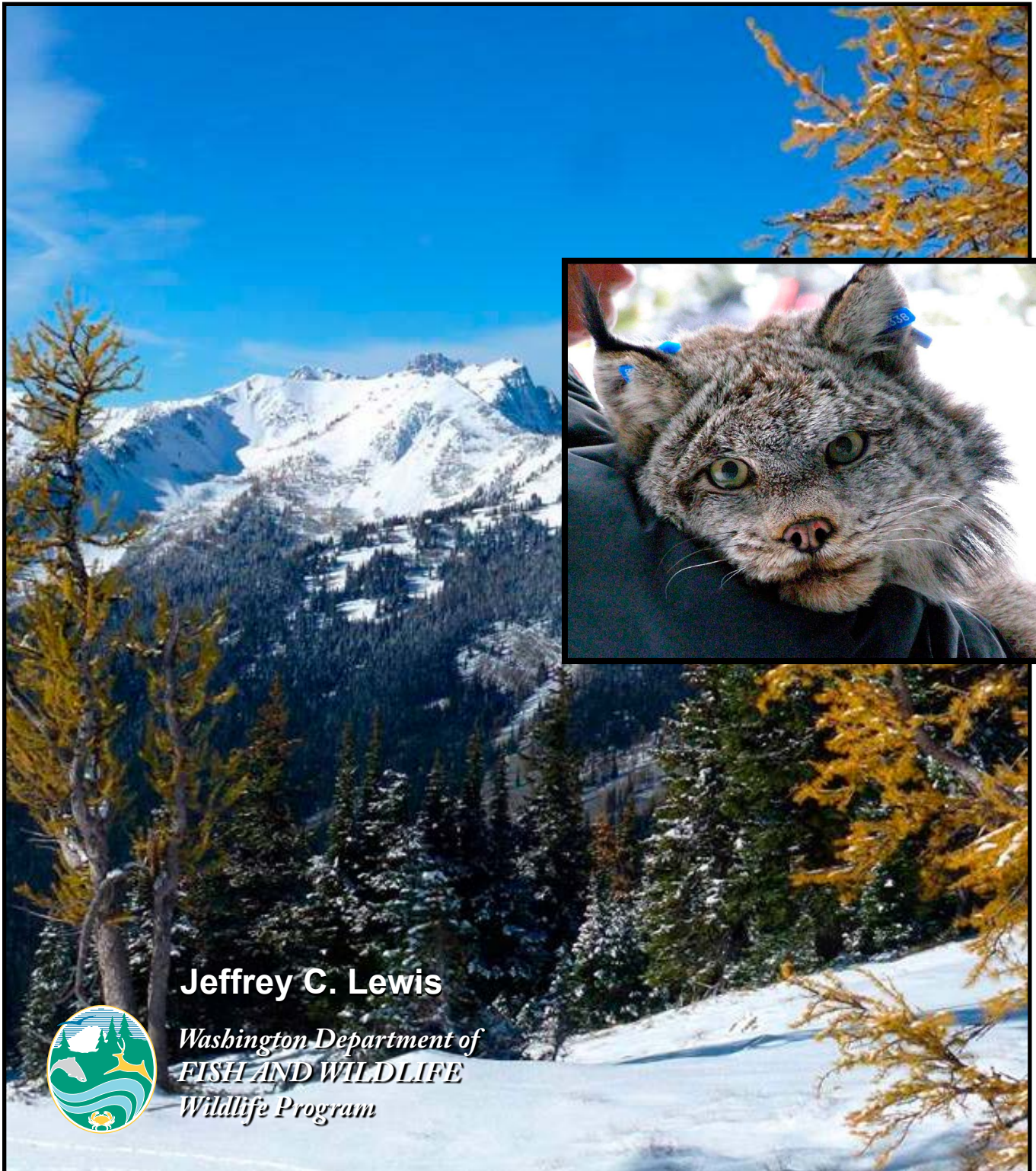


Periodic Status Review for the Lynx



Jeffrey C. Lewis



*Washington Department of
FISH AND WILDLIFE
Wildlife Program*

The Washington Department of Fish and Wildlife maintains a list of endangered, threatened, and sensitive species (Washington Administrative Codes 232-12-014 and 232-12-011). In 1990, the Washington Wildlife Commission adopted listing procedures developed by a group of citizens, interest groups, and state and federal agencies (Washington Administrative Code 232-12-297). The procedures include how species listings will be initiated, criteria for listing and delisting, a requirement for public review, the development of recovery or management plans, and the periodic review of listed species.

The Washington Department of Fish and Wildlife is directed to conduct reviews of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing by the Washington Fish and Wildlife Commission. The periodic status reviews are designed to include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification. The agency notifies the general public and specific parties who have expressed their interest to the Department of the periodic status review at least one year prior to the five-year period so that they may submit new scientific data to be included in the review. The agency notifies the public of its recommendation at least 30 days prior to presenting the findings to the Fish and Wildlife Commission. In addition, if the agency determines that new information suggests that the classification of a species should be changed from its present state, the agency prepares documents to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act.

This document is the Draft Periodic Status Review for the Lynx. It contains a review of information pertaining to the status of the lynx in Washington. It was reviewed by species experts and will be available for a 90-day public comment period. All comments received will be considered during the preparation of the final periodic status review.

The Department intends to present the results of this periodic status review to the Fish and Wildlife Commission at a meeting in Olympia in November 2016.

Submit written comments by e-mail on this report by 10 October 2016 to:

T&Epubliccom@dfw.wa.gov

Or by mail to:

**Listing and Recovery Section Manager, Wildlife Program
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This report should be cited as:

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On the cover: Photo of lynx by U. S. Forest Service; background by Scott Fitkin.
Black and white illustration on title page by Darrell Pruett

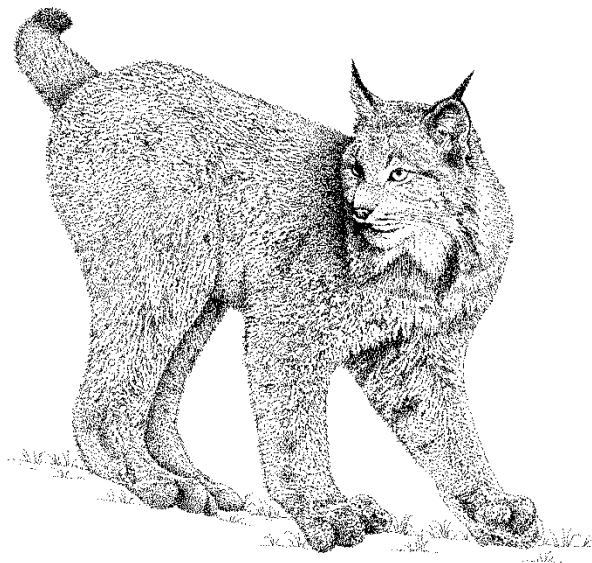


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DRAFT

Periodic Status Review for the Lynx in Washington



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July 2016

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EXECUTIVE SUMMARY

The lynx is one of three wild felids that are native to Washington State. It occurred historically in the boreal forests within the Cascade Range and northeastern Washington. A number of factors, including trapping for fur, likely contributed to the contraction of the lynx range in Washington. The lynx is now largely restricted to the boreal forests in western Okanogan County in the northeastern Cascades, a fraction of its former range. To protect the species, lynx trapping in Washington was prohibited in 1991, and lynx were state and federally listed as a threatened species in 1993 and 2000, respectively. The resident population in the northeastern Cascade Range has been impacted by numerous large wildfires in the past 20 years, which removed large areas of suitable habitat for lynx. The loss and fragmentation of habitat as a result of wildfires and the direct and indirect effects of climate change are considered substantial threats. As a small population located at the margin of the species global range, the Washington lynx population is vulnerable to a number of demographic factors that could influence its likelihood of persistence including the stochastic effects of survival, reproduction, and sex ratio of litters, density dependence or Allee effects, and lack of immigration from British Columbia. These factors are likely to work in concert with habitat loss and fragmentation to threaten the remaining lynx population in Washington. Given the 1) observed range contraction Washington following protection efforts, 2) the substantial loss of habitat in the last 20 years, and 3) the ongoing and anticipated threats to lynx population persistence, we recommend that the status of the lynx in Washington be changed from threatened to endangered.

DESCRIPTION & LEGAL STATUS

The lynx (*Lynx canadensis*) is the rarest of the three native felids that occur in Washington State, which also include bobcats (*Lynx rufus*) and mountain lions (*Felis concolor*). Lynx are slightly larger than bobcats and smaller than cougars, with adults averaging 8.5-10.0 kg and males being slightly larger and heavier than females. The lynx's longer legs, larger paws, fuller facial ruff, longer ear tufts (Figure 1), and the entirely black tip of its tail distinguish it from bobcats. Lynx were prized as a fur-bearing species but concern about decreasing population size led to protection from trapping or hunting in Washington in 1991. The species was listed as a state threatened species in 1993 and a recovery plan was developed for the lynx in Washington (Stinson 2001); lynx were federally listed as a threatened species in 2000 (USFWS 2000). A federal status review for the lynx is currently being conducted by the U.S. Fish and Wildlife Service (USFWS 2015).



Figure 1. Lynx

DISTRIBUTION

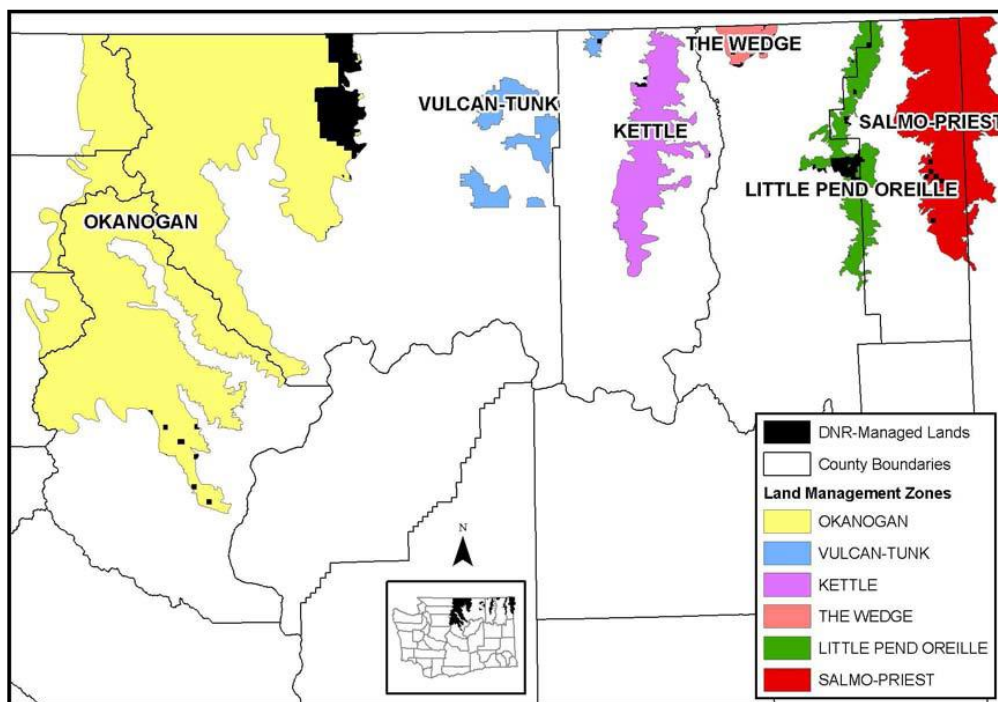


Figure 2. Lynx management zones (LMZs) in Washington indicate the general areas historically occupied by lynx in northcentral and northeastern Washington.

The range of the lynx includes much of the boreal forest of North America, and its range extends south from northern Canada and Alaska to several areas of the contiguous United States including Washington, the northern and central Rocky Mountains (in Idaho, Montana, Wyoming, Utah, and Colorado), and the northern portions of Minnesota, Michigan, Vermont, New Hampshire and Maine (Anderson and Lovallo 2003, Poole 2003). Lynx once occurred throughout the high-elevation conifer forests of northcentral and northeastern Washington from the Cascade crest in western Okanogan and Chelan Counties east to Pend Oreille County (Figure 2). Historical observations suggest that lynx may have also occupied portions of the southern Cascade Range and the Blue Mountains (Dalquest 1948).

NATURAL HISTORY

Habitat requirements. Lynx inhabit boreal, sub-boreal and subalpine forests in North America (Aubry et al. 2000, Mowat et al. 2000). In Washington, lynx currently occur in mid to high-elevation forested habitats (generally >1400 m elevation) in the northeastern portion of the Cascade Range (Koehler et al. 2008). Forests dominated by Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), and lodgepole pine (*Pinus contorta*) were selected by lynx, whereas those dominated by Douglas-fir (*Pseudotsuga menziesii*) or ponderosa pine (*Pinus ponderosa*) were avoided (Koehler 1990, Koehler et al. 2008, Maletzke et al. 2008). Koehler et al. (2008) found that lynx selected forest stands at elevations ranging from 1525 m to 1829 m with moderate canopy and understory cover, and avoided open areas, recently burned areas (<10 years after a burn), and areas with steep slopes.

Lynx are highly specialized predators; snowshoe hares (*Lepus americanus*) generally comprise 50-100% of the lynx's diet throughout its range (Aubry et al. 2000, Mowat et al. 2000, Roth et al. 2007). A dependence on snowshoe hares was also indicated by the coincidence of the lynx range with that of the snowshoe hare (Anderson and Lovallo 2003, Murray 2003) and the synchronized population cycles of these two species in much of northern North America (Krebs et al. 2001). Snowshoe hares were the dominant prey in the lynx diet in Washington as indicated by the detection of snowshoe hares in 23 of 29 (79%) scats collected by Koehler (1990) and in 40 of 46 (87%) collected by von Kienast (2003); red squirrels (*Tamiasciurus hudsonicus*) were the second most important prey species in both studies. The importance of snowshoe hares in the diet of Washington lynx was also apparent in the large proportion of prey chases (75% [Koehler 1990], 61% [von Kienast 2003]), and captures (81% [Maletzke et al. 2008]) of snowshoe hares found during lynx snowtracking studies.

Lynx select early seral forest habitats because these forests frequently support the greatest densities of snowshoe hares (Aubry et al. 2000). Snowshoe hares are closely tied to understory cover provided by shrubs or young trees, and hare density may increase with understory density (Hodges 2000). A moderate to dense understory is commonly found in early seral-forests. In northcentral Washington, Koehler (1990) found that snowshoe hares were most abundant in 20-year old lodgepole pine stands (i.e., early seral), and these same forests were commonly used by lynx, as well as Engelmann spruce and subalpine fir forests. Lewis et al. (2011) found that sapling density was the best predictor (+ relationship) of snowshoe hare density in northcentral Washington and was strongly correlated to understory cover. Importantly, snowshoe hares can be found in older forests as well. Although strong links between lynx and older forests have yet to be detected in Washington, studies in the nearby Rocky Mountains of Montana have documented selection for mature, multi-storied forests with high horizontal cover in winter (Squires et al. 2010).

In the southwestern portion of their global range (i.e., southwestern Canada, northwestern US), den sites of radio-collared lynx have been located within late seral forests (stands >200 years old) of Engelmann spruce, lodgepole pine and subalpine fir (Koehler and Brittell 1990, Koehler 1990, Aubry et al. 2000). Understory structure is likely the most important determinant for adequate denning cover as young-aged forests can also provide denning cover. Den sites were commonly located in spaces under a pile of fallen trees (following windthrow, disease or a burn) that provide cover for kittens (Interagency Lynx Biology Team 2013).

Movements and dispersal. Lynx make long distance movements (up to 1100 km) during juvenile dispersal or when individuals of both sexes and all ages leave established populations in northern boreal forests when snowshoe hare population are at the low phase of the population cycle (Poole 1997, 2003; Mowat et al. 2000; Schwartz et al. 2002). The long distance movements of lynx help to explain the limited genetic structure among lynx populations in North America (Schwartz et al. 2002).

POPULATION AND HABITAT STATUS

Occupied habitat. Washington's lynx population now appears to be largely restricted to western Okanogan and northern Chelan Counties as well as the eastern edges of Whatcom and Skagit Counties and largely coincides with the Okanogan LMZ (Figure 3). The Okanogan LMZ is dominated by federal lands including the Okanogan-Wenatchee National Forest, North Cascades National Park, and the Mount Baker-Snoqualmie National Forest. The Loomis State Forest is managed by Washington Department of Natural Resources (WDNR; Figure 2) and comprises a significant portion of the lynx habitat in the Okanogan LMZ. The Colville National Forest is located in Ferry, Stevens and Pend Oreille Counties and comprises the bulk of the land in the five eastern LMZs. Lynx have been detected on three occasions in Stevens and Pend Oreille Counties since 2005 (Figure 3), however numerous systematic lynx surveys conducted in northeastern Washington since 2005 failed to detect lynx (Table 1) and indicate that resident lynx populations no longer occupy Ferry, Stevens and Pend Oreille Counties.

Table 1. Location, timing, techniques used, and results of lynx surveys conducted in northeastern Washington since 2005.

| LMZ | Year(s) | Survey technique ^a | Lynx detections ^b | Surveyors ^c |
|---------------------|---------|-------------------------------|------------------------------|------------------------|
| Little Pend Oreille | 2014 | Camera Stations (n=10) | 0 | Washington State Univ. |
| Kettle | 2009-11 | Hair-snare stations (n=50) | 0 | USFS, WDFW & CNW |
| Kettle | 2008 | Track surveys (158.5 miles) | 0 | WDFW & USFS |
| Kettle | 2007 | Track surveys (150.5 miles) | 0 | WDFW & USFS |
| Salmo-Priest | 2006 | Track surveys | 0 | WDFW & USFS |
| Kettle | 2005 | Track surveys | 0 | WDFW |
| Salmo-Priest | 2005 | Track surveys | 0 | USFS |

^a Track surveys involve looking for and identifying lynx tracks in the snow while driving a snowmobile on trails and roads within LMZs. Total number of miles surveyed are listed when known.

^b Although lynx were not detected during these surveys, lynx were incidentally detected on 3 occasions in northeastern Washington since 2005 (Figure 3).

^c USFS = U.S. Forest Service (Colville National Forest), WDFW = Washington Department of Fish and Wildlife, CNW = Conservation Northwest.

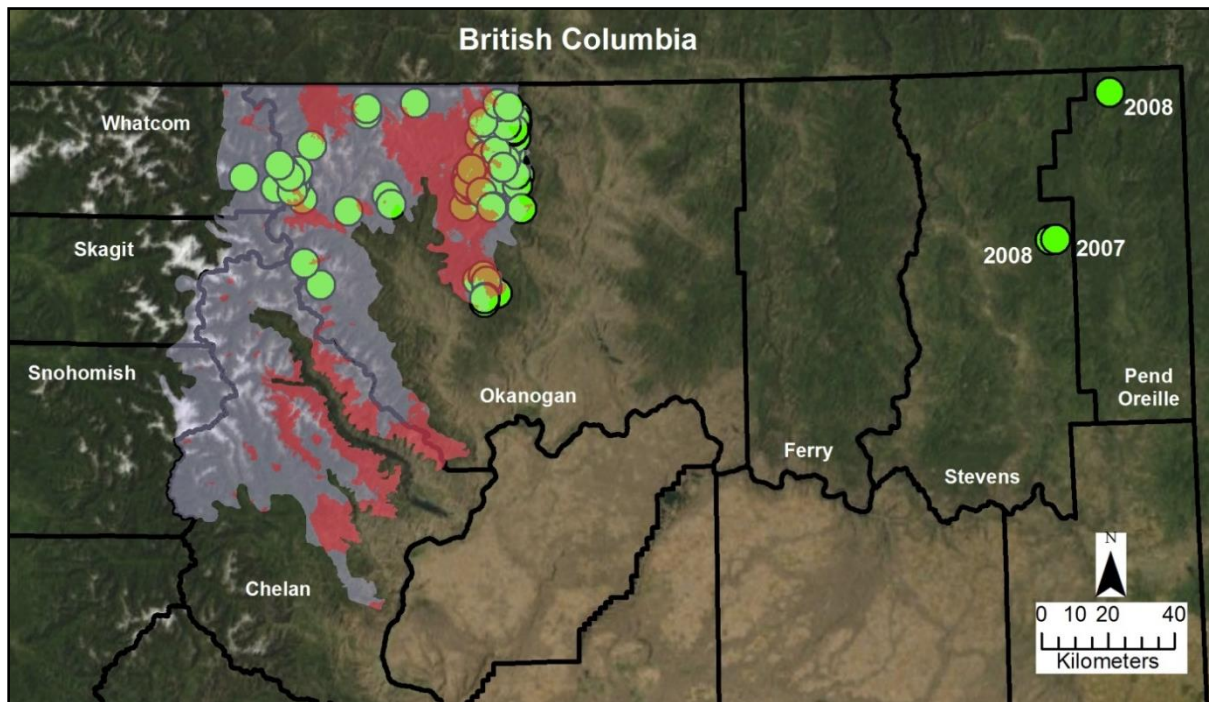


Figure 3. Lynx detections (green circles) from track surveys, lynx captures, or photographs in Washington from 2005-2015. The red shaded area delineates portions of the Okanogan LMZ (grey shading) burned from 1992-2015 (33.5% of the LMZ).

Population trend and viability. There is little information available to estimate the size of the lynx population that was present in Washington historically. In addition, even though recent telemetry and detection data indicate that lynx occupy the Okanogan LMZ, there are few data to indicate the distribution of lynx in this LMZ or the amount or configuration of suitable habitat required to support male or female lynx occupancy within this LMZ. Koehler et al. (2008) estimated the number of lynx occurring in Washington at approximately 87 individuals based on estimates of home range size and available suitable habitat. Revised estimates made in 2015 of average home range sizes of lynx in Washington and the

extent of suitable habitat in the Okanogan LMZ (B. Maletzke, Washington Department of Fish and Wildlife, unpublished data) suggested that the carrying capacity for female lynx has declined from 43 in 1996 to 27 in 2014 (Table 2). The loss of suitable habitat has resulted largely from extensive wildfires that have occurred in this LMZ since 1992 (Figure 3). No formal population viability assessment has been conducted to evaluate the likelihood of lynx persisting in the Okanogan LMZ. However, the continued viability of this population is in question because of the risks associated with 1) the recent loss and fragmentation of suitable habitat (from wildfires), 2) the small estimated female carrying capacity, and 3) uncertainty about the extent that lynx immigration from British Columbia supports this population.

FACTORS AFFECTING CONTINUED EXISTENCE

Adequacy of Regulatory Protection

Federal Listing. The lynx has been federally listed as a threatened species since 2000, which protects the lynx from take or harassment. Throughout its range in the contiguous U.S. the lynx is threatened by human alteration of forests, low numbers as a result of past overexploitation, expansion of the range of competitors (bobcats (*Felis rufus*) and coyotes (*Canis latrans*)), and elevated levels of human access into lynx habitat (USFWS 2000, 2015). In addition, the area of Washington State currently occupied by lynx is designated as critical habitat (USFWS 2014), providing an additional layer of evaluation to all proposed actions with a federal nexus. Critical habitat for lynx is predominantly composed of National Forest lands that are managed under the federal lynx conservation strategy (Interagency Lynx Biology Team 2013) or Washington Department of Natural Resources (WDNR) lands that are managed under a lynx habitat management plan (WDNR 2006).

State Listing. The lynx has been listed as a threatened species within Washington State since 1993 (Stinson 2001). This listing prompted the development of Washington Department of Natural Resources' (WDNR) Lynx Habitat Management Plan (WDNR 1996, 2006), which was implemented on over 5 million acres of state forest lands in lieu of a state-wide forest practices rule for the lynx. There has been no trapping or hunting season for lynx in Washington since 1991 (Stinson 2001), and the state listing protects lynx from take or harassment.

Loss and Fragmentation of Habitat. From 1992 to 2015, 3130 km² of forest cover in the Okanogan LMZ has been burned by wildfires (Figure 3). Given slow growing conditions in high-elevation forests where lynx occur, a regeneration period of 10-40 years is generally required to create suitable winter habitat for snowshoe hares and, consequently, foraging habitat for lynx (Interagency Lynx Biology Team 2013). Habitat may also be lost as a result of timber harvest within the Okanogan LMZ, but the bulk of habitat loss is due to large wildfires that burn subalpine fir, Engelmann spruce and lodgepole pine forests at mid and high-elevations. For example, approximately 18% of the Okanogan LMZ was burned in 2006 (865 km²; 9% of the LMZ) and 2015 (857 km²; also 9%), which resulted in the substantial loss of high-quality lynx habitat. Given the small and isolated nature of the population, the recent loss of habitat from wildfires, and the anticipated effects of climate change (Interagency Lynx Biology Team 2013), additional loss (and fragmentation) of habitat due to large wildfires is a major threat to the population in the Okanogan LMZ.

Demographic Factors. WDFW estimated that the Okanogan LMZ could support approximately 27 female lynx (Table 2; and presumably a similar number of males for a total of 54 lynx) (WDFW unpublished data); however this does not indicate the actual number of lynx that currently occupy the LMZ, which could be significantly fewer than 54 due to the fact that all suitable habitat may not be

occupied. As a small population located at the margin of the species range, the Washington lynx population is vulnerable to a number of demographic factors that could influence its likelihood of persistence. These demographic factors include the stochastic effects of survival, reproduction, and sex ratio of litters (Lande 1993); density dependence or Allee effects (Gascoigne et al. 2009); and immigration from, or emigration to, British Columbia (Vanbianchi 2015).

Table 2. Estimated area of suitable habitat and female carry capacities of lynx management zones in northcentral and northeastern Washington in 1996 and in 2014 (B. Maletzke, WDFW, unpublished data).

| Lynx Management Zone | 1996 | | 2014 | |
|--|----------------------------|--------------------------|----------------------------|--------------------------|
| | Habitat (km ²) | Est. ♀ carrying capacity | Habitat (km ²) | Est. ♀ carrying capacity |
| Okanogan | 2581 | 43 | 1630 | 27 |
| Kettle | 404 | 8 | 376 | 7 |
| Wedge, Little Pend Oreille, and Salmo Priest | 785 | 7 | 784 | 7 |

Lynx are currently trapped for their fur in the area just to the north of the Washington border. Trapping in British Columbia thus removes potential immigrants that could bolster the population in the Okanogan LMZ or could remove emigrants from this population that might have returned. Moreover, immigration to Washington may be limited by the distribution of suitable habitats, as well as impediments and barriers to movement (e.g., highways, cities, rivers, and railroads) in southern British Columbia (Washington Wildlife Habitat Connectivity Working Group 2010).

Climate Change. Climate change is expected to have a significant influence on the continued existence of lynx in Washington by altering the extent and quality of habitats that can be successfully exploited and occupied by lynx (Interagency Lynx Biology Team 2013). Specifically, climate change is expected to reduce the extent of suitable habitat by 1) increasing the frequency, intensity or distribution of wildfires (McKenzie et al. 2004, Westerling et al. 2006), 2) promoting forest types that provide lower quality habitat for lynx and snowshoe hares (e.g., Douglas fir, ponderosa pine; Gonzalez et al. 2007), and 3) altering the spatial/elevational extent and physical qualities (e.g., depth, density, consistency) of the snowpack required by lynx and snowshoe hares (Interagency Lynx Biology Team 2013). In addition to eliminating suitable habitat, climate change effects could also decrease habitat quality (e.g., by reducing the availability of deep snow) and thereby diminish the competitive advantage lynx have over bobcats and coyotes for snowshoe hares that is conferred by lower foot-loading (Buskirk et al. 2000). Reduced snowpack could also expose lynx to a greater risk of predation by wolves or mountain lions (Buskirk et al. 2000). Climate change could also affect lynx by enabling novel disease-causing pathogens or parasites to become invasive or by increasing the prevalence of existing ones. The lynx management plan for British Columbia indicates that lynx populations in southern B.C. are likely to decline if climate change proceeds on its current trajectory (Apps and Kinley 2006).

Other Factors Affecting Lynx. Lynx may avoid areas with high levels of winter recreational use (i.e., snowmobiling and snowmobile trails), but appear to consistently use areas with moderate or low levels of use (Interagency Lynx Biology Team 2013). It has been hypothesized that snowmobile trails could improve the accessibility of lynx habitat to coyotes and bobcats, which are potential competitors of lynx for snowshoe hares (Buskirk et al. 2000); however, Kolbe et al. (2007) found that snowmobile trails did not appreciably influence the movements or foraging behaviors of coyotes. Although incidental captures, illegal killing, vehicle collision mortalities, and disease events have been reported in the literature (Interagency Lynx Biology Team 2013), the effects of these factors do not appear significant enough to affect the persistence of lynx in Washington.

MANAGEMENT ACTIVITIES

Habitat management. Lynx habitat management on National Forest lands follows the lynx conservation strategy as incorporated into specific National Forest management plans. This management involves identifying and protecting high quality habitat mosaics occupied by reproductive populations of lynx (i.e., core areas: Interagency Lynx Biology Team 2013). While the conservation strategy has been considered sound, the monitoring efforts associated with strategy implementation have been inadequate to determine if the strategy is successful in the Okanogan LMZ. However, given the extensive protection of the federal landscapes occupied by lynx, it is unclear how additional measures could be employed to improve habitat conditions on federal lands if monitoring efforts indicate limited occupancy by lynx.

On the Loomis State forest and other Washington state lands in northeastern Washington, WDNR lynx habitat management involves 1) providing a mosaic of forest successional stages over time that are suitable for lynx foraging, denning and travel within recognized lynx analysis units (i.e., units are approximately the size of an average female lynx home range), and 2) providing habitat connectivity between denning and foraging areas (WDNR 2006). In 2011, WDFW and WDNR created additional interim management guidelines for lynx habitat in the Okanogan LMZ to achieve “no net loss” of quality forage habitat for lynx (WDFW and WDNR, 2011, unpubl. guidelines). Monitoring efforts to detect lynx presence have been initiated in the Loomis in 2015, and these can provide an indication of the success of WDNR’s habitat plan, however additional monitoring efforts are required to evaluate its overall success. It will be important for the upcoming update of WDNR’s habitat management plan (i.e., due in 2016) to include findings from recent and ongoing research on the habitat use of snowshoe hares and habitat selection by lynx. The plan should also incorporate monitoring results to show how habitat goals for lynx are being met, and to validate assumptions made in the plan to predict habitat availability at prescribed time-frames.

Population monitoring. From 2005 to 2014 there were a number of formal surveys conducted in the Kettle, Little Pend Oreille and Salmo-Priest LMZs that resulted in no detections of lynx (Table 1); no formal surveys were conducted during this time in the Vulcan-Tunk, Wedge, or Okanogan LMZs. Consequently, we lack reliable information on the current status of the lynx population in the Okanogan LMZ; however, there have been a number of verifiable detections of lynx within this LMZ since 2005 obtained during research studies or incidentally (Figure 3). New surveys for lynx were initiated in 2015 in the Kettle, Wedge, and Okanogan LMZs by Dan Thornton (Washington State Univ.) and his students; their preliminary results include only lynx detections within the Okanogan LMZ.

Research. Since 1990, there has been a substantial amount of field research focused in the Okanogan LMZ to evaluate home range composition (Koehler and Brittell 1990), density (Koehler and Brittell 1990; Koehler et al. 2008; A. Scully and D. Thornton, WSU, ongoing), habitat selection (Von Kienast 2003, Maletzke 2004), and habitat connectivity (Vanbianchi 2015) of lynx. Research has also focused on the habitat selection (Koehler 1990), habitat matrix and density (Koehler 1990; Walker 2005; Lewis et al. 2011) and predation of snowshoe hares (A. Wirsing and students, UW, ongoing).

Partners and Cooperators

A number of state and federal agencies, tribes, universities, and conservation organizations have been conducting and contributing to lynx surveys (Table 1) and research in Washington. These include, but are not limited to, the U.S. Forest Service, U.S. Fish and Wildlife Service, Washington Department of Natural Resources, Washington Department of Fish and Wildlife, Conservation Northwest, Colville

Confederated Tribes, University of British Columbia Okanagan, Washington State University, and University of Washington. Representatives from these agencies and organizations have been involved in meetings/workshops at the 2014 and 2015 Wildlinks conferences (<http://www.conservationnw.org/what-we-do/wildlife-habitat/wildlinks>) to discuss lynx status and recovery in Washington.

CONCLUSIONS AND RECOMMENDATIONS

Available information indicates that the distribution of lynx in Washington has become more restricted recently and that western Okanogan County is the only area that currently supports a resident lynx population. Estimates of population size, while rudimentary, suggest that this population may include approximately 54 individuals. Threats to this population include loss and fragmentation of habitat due to wildfire, small population size, demographic stochasticity, and the unpredictable effects of climate change. There has been no indication that the conservation status of Washington's lynx population has improved since it was state (1993) or federally (2000) listed. Given the reduced distribution, small and restricted population, and an increase in the number and severity of threats to lynx in Washington, WDFW recommends that the status of the lynx in the state be changed from threatened to endangered. Up-listing the lynx from threatened to endangered status at either the federal or state level could result in new efforts to conserve lynx habitats and populations, and it could focus greater attention on these efforts and lynx conservation in Washington and throughout North America.

LITERATURE CITED

- Anderson, E. and M. Lovallo. 2003. Bobcat and lynx. Pages 758–786 in G. A. Feldhamer, B. C. Thompson, and J. A. Chapman (Eds.), *Wild Mammals of North America: Biology, Management, and Economics*. Johns Hopkins Press, Baltimore, Maryland.
- Apps, C. and T. Kinley. 2006. A Management Plan for the Canada Lynx in British Columbia (Draft). British Columbia Ministry of Environment, Victoria, BC. 73 pp.
- Aubry, K. B., G. M. Koehler, and J. R. Squires. 2000. Ecology of Canada lynx in southern boreal forests. Pages 373–396 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires, editors. *Ecology and conservation of lynx in the United States*. University Press of Colorado. Boulder, Colorado, USA.
- Buskirk, S. W., L. F. Ruggiero, and C. J. Krebs. 2000a. Habitat fragmentation and interspecific competition: implications for lynx conservation. Pages 83–100 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires, editors. *Ecology and conservation of lynx in the United States*. University Press of Colorado. Boulder, Colorado, USA.
- Buskirk, S. W., L. F. Ruggiero, K. B. Aubry, D. E. Pearson, J. R. Squires, and K. S. McKelvey. 2000b. Comparative ecology of lynx in North America. Pages 397–417 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires, editors. *Ecology and conservation of lynx in the United States*. University Press of Colorado. Boulder, Colorado, USA.
- Dalquest, W.W. 1948. *Mammals of Washington*. University of Kansas, Lawrence, Kansas.
- Fuller, A.K., D.J. Harrison, and J.H. Vashon. 2007. Winter habitat selection by Canada lynx in Maine: prey abundance or accessibility. *Journal of Wildlife Management* 71(6):1980-1986.
- Gascoigne, J. L. Berec, S. Gregory, and F. Courchamp. 2009. Dangerously few liaisons: a review of mate-finding Allee effects. *Population Ecology* 51:355–372.
- Gonzalez, P., R. P. Neilson K. S. McKelvey, J. M. Lenihan, and R. J. Drapek. 2007. Potential impacts of climate change on habitat and conservation priority areas for *Lynx canadensis* (Canada Lynx). The Nature Conservancy, Arlington, Virginia, USA.
- Hodges, K.E. 2000. Ecology of Snowshoe Hares in Southern Boreal and Montane Forests. Pages 163–206 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires, editors. *Ecology and conservation of lynx in the United States*. University Press of Colorado. Boulder, Colorado, USA.
- Interagency Lynx Biology Team. 2013. *Canada lynx conservation assessment and strategy*. 3rd edition. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Forest Service Publication R1-13-19, Missoula, MT. 128 pp.
- Koehler, G. M. 1990. Population and habitat characteristics of lynx and snowshoe hares in north central Washington. *Canadian Journal of Zoology* 68:845–851.
- Koehler, G. M. and J. D. Britnell. 1990. Managing spruce-fir habitat for lynx and snowshoe hares. *Journal of Forestry* 88:10–14.
- Koehler, G. M., B. T. Maletzke, J. A. von Kienast, K. B. Aubry, R. B. Wielgus, and R. H. Naney. 2008. Habitat fragmentation and the persistence of lynx populations in Washington State. *Journal of Wildlife Management* 72:1518–1524.
- Krebs, C. J., R. Boonstra, S. Boutin, and A. R. E. Sinclair. 2001a. What drives the 10-year cycle of snowshoe hares? *BioScience* 51(1):25–35.
- Lewis, C. W., K. E. Hodges, G. M. Koehler, and L. S. Mills. 2011. Influence of stand and landscape features on snowshoe hare abundance in fragmented forests. *Journal of Mammalogy* 92:561–567.
- Maletzke, B.T. 2004. Winter habitat selection of lynx (*Lynx canadensis*) in northern Washington. M.S. Thesis, Washington State University, Pullman, Washington, USA.

- Maletzke, B. T., G. M. Koehler, R. B. Wielgus, and K. B. Aubry. 2008. Habitat conditions associated with lynx hunting behavior during winter in Northern Washington. *Journal of Wildlife Management* 72:1473–1478.
- Mowat, G., K. G. Poole, and M. O'Donoghue. 2000. Ecology of lynx in northern Canada and Alaska. Pages 265–306 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires, editors. *Ecology and conservation of lynx in the United States*. University Press of Colorado. Boulder, Colorado, USA.
- Murray, D.L. 2003. Snowshoe hare and other hares. Pages 147–175 in Feldhamer, G.A. and B. Thompson, editors. *Wild mammals of North America*. Vol. II. Johns Hopkins University Press, Baltimore, Maryland, USA.
- Poole, K.G. 1997. Dispersal patterns of lynx in the Northwest Territories. *Journal of Wildlife Management* 61:497–505.
- Poole, K.G. 2003. A review of the Canada Lynx, *Lynx canadensis*, in Canada. *Canadian Field-Naturalist* 117(3): 360-376.
- Roth, J. D., J. D. Marshall, D. L. Murray, D. M. Nickerson, and T. D. Steury. 2007. Geographical gradients in diet affect population dynamics of Canada lynx. *Ecology*. 88:2736–2743.
- Schwartz, M. K., L. S. Mills, K. S. McKelvey, L. F. Ruggiero, and F. W. Allendorf. 2002. DNA reveals high dispersal syn-chronizing the population dynamics of Canada lynx. *Nature* 415:520–522.
- Stinson, D. W. 2001. Washington state recovery plan for the lynx. Washington Department of Fish and Wildlife, Olympia, Washington. 78 pp.
- Vanbianchi, C. 2015. Habitat use and connectivity for Canada lynx in the north Cascade Mountains, Washington. M.S. Thesis. University of British Columbia, Okanagan. 271 pp.
- von Kienast, J.A. 2003. Winter habitat selection and food habits of lynx on the Okanogan Plateau, Washington. Thesis, University of Washington, Seattle, Washington, USA.
- USFWS. 2000. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Contiguous U.S. Distinct Population Segment of the Canada Lynx and Related Rule; Final Rule. *Federal Register* 65(58):16052-16086.
- USFWS. 2014. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx and Revised Distinct Population Segment Boundary; Final Rule. *Federal Register* 79(177):54782-54846.
- USFWS. 2015. News Release: Service Conducting Five-Year Review for Canada Lynx in Preparation for Recovery Planning. <http://www.fws.gov/mountain-prairie/species/mammals/lynx/5yearreview.htm>
- Walker, C. J. 2005. Influences of landscape structure on snowshoe hare populations in fragmented forests. Thesis, University of Montana, Missoula, USA.
- Washington Wildlife Habitat Connectivity Working Group. 2010. Washington Connected Landscapes Project: Statewide Analysis. Washington Departments of Fish and Wildlife, and Transportation, Olympia, WA.
- Washington Department of Natural Resources [WDNR]. 1996. Lynx Habitat Management Plan for DNR managed lands. Olympia, WA. 180 pp.
- Washington Department of Natural Resources [WDNR]. 2006. Lynx habitat management plan for all DNR managed lands. Washington Department of Natural Resources. Olympia, WA. 159 pp.

WASHINGTON STATE STATUS REPORTS, PERIODIC STATUS REVIEWS, RECOVERY PLANS, AND CONSERVATION PLANS

Status Reports

| | |
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| 2015 | Tufted Puffin |
| 2007 | Bald Eagle |
| 2005 | Mazama Pocket Gopher, Streaked Horned Lark, and Taylor's Checkerspot |
| 2005 | Aleutian Canada Goose |
| 2004 | Killer Whale |
| 2002 | Peregrine Falcon |
| 2000 | Common Loon |
| 1999 | Northern Leopard Frog |
| 1999 | Olympic Mudminnow |
| 1999 | Mardon Skipper |
| 1999 | Lynx Update |
| 1998 | Fisher |
| 1998 | Margined Sculpin |
| 1998 | Pygmy Whitefish |
| 1998 | Sharp-tailed Grouse |
| 1998 | Sage-grouse |
| 1997 | Aleutian Canada Goose |
| 1997 | Gray Whale |
| 1997 | Olive Ridley Sea Turtle |
| 1997 | Oregon Spotted Frog |
| 1993 | Larch Mountain Salamander |
| 1993 | Lynx |
| 1993 | Marbled Murrelet |
| 1993 | Oregon Silverspot Butterfly |
| 1993 | Pygmy Rabbit |
| 1993 | Steller Sea Lion |
| 1993 | Western Gray Squirrel |
| 1993 | Western Pond Turtle |

Periodic Status Reviews

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| 2016 | Killer Whale |
| 2016 | Streaked horned Lark |
| 2016 | Greater Sage-grouse |
| 2016 | Snowy Plover |
| 2016 | Northern Spotted owl |
| 2016 | Western Gray Squirrel |
| 2015 | Brown Pelican |
| 2015 | Steller Sea Lion |

Recovery Plans

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| 2012 | Columbian Sharp-tailed Grouse |
| 2011 | Gray Wolf |
| 2011 | Pygmy Rabbit: Addendum |
| 2007 | Western Gray Squirrel |
| 2006 | Fisher |
| 2004 | Sea Otter |
| 2004 | Greater Sage-Grouse |
| 2003 | Pygmy Rabbit: Addendum |
| 2002 | Sandhill Crane |
| 2001 | Pygmy Rabbit: Addendum |
| 2001 | Lynx |
| 1999 | Western Pond Turtle |
| 1996 | Ferruginous Hawk |
| 1995 | Pygmy Rabbit |
| 1995 | Upland Sandpiper |
| 1995 | Snowy Plover |

Conservation Plans

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| 2013 | Bats |
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Status reports and plans are available on the WDFW website at:
<http://wdfw.wa.gov/publications/search.php>

