Canada Lynx
Lynx canadensis

REGULATORY STATUS
USFWS: Threatened
USFS R2: No special status
USFS R4: No special status
Wyoming BLM: No special status
State of Wyoming: Protected Animal

CONSERVATION RANKS
USFWS: No special status
WGFD: NSS1 (Aa), Tier I
WYNDD: G5, S1
Wyoming Contribution: LOW
IUCN: Least Concern

STATUS AND RANK COMMENTS
Canada Lynx (*Lynx canadensis*) was designated Threatened under the U.S. Endangered Species Act (ESA) in 2000 [1, 2]. The U.S. Fish and Wildlife Service (USFWS) has designated northwestern Wyoming as part of the "Greater Yellowstone Area unit of Critical Habitat" for Canada Lynx recovery. Canada Lynx in southern Wyoming (primarily the Medicine Bow Mountains and Sierra Madre) and Colorado are considered by the USFWS to be part of a Southern Rocky Mountain subpopulation, and the agency originally did not propose Critical Habitat in that region. However, a September 2016 court decision directed the USFWS to re-evaluate the need to designate Critical Habitat in the Southern Rocky Mountains [3].

NATURAL HISTORY

Taxonomy:
Older designations of Canada Lynx as *Felis lynx* and *L. lynx* have formally yielded to *L. canadensis*, but still appear in some relevant literature [1, 4]. Canada Lynx was formerly considered conspecific with Eurasian Lynx (*L. lynx*), but the two species have since been clearly distinguished morphologically, behaviorally, and genetically [5, 6]. Canada Lynx is the only form in North America. There are two recognized subspecies: *L. c. canadensis*, which occurs throughout most of the species' range including Wyoming; and *L. c. subsolanus* which is restricted to Newfoundland [4, 6]. Individuals reintroduced into Colorado (with subsequent dispersal of some into Wyoming) from 1999–2006 were *L. c. canadensis* originally captured in Canada and Alaska [7]. Hybridization with Bobcat (*L. rufus*) is possible, but no such animals have been documented in the western U.S. [2, 8].

Description:
Canada Lynx is identifiable in the field. It is a medium-sized (adult weight 6–12 kg) cat with relatively long legs, short tail, and tufted ears. Winter pelage is brownish-gray with a grayish-white to buff-white underside; summer pelage is reddish to gray-brown. There is a noticeable

flared ruff of fur around the face and jaws. Canada Lynx can be distinguished from the similar-appearing Bobcat by its completely black-tipped tail (Bobcat tail tips are black above and white below), longer legs, more prominent ear tufts, lack of noticeable spotting on fur, and larger paws (especially useful in identifying tracks in snow) [4, 5, 9].

Distribution & Range:

Canada Lynx extend from Alaska eastward to the Atlantic coast of Canada, with southern extensions into the contiguous U.S. along the Rocky Mountains and Cascade Mountains, and also into New England and the Great Lakes region [4, 9]. Historically, the species may have extended throughout the Southern Rocky Mountains to northern New Mexico, but a ca. 40% reduction in the continental range of the species over the past century likely resulted in extirpation from that ecoregion [2, 10]. Despite this range contraction, Canada Lynx likely persisted in the forests of northwestern Wyoming. Canada Lynx has been recently reintroduced into Colorado (1999–2006), and some individuals have dispersed into adjacent states including Wyoming [5, 7]. It is unknown if this reintroduction will result in long-term occupation of the Southern Rocky Mountains. Persistence of Canada Lynx in southern portions of its range, including Wyoming, may depend highly on continued in-migration of individuals from more northerly breeding centers [11, 12]. Canada Lynx can disperse very long distances across non-typical habitats (i.e., grasslands, desert basins), and individual dispersers are occasionally documented far from the species' main mountain centers of occurrence [2, 7, 13]. Home range size fluctuates with prey availability, and adults are known to become nomadic and disperse to new regions when prey is extremely low [2].

Habitat:

Canada Lynx occupies cool, moist coniferous forests at 1,500–3,500 m elevation. The species prefers forested landscapes with cold, snowy winters and abundant Snowshoe Hare (*Lepus americanus*), its primary prey [4, 9]. Preferred forest types in Wyoming differ in subtle but important ways from preferred types in more northern areas. Early-seral, regenerating conifer stands can be good habitat for Snowshoe Hare and Canada Lynx in moist northern forests [14], but in the drier mountains of Wyoming and Colorado such stands often lack the brushy under- and mid-stories apparently preferred by both species. Late-seral, multi-storied conifer stands dominated by Engelmann Spruce (*Picea engelmannii*) and Subalpine Fir (*Abies lasiocarpa*), and mid-seral (i.e., 30–70 year-old) stands of Lodgepole Pine (*Pinus contorta*) with high stem densities, support the most Snowshoe Hare in western Wyoming [15]. Mosaics of these two forest types are recommended for producing high availabilities of Snowshoe Hare and Red Squirrel (*Tamiasciurus hudsonicus*) – an important alternative prey item (see Diet) – in Colorado [2, 16]. Canada Lynx raises kittens in dens established under upturned rootwads, within piles of downed trees, among boulders, and in other natural shelters within or near foraging habitat [2, 17]. Deep, soft, and persistent snow is an important winter habitat feature, as Canada Lynx is better adapted for moving across snow than other carnivores such as Coyote (*Canis latrans*) and Bobcat, which can prey on and compete with Canada Lynx. Southern populations of Canada Lynx coexist with a rather diverse and dense community of generalist carnivores, the consequences of which are likely complex and not well-understood [18].

Phenology:

Canada Lynx is solitary except during breeding season, which occurs in March and April. Kittens are born about two months later. Rangewide, litters typically include 3–4 kittens [9], but in Wyoming and other southern areas litters may be consistently smaller [2, 4]. Females provide all

parental care and often move kittens to different dens during development. Kittens open their eyes at about 15 days, walk at about 27 days, and eat solid food at about 30 days but can continue to nurse for 6 months. Kittens remain with their mother for 8–10 months and then disperse in late winter or early spring [4, 9]. Canada Lynx do not migrate in the classic sense, but they may track deeper snow conditions by generally moving down in elevation in the fall and up in the spring. Dispersing individuals can traverse vast distances and non-typical habitats [1, 7], and dispersal is possible in any season as even adults will disperse in response to low prey availability. Importantly, southern populations of Canada Lynx (and Snowshoe Hare) do not appear to undergo regular multi-year cycles in abundance like core northerly populations [2].

Diet:
Throughout its range Canada Lynx relies heavily upon Snowshoe Hare as primary prey [9], but it is also an effective predator of many birds and small-to-medium sized mammals [2]. Canada Lynx in southern areas relies more heavily on alternative prey, as Snowshoe Hare densities are chronically low relative to Canada and Alaska. Red Squirrel is an important alternative prey in many areas, including Colorado and likely Wyoming [16]. The diet breadth of Canada Lynx in Wyoming may be rather large and requires more state-specific research.

CONSERVATION CONCERNS

Abundance:
Continental: WIDESPREAD
Wyoming: VERY RARE
Canada Lynx is found at very low densities in Wyoming. The Wyoming Game and Fish Department (WGFD) conducted extensive surveys in the northwest corner of the state in 2005 and 2006, finding a total of three individual Canada Lynx (two of which originated from the Colorado reintroduction) [19, 20]. It is thought that most Canada Lynx in Wyoming originate from populations outside of the state (i.e., Idaho, Montana, and Colorado), with only occasional recruitment of individuals produced within Wyoming itself [4].

Population Trends:
Historic: MODERATE DECLINE
Recent: MODERATE INCREASE
Because of naturally low densities, extreme movement ability, and cryptic lifestyle, there is little information about Canada Lynx population trends in Wyoming or surrounding regions. It is assumed that increased human development of Canada Lynx habitat has caused a decline from historic numbers across the species' southern range [2, 10]. Fragmented landscapes are thought to increase disperser mortality and decrease dispersal rates [2]. Because Canada Lynx abundance in Wyoming is very low and may depend largely on dispersal from populations outside the state, it is difficult to estimate short-term trends in Wyoming [4]. The Colorado reintroduction has provided a new source of animals dispersing into Wyoming [7], but the long-term productivity and persistence of the reintroduced population is still in question [11, 12].

Intrinsic Vulnerability:
HIGH VULNERABILITY
Canada Lynx in Wyoming is a strong habitat specialist that depends on large expanses (home ranges ca. 100–200 km^2 in Wyoming [17, 21]) of mature subalpine forest, making the species vulnerable to habitat fragmentation and alteration [2, 4]. Canada Lynx depends strongly on Snowshoe Hare, and to a lesser extent Red Squirrel, as primary prey, and such prey

specialization further increases intrinsic vulnerability. Canada Lynx has the potential to have large litters (up to 6 kittens) [9], but when prey density is low (as may always be the case in Wyoming relative to northern population centers) litter sizes are smaller and kittens are less likely to survive [2, 4]. Canada Lynx persistence in Wyoming may depend highly on continual in-migration from distant centers of reproduction. Evidence suggests limited local reproduction – failure to reproduce, and complete litter mortality from starvation, have been documented in Wyoming [2, 4, 17, 20].

Extrinsic Stressors:

MODERATELY STRESSED

Across its range Canada Lynx was subjected to unrestricted shooting and trapping, enhanced by bounties and predator/pest designations, until the mid-20th century [1]. The species is now protected from deliberate harvest in Wyoming and adjacent states but still suffers some human-caused mortality. Of 65 known-cause deaths of Canada Lynx documented during the first 8 years of the Colorado reintroduction, 13 (20%) were from vehicle collision, 14 (22%) were from shooting, and 5 (8%) were from probable shooting [7]. Human-caused mortality is commonly noted elsewhere in the species' range [2]. Compared to northern areas, habitat quality (measured primarily by Snowshoe Hare density) and connectivity is generally low in Wyoming, and thus populations may be less resilient to habitat disturbances in the state [2]. Large scale habitat conversion is unlikely, but activities like clearcut timber harvesting, wildfire fuel reductions, changes to fire regimes, and increased recreation decrease habitat quality for Canada Lynx [2]. Disturbances to low-elevation habitats may also threaten the species' persistence if it impedes dispersal into the state [4]. Plowed roads, packed ski paths, and snow-machine trails allow Coyotes and other generalist carnivores to extend their winter ranges into formerly snow-bound areas [22-24], although if and to what degree this impacts Canada Lynx populations is still unknown. The effects of global climate change on boreal ecosystems is still debated in the expert community, but there is substantial concern about potential negative effects on boreal forests and associated species like Canada Lynx [2, 25].

KEY ACTIVITIES IN WYOMING

The Lynx Conservation Assessment and Strategy was developed in 1998 by federal agencies to provide guidelines to better conserve Canada Lynx on federal lands. The document has been revised, with the latest version (3rd Edition) published in 2013 [2]. In 2005 the USFWS outlined a recovery plan for Canada Lynx in the U.S. [25], and a final Recovery Plan is expected by January 2018. The USFWS is also currently developing a Species Status Assessment and 5-year review for Canada Lynx. The reintroduction of Canada Lynx into Colorado (1999–2006) has generated a new source of individuals that occasionally disperse into Wyoming [7]. WGFD conducted extensive surveys in the northwest corner of the state in 1997-2000 and again in 2005-2006. The first set of surveys documented Canada Lynx tracks in the Wyoming, Absaroka, and Wind River Ranges, and a male and female were captured and collared. Although they produced kittens, none were thought to survive, and the female eventually died, likely from starvation [17, 26, 27]. The second set of surveys resulted in detections of 3 Canada Lynx (2 of which originated from the Colorado reintroduction program) [19]. The U.S. Forest Service began conducting remote-camera, occupancy surveys in Canada Lynx habitat throughout the Bridger-Teton and southern Shoshone National Forests in Wyoming in 2015; surveys have not yet resulted in any detections. The WGFD will begin incorporating a lynx-specific lure into on-going Wolverine (*Gulo gulo*) occupancy surveys in northwestern Wyoming in an attempt to document Canada Lynx. Recent

work has helped clarify Snowshoe Hare habitat preferences in Wyoming [15], which is a critical piece of information for managers.

ECOLOGICAL INFORMATION NEEDS

Canada Lynx has been well-researched within the core of its range, but, due to extremely low densities, relatively little is known about the species in southern areas like Wyoming, although research into population metrics and threats to the Colorado subpopulation is on-going. Given the species' apparently tenuous residency in Wyoming, research that elucidates the relative dependence of the state population segment on immigrants versus recruitment of individuals produced within Wyoming itself will be valuable to resource managers. Several aspects of Canada Lynx life history may be different in Wyoming compared to better-understood northern areas, and thus within-state research – although difficult given low densities – could also assist managers. Relevant topics include diet breadth and use of prey other than Snowshoe Hare, competition with and predation by generalist carnivores such as Coyote and Bobcat, and Canada Lynx (and Snowshoe Hare) use of forests recovering from Mountain Pine Beetle (*Dendroctonus ponderosae*) epidemics. Continued use of occupancy-based detection methods, coordinated both spatially and temporally with similar efforts in surrounding states, would be an efficient and effective way to monitor Canada Lynx in Wyoming [28].

MANAGEMENT IN WYOMING

This section authored solely by WGFD; Nichole L. Bjornlie. Survey efforts for Canada Lynx in Wyoming in the last 2 decades have resulted in decreasing numbers of detections, with no verified observations in roughly the last 10 years. Consequently, management priorities in the short term include collaborating with partners to evaluate current status and presence of Canada Lynx in the state, including incorporating protocols to detect Canada Lynx with other ongoing forest carnivore surveys. In the longer term, priorities include working with the USFWS to develop a final Recovery Plan and implementing recommended management and conservation actions to ensure recovery objectives are being met.

CONTRIBUTORS

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REFERENCES

[1] United States Fish and Wildlife Service. (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, *Federal Register 65*, 16052-16086.

[2] Interagency Lynx Biology Team. (2013) Canada lynx conservation assessment and strategy, 3rd edition, pp 1-128, USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, USDI National Park Service, Missoula, MT.

[3] United States District Court for the District of Montana. (2016) WildEarth Guardians vs U.S. Department of Interior, C 14-270-M-DLC, pp 1-30, U.S. District Court for the District of Montana, Missoula, MT.

[4] Meaney, C., and Beauvais, G. P. (2004) Species assessment for Canada Lynx (*Lynx canadensis*) in Wyoming, p 45, Wyoming Natural Diversity Database and USDI Bureau of Land Management, University of Wyoming, Laramie, WY.

[5] Buskirk, S. W. (2016) *Wild Mammals of Wyoming and Yellowstone National Park*, University of California Press, Oakland, California.
[6] Poole, K. G. (2003) A review of the Canada Lynx, *Lynx canadensis*, in Canada, *The Canadian Field-Naturalist 117*, 360-376.
[7] Devineau, O., Shenk, T. M., White, G. C., Doherty, P. F., Jr., Lukacs, P. M., and Kahn, R. H. (2010) Evaluating the Canada Lynx reintroduction programme in Colorado: patterns in mortality, *Journal of Applied Ecology 47*, 524-531.
[8] Koen, E. L., Bowman, J., Lalor, J. L., and Wilson, P. J. (2014) Continental-scale assessment of the hybrid zone between bobcat and Canada lynx, *Biological Conservation 178*, 107-115.
[9] Tumlinson, R. (1987) Felis lynx, *Mammalian Species 269*, 1-8.
[10] Laliberte, A. S., and Ripple, W. J. (2004) Range contractions of North American carnivores and ungulates, *BioScience 54*, 123-138.
[11] United States Fish and Wildlife Service. (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, *Federal Register 79*, 54781-54846.
[12] Murray, D. L., Steury, T. D., and Roth, J. D. (2008) Assessment of Canada Lynx research and conservation needs in the southern range: another kick at the cat, *Journal of Wildlife Management 72*, 1463-1472.
[13] Squires, J. R., and Oakleaf, R. (2005) Movements of a male Canada Lynx crossing the Greater Yellowstone area, including highways, *Northwest Science 79*, 196-201.
[14] Kosterman, M. K. (2014) Correlates of Canada Lynx reproductive success in northwestern Montana, In *Ecosystem and Conservation Sciences*, p 69, University of Montana, Missoula, Montana.
[15] Berg, N. D., Gese, E. M., Squires, J. R., and Aubry, L. M. (2012) Influence of forest structure on the abundance of snowshoe hares in western Wyoming, *Journal of Wildlife Management 76*.
[16] Ivan, J. S., and Shenk, T. M. (2016) Winter diet and hunting success of Canada Lynx in Colorado, *Journal of Wildlife Management 80*, 1049-1058.
[17] Squires, J. R., and Laurion, T. (2000) Lynx home range and movements in Montana and Wyoming: preliminary results, In *Ecology and conservation of lynx in the United States* (Ruggiero, L. F., Aubry, K. B., Buskirk, S. W., Koehler, G. M., Krebs, C. J., McKelvey, K. S., and Squires, J. R., Eds.), pp 337-350, University Press of Colorado, Boulder, Colorado.
[18] Wirsing, A. J., Buskirk, S. B., Ripple, W. J., and Beschta, R. L. (2012) Wolves and lynx: plausible ideas make for testable hypotheses, *Wildlife Society Bulletin 36*, 572-577.
[19] Grenier, M., Van Fleet, L., and Oakleaf, B. (2007) Canada Lynx Surveys in Wyoming, In *Threatened, Endangered, and Nongame Bird and Mammal Investigations: Annual Completion Report* (Cerovski, A. O., Ed.), pp 43-50, Wyoming Game and Fish Department.
[20] Van Fleet, L., Wells, M., Grenier, M., and Oakleaf, B. (2006) Canada Lynx trapping on the Shoshone and Bridger-Teton National Forests, Wyoming; completion report, In *Threatened, endangered, and nongame bird and mammal investigations* (Cerovski, A. O., Ed.), pp 46-54, Wyoming Game and Fish Department, Cheyenne, Wyoming.
[21] Burdett, C. L., Moen, R. A., Niemi, G. J., and Mech, L. D. (2007) Defining space use and movements of Canada Lynx with global positioning system telemetry, *Journal of Mammalogy 88*, 457-467.
[22] Bunnell, K. D., Flinders, J. T., and Wolfe, M. L. (2006) Potential impacts of Coyotes and snowmobiles on lynx conservation in the Intermountain West, *Wildlife Society Bulletin 34*, 828-838.
[23] Gese, E. M., Dowd, J. L. B., and AUbry, L. M. (2013) The influence of snowmobile trails on coyote movements during winter in high-elevation landscapes, *PLoS ONE 8*, e82862.
[24] Whiteman, J. P., and Buskirk, S. W. (2013) Footload influences wildlife use of compacted trails in the snow, *Wildlife Biology 19*, 156-164.
[25] Nordstrom, L., Hecht, A., McCollough, M., Naney, B., Trick, J., Warren, N., and Zwartjes, M. (2005) Recover outline, contiguous United States distinct population segment of the Canada Lynx, p 21, U.S. Fish and Wildlife Service, Denver, Colorado.
[26] Laurion, T., and Oakleaf, B. (1998) Wyoming lynx inventories; completion report, In *Threatened, endangered, and nongame bird and mammal investigations* (Cerovski, A. O., Ed.), pp 169-187, Wyoming Game and Fish Department, Cheyenne, Wyoming.
[27] Laurion, T., and Oakleaf, B. (2000) Wyoming lynx inventories; completion report, In *Threatened, endangered, and nongame bird and mammal investigations* (Cerovski, A. O., Ed.), pp 108-128, Wyoming Game and Fish Department, Cheyenne, Wyoming.

[28] Squires, J. R., Olson, L. E., Turner, D. L., DeCesare, N. J., and Kolbe, J. A. (2012) Estimating detection probability for Canada Lynx *Lynx canadensis* using snow-track surveys in the northern Rocky Mountains, USA, *Wildlife Biology 18*, 215-224.

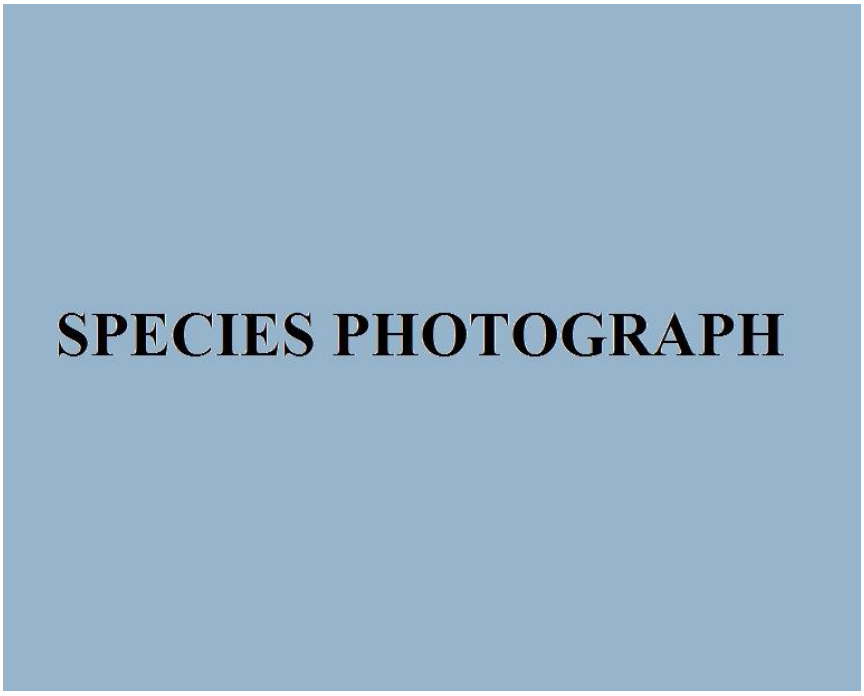

Figure 1: Photo not available.

Figure 2: North American range of *Lynx canadensis*. (Map from: Patterson, B. D., et al. (2007) Digital Distribution Maps of the Mammals of the Western Hemisphere, version 3.0, NatureServe, Arlington, Virginia.)

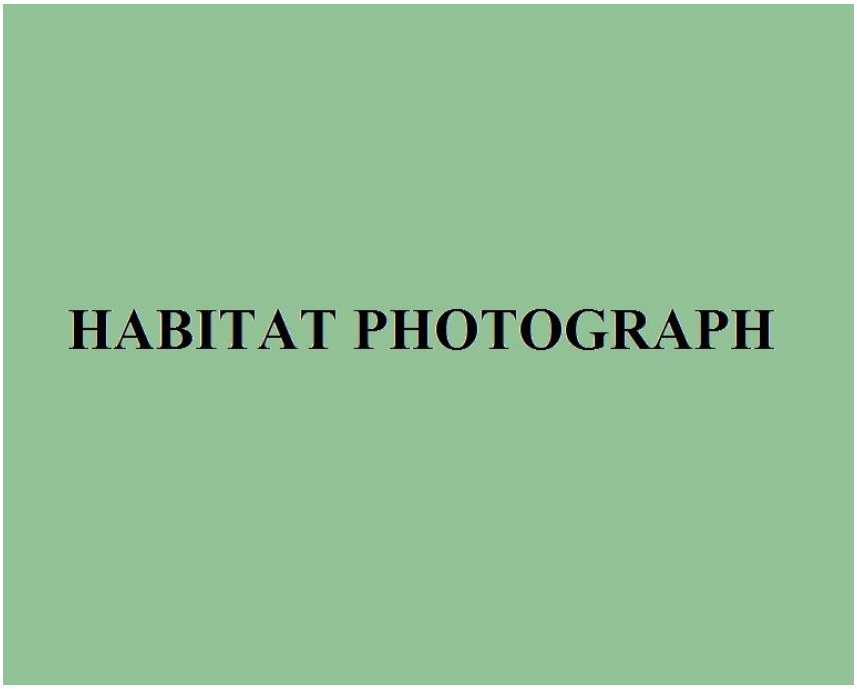

Figure 3: Photo not available.

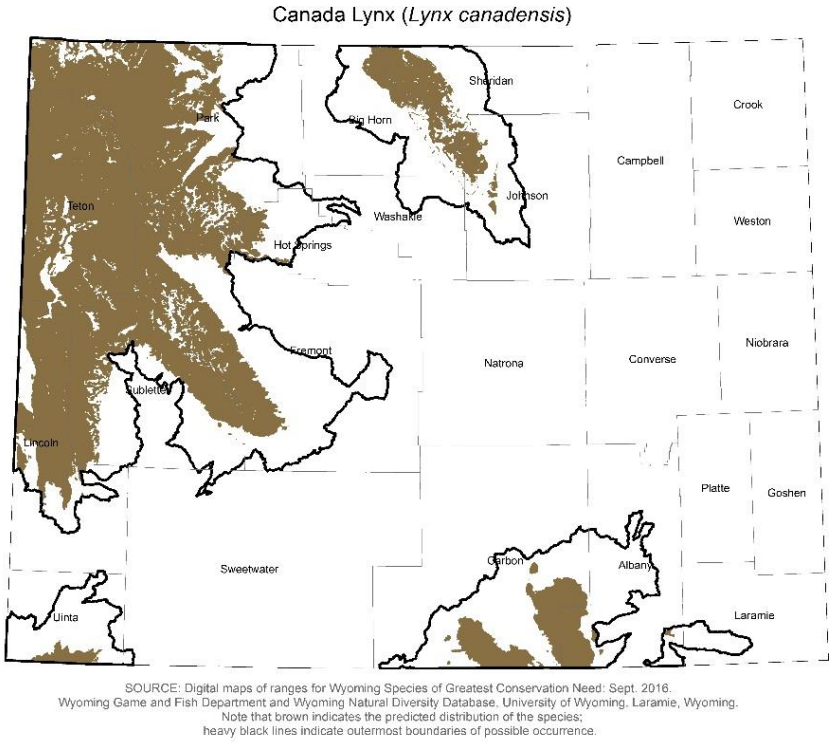

Figure 4: Range and predicted distribution of *Lynx canadensis* in Wyoming.