forest over time w/ climate change.
- Frequency of large damaging storms will increase, facilitating temperate forest conversion.

#### Climate Change and Uncertainty: Implications for Canada lynx Conservation and Management in the Contiguous US – Alexej Siren

- Lynx presence associated w/ snowpack persistence greater than 4 months and deep (>270 cm per year in Northeast), fluffy snowfall.
- Discussed ways in which climate may influence lynx - population cycles and viability, increased competition with bobcats, hare coat-color mismatch, access to hares.
- Warmer global mean surface temps in recent decades and into the future.
- Warmer winter temps, especially in the Northeast US where increases will be greatest.
- Winter precipitation projected to increase in eastern US, drier in western US.
- Discussed emissions scenarios and projected changes across the range of lynx, see presentation file.
- Northwest - overall drying, slight increase in winter precipitation, unsure how much will be snow (vs. rain).

- Northern Rockies - increased winter temperature and precipitation but not in NW Montana; long term may have best snow conditions for lynx because of high elevation; depends on snow depth and quality.
- Southern Rockies - declining number of days below freezing, decline in winter snow and snowpack.
- Great Lakes - increase in winter temperatures but increase in lake-effect precipitation and snow because of loss of ice on great lakes; in short term - best snow conditions for lynx.
- Northeast - increase in winter temperatures and precipitation, dryer in summer, decrease in days below freezing and persistence of snowpack.
- Generally across the range warmer winters, less snowfall and snowpack, warmer summer temps, increase in winter precipitation and non-snow precipitation in winter, less precipitation in summer, decreased snowpack period.

#### Projected Climate-change Impacts on Snow, Vegetation, and Lynx Populations in the Western US – Josh Lawler and Chad Wilsey

- Vegetation modeled across western range of lynx under climate change projections to end of century – shift from subalpine forest to temperate evergreen needleleaf forests in western lynx range.
- Projected decrease in lynx-appropriate forest across range in western states.
- Fire projected to double by 2040 and triple by 2080; projected increase in fire frequency and larger fires.
- Modeled lynx habitat and lynx ecological traits w/ climate change scenarios – projected simulated densities in lynx in western range in 2020s, 2050s, 2090s.
- Shows some decrease in lynx densities across western range; decline of lynx habitat suitability in the Northwest; greatest likelihood of persistence in NW Montana.
- Also looked at effect of population cycling impact on projected changes – overall changes in density not affected by population cycling.
- On average simulated moderate declines in Canada lynx – some growing populations and some declines.

#### Forest Management and Lynx Habitat Trends – Erin Simons-Legaard

- Eastern spruce budworm outbreak cycles in Maine ~~became~~ **may have become** more ~~wide ranging~~ **frequent** since 1970's (historically outbreaks at roughly 65-year intervals; recently 30-40 years; severe outbreak in the 1970s).
- Severe spruce and fir budworm mortality was followed by large-scale clear cuts mid-1970s - mid-1980s to salvage-harvest trees - created current lynx habitat.
- Regulations (Maine Forest Practices Act 1989) then put in place to manage clearcutting making cuts smaller, shift from clearcutting to various forms of partial harvesting; this caused the annual harvest footprint to double in northern Maine with lower quality habitat.;

- since 1989, 65% of landscape has been affected by partial harvesting, which supports lower hare densities than regenerating clearcuts.
- Ownership changes in northern Maine, more and diverse ownership now than historically; REITS and TMOs; short-term investment horizon and different forestry outcomes.
  - Non-development easements in place in many areas of northern Maine, but they do not regulate forest management.
  - Conifer stem density influences hare density in Maine - hare/lynx habitat created by even-aged management and dense regeneration of spruce-fir.
  - Timber harvest levels increased over past several decades; modeled ~~emulated~~ **2000-2010 harvest rates** ~~tree species change over this time.~~
  - Modeled lynx habitat into the future. Assumptions of forest practices used by current landowners. Also used stochastic modeling (which includes harvest).
  - Lynx foraging habitat – spruce-fir forest – modeled to 2050 – high quality habitat for lynx is currently about 8% of the northern Maine landscape. Projections are that habitat and lynx occurrence will decline to about 5% of the landscape by 2030, and then level off.
  - Prevalence of partial harvesting will lead to elimination of most areas with concentrated high-quality habitat. Most of the landscape will have a low (<30%) ~~probability of supporting lynx~~ **percentage of high-quality habitat for snowshoe hare at the lynx home-range scale.**
  - As clear cuts regenerate and age, become less appropriate for hares and lynx at about 35-40 years post-harvest, probability of lynx occurring in areas where they currently are will go down over time to 2050.
  - When forest is disturbed, composition shifts to red maple and balsam fir; however, next outbreak of spruce budworm coming in 2 to 5 years, which may greatly affect fir component of lynx habitat.
  - It is unlikely budworm will be controlled by spray; unlikely that landowners will clearcut and herbicide as they did in the last budworm outbreak.
  - Quebec – currently being heavily impacted by spruce budworm outbreak, spreading to Maine, not likely to be managed in Maine.
  - Snow will decrease in Maine in light of climate change (20% projected decline in snowfall).
  - If quality hare habitat is ~~greater than~~ **requires only** 50% spruce-fir forest, ~~habitat for lynx should increase over time~~ **after reaching a low point in 2030, habitat may increase between 2030-2040 and then level off at ~5% of the landscape.** But if hares require higher spruce-fir content, lynx habitat would ~~go down~~ **not rebound 2030-2040 (remaining at only 2-3% of the landscape)** as there will be fewer areas w/ high percentage spruce-fir content.
  - Climate envelope modeling suggests balsam fir, white spruce, and red spruce will be largely gone from Maine and areas of eastern Canada by 2060.

#### Southern Snowshoe Hares: Updates, Questions, Forecasts – Karen Hodges

- Northern hare cycles are highly variable; peaks and amplitudes do not line up as nicely as has been described in the literature.

- Some southern hare populations show “cycle-ish” dynamics and high densities.
- Flathead National Forest, MT in lynx CH, has high hare densities but no lynx, has bobcats, why?
- Regional differences in maximum hare abundances observed in highest quality habitats across western and eastern landscapes – presented distributions of hares in western and eastern states in lynx range, see presentation file for numbers.
- Reported hare densities w/ habitat attributes.
- Forestry that reduces stand structure reduces hare abundances, hares increase w/ number of years since pre-commercial and commercial thinning.
- Hares recolonize burned areas as soon as they become suitable as the stand regenerates over time.
- How many hares do we need to keep lynx around? Landscape hare densities of 0.5 hares/ha (LCAS) to 1.1 to 1.3 (Steury and Murray). Maine and MN landscape hare densities needed to support lynx in between these values. Question why the GYA with low landscape hare densities still (may) support lynx.
- Red squirrels are major alternative prey to snowshoe hares – little known about their densities.
- If we lose boreal forests we will lose snowshoe hares.
- Hares and shrubs – understory important to hares, but little studied. Need to be studying understory structure - are those data collected on National Forests?
- Impacts of climate change on hares – changes to habitat structure and changes from boreal forest to other types will impact hare abundance.
- Salvage vs clearcut – salvage logging post fire will lengthen time for hares to recolonize burned areas. In Quebec harvest may create higher hare densities than fire.
- Climate change will affect hares. Increased fire and insect outbreaks. Forests may not regenerate to boreal forest. Coat change mismatch (Mills paper) - had some concerns.
- Changing forest community - hare is only ~20% of bobcat diet (bobcats eating primarily red squirrels), hares used by fishers, raptors, coyotes, fox, etc. - diverse predator assemblage at southern edge of range.
- Uncertain of the impacts of bobcats moving into lynx territory.

#### Lynx Population Status and Threats Updates:

##### Maine/Northeast – Jennifer Vashon

- A “happy story.”
- 1990’s to today – extensive areas of regenerating spruce-fir forest in Maine – good for hares and lynx.
- This has resulted in a presumed increase in suitable habitat above likely historic conditions.
- 18 million forested acres in Maine; 6 million acres of spruce-fir, of which 3 million acres are lynx habitat.

- Lynx habitat (sapling habitat in Forest Inventory and Analysis [FIA] data) increasing in the state; 40% of total spruce-fir is in sapling stage.
- 2006 - 700,000 acres of dense spruce-fir stands; 2015 – now 805,000 acres.
- Discussed telemetry study in Maine, conducted from '99-'11, with 191 individuals – see presentation file for more details.
- Demographic values from the telemetry study resulted in an estimated reproductive rate of 65%, an average of 2.63 kittens per breeding female, and a 78% kitten survival rate, see presentation for full details.
- 4.5 adult lynx/100 square km in study area with 5 to 9 kittens.
- Strong selection for spruce-fir sapling habitat.
- Measured some-demographics on survival and reproduction.
- 2006 pop estimate 750-1000 adult lynx, 2015 more lynx than 2006 and various indices (road mortality, **track surveys** and **incidental** trappings) suggest population still increasing.
- ~~— This estimate is based on estimated extent/amount of suitable lynx habitat and estimates of lynx density derived from the telemetry study. Total amount of habitat (from FIA data) X proportion of townships with lynx tracks X densities observed on the study area = total Maine lynx population.~~ **This estimate is based on data of extent/amount of suitable lynx habitat, occupancy from systematic surveys, and estimate of lynx density derived from a 12 yr telemetry study. See Day 3 parking lot questions on page X for more detail explanation.**
- Budworm outbreak and clearcutting to occur in the near future.
- Clear cuts still providing good conditions for lynx and hare 30 years post clear cut.
- Future impacts of changes to forestry resulting from Forestry Practices Act are unknown. ~~but likely will result in a decrease in lynx habitat.~~
- **The current abundance of habitat for lynx in Maine following extensive clear-cutting of budworm impacted stands prior to forest harvest restrictions (i.e., Forest Practices Act).**
- ~~— Does not believe that forestry guidelines are needed. Allow landowners to make choices on what they believe lynx need.~~ **An objective of IFW/USFWS lynx telemetry study was to provide landowners with the forest stand characteristics that support lynx to guide their management on private lands.**
- **Lynx population connected to neighboring Canadian provinces.**

#### Minnesota/Upper Midwest – Ron Moen and Susan Catton

- “Non-estimate/guess” of 50-300 lynx in MN, confident of minimum of ~50 due to genetic sampling, but the other end of the range is speculative. High degree of uncertainty. In 2015, there were 133 DNA samples collected - 48 individuals with 20 recaptures.
- Lynx population in MN connected to Ontario, not separated; dispersal into and from Ontario is common.
- Discussed home ranges and cover types in home ranges - amount of regenerating (young) forest is predictive.

- Studied hare densities in NE MN, higher in southern Ontario. Much fluctuation in hare numbers in recent years.
- Lynx are concentrated on the landscape in areas of high-quality hare habitat.
- Majority of mortality in MN observed in radio telemetry study was human caused (incidental trapping, road mortality). This was a small study with ~20 collared individuals. *Tamara Smith noted that Twin Cities FO maintains an incidental take database that is cross-referenced to the Superior National Forest (SNF) DNA database.*
- Bobcats are moving into NE MN; harvest increasing from 2000 to 2015, but still very few in the Arrowhead (northeastern MN, where the lynx are).
- Projected to lose lynx habitat in the future w/ climate change. Several modeled scenarios show almost complete loss of snow suitable for lynx by 2095, only a small area extreme NE Minn may retain.
- Documented hybridization w/ bobcats, 13 hybrids among 268 individual lynx identified from DNA samples.
- In general male lynx in MN were more migratory, moving in and out of Ontario, whereas females tended to disperse and then remain in the new location, either going to Ontario to stay, or vice versa
- SNF conducts focused snow track surveys in areas known to have lynx. SNF collects genetic samples to identify individual lynx and to track persistence. Additional DNA samples are collected opportunistically (e.g., from road kills, incidental trapping, etc.). Their database contains 268 identified individuals (48 individuals identified in 2014-15 winter - 20 recaptures [including 2 hybrids] and 28 new lynx).
- SNF annually collects/tracks 3-5 family groups.
- Reproduction documented each year. One female lynx was tracked for 5 years - she produced 7 kittens in MN.
- SNF is working with Twin Cities FO and NC State University to refine the survey protocol to get more meaningful data with little added effort.

#### Montana and Greater Yellowstone – John Squires

- Wyoming – in 1990's and early 2000's ~~few detections of lynx~~ lynx were detected reliably in the Wyoming Range, Union Pass, and both sides of Togwotee Pass.
- The long-term persistence of lynx in the GYA is unknown, but early records from Yellowstone Park documented presence in the 1920-1930s.
- Yellowstone – 3 lynx confirmed and reproducing in 2000-2004; few, if any, lynx remaining in the Wyoming Range and on Togwotee Pass based on recent surveys. The presence of lynx throughout the remainder of the ~~and~~ GYA is unknown. ~~since then despite extensive survey effort.~~
- Presence confirmed in Wyoming Range Teton area in early 2000s; 2 individuals collared and movements recorded.

- Snow track surveys have been conducted over time and indicate a clear pattern of lynx presence in the Wyoming Range, Union Pass and Togwotee Pass~ 6 tracks per year of survey. However, the current status of this population is unknown, but believed to be at low numbers based on current on-going surveys. The distribution of lynx in the Yellowstone National Park was determined with an extensive survey (2001 – 2004) that indicated lynx were present and documented reproduction; additional representative surveys were not conducted., without any notable pattern, which have found ~ 6 tracks per year of survey.
- Reintroduced 2010 genetic sampling resulted in no “native” GYA Lynx individuals being identified—only lynx from Colorado have traveled to the GYA and occupied previous home ranges of “native” lynx in the Wyoming Range and on Togwotee Pass, including males and females with overlapping home ranges. that dispersed from Colorado.
- Oil and gas leasing – potential risk to lynx in WY, overlaps lynx range in the Wyoming Range of western/northwestern WY.
- Montana – more lynx in northwest MT than GYA.
- Studied reproduction and litters in MT in Seeley Lake Area and Purcell Mts.
- 175 individuals were collared; the average lifespan for lynx in this area is 8.6 years.
- An average of 2.5 kittens per litter (2.25 in Seeley Lake and 2.95 Purcell Mtns.). Productivity was ~0.7 on average, and annual survival was 0.5 for sub-adults and 0.75 for adults on average.
- Lambda (rate of population increase) was 0.92 for the Seeley Lake area (e.g., population declining) and 1.16 for the Purcell Mtns. (population increasing).
- Lynx have recently contracted/perhaps extirpated from the Garnet Range.
- Modeled monthly survival rates – see presentation file for numbers.
- Predation (mountain lions), starvation, and human-caused mortality each about 1/3 of documented mortality in MT.
- Evidence of cyclicity in vital rates was not observed.
- Most of MT probably decreasing lynx abundance. Areas outside the Purcell Mountains in Montana may have declining population numbers based on PVA analyses.
- Protection of lynx habitat in core area in Seeley Lake increased substantially with conservation land purchases., hundreds of thousands of acres “protected”
- 2000-2013 over a million acres burned in lynx range in MT.
- Good habitat is habitat in which females produce litters, positively related to connectivity to mature forest and low fragmentation.
- Lynx persisted in low population numbers in WY and MT, may not currently be any lynx in WY. Montana is believed to support the largest lynx population in the western United States, but minimum population sizes have not been calculated. Lynx in Montana are more abundant compared to Wyoming.
- Last surge/wave of lynx out of Canada was in 1980s; no recent surges have been observed in sampling areas, is this related to the status in MT today?

- Fire prevalence in the last 13 years is far greater than it was for the previous decadal periods going back to the 19260s? [Note to Reviewer- is this date correct?]. Major factor in persistence of lynx in MT.
- Silviculture in MT has both positive and negative effects - **research is currently investigating lynx-use of forest management** ~~not much evaluation of whether the USFS guidelines are working.~~
- No evidence of “waves” of lynx during hare/lynx peak: little demographic effects. Are we in a “lynx drought?” Recent wave of lynx from Canada seem relatively low magnitude, thus MT population slowly declining?
- **Lynx in Montana exhibit fine-scale genetic sub-structuring.**

#### Parking Lot topics (Answered on day 3)

- 2000 LCAS is adopted in Forest Service plans, still operating under 2000 LCAS standards and guides. The 2013 LCAS is less restrictive than 2000 version, so by operating under the 2000 version the 2013 standards and guides are sufficiently covered.
- If Maine’s lynx population is so large, why was the State’s incidental take request for lynx relatively low?
- How exactly did Maine estimate lynx population?

#### Northern Washington – Ben Maletzke

- Lynx are state-threatened in WA; possible justification to update to endangered status based on current status of threats.
- DNR has a management plan (HCP) and recovery plan for lynx.
- USFS has 98% of lynx habitat in WA.
- Okanogan Lynx Management Zone (LMZ) only area in WA w/ consistent lynx records from 2005-2015
- Went over 5 listing factors in WA:
  - o Reg mechs/lynx plans in place;
  - o No disease, little predation, could increase w/ climate change and snow changes;
  - o Bark beetle, bud worm – trees dying, increased fire, many burned areas in previously good lynx habitat, see presentation file for numbers;
  - o Regeneration of burned areas could create good habitat, but takes 20-40 yrs for these areas to grow up to hare/lynx habitat again;
  - o Climate change may have effects on veg cover, precipitation, fire size and frequency, prey densities;
  - o Small blocks of populations, vulnerable to stochastic events;
  - o Connectivity of Okanogan w/ Canada okay, Kettle crest less connected to Canada.
- Rough ideas on population. 1990s there were 90 to 120 females, currently as few as 24 females.

- Lynx currently have larger home ranges, reduced habitat. May be vulnerable to trapping in BC Canada. No long term studies - snapshots of data.
- Discussed WA potential management and recovery actions - concerned about climate change effects on snow depth, quality (crusting), duration and effects on fire frequency.
- Connectivity during surge events from Canada more important for areas other than Okanogan in WA; have not seen waves of lynx during recent high hare/lynx years in Canada.
- Thoughts for future study include probability of population persistence, need and feasibility for augmentations, collaboration with British Columbia, state status in WA, management, surveys and monitoring.

#### Colorado/Southern Rockies – Jake Ivan

- Showed map of 90% UD – most hanging around southwest and central CO.
- State endangered (1973); widespread federal predator control 1910s-1920s .
- 1978-1997 statewide surveys (11) found only a few tracks.
- 1999-2006: 218 lynx translocated from Canada and Alaska. During the period of monitoring (1999-2010) the population persisted and had relatively high annual survival, relatively high reproduction.
- First denning documented in 2003, 48 dens by 2010.
- Modeled population – trajectory of pop is slightly increasing maybe, but at least holding steady.
- Intensive monitoring concluded in 2010; now conducting occupancy monitoring (only in San Juan Mountains now; hope to expand to rest of potential habitat and for 10 years) and hope to be able to detect trends.
- Evidence of some continued reproduction 2010-2015 (kittens at camera stations, and 38% of Squire’s captures were “new” individuals).
- Current survival unknown.
- Potential threats – climate change, bark beetle epidemics, fire, concentrated recreation (seem tolerant of humans, but more and more people in the backcountry), highways.
- Spruce-fir moderately vulnerable to climate change, habitat expected to migrate upslope over time.
- 4 million acres of trees killed by bark beetle, but lynx are still using beetle kill areas for now as long as understory vegetation is available for hare production.
- Potential elevation refugia may be unique for lower 48 states for climate change.
- ~~Development (extensive ski areas) may be affecting lynx (avoidance).~~ **A cursory, pre-analysis review of location data suggests that lynx make use of landscapes in which heavy winter recreation occurs. However, use of developed ski areas is light, and outside of ski areas, heavy lynx use tends to occur in thick timber that is unused by snowmobiles and other backcountry users.**
- Red squirrels can provide 25% (Jake - was this 25% or 20%?) of lynx diet, but losing cone-producing trees at large geographic scale after beetle outbreak may be significant during

landscape level dips in hare density. Over 10 winters of snow-tracking in Colorado, red squirrels comprised an average of 25% (range = 7-72% for any given year) of lynx diet by occurrence; they comprised an average of 6% (range = 1-32%) by biomass.

- Lynx snow track and camera surveys have been initiated.

#### Expert Elicitation of lynx status via questioning on representation, redundancy and resiliency

Following the presentations, an expert elicitation was conducted to collect additional information on the status of lynx for each the three measures of viability used in a species status assessment, namely the levels of representation and redundancy for the DPS, and resiliency for each lynx population/geographic area within the DPS.

#### **Redundancy Questions:**

1. List the factors/catastrophic events that could eliminate an entire population.

Response Type: index card list

- Some discussion around defining catastrophic event – a single point in time event, ex. Hurricane, large fire vs event that takes 10 yrs to occur or series of events. For this question the event was defined as a single point in time. And discussion around population – in this case each of the 6 geographic areas is a “population”. Eliminate means functional extirpation.
- Experts asked whether climate change was considered a catastrophic event; USFWS answered that because it operates and its effects are manifested over longer time frames, it should not be considered a catastrophic event for the purposes of this elicitation.
- Experts asked whether the “population” lost meant the DPS in its entirety or a single one of the 6 subpopulations or units. Experts were asked to consider the loss of any one subpopulation.
- See Redundancy expert response handout.

2. Could any of the catastrophic events listed eliminate all 6 populations/geographic areas simultaneously?

Response type: experts supplied a written response of yes or no.

- See Redundancy expert response handout.

3. What is the probability that any single population could be eliminated by a single catastrophic event in the next 10 yrs?

Response type: 1-point elicitation.

- See Redundancy expert response handout.

4. What is the percent likelihood that a series of catastrophic events within the next ten years could cause functional extirpation of one or more lynx populations?

Response type: 1-point elicitation.

- See Redundancy expert response handout.

5. How long would a population eliminated by a catastrophic event require to become reestablished naturally?

Response type: 3-point elicitation.

- See Redundancy expert response handout.

### **Day 3**

Parking lot questions: How was pop estimate in Maine done? – Jen Vashon answered: FIA data to estimate the amount of spruce-fir forest in the core lynx range, FIA data to measure how much was sapling, winter snow track surveys used to estimate the proportion of habitat that was occupied. Looked at areas to likely have lynx vs all the areas, tells how much of the habitat is likely occupied by lynx in 2006. Looked at home ranges of lynx, how many acres are in a female and male home range. If lynx could occupy all the spruce-fir and all the spruce-fir sapling available to give estimate of number of lynx.

How did you determine primary predation in Maine? Jen Vashon: Found primary predator was fisher. A lot of **initial** skepticism around this. Close tie to snow storms and lynx bedding in **hardwood mature softwood** forests, where fisher are. Assume **they many** were killed while bedding. **All Most** were killed by bite around the neck. Forensic evidence at the sites was consistent w/ fisher predation. **We have a draft manuscript in prep.**

For Maine, w/ a pop maybe greater than 1000, why is incidental take in the trapping HCP so low? Jenn Vashon: MDIFW implemented measures we thought would reduce trapping injury and mortality leading up to the time we submitted the ITP application. We used the recommendations in the AFWA booklet and killer-type traps on a leaning pole 4 feet off the ground at a 45 degree angle. We believed that these measures would result in low mortality, thus a request of 3 lynx mortalities in traps over the next 15 years.

Question about pellet index vs live trapping of hares – Karen Hodges answered: Pellet counts are proven to be robust & are the most reliable survey index method to provide **variance-population** estimates; differences in methodology don't explain variation in survey results across range. **Pellet counts have been thoroughly studied by many researchers and we know they relate well to snowshoe hare densities across the range and through the cycle. They do a much better job than tracks or browse or other index methods. Mark-recapture is still the gold standard because it is an estimator, not an index, but pellets are by far the best index because their properties are well known and they do map onto capture-mark-recapture estimates well.**

### **Resiliency Questions: Probability of Persistence Exercise**

1. What is the probability of persistence over time (particularly currently and at 2025, 2050, 2100) for each of the 6 major geographic units with lynx populations?

Response type: 3-point elicitation. What are the lowest probability, highest probability, and most likely probability of persistence? Experts were asked to connect the points through time to create a risk profile for each of the 6 geographic units.

- See Resilience expert response handout.

2. What are the major drivers/factors (up to 3) reducing or influencing probability of persistence for each of the major geographic units?

Response type: Ranked list of factors, for each point in time (2025, 2050, and 2100), with % contribution of each factor.

- See Resilience expert response handout.

### **Conservation Brainstorming Exercise**

3. What conservation actions could be taken that would address the factors impacting the probability of persistence or otherwise increase the probability of persistence?

Response type: Individual list with rounds responses. Experts were asked to each write their own list of conservation actions that could be taken. They were given 5 minutes for this task. Facilitators then asked one expert at a time to provide one item from their list, cycling through the set of experts until experts had exhausted their lists. Experts were given the opportunity to add items when it was their turn that had not been on their written lists.

List of potential conservation actions:

Reduce CO2 emissions.

Continue protections associated w/ Federal and/or State listing.

Adjust forest management to retain spruce-fir and reduce fire burn rates.

Conserve/promote habitat connection w/ Canada populations through land use planning.

Management of salvage logging associated with fire and insect damage to facilitate/expedite conditions favorable to hares and lynx.

Configure and design lynx-friendly landscape at appropriate scales; maintain habitat mosaic.

Manage fuels-reduction (wildland fire) projects to maintain hare/lynx habitat features.

Population augmentation/reintroductions for currently small or extirpated populations (GYA, Kettle, etc.); bolster populations before future impacts.

Additional research to fill knowledge gaps (particularly related to conservation effects) – forest conditions that support hares, hare densities needed for lynx, range of habitat needed for lynx, unclear exactly what is needed for lynx across the range, viability, landscape hare densities, etc.

Cross border cooperation with Canada to increase near border populations, maintain connectivity.

Consider cumulative impacts of mining, ski areas, oil and gas, etc. in management decisions.

Promote reforestation of heavily-fragmented areas (WY, MN); reduce fragmentation.

Strategic habitat conservation, model and identify key areas and focus on those areas still in need of protection and management (e.g. private forest lands).

Maximize redundancy of lynx populations throughout the DPS.

Develop fire-management BMPs to create high- and low-intensity mosaic fire patterns to benefit lynx and hare habitats.

Is there a need for a consistent lynx (and hare?) monitoring strategy? Maybe could couple w/monitoring of other carnivores. Structured occupancy modeling with genetics sampling, could be very informative, and is cost effective. Known-fate monitoring. Monitoring pellet plots is proven and reliable way to monitor hares.

Could benefit from more funding specially devoted to mesocarnivores. Lynx are in worse shape than other carnivores that receive a lot of funding, have more secure populations, and will respond to climate change better.

### **Representation Questions –**

1. Are any of the populations susceptible to genetic drift on a scale that would limit genetic viability? If yes, which populations?

Response type: Experts supplied a written response of yes or no, with a yes answer accompanied by the list of populations.

- See Representation expert response handout.

2. Are there locations from a lynx perspective that have unique habitat conditions relative to other areas in the lynx range that are necessary to foster future adaptive capacity of the DPS? If yes, where?

Response Type: Open discussion.

- See Representation expert response handout.

Other things the experts thought we should consider –

Monitoring of prey base (hares, red squirrels) should be considered, would be very informative. Pellet based or mark recapture are most reliable methods. Need to sort out if these areas that we think are going to become poor habitat for a variety of reasons could still hold hares and lynx in the future. Maybe hares still can use areas we think will be poor habitat. Monitoring of these areas could help inform.

*[Participants are invited to provide additional notes in this section]*

MEETING ADJOURNED