Draft Nez Perce–Clearwater National Forests Forest Plan Assessment

5.0 Threatened, Endangered, Proposed and Candidate Species—Wildlife

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5.1 CANADA LYNX

5.1.1 *Distribution*

Lynx (*Lynx canadensis)* currently are found throughout Alaska and Canada (except arctic islands) south through the Rocky Mountains, northern Great Lakes Region, and northern New England. Lynx historically occurred in 16 states represented by five ecologically distinct regions: Cascade Range (Washington, Oregon), northern Rocky Mountains (northeastern Washington, northeastern Oregon, Idaho, Montana, western Wyoming, northern Utah), southern Rocky Mountains (southeastern Wyoming, Colorado), northern Great Lakes (Minnesota, Wisconsin, Michigan), and northern New England (Maine, New Hampshire, Vermont, New York, Pennsylvania, Massachusetts).

Resident populations currently exist only in Maine, Montana, Washington, and possibly Minnesota. There are considered extant, but no longer sustain self-supporting populations in Wisconsin, Michigan, Oregon, Idaho, Wyoming, Utah, and Colorado; they may be extirpated from New Hampshire, Vermont, New York, Pennsylvania, and Massachusetts (Ruediger, et al. 2000). The lynx was listened as threatened under the Endangered Species Act in 2000.

5.1.2 *Life History*

Canada lynx are medium-sized cats generally 30–35 inches long and weighing 18–23 pounds. They have large feet adapted to walking on snow, long legs, tufts on ears, and black-tipped tails (Ruediger et al. 2000).

Lynx occur in boreal coniferous forests that have cold, snowy winters and provide a prey base of snowshoe hare (74 FR 8616–8696; McKelvey et al. 2000b; Ruggiero et al. 2000). In North America, the distribution of lynx is nearly coincident with that of snowshoe hares. Lynx are uncommon or absent from the wet coastal forests of Canada and Alaska. Snowshoe hares are the primary prey of lynx, comprising 35-97% of the diet. Other prey species include red squirrel, grouse, flying squirrel, and ground squirrels, among others.

Southern populations of lynx may prey on a wider diversity of species than northern populations because of lower average hare densities and differences in small mammal communities; however, snowshoe hares are still their primary prey species. Squires indicated that lynx in western Montana prey almost exclusively on snowshoe hares during the winter (Squires et al. 2007). Squires located 86 lynx kills that included 7 prey species: blue grouse, spruce grouse, northern flying squirrel, red squirrel, snowshoe hare, least weasel, and white-tailed deer. Snowshoe hares contributed 96% of prey biomass (4-year average, range equals 94%–99%). Red squirrels were the second most common prey (11 kills), but they only provided 2% biomass to the winter diet (Squires et al. 2007; Squires et al. 2010; 74 FR 8616-8696; Koehler et al. 1979; Koehler 1990). In areas characterized by patchy distribution of lynx habitat, lynx may prey opportunistically on other species that occur in adjacent habitats, potentially including white-tailed jackrabbit, black-tailed jackrabbit, sage grouse, and Columbian sharp-tailed grouse (Lewis and Wenger 1998).

The home range size of a snowshoe hare is 5–10 ha (12–25 ac); estimates vary depending on the sampling method (e.g., live-trapping vs. radio telemetry) (Keith 1990; Hodges 2000*a;* Murray 2003 *in* LCAS 2013, p.10)). Although hares are non-migratory and generally occupy the same area throughout the year, short-distance seasonal movements between winter and summer foraging areas have been documented (Adams 1959; Bookhout 1965; Wolff 1980; Wolfe et al. 1982 *in* LCAS 2013, p.10*)*. Lynx densities vary across the southern periphery of its range and may be linked to snowshoe hare density and abundance (LCAS 2013, pp. 23–24). Generally, home ranges in the western United States are larger than those reported from the eastern United States or from northern Canada during peaks in snowshoe hare abundance (Aubry et al. 2000).

Both snow conditions and vegetation type are important factors to consider in defining lynx habitat. Across the northern boreal forests of Canada, snow depths are relatively uniform and only moderately deep (total annual snowfall of 39–50 inches) (Kelsall et al. 1977). Snow conditions are very cold and dry. In contrast, in the southern portion of the range of the lynx, snow depths generally increase, with deepest snows in the mountains of southern Colorado. Snow in southern lynx habitats may be subjected to more freezing and thawing than in the northern portion of lynx range (Buskirk et al. 2000b), although this varies depending on elevation, aspect, and local weather conditions. Crusting or compaction of snow may reduce the competitive advantage that lynx have in soft snow, with their long legs and low-foot loadings (Buskirk et al. 2000a). At lower snow depths there is an increase in competition for prey and an increase in potential predation on lynx

Most lynx occurrences in the western United States were associated with Rocky Mountain conifer forests and most were within the 4920- to 6560-foot elevation zone. In Squires' northwest Montana study area, lynx used mid- to high-elevation forests during winter (range = 4134 to 7726 feet, mean = 5715 feet) and slightly higher elevations during summer (Squires et al. 2010). There is a gradient in the elevational distribution of lynx habitat from the Northern to the Southern Rocky Mountains, with lynx habitat occurring at 8000-11500 feet in the Southern Rockies.

Primary vegetation that contributes to lynx habitat is lodgepole pine, subalpine fir, and Engelmann spruce (Aubry et al. 2000). In extreme northern Idaho, northeastern Washington, and northwestern Montana, cedar-hemlock habitat types may also be considered primary vegetation. In central Idaho, Douglas-fir on moist sites at higher elevations may also be considered primary vegetation. Secondary vegetation, when interspersed within subalpine forests, that may also contribute to lynx habitat includes cool, moist Douglas-fir, grand fir, western larch, and aspen forests. Dry forest types (e.g., ponderosa pine, Douglas-fir, or lodgepole pine with a grass-like understory) do not provide lynx habitat (Squires 2010).

Based on examination of historical and recent evidence, the 2005 Canada lynx recovery outline categorized lynx habitat and occurrence within the contiguous United States as either core areas, secondary areas, or peripheral areas (USDI Fish and Wildlife Service 2005). The areas with the strongest long-term evidence of the persistence of lynx populations within the contiguous United States are defined as "core areas." Core areas have both persistent verified records of lynx occurrence over time and recent evidence of reproduction. At this time, the role of areas outside of these core areas (secondary and peripheral) in sustaining lynx populations in the contiguous United States is unclear. The fluctuating nature of lynx population dynamics and the ability of lynx to disperse long distances have resulted in many individual occurrence records outside of core areas, without accompanying evidence of historic or current presence of lynx populations. Areas classified as "secondary areas" are those with historical records of lynx presence with no record of reproduction; or areas with historical records and no recent surveys to document the presence of lynx and/or reproduction. If future surveys document presence and reproduction in a secondary area, the area could be considered for elevation to core. Secondary areas may contribute to lynx persistence by providing habitat to support lynx during dispersal movements or other periods, allowing animals to then return to "core areas." In "peripheral areas" the majority of historical lynx records is sporadic and generally corresponds to periods following cyclic lynx population highs in Canada. There is no evidence of long-term presence or reproduction that might indicate colonization or sustained use of these areas by lynx. However, some of these peripheral areas may provide habitat enabling the successful dispersal of lynx between populations or subpopulations. Based on historical lynx occurrence information (McKelvey et al. 2000*b in* LCAS 2013), recent research (e.g., Hoving 2001; von Kienast 2003; Squires et al. 2003; Maletzke 2004; Fuller et al. 2007; Burdett 2008; Koehler et al. 2008; Vashon et al. 2008*;* Devineau et al. 2010; and Squires et al. 2010 *in* LCAS 2013), results from the National Lynx Survey (K. McKelvey, unpublished data *in* LCAS 2013, p.87), as well as snow-tracking surveys, evidence of persistence and reproduction of lynx in the core areas has been confirmed.

Within the boreal forest, lynx foraging habitat supports lynx primary prey (snowshoe hare) and has the vegetation structure suitable for lynx to capture prey. Dense saplings or mature multi-layered stands are the conditions that maximize availability of food and cover for snowshoe hares at varying snow depths throughout the winter (LCAS 2013, p. 27). Natural disturbance processes that create early successional stages exploited by snowshoe hares include fire, insect infestations, wind throw, and disease outbreaks (Plate 2.15; Kilgore and Heinselman 1990; Veblen et al. 1998; Agee 2000 *in* LCAS 2013, p. 27). Both timber harvest and natural disturbance processes provide foraging habitat for lynx when the resulting stem densities and stand structure meet the habitat needs of snowshoe hare (Plate 2.16; Keith and Surrendi 1971; Fox 1978; Conroy et al. 1979; Wolff 1980; Parker et al. 1983; Litvaitis et al. 1985; Bailey et al. 1986; Monthey 1986; Koehler 1990*a*, *b in* LCAS 2013, p. 28).

In the western United States, development of a high density >4,500/acre of young conifer stems and branches protruding above the snow was found to provide foraging habitat for lynx within about 10–40 years following disturbance, depending on site productivity, forest type and intensity of disturbance (Sullivan and Sullivan 1988; Koehler 1990*a in* LCAS 2013, p.29). This habitat is temporary, as the tree stems and branches eventually grow out of reach of snowshoe hares and shade out understory saplings and shrubs. Mature multi-story conifer forests with low limbs and containing a substantial understory of young trees and shrubs provide stable lynx foraging habitat (Murray et al. 1994; Koehler et al. 2008; Squires et al. 2010; Ivan 2011). In north central Washington, high snowshoe hare densities (0.4 hares/ac) were associated with sapling (<4 in dbh) densities of 1,127± 114 stems/ac and medium-sized (4–11 in dbh) tree densities of 288±32 stems/ac (Walker 2005 *in* LCAS 2013, p. 29).

Landscapes containing a mix of forest age classes are more likely to provide lynx foraging habitat throughout the year (Poole et al. 1996; Griffin and Mills 2004; Squires et al. 2010 *in* LCAS 2013, p.28). Winter habitat may be more limiting for lynx (Squires et al. 2010). In winter, lynx do not appear to hunt in openings, where lack of cover limits habitat for snowshoe hares (Mowat et al. 2000; Maletzke et al. 2008; Squires et al. 2010 *in* LCAS 2013, p. 28). Squires (2010) found that when lynx did cross openings, they remained closer to forest edges compared to random tracks, with an average distance of 384 feet from the forest edge. Areas with recent timber harvest and areas recently burned can contribute herbaceous summer foods for snowshoe hares, and woody winter browse will develop on older sites (Fox 1978 *in* LCAS 2013, p.28,). Multi-story stands may provide a greater availability of browse as snow depths vary throughout the winter (LCAS 2013, p. 27).

Stem density and snowshoe hare density are directly and positively correlated (Conroy et al. 1979; Sullivan and Sullivan 1988; Koehler 1990*b;* Koehler and Brittell 1990; Thomas et al. 1997; Hodges 2000*a;* Mowat et al. 2000; Homyack et al. 2006 *in* LCAS 2013, p. 72). Stands may continue to provide suitable snowshoe hare habitat for many years until woody stems in the understory become too sparse, as a result of undisturbed forest succession or management (e.g., clear-cutting or thinning)(USDI 2009 74 FR p. 8637).

Denning habitat is the environment lynx use when giving birth and rearing kittens until they are mobile. The most common component is large amounts of coarse woody debris to provide escape and thermal cover for kittens. Den sites typically are situated within older regenerating stands (>20 years since disturbance) or in mature conifer or dense regenerating mixed conifer-deciduous (typically spruce/fir or spruce/birch) forests (Koehler 1990*a;* Slough 1999; Moen et al. 2008; Organ et al. 2008; Squires et al. 2008 *in* LCAS 2013, p. 30). Stand structure appears to be more important than forest cover type (Mowat et al. 2000). The availability of den site does not appear to be limiting (Gilbert and Pierce 2005; Moen et al. 2008; Organ et al. 2008; Squires et al. 2008 *in* LCAS 2013, p.30). Denning habitat must be located within daily travel distance of an adult female lynx (typical distance is 3-6 mi) to snowshoe hare habitat (LCAS 2013). In Montana, Squires found that lynx located their dens in a variety of forest stand types. Eighty% of dens were in mature forest stands and 13% in mid-seral, regenerating stands. Young stands that were either naturally sparse or mechanically thinned were seldom used for denning. Lynx denned along the edges of regenerating forests where trees had blown down into jack-strawed piles of woody debris. At a landscape level, dens were generally in concave or drainage-like topographies and often on northeast aspects. Squires found that denning habitat is generally abundant across the coniferous forested landscape, especially in riparian habitats and in areas where insect or disease kills patches of trees. Given the large home ranges and low den site fidelity of lynx, den sites are not likely to be limiting (Squires et al. 2008).

5.1.3 *Lynx in Idaho*

Canada lynx are classified as an S1 Idaho species of greatest conservation need. S1 is a statewide ranking assigned by the Idaho Conservation Data Center and indicates critically imperiled: at high risk due to extreme rarity, rapidly declining numbers or other factors that make it particularly vulnerable to rangewide extinction or extirpation (Idaho Department of Fish and Game 2005). Specimen records of lynx in Idaho during the early 1900s are relatively common (McKelvey et al. 2000b). McKelvey et al. (2000b) reported 22 museum specimens of lynx from 1874 to 1917, all of which were collected north of the Snake River Plain in Idaho. Thirteen other verified records prior to 1960 were also from the north-central and northern regions of the state (McKelvey et al. 2000b in LCAS 2013 p. 57). There are 35 verified records from 1960 to 1991, most coinciding with lynx irruptions in the 1970s. The National Lynx Survey found lynx in the Boise National Forest (K. McKelvey, unpublished data, in LCAS 2013, p. 57). Idaho Department of Fish and Game (IDFG) personnel surveyed 20 routes that had adequate snow conditions from 2004-2006 and detected no lynx (Patton 2006, *in* LCAS 2013, p. 57). In 2010-2013, IDFG conducted forest carnivore surveys in the Selkirk, Purcell, and West Cabinet Mountains, finding one male lynx in the Selkirks in 2010, and one male lynx in the Idaho Purcell Mountains in 2011.

In 2012 a lynx was found on the Salmon-Challis National Forest, and in northern Idaho in 2013. In February of 2014, a lynx was captured and collared in the West Cabinet Mountains.

Subalpine fir potential vegetation types occur at upper elevations. Engelmann spruce potential vegetation types occur on very wet sites, on steep northerly aspects where snow accumulates, and along streams and valley bottoms (Steele et al. 1981, *in* LCAS 2013, p. 60). Large stands of fire-induced lodgepole pine commonly dominate much of the subalpine fir series in central Idaho (Steele et al. 1981, *in* LCAS 2013, p. 60). Sites that are capable of producing dense, tall understory shrubs may be capable of supporting snowshoe hares and lynx. In the western United States, most snowshoe hare populations occurred within conifer forests at elevations from 2116-11,204 feet (Dolbeer and Clark 1975, Griffin 2004, Lewis et al. 2011, Berg and Gese 2012 *in* LCAS 2013, p. 12). Cover types that support snowshoe hares in this region include Engelmann spruce, subalpine fire, mixed spruce-fir, mixed aspen and spruce-fir, and mixed lodgepole pine and spruce-fir (Hodges 2000c, Zahratka 2004, Zimmer 2004, Miller 2005, Berg et al. 2012 *in* LCAS 2013, p. 12). Hare densities on the Clearwater National Forest ranged from 0.004- 0.04 hares/acre, and hare distribution throughout the study area was positively correlated with the availability of understory cover (Wirsing et al. 2002, *in* LCAS 2013, p. 62). A landscape density of > 0.2 hares/acre has been suggested to be necessary to sustain lynx within their home ranges (Mowat et al. 2000, Ruggiero et al. 2000b). In northern Idaho, western red-cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*) and moist grand-fir potential vegetation types support snowshoe hares (Murray et al. 2002), although these areas do not appear to support lynx (LCAS 2013, p. 62). Ellsworth (2009 *in* LCAS 2013, p. 11) also highlighted the importance of young lodgepole pine stands with high sapling densities to hares in northern Idaho.

Most lynx occurrences in the western U.S. (83%) are associated with Rocky Mountain conifer forest, and most (77%) fall within the 4920-6560 feet elevation zone (McKelvey et al. 2000b), except in Colorado where elevations are higher. Engelmann spruce, subalpine fir and lodgepole pine forest cover types occurring on cold moist potential vegetation types provide habitat for lynx (Aubry et al. 2000). Dry forest cover types (e.g., ponderosa pine, dry Douglas-fir) do not provide lynx habitat (Koehler et al. 2008, Maletzke et al. 2008, Squires et al. 2010). In winter, lynx selected for mature multi-story stands dominated by Engelmann spruce and subalpine fir consisting of primarily large diameter trees where limbs reached the snow at ground level and contributed to dense horizontal cover (Koehler et al. 2008, Squires et al. 2010). In summer, lynx broadened their selection to include younger regenerating stands comprised of Engelmann spruce and subalpine fir with abundant small diameter and pole sized trees (3-7 inch dbh), abundant total shrubs, and high horizontal cover (Squires et al. 2010). Koehler's work was in Washington, and most of Squires' work was in western Montana.

Snow track surveys in 2007(Ulizio et al. 2007) and again in 2013(Stone et al. 2013) on the Nez Perce National Forest using protocol developed by Squires et al. (2004 and 2012) did not detect lynx. In 2013, the experienced lynx tracking crew covered all routes twice, which strengthens the detection probability if present or conversely, can suggest absence with 95% certainty (Squires et al. 2012. Much of the surveyed area appeared to be suitable habitat that supported snowshoe hares (*Lepus americanus*), and the lack of detections suggests that lynx are rare or infrequent to the Nez Perce National Forest. Hair snare surveys (5 transects) during summer and fall of 2008 on the Nez Perce National Forest following the protocol established by McKelvey et al. 1999 also did not detect lynx (Bonn 2008).

Lynx are wide-ranging animals, and given the lynx specific survey work conducted on the

Nez Perce National Forest and extensive surveys for other species using hair snares, snow track surveys, and camera stations conducted on the Clearwater National Forest (e.g., U.S. Fish and Wildlife Service, grizzly bear in 2008-2009; U.S. Forest Service, fisher 2002-2014; IDFG, yearly aerial surveys for many species) presence of a population should be evident given the vast network of roads and trails. Historical sitings that have been confirmed may be the result of transient lynx moving through the Forest, but the infrequency of such reports suggests that lynx are incidental to the area (Ulizio et al. 2007). Compared to cores areas, secondary areas are defined as having fewer and more sporadic records of lynx occurrence and the quality and quantity of habitat to support populations of snowshoe hares and lynx is questionable (USDI Fish and Wildlife Service 2005). The snow in lynx habitats on the Nez Perce Clearwater National Forests may be subjected to more freezing and thawing than in the northern portion of lynx range. Crusting or compaction of snow may reduce the competitive advantage that lynx have in soft snow, with their long legs and low-foot loadings (Buskirk et al. 2000a). At lower snow depths there is an increase in competition for prey and an increase in potential predation on lynx. While lynx have occasionally been sited on the Forests, currently, due to the infrequent nature of lynx observations, there is no evidence of a resident lynx population or reproduction on the Nez Perce–Clearwater National Forests. The 2005 Canada Lynx Recovery Area map identified the Nez Perce–Clearwater National Forests as secondary Canada lynx habitat (USDA Forest Service and USDI Fish and Wildlife Service 2006).

Northern Rockies Lynx Management Direction and Application on the Nez Perce Clearwater National Forest

The U.S. Fish and Wildlife Service (FWS) listed Canada lynx as a threatened species under the Endangered Species Act (ESA) in March 2000. The Lynx Conservation Assessment and Strategy (LCAS) were developed to provide a consistent and effective approach to conserve Canada lynx, and to assist with Section 7 consultation under the Endangered Species Act on federal lands in the contiguous United States. The Forest Service (FS) signed a Lynx Conservation Agreement with the FWS in 2001 to consider the Lynx Conservation Assessment and Strategy (LCAS) during project analysis, and the FS agreed to not proceed with projects that would be "likely to adversely affect" lynx until the plans were amended. The LCAS was renewed in 2005 and added the concept of occupied mapped lynx habitat. The FWS issued a Recovery Outline for Canada lynx (USDI FWS 2005) in September 2005 to serve as an interim strategy to guide and encourage recovery efforts until a recovery plan is completed. In 2006, the LCAS was amended to define occupied habitat and to list those National Forests that were occupied; to provide guidance necessary to conserve lynx (USDA Forest Service and USDI Fish and Wildlife Service 2006). In March 2007, 18 Forest Plans were amended with the Northern Rockies Lynx Management Direction (NRLMD) Record of Decision (USDA Forest Service 2007 NRLMD ROD, Attachment 1, p. 1). The LCAS was revised in August 2013 by the Interagency Lynx Biology Team, incorporating the best available science that had been published since previous editions.

The special habitat management considerations needed to ensure lynx recovery were described in the Northern Rockies Lynx Management Direction (NRLMD) and on March 23, 2007, the U.S. Fish and Wildlife Service issued a Biological Opinion on the effects of the NRLMD (USDI FWS 2007). The Biological Opinion was identified as the first-tier of a consultation framework, with subsequent projects that may affect lynx, as implemented under the amended Forest Plans, being the second tier of consultation. Second-tier opinions would be issued when appropriate.

In the NRLMD, the Nez Perce was considered to be unoccupied while the Clearwater was considered to be occupied based on the best scientific information available at that time of the NRLMD Forest Plan Amendment. However, due to inconsistencies on the status of lynx presence or occupancy on the Nez Perce NF, the US Fish and Wildlife Service (FWS) sent a letter addressed to the Forest Supervisor, Rick Brazell on December 10, 2012 stating that “there is consensus that transient lynx may be present on the NPNF, at least occasionally”. The FWS referenced two pieces of information to come to this conclusion: 1) Ulizio et al. (2007) that noted, “Historical sightings that may have been confirmed may be the result of transient lynx moving through the forest, but the infrequency of such reports suggests lynx are incidental to the area”, and 2) McKelvey et al. (2000) reported “numerous verified historical records from Idaho County”. The letter also stated that, “the issue of lynx occupancy on the NPNF is a separate but related matter that is not the focus of this letter, and did not change the NPNF status as ‘unoccupied’. Therefore, under the NRMLD the Nez Perce is considered unoccupied, and the Clearwater is considered occupied, the FWS has determined that lynx “may be present” on both Forests, and both Forests are considered to be secondary habitat.

5.1.3.1 Lynx Critical Habitat

In February 2009, the FWS designated revised critical habitat in Montana, Wyoming, Idaho and Washington and other states [50 CFR Part 17, Volume 74 (No. 36), Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx; Final Rule, 2009. Critical habitat was not designated on the Nez Perce or Clearwater National Forests (74 FR 8616 8702 and USDI Fish and Wildlife Service 2009). On September 26, 2013 the USFWS published a proposed rule for revised critical habitat in the Federal Register (78 FR 59429). No critical habitat was proposed for the Nez Perce Clearwater National Forests in the proposed rule.

5.1.3.2 Lynx Linkages

A linkage area is defined in the NRLMD, Record of Decision as “providing connectivity between blocks of lynx habitat”. Linkage areas occur both within and between geographic areas, where basins, valleys, or agricultural lands separate blocks of lynx habitat, or where lynx habitat naturally narrows between blocks. Linkages are designated or officially mapped by the Forest Service and US Fish and Wildlife Service to provide for connectivity across areas that are generally non-forested. The linkage areas on the Nez Perce Clearwater National Forests are mapped in Figure 1-1 of the NRLMD FEIS (2007).

5.1.4 *Human Activity and Development*

Some human activities such as development of reservoirs or highways with high-speed and high-traffic volumes may impede lynx movement or increase lynx mortality (Ruediger et al. 2000). Although many species of wildlife are disturbed when forest roads are used (Ruediger 1996), preliminary information suggests lynx do not avoid roads (Ruggiero et al. 2000) except at high-traffic volumes (Apps 2000). Along less-traveled roads where the vegetation provides good hare habitat, sometimes lynx use the roadbeds for travel and foraging (Koehler and Brittell 1990 *in* LCAS 2013). An analysis on the Okanogan NF in Washington showed lynx neither preferred nor avoided forest roads, and the existing road density did not appear to affect lynx habitat selection (McKelvey et al. 2000).

Few studies have examined how lynx react to human presence. Some anecdotal information suggests that lynx are quite tolerant of humans, although given differences in individuals and contexts, a variety of behavioral responses to human presence may be expected (Staples 1995; Mowat et al. 2000 *in* LCAS 2013). Preliminary information from winter recreation studies in Colorado indicates that some recreation uses are compatible, but lynx may avoid some developed ski areas (J. Squires, personal communication 2012 *in* LCAS 2013).

With respect to snow compaction due to human activities, Kolbe was able to directly measure relationships between coyotes, compacted snow routes and snowshoe hare in an area that also supports a lynx population (USDI FWS 2007). Kolbe and others in 2007 suggested that compacted snow routes did not appear to enhance coyotes' access to lynx and hare habitat, and so would not significantly affect competition for snowshoe hares. After evaluating Bunnell *et al.* (2006, entire) and Kolbe *et al.(* 2007, entire), the USFWS determined that the best information available did not indicate that compacted snow routes increase competition from other species to levels that adversely impact lynx populations (CH FR 2009, p. 8639), therefore, such activities would result in effects that are insignificant to lynx.

Lynx mortality can be caused by trapping or shooting, predation (especially by mountain lions during the snow-free season), and starvation (Squires et al. 2006).

A thorough discussion of the effects of climate change, vegetation management, wildland fire management and fragmentation of habitat on lynx and lynx habitat can be found in the revised LCAS (2013), pp. 68-85. Additional discussion of the effects of incidental trapping, recreation, minerals and energy exploration and development, illegal shooting, forest/backcountry roads and trails, and grazing by domestic livestock is there as well.

5.1.5 *Lynx Habitat Mapping*

The Northern Rockies Lynx Management Direction (NLRMD) and the Lynx Conservation Assessment and Strategy (LCAS)(Ruggiero et al. 2000) outlined a number of criteria that should be considered in the mapping of lynx habitat. This information provided the starting point for lynx habitat mapping. On August 22, 2000 additional guidance was provided to field units by the Deputy Regional Forester, USFS Region 1, the Region 6 Director of the FWS, and the Group Manager for Fish, Wildlife, and Forests of the BLM in a document titled "Lynx Habitat Mapping Direction", which developed a set of mapping criteria and procedures to guide and clarify the mapping process. The consequences of applying these criteria were also assessed.

Mapping of primary habitat should be based on forest types necessary to support lynx survival and reproduction specific to each geographic area (Ruediger et al. 2000, Interagency Lynx Biology Team 2013). In northern and central Idaho this consists of subalpine fir, Engelmann spruce, and lodgepole pine potential vegetation types (Interagency Lynx Biology Team 2013). The LCAS indicated that Lynx Analysis Units (LAUs) should be developed and used to map lynx habitat, determine habitat conditions, and assess management effects to lynx. A lynx analysis unit (LAU) is delineated to represent a home range of a female lynx. Habitat mapping criteria were developed to represent important life history characteristics: foraging and denning. LAU delineations and habitat mapping actions directed by the LCAS (Ruediger et al. 2000) were completed for both Forests. The Nez Perce National Forest mapped lynx habitat on the forest between 2000-2002 and then revised the mapped habitat in 2004. The Clearwater National Forest revised mapped lynx habitat in 2007. This mapping was completed in coordination with the U.S. Fish and Wildlife Service.

In 2014, as part of Forest Plan Revision, mapped lynx habitat was revised to develop consistent mapping criteria across both Forests, and to include the best available scientific information (BASI) concerning lynx population dynamics, distribution, habitat use, competitor interactions, prey species, and human interactions that has become available since 2007. This mapping was also completed in coordination with the U.S. Fish and Wildlife Service. This process resulted in the mapping of 78 LAUs across the Nez Perce Clearwater National Forest (Figure 5-1 and Figure 5-2). LAUs will be used to display the amount, relative quality, and distribution of lynx habitat across the Forests.

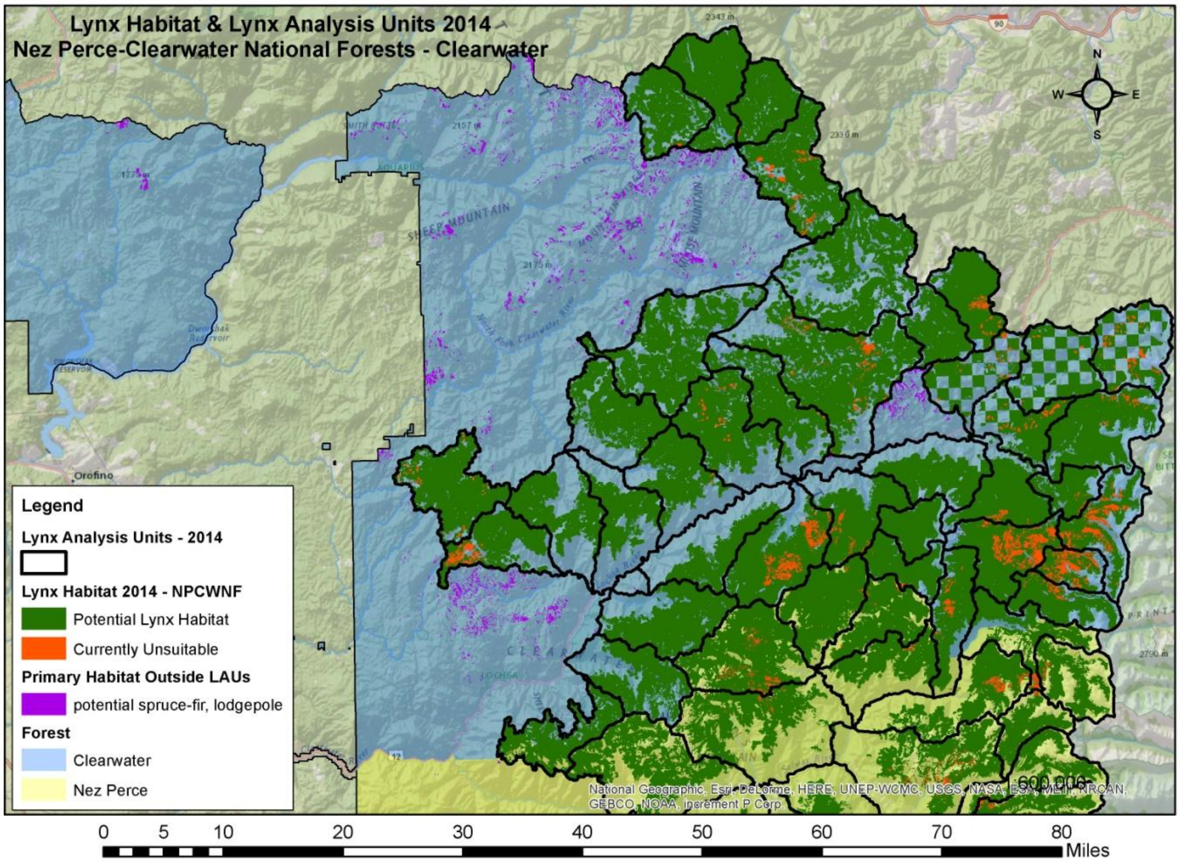

Figure 5-1. Lynx habitat and analysis units for the Clearwater National Forest portion of the Nez Perce–Clearwater National Forest

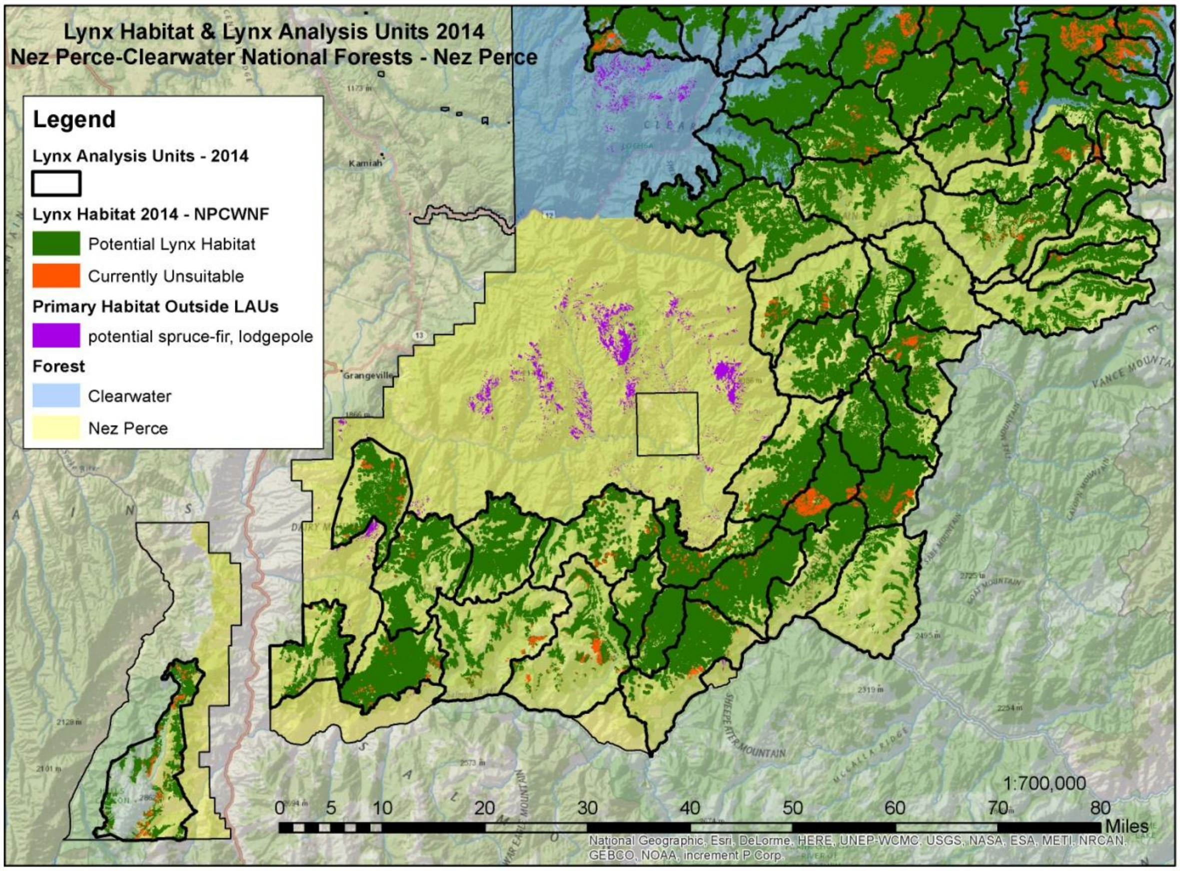

Figure 5-2. Lynx habitat and analysis units for the Nez Perce National Forest portion of the Nez Perce–Clearwater National Forests

5.1.5.1 Mapping Criteria

Potential natural vegetation types were the basis for mapping lynx habitat on the Nez Perce-Clearwater National Forest (NPCNF) because they represent the ecological potential for an area to support primary lynx habitat. Potential vegetation is a landscape scale classification that delineates expected vegetation type groups using ecosystem attributes such as land type, soils, topography, climate, and geographic location. Potential vegetation types define sites within a climatic region that have the potential to produce similar vegetation. Classifications of potential vegetation are often associated with well-documented stable vegetation communities, or habitat types, that occur in the absence of disturbance (e.g., Cooper et al. 1991 for northern Idaho).

There are important advantages to using potential vegetation type groups rather than existing vegetation for lynx mapping. Existing vegetation better describes the variability in vegetation cover that exists because of disturbance and seral stage, however, potentially suitable lynx habitat would be underestimated if defined using existing vegetation because stands affected by stand-replacing wildfires and regeneration harvest, which produce stands in initiation structural stage, are reflected in existing vegetation. Forest managers need to consider that stands in early stand initiation stage and stands in stem exclusion stage are potential lynx habitat even if they cannot currently support lynx.

Potential Vegetation Model Selection

Potential Vegetation Type (PVT) classification for western Montana and northern Idaho completed in 2004 for Region 1 (Appendix A) were used as the basis for mapping lynx habitat. We considered three existing mapped models of landscape classification for their usefulness in delineating potential vegetation types that characterize lynx habitat: (1) Potential Vegetation Types for Region 1 (PVT) (see Table 5-2), (2) Vegetative Response Units (VRU) available for the Nez Perce National Forest (NPNF) (Table 5-1), and (3) the Land Type Associations (LTA) for the Clearwater National Forest (CWNF) (Table 5-1). We did not consider using stand-based Habitat Type Groups (HTG) provided in FSVeg (USDA Forest Service 2014). Although HTG are classifications of potential natural vegetation types; in FSVeg they are based on individual stand assessment determined from common stand exams, which are not appropriate input for landscape-level modeling because they are based on a project-level sampling design and the level of data collection and accuracy requirements are highly spatially varied (USDA Forest Service 2014, chapter 2).

After reviewing the classifications and mapped distributions for the three landtype models (PVT, VRU, and LTA), we selected PVT to define potential lynx habitat. PVT is an ecoregional model based on spatially referenced field data that refers to habitat type and has been extrapolated across the region using climate data, solar radiation, potential lifeform, elevation, aspect, slope, and soils data (Appendix A). One basic advantage of using PVT is that it provides seamless and consistently-determined coverage regardless of ownership across both NPCNF. Additionally, PVT classes are combined into groups based on seral tree species that we were able to cross-reference to habitat types (Cooper et al. 1991) and HTGs (USDA Forest Service 2005) using lookup tables provided by Region 1 (Renewable Resources Management) and the appendices in Chew et al. (2012) which, provided us with a method for selecting PVT classes that are suitable lynx habitat.

We recognized that there were certain limitations to using PVT as a basis for lynx habitat mapping. The metadata for the PVT model (Appendix A) does not provide accuracy statistics and, other than the metadata, we could not find a report or document of the model-building. In addition, the model is designed for characterizing broad-scale patterns and although it is mapped at a 90-meter resolution, the metadata warns that, "the expected accuracy does not warrant their use for analyses of areas smaller than about 10,000 acres (for example, assessments that typically require 1:24,000 data)". However, we reviewed other potential vegetation models (see below) and felt that PVT outperformed the other systems in terms of being able to predict areas that support primary lynx habitat. In addition, although the Regional Geospatial Analysis Team recognizes the model needs to be updated (J. Barber, GIS specialist, Engineering, USFS Region 1, Missoula, MT, pers. comm.), it is currently the accepted model for potential vegetation in the Region. Of seven remapping efforts currently in progress in Region 1, six National Forests are using PVT (J. Barber pers. comm.). PVT was proven to be reasonable for predicting lynx locations on the Flathead National Forest where 94-95% of the locations of 8 radio-collared lynx were within PVT = abla1, 2, 3, or 4 (Flathead National Forest 2013). The same location data were not sensitive to existing vegetation in the Forest Service Region 1 Vegetation Map Product (VMap, Barber et al. 2011) dominance type classes .

There were compelling reasons to not use a combination of LTAs and VRUs for the two forests after exploring how effective the systems are in defining potential lynx habitat. The primary reason was that both systems delineate multiple classes that include other habitat types that are considered secondary habitat (grand fir (*Abies grandis*), mountain hemlock (*Thuja mertensiana*), western red cedar (*Thuja plicata*), and Douglas-fir (*Pseudotsuga menziesii*)) in addition to subalpine fir habitat types (Table 1). When we reviewed the distribution of potential primary habitat as selected by the different systems, 18% more area of the NPNF was selected by VRUs than PVT and 10% of the CWNF was selected by LTA groups than PVT, which we attributed to the inclusion of the secondary habitat types. We did not just assume that less primary habitat meant the PVT was more accurate, rather we carefully reviewed the differences in GIS using satellite imagery, existing vegetation maps (VMap and FSVEG) and determined that LTA groups and VRUs delineated areas as primary lynx that would not be spruce-fir or lodgepole pine habitat types. Additionally, when we reviewed the distributions of potential primary habitat adjacent to the border between the two forests, there were major differences in distribution that could have been a result of the different methods used for classification for the two systems; LTAs are primarily based on soil and water attributes while the VRUs are primarily based on vegetative components, disturbance regime, and successional pathways (Nez Perce and Clearwater National Forests 2013).

Primary Habitat

Mapping of primary habitat should be based on forest types necessary to support lynx survival and reproduction specific to each geographic area (Ruediger et al. 2000, Interagency Lynx Biology Team 2013), which in northern and central Idaho is subalpine fir, Englemann spruce, and lodgepole pine potential vegetation types (Interagency Lynx Biology Team 2013). We used PVT classes to delineate lynx primary habitat potential to produce forests dominated by sub-alpine fir, Englemann spruce, or lodgepole pine. The PVT model has four classes of potential vegetation dominated by subalpine fir, one class dominated by spruce, and one class dominated by lodgepole pine (Table 2).

Secondary Habitat

Where it is interspersed with primary habitat, cedar-hemlock, grand fir, or Douglas-fir on moist sites at higher elevations in central Idaho support snowshoe hares (Murray et al. 2002) and may provide secondary habitat for lynx (LCAS). Secondary habitat was selected from PVT classes where these tree species were dominant where it was directly adjacent to primary habitat. Because lynx are not associated with these forest types (Interagency Lynx Biology Team 2013) but because they do support snowshoe hares, we only included secondary habitat within 200-meters of primary habitat. There are multiple PVT classes for which each of these tree species is the dominant habitat type (e.g., abgr1, abgr2, abgr3 for grand fir) so we reviewed the PVT description and cross-referenced which habitat types and habitat type groups were associated with each PVT class using lookup tables provided by Region 1 (Renewable Resources Management) and the appendices in Chew et al. (2012) (Table 5-2).

We thoroughly researched the different habitat types (Cooper et al. 1991) and HTGs (USDA Forest Service 2005) to determine which were capable of providing the dense horizontal cover to support snowshoe hares. In the following section on secondary habitat, any information on habitat types comes from Cooper et al. 1991, the information about HTG comes from(USDA Forest Service 2005), and the table we used to cross-reference habitat types is Table 5-2 of this document. Many of the PVT classes included both (a) habitat types that were capable, and (b) habitat types that were unlikely, to provide habitat. Because secondary habitat must be directly adjacent to the primary habitat to be selected in the lynx habitat model and because it was to be cut-off 200-meters from any primary habitat, we tended toward being inclusive. We reasoned that habitat types that were too warm or dry to be suitable as secondary habitat were not likely to be growing within 200-meters of primary habitat and would not be selected anyway.

We selected two grand fir classes: abgr2 and abgr3 (Table 2). Abgr2 is in HTG 3, which is a group of moderately warm and moderately dry habitat types so we were originally not going to include it as potential secondary habitat. However, abgr2 includes one series with *Vaccinium globulare* (blue huckleberry) as the main undergrowth species, and another habitat type where subalpine fir and spruce can be co-dominant and huckleberry can be present in the shrub layer. Huckleberry is often present in known lynx habitat (Squires et al. 2010) and has the potential to provide cover and forage for snowshoe hare so included this PVT class as secondary habitat. Abgr3 includes ABGR/*Asarum caudatum* (ASCA) (wild ginger), ABGR/*Clintonia uniflora* (CLUN) (queen's cup), and ABGR/*Senecio triangularis* (SETR) (ragwort) series, which are in HTG 4. *Menziesia ferruginea* (MEFE) is a shrub species that is often present in known-lynx habitat (Squires et al. 2010, Interagency Lynx Biology Team 2013) and potentially provides cover and forage for snowshoe hare (Wirsing and Murray 2002). MEFE is a phase of both ABGR/ASCA and ABGR/CLUN series, which provided more support for selecting it as potential secondary habitat.

In northern Idaho, cedar-hemlock habitat types were previously thought to support lynx (LCAS) but are currently thought to only be potentially secondary habitat (Interagency Lynx Biology Team 2013). There were two PVT cedar classes (wet type 1 & moist type 2). We did not include the wet type because it includes habitat types that grow in elevations that are too low (1,500 - 4,700 ft.) to be considered snowshoe hare habitat. We selected the cedar moist type 2 and western hemlock habitat type because they include phases with MEFE and therefore have the potential to provide hare foraging habitat. We included all PVT classes with mountain hemlock as the dominant tree species (tsme1, tsme2, tsme3). Mountain hemlock is in the same cool HTGs (7 & 8) as spruce-fir habitat types, it grows in subalpine elevations, and there is suitable horizontal structure in the understory because the undergrowth is dominated by MEFE and VAGL is also well represented.

Moist high-elevation Douglas-fir habitat types in central Idaho potentially contribute to lynx habitat (NRLMD, Recommendations by the Lynx Steering Committee 2000). In central Idaho, Douglas-fir habitat types are varied and are distributed over a broad range of habitat types (Cooper et al. 1991). On the NPCNF most of the moist Douglas-fir habitat types are PSME/*Physocarpus capitatus* (PHCA) (ninebark) series. On the NPNF, these habitat types lack the characteristics necessary to provide hare habitat as spruce and lodgepole pine are generally negligible components and there is a limited presence of tall shrubs (P. Green, data analyst, USFS Region 1, NPCNF, pers. comm.). On the CWNF PSME/PHCA above 4,000 ft. might be suitable secondary habitat (P. Green pers. comm.) so we only considered PVT with PSME on the CWNF above 4,000 ft. We used the PVT class psme2 because it included the PSME/PHCA series that is potentially suitable as secondary habitat.

Elevation

In northwest Montana, lynx occupy subalpine elevations between 4,134 and 7,726 ft. (Squires et al. 2010). The LCAS did not directly provide elevation ranges specific to central Idaho but mapping direction provided by the Lynx Biology Team (7/12/2000) recommended that areas below 4,000 ft. should "usually" be excluded from mapping. Snow is a defining characteristic of winter lynx habitat and the snow is deeper in areas used by lynx compared to random availability (Squires et al. 2010). The upper limits of lynx habitat are the upper limits of subalpine forest cover. Lynx select home ranges with high canopy cover (Squires et al. 2013) and above the subalpine zone tree cover is too sparse to support lynx.

The NPCNF has deep snows in the winter but the elevation band of persistent snow is higher than on the east side of the Continental Divide (M. Bienkowski, silviculturist, USFS Region 1, NPCNF, pers. comm.) so we considered raising the minimum elevation in the mapping to higher than 4,000 ft. However, throughout the course of evaluating a preliminary map of primary habitat and discussing the matter with Bryon Holt, USFWS, Northern Idaho Field Office, Spokane, WA, we decided against having a lower elevational limit to the lynx habitat map. Potential spruce-fir habitat rarely occurred below 4,000 ft. on NPCNF but when it did we decided it could be within natural pockets affected by topographic features and climate and we did not want to exclude potentially suitable habitat based on elevation alone.

We excluded potential habitat above 7,000 ft. because of sparse tree cover above this elevation on NPCNF. The selected PVT classes for primary habitat included much of the area above 7,000 ft. on NPCNF. After carefully reviewing the high elevation potential primary habitat over satellite imagery and VMap and FSVEG in GIS, we determined that above 6,800-7,000 ft. there were very few conifer stands of a size that could potentially support snowshoe hare and lynx.

Denning

Denning habitat is used by females in the late winter and early spring when giving birth and rearing kittens. In northwest Montana, lynx dens were located in mature multi-storied stands of spruce-fir with high horizontal cover, abundant coarse woody debris, and higher canopy closure (Squires et al. 2008). Lynx prefer to den in coarse woody debris such as large diameter mature downed trees or small-diameter piled logs, but will also use protected areas in talus and boulders, disease-infected forests, etc. (Squires et al. 2008). To delineate denning habitat within our map of potential lynx habitat, we used maps of existing vegetation (VMap) to select mature stands with high canopy closure. We selected stands with ≥ 40% canopy cover and used large trees as an indicator for mature forest by selecting for stands with trees with ≥ 20” diameter at breast height (DBH).

Denning habitat is generally abundant across the coniferous forest landscape and den sites are not likely to be limiting (USDA Forest Service 2007, Squires et al. 2008). For this reason, some forests are not delineating denning habitat in remapping efforts. However, maintaining high quality and good distributions of denning habitat within an LAU helps to assure survival and reproduction by adult females. To have the option of assessing potential denning habitat and changes based on management, in order to inform management, we included the denning category in this remapping effort.

Currently Unsuitable

Forest stands that are in early stand initiation and stem exclusion structural stage do not provide forage and cover for snowshoe hares in the winter and, therefore, do not provide winter foraging habitat for Canada lynx (Ruediger et al. 2000, Squires et al. 2010, 2013, Interagency Lynx Biology Team 2013). Stands in initiation structural stage are short enough to be covered by snow in the winter and stands in stem exclusion stage don’t have low horizontal cover and high stem densities to provide cover and foraging for snowshoe hare in the winter (Hodges 2000b, Lewis et al. 2011).

Stand-replacing wildfires and regeneration timber harvest create stands that are unsuitable for snowshoe hares and lynx until the stand grows beyond the stem exclusion stage. The number of years after a severe burn or regeneration harvest before a stand has the horizontal stand structure required to support snowshoe hare and lynx depends greatly on the degree of disturbance, stand ecology, local climate, and topography. Therefore, it is difficult to predict an average time a stand grows before it surpasses the stem exclusion stage across the Forests (M. Bienkowski pers. comm.). We estimated 25-years based on a recent forest vegetation simulation analysis by M. Bienkowski (pers. comm.) near Powell, ID. This was consistent with what the Nez Perce NF and similar to what the Clearwater NF used in previous lynx mapping. We used forestry and fire severity data by year to determine which stands were in unsuitable condition because of stand age and classified those as currently unsuitable.

We would have liked to run a forest vegetation simulation model on representative stands within each LAU to determine the age at which a stand grows beyond stem exclusion stage (as suggested by M. Bienkowski) but did not have the time. We plan to complete this in the near future to further refine the currently unsuitable habitat for the NPCNF lynx habitat map.

Lynx Analysis Units

The Lynx Conservation Assessment Strategy recommended that Lynx Analysis Units (LAUs) be identified for all areas with lynx habitat in order to provide an area to monitor habitat changes and the effects of management on individual lynx (Ruediger et al. 2000). LAUs are intended to approximate an area needed to support a female lynx year-round and should have sufficient primary vegetation in condition that is suitable for survival and reproduction (Ruediger et al. 2000, USDA Forest Service 2007, Interagency Lynx Biology Team 2013). LAUs should be approximately 16,000 to 32,000 acres but may be larger in less continuous, fragmented habitat (Ruediger et al. 2000). There should be at least 6,400 acres (10 miles^2) of primary habitat within each LAU, which is the estimated amount of habitat needed to support a female lynx all year (Interagency Lynx Biology Team 2013). Existing ecological units such as watersheds (6th hydrologic unit codes (HUCs)) are to be used as the basis for mapping LAUs except for the following situations: (a) when there are HUCs with only small patches of habitat beyond the daily movement distance of a lynx, the LAU can be discarded (Interagency Lynx Biology Team 2013), or (b) HUCs with insufficient amounts of lynx primary habitat can be combined among neighboring LAUs (Ruediger et al. 2000).

Once we mapped primary habitat, we mapped new LAUs for the NPCNF (Table 4). Watersheds (HUCs) were the basis for delineating the LAUs. We mapped primary habitat and used the calculated area of primary habitat within each HUC to determine if it contained sufficient habitat to support a lynx. Where there were HUCs that did not contain sufficient habitat, adjacent HUCs were either combined in full or portions of those were appended to neighboring HUCs. When combining portions of neighboring HUCs, we attempted to consolidate habitat in a way that best represented a potential lynx home range. When drawing LAU boundaries that did not follow HUC boundaries, we preferred to follow geographic features such as streams or ridges. In some areas, consolidated habitat was not bounded by a geographic feature to follow, and in these cases, we buffered the primary habitat by 200-meters and drew the LAU boundary on or near to the buffer edge (Figure 5-3 and Figure 5-4).

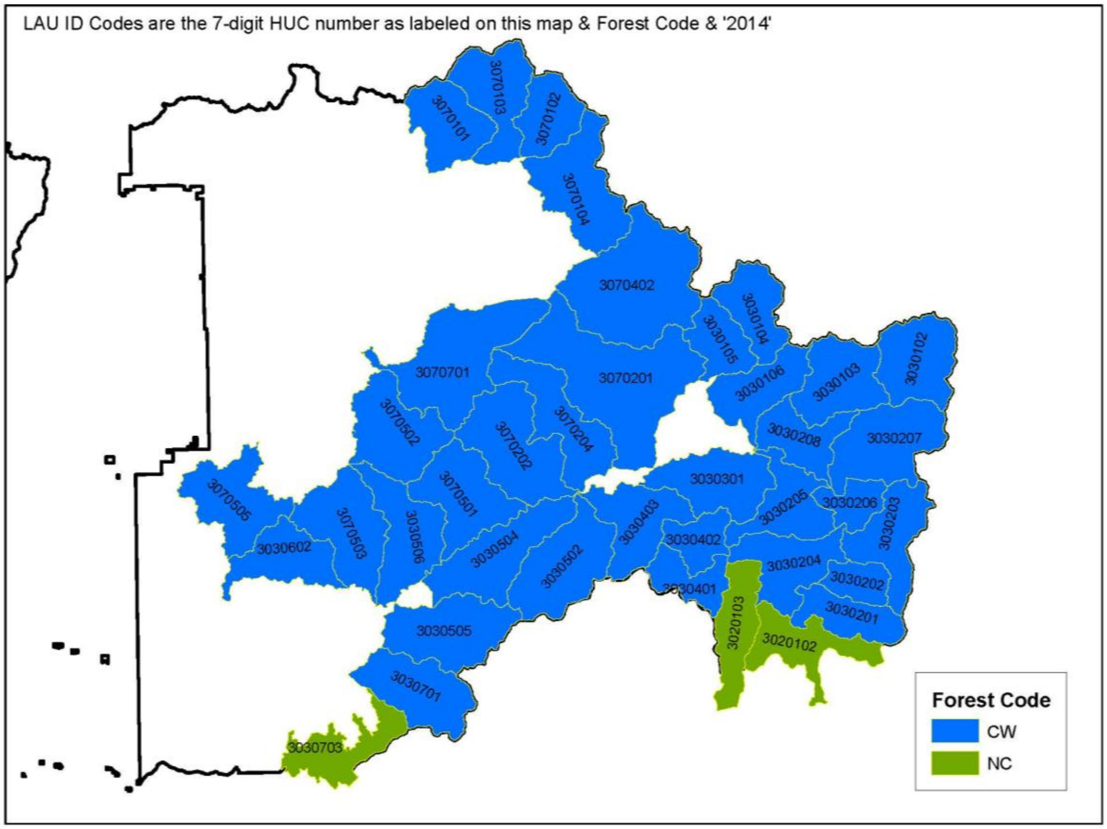

Figure 5-3. Lynx Analysis Unit Identification (LAUID) codes for the Clearwater National Forest portion of the Nez Perce–Clearwater National Forests

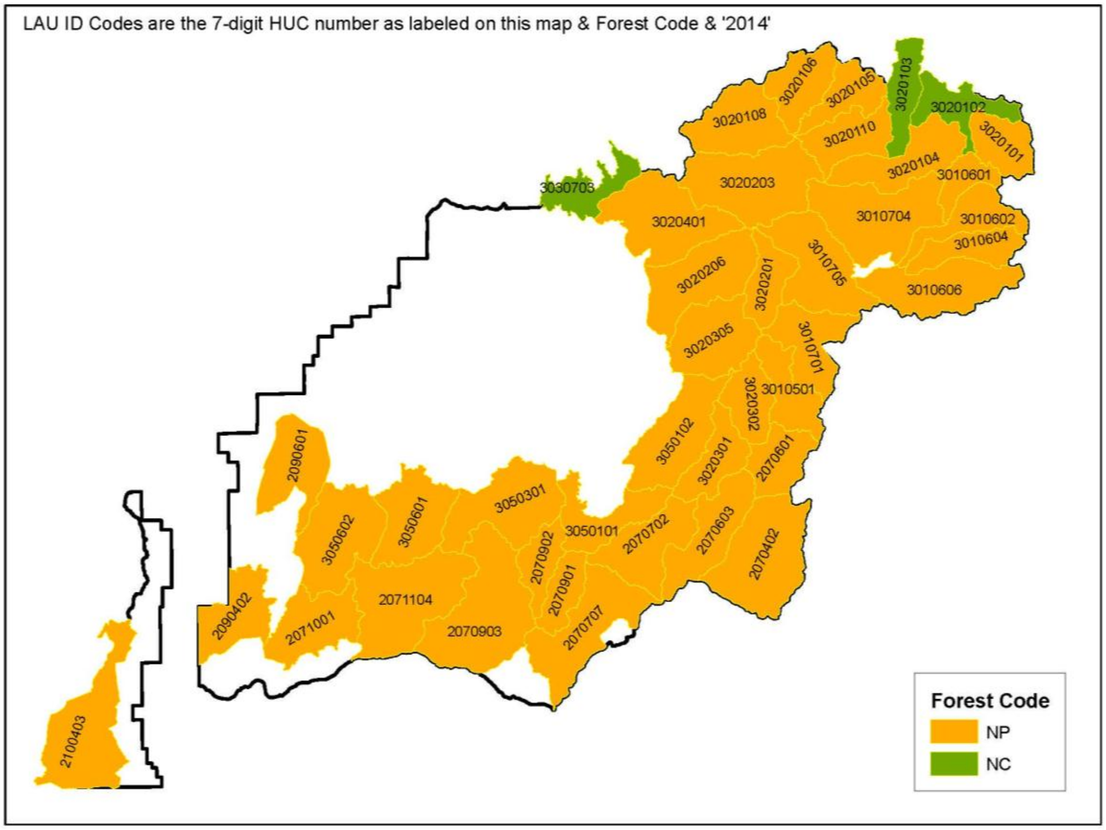

Figure 5-4. Lynx Analysis Unit Identification (LAUID) codes for the Nez Perce National Forest portion of the Nez Perce–Clearwater National Forests

5.1.5.2 Mapping Process/Steps

See Table 5-5 for a summary of all GIS datasets used in the mapping process including: full name, acronym, data type, file name, and file pathway for storage location on the T-drive or (in the case of PVT) location to download data on the web. All GIS processing was done by Kathy Brodhead, wildlife biologist, USFS Region 1, NPCNF.

Primary Habitat

- I used Potential Vegetation Type (PVT) for Region 1 and clipped it to the boundary of the two forests (PVT_NPCNF). I reclassified the raster using PVT classes: abla1, abla2, abla3, abla4, picea, and pico classes were classified to 1 and all other classes as NoData. I converted the reclassified raster to polygon feature class 'primary' with an added field habTyp calculated all features = 1.
- I dissolved primary habitat based on habTyp but did not allow the creation of multipart features so that all contiguous primary habitat was one polygon feature but spatially distinct habitat clumps were separate features (primary_1_dissolved).

- I deleted primary habitat above 7,000 ft in two steps: (1) I reclassified a 10-meter DEM to three classes: <4,000 ft., 4,000–7,000 ft., >7,000 ft (<1219 m, 1219–2134 m, >2134 m) and converted to a polygon feature class with 3 features for each elevational band (elev_4to7k), then (2) I selected the >7,000 ft feature from elev_4to7k and clipped primary_1_dissolved to elev_4to7k and created a new feature class primary_2_below7kft.
- I excluded primary habitat in private landholdings by (1) selecting features from Ownership for each forest where owner = private and making new layers with selected features and merging those for one private feature class across both forests (owner_pvt), (2) and clipping primary_2_below7kft by owner_pvt (primary_3_nopvt). I did this step before combining with secondary because I wanted to have a separate final feature class for primary.

Secondary habitat

- I reclassified potential secondary lynx habitat from PVT_NPCNF using PVT classes: abgr2, abgr3, thpl2, tshe, tsme1, tsme2, and tsme3. These classes were reclassified to 2 and all other classes as NoData. I converted the reclassified raster to polygon feature class 'secondaryA' with an added field habTyp and calculated all features = 2.
- I reclassified PVT_NPCNF a second time to create a separate raster for psme2 because I needed to process it further before combining it with other secondary habitat. Using PVT_NPCNF, I reclassified psme2 to 2 and all other classes as NoData. I converted the reclassified raster to polygon feature class 'psme2' with an added field habTyp and calculated all features = 2.
- I clipped psme2 to the CWNF boundary (psme2_clw). I selected the 4,000-7,000 ft feature from elev_4to7k and clipped psme2 to elev_4to7k and created a new feature class psme2_above4kclw.
- I merged psme2 with secondaryA to create a new feature class 'secondary'.

Potential Lynx Habitat

- I buffered the primary habitat by 200-meters (primary_4_200buff) and clipped the secondary habitat to the buffer (secondary_2_clip2buff).
- I deleted features of the buffered secondary habitat if they were not directly adjacent to primary habitat using select by location and editing the secondary feature class.
- I dissolved secondary_1_clip2buff based on HabTyp but did not allow the creation of multipart features so that all contiguous secondary habitat was one polygon feature but spatially distinct habitat clumps were separate features (secondary_3_disslvHabTyp).
- I excluded habitat in private landholdings by clipping secondary_3_disslvHabTyp by owner_pvt (secondary_4_nopvt). I did this step before combining with primary because I wanted to have a separate final feature class for secondary.
- I merged primary_3_nopvt with secondary_4_nopvt (potential).

Denning

- Vmap and potential were combined by intersect.
- Features were selected using vmap attributes where canopy cover was greater than 40% and where, (a) DBH >= 15 for lodgepole (DOM_MID_60 = PICO) or (b) DBH >= 20" for all other species.

- The selected features were exported as denning habitat.

Currently Unsuitable

- The forest's Activity Polygons were related to the Activity Tables (NEZ_ACTV160_2014_02_25 & CLW_ACTV160_2014_02_25). Polygons were selected with Activity Codes =4100 to 4199 and date > 02/1989 and exported to new feature classes (a_nez_regen_p021989 and b_clw_rengen_p021989).
- High severity fires in year > 1988 were selected from Fire Severity by Year (c_sevrfire_p1988).
- The three feature classes above were merged (d_RegenNFire_merged) and then clipped to lynx habitat (e_RegenNFire_inLynxhab).

5.1.5.3 Final Model

Potential habitat, denning, and currently unsuitable were combined by union (Table 5-1).

Table 5-1. Summary of Vegetation Response Units (VRU) on the NPNF and Land Type Association Groups on the Clearwater National Forest

System	Description	Habitat Type Groups	Forest Cover Type
VRU 1	Convex slopes, ABLA	9, 7, 3, 4	ABLA, ABGR, PICO
VRU 2	Glaciated slopes, ABLA	9, 7, 10, 11	ABLA, PIAL, PICO, PIEN
VRU 5	Moraines, ABLA & ABGR	9, 7, 8	PICO, PIEN, PIAL
VRU 6	Cold basins, ABGR & ABLA	3, 4, 9, 7, 8	ABGR, ABLA
VRU 9	High elevation ridges, ABLA & PIAL	9, 10, 11, 7	ABLA, PIAL
VRU 10	Uplands, alder, ABGR & ABLA	4, 5, 7, 8	ABGR, ABLA, TSME
LTA G2	High elevation stream bottoms and glacial terraces	7, 8, 9	ABLA, PIEN, PICO
LTA G6	Alpine glaciated ridges	7, 8, 9, 10, 11	ABLA, PIEN, PICO, PIAL, TSME
LTA G7	Scoured alpine glaciated troughs	9, 10, 11	PICO, ABLA, PIAL, TSHE, PSME
LTA G8	Plastered alpine glaciated troughs	7, 8	ABLA, PIEN, TSME
LTA G9	Alpine icecap uplands and basins	7, 8, 9	ABLA, PIEN, PSME, PICO
LTA G12	High elevation frost churned ridges	10, 11	PIAL, ABLA
LTA G13	Dry frost churned ridges	7, 9, 4, 8, 9	ABLA, PICO, PSME, ABGR
LTA G14	Moist frost churned ridges	7, 4, 5, 8	ABLA, PICO, ABGR, PSME
LTA G16	Low relief rolling hills - umbric or fragipan	5, 4, 6	ABGR, PSME, ABLA

Note: See Table 5-3 for tree species codes listed in Description and Forest Cover Type

Table 5-2. Potential lynx habitat (primary or secondary), PVT classes that were selected for consideration in mapping potential lynx habitat (see Appendix A), habitat type codes (HT_code) and groups (HTG) for the Nez Perce National Forest (see HTG 2005), habitat types (see Cooper et al. 1991), and habitat type group descriptions (see HTG 2005)

Habitat	PVT	HT_code	HTG NPCNF	Habitat Type	HTG Description
primary	abla1	610	8	abla/opho	cool_wet
primary	abla1	630	8	abla/gatr	cool_wet
primary	abla1	635	8	abla/stam	cool_wet
primary	abla1	636	8	abla/stam-mefe	cool_wet
primary	abla1	637	8	abla/stam-lica	cool_wet
primary	abla1	650	8	abla/caca	cool_wet
primary	abla1	651	8	abla/caca-caca	cool_wet
primary	abla1	652	8	abla/caca-lica	cool_wet
primary	abla1	653	8	abla/caca-gatr	cool_wet
primary	abla1	654	8	abla/caca-vaca	cool_wet
primary	abla1	655	8	abla/caca-legl	cool_wet
primary	abla2	620	7	abla/clun	cool_moist
primary	abla2	621	7	abla/clun-clun	cool_moist
primary	abla2	622	7	abla/clun-arnu	cool_moist
primary	abla2	623	7	abla/clun-vaca	cool_moist
primary	abla2	624	7	abla/clun-xete	cool_moist
primary	abla2	625	7	abla/clun-mefe	cool_moist
primary	abla2	660	7	abla/libo	cool_moist
primary	abla2	661	7	abla/libo-libo	cool_moist
primary	abla2	662	7	abla/libo-xete	cool_moist
primary	abla2	663	9	abla/libo-vasc	cool_mod_dry
primary	abla2	671	7	abla/mefe-cooc	cool_moist
primary	abla2	673	7	abla/mefe-xete	cool_moist
primary	abla2	740	7	abla/alsi	cold_mod_dry
primary	abla3	640	9	abla/vaca	cool_mod_dry
primary	abla3	691	9	abla/xete-vagl	cool_mod_dry
primary	abla3	693	9	abla/xete-cooc	cool_mod_dry
primary	abla3	720	9	abla/vagl	cool_mod_dry
primary	abla3	730	10	abla/vasc	cold_mod_dry
primary	abla3	750	9	abla/caru	cool_mod_dry
primary	abla3	770		abla/clps	cool_mod_dry
primary	abla3	780	9	abla/arco	cool_mod_dry
primary	abla3	790	9	abla/cage	cool_mod_dry
primary	abla3	791	9	abla/cage-cage	cool_mod_dry
primary	abla3	792	9	abla/cage-psme	cool_mod_dry
primary	abla4	670	7	abla/mefe	cool_moist
primary	abla4	672	10	abla/mefe-luhi	cool_moist

Habitat	PVT	HT_code	HTG NPCNF	Habitat Type	HTG Description
primary	abla4	674	10	abla/mefe-vasc	cool_moist
primary	abla4	690	9	abla/xete	cool_mod_dry
primary	abla4	692	10	abla/xete-vasc	cool_mod_dry
primary	abla4	694	10	abla/xete-luhi	cool_mod_dry
primary	abla4	731	10	abla/vasc-caru	cool_mod_dry
primary	abla4	732	10	abla/vasc-vasc	cold_mod_dry
primary	abla4	733	10	abla/vasc-thoc	cool_moist
primary	abla4	810		abla/rimo	cool_moist
primary	abla4	830	10	abla/luhi	cold_mod_dry
primary	abla4	831	10	abla/luhi-vasc	cold_mod_dry
primary	abla4	832	10	abla/luhi-mefe	cool_moist
primary	picea	400		picea series	
primary	picea	410	8	picea/eqar	cool_wet
primary	picea	420	7	picea/clun	cool_moist
primary	picea	421	7	picea/clun-vaca	cool_moist
primary	picea	422	7	picea/clun-clun	cool_moist
primary	picea	430		picea/phma	cool_mod_dry
primary	picea	440	8	picea/gatr	cool_wet
primary	picea	450	9	picea/vaca	cool_mod_dry
primary	picea	460	7	picea/sest	mod_cool_moist
primary	picea	461	7	picea/sest-psme	mod_cool_moist
primary	picea	462	7	picea/sest-picea	mod_cool_moist
primary	picea	470	7	picea/libo	cool_moist
primary	picea	480	8	picea/smst	cool_wet
primary	pico	900		pico series	
primary	pico	910	9	pico/putr	cool_mod_dry
primary	pico	920	9	pico/vaca	cool_mod_dry
primary	pico	925	10	pico/xete	cold_mod_dry
primary	pico	930	9	pico/libo	cool_mod_dry
primary	pico	940	10	pico/vasc	cold_mod_dry
primary	pico	950	9	pico/caru	cool_mod_dry
secondary	abgr1	505	2	abgr/spbe	mod_warm_dry
secondary	abgr1	506	2	abgr/phma	mod_warm_dry
secondary	abgr1	507	2	abgr/phma-cooc	mod_warm_dry
secondary	abgr1	508	2	abgr/phma-phma	mod_warm_dry
secondary	abgr2	510	3	abgr/xete	mod_warm_mod_dry
secondary	abgr2	511	3	abgr/xete-cooc	mod_warm_mod_dry
secondary	abgr2	512	3	abgr/xete-vagl	mod_warm_mod_dry
secondary	abgr2	515	3	abgr/vagl	mod_warm_mod_dry
secondary	abgr2	590	3	abgr/libo	mod_warm_mod_dry

Habitat	PVT	HT_code	HTG NPCNF	Habitat Type	HTG Description
secondary	abgr2	591	3	abgr/libo-libo	mod_warm_mod_dry
secondary	abgr2	592	3	abgr/libo-xete	mod_warm_mod_dry
secondary	abgr3	516	4	abgr/asca	mod_warm_moist
secondary	abgr3	517	4	abgr/asca-asca	mod_warm_moist
secondary	abgr3	518	4	abgr/asca-mefe	mod_warm_moist
secondary	abgr3	519	4	abgr/asca-tabr	mod_warm_moist
secondary	abgr3	520	4	abgr/clun	mod_warm_moist
secondary	abgr3	521	4	abgr/clun-clun	mod_warm_moist
secondary	abgr3	522	4	abgr/clun-arnu	mod_warm_moist
secondary	abgr3	523	3	abgr/clun-xete	mod_warm_mod_dry
secondary	abgr3	524	4	abgr/clun-phma	mod_warm_moist
secondary	abgr3	525	4	abgr/clun-mefe	mod_warm_moist
secondary	abgr3	526	4	abgr/clun-tabr	mod_warm_moist
secondary	abgr3	529	4	abgr/setr	mod_warm_moist
secondary	psme1	210	1	psme/agsp	warm_dry
secondary	psme1	220	1	psme/feid	warm_dry
secondary	psme1	230	1	psme/fesc	warm_dry
secondary	psme1	380		psme/syor	mod_warm_dry
secondary	psme2	250	2	psme/vaca	mod_warm_dry
secondary	psme2	260	2	psme/phma	mod_warm_dry
secondary	psme2	261	2	psme/phma-phma	mod_warm_dry
secondary	psme2	262	2	psme/phma-caru	mod_warm_dry
secondary	psme2	263	2	psme/phma-smst	mod_warm_dry
secondary	psme2	280	2	psme/vagl	mod_warm_dry
secondary	psme2	281	2	psme/vagl-vagl	mod_warm_dry
secondary	psme2	282	2	psme/vagl-aruv	mod_warm_dry
secondary	psme2	283	2	psme/vagl-xete	mod_warm_dry
secondary	psme2	290	3	psme/libo	mod_warm_mod_dry
secondary	psme2	291	3	psme/libo-syal	mod_warm_mod_dry
secondary	psme2	292	2	psme/libo-caru	mod_warm_dry
secondary	psme2	293	3	psme/libo-vagl	mod_warm_mod_dry
secondary	psme2	310	2	psme/syal	mod_warm_dry
secondary	psme2	311	1	psme/syal-agsp	warm_dry
secondary	psme2	312	2	psme/syal-caru	mod_warm_dry
secondary	psme2	313	2	psme/syal-syal	mod_warm_dry
secondary	psme3	320	2	psme/caru	mod_warm_dry
secondary	psme3	321	1	psme/caru-agsp	warm_dry
secondary	psme3	322	2	psme/caru-aruv	mod_warm_dry
secondary	psme3	323	2	psme/caru-caru	mod_warm_dry
secondary	psme3	324	2	psme/caru-pipo	mod_warm_dry

Habitat	PVT	HT_code	HTG NPCNF	Habitat Type	HTG Description
secondary	psme3	330	2	psme/cage	mod_warm_dry
secondary	psme3	340	2	psme/spbe	mod_warm_dry
secondary	psme3	350	2	psme/aruv	mod_warm_dry
secondary	psme3	360	2	psme/juco	mod_warm_dry
secondary	psme3	370	2	psme/arco	mod_warm_dry
secondary	thpl1	540	6	thpl/atfi	mod_cool_wet
secondary	thpl1	541	6	thpl/atfi-adpe	mod_cool_wet
secondary	thpl1	542	6	thpl/atfi-atfi	mod_cool_wet
secondary	thpl1	550	6	thpl/opho	mod_cool_wet
secondary	thpl1	555	5	thpl/gydr	mod_cool_moist
secondary	thpl1	560	6	thpl/adpe	mod_cool_wet
secondary	thpl2	530	5	thpl/clun	mod_cool_moist
secondary	thpl2	531	5	thpl/clun-clun	mod_cool_moist
secondary	thpl2	532	5	thpl/clun-arnu	mod_cool_moist
secondary	thpl2	533	5	thpl/clun-mefe	mod_cool_moist
secondary	thpl2	534	5	thpl/clun-xete	mod_cool_moist
secondary	thpl2	535	5	thpl/clun-tabr	mod_cool_moist
secondary	thpl2	545	5	thpl/asca	mod_cool_moist
secondary	thpl2	546	5	thpl/asca-asca	mod_cool_moist
secondary	thpl2	547	5	thpl/asca-mefe	mod_cool_moist
secondary	thpl2	548	5	thpl/asca-tabr	mod_cool_moist
secondary	tshe	502		tshe series	
secondary	tshe	565	5	tshe/gydr	mod_cool_moist
secondary	tshe	570	5	tshe/clun	mod_cool_moist
secondary	tshe	571	5	tshe/clun-clun	mod_cool_moist
secondary	tshe	572	5	tshe/clun-arnu	mod_cool_moist
secondary	tshe	573	5	tshe/clun-mefe	mod_cool_moist
secondary	tshe	574	5	tshe/clun-xete	mod_cool_moist
secondary	tshe	575	5	tshe/asca	mod_cool_moist
secondary	tshe	576	5	tshe/asca-arnu	mod_cool_moist
secondary	tshe	577	5	tshe/asca-mefe	mod_cool_moist
secondary	tshe	578	5	tshe/asca-asca	mod_cool_moist
secondary	tshe	579	7	tshe/mefe	cool_moist
secondary	tsme1	675	8	tsme/stam	cool_wet
secondary	tsme1	676	10	tsme/stam-luhi	cool_wet
secondary	tsme1	677	8	tsme/stam-mefe	cool_wet
secondary	tsme1	685	7	tsme/clun	cool_moist
secondary	tsme1	686	7	tsme/clun-mefe	cool_moist
secondary	tsme1	687	7	tsme/clun-xete	cool_moist
secondary	tsme2	682	7	tsme/mefe-xete	cool_moist

Habitat	PVT	HT_code	HTG NPCNF	Habitat Type	HTG Description
secondary	tsme2	710	9	tsme/xete	cool_mod_dry
secondary	tsme2	712	9	tsme/xete-vagl	cool_mod_dry
secondary	tsme3	680	7	tsme/mefe	cool_moist
secondary	tsme3	681	10	tsme/mefe-luhi	cool_moist
secondary	tsme3	711	10	tsme/xete-luhi	cool_mod_dry
secondary	tsme3	713	10	tsme/xete-vasc	cool_mod_dry
secondary	tsme3	840	10	tsme/luhi	cold_mod_dry
secondary	tsme3	841	10	tsme/luhi-vasc	cold_mod_dry
secondary	tsme3	842	10	tsme/luhi-mefe	cold_mod_dry

Note: See Table 5-3 for 4-letter tree species codes or see Cooper et al. 1991 or USDA Plants Database online (available at URL: http://plants.usda.gov) for 4-letter understory associate species codes.

Table 5-3. Tree species and species codes

Scientific Name	Common Name	Species Code
Abies grandis	grand fir	ABGR
Abies lasiocarpa	subalpine fir	ABLA
Pinus albicaulis	whitebark pine	PIAL
Pinus contorta	lodgepole pine	PICO
Picea engelmannii	Englemann spruce	PIEN
Pinus monticoloa	western white pine	PIMO
Pinus ponderosa	ponderosa pine	PIPO
Pseudotsuga menziesii	Douglas-fir	PSME
Taxus brevifolia	Pacific yew	TABR
Thuja plicata	western red cedar	THPL
Tsuga heterophylla	western hemlock	TSHE
Tsuga mertensiana	mountain hemlock	TSME

Table 5-4. Lynx Analysis Units summary. Acres of foraging habitat, denning habitat, and currently unsuitable habitat (CUS). The number of acres and square miles in each LAU. The watershed (HUC12) with the most area in each LAU is listed.

LAU 2014 ID	Forest	Forage (acres)	Denning (acres)	TotHab (acres)	TotHab (mi^2)	CUS (acres)	LAU (acres)	LAU (mi^2)	HUC12 Name
3020103NC2014	BOTH	14,688	174	14,862	23	691	20,935	33	Cedar Creek
3030204CW2014	CLW	17,874	9	17,883	28	4,830	24,497	38	Lower Big Sand Creek
3030402CW2014	CLW	10,562	58	10,620	17	0	12,560	20	Wind Lakes Creek
3030502CW2014	CLW	24,127	0	24,127	38	3,518	33,307	52	Lake Creek
3030205CW2014	CLW	17,839	102	17,941	28	507	22,562	35	Colt Creek
3030403CW2014	CLW	17,733	9	17,742	28	747	25,443	40	Lower Warm Springs Creek
3030206CW2014	CLW	8,532	24	8,556	13	248	10,811	17	Middle Colt Killed Creek
3070204CW2014	CLW	19,855	925	20,780	32	82	30,022	47	Middle Cayuse Creek
3030105CW2014	CLW	13,008	108	13,116	20	0	16,032	25	Boulder Creek-Crooked Fork Creek
3030104CW2014	CLW	16,519	145	16,664	26	859	19,448	30	Upper Crooked Fork Creek
3030701CW2014	CLW	16,896	0	16,896	26	0	28,122	44	Old Man Creek
3030505CW2014	CLW	23,943	0	23,943	37	0	32,109	50	Boulder Creek
3030202CW2014	CLW	5,076	0	5,076	8	2,721	10,518	16	Hidden Creek
3030201CW2014	CLW	12,315	0	12,315	19	673	17,368	27	Upper Big Sand Creek
3030203CW2014	CLW	11,674	0	11,674	18	2,926	24,758	39	Upper Colt Killed Creek
3030207CW2014	CLW	24,627	13	24,640	39	513	32,708	51	Storm Creek
3030102CW2014	CLW	10,735	0	10,735	17	1,122	26,150	41	Spruce Creek
3030103CW2014	CLW	13,609	40	13,649	21	165	25,841	40	Lower Brushy Fork Creek
3070201CW2014	CLW	44,494	1,763	46,257	72	1,833	66,882	105	Upper Cayuse Creek
3070101CW2014	CLW	16,506	2,002	18,508	29	131	23,476	37	Meadow Creek
3070402CW2014	CLW	34,743	2,103	36,846	58	3	56,871	89	Upper Kelly Creek
3070102CW2014	CLW	16,253	831	17,084	27	94	17,916	28	Long Creek
3070503CW2014	CLW	14,626	2,961	17,587	27	0	31,590	49	Little Weitas Creek

LAU 2014 ID	Forest	Forage (acres)	Denning (acres)	TotHab (acres)	TotHab (mi^2)	CUS (acres)	LAU (acres)	LAU (mi^2)	HUC12 Name
3070501CW2014	CLW	17,856	75	17,931	28	58	29,827	47	Upper Weitas Creek
3020301NP2014	NEZ	19,223	0	19,223	30	4,003	24,072	38	Headwaters Meadow Creek
3050602NP2014	NEZ	24,984	2,292	27,276	43	265	48,303	75	Gospel Creek
3020102NC2014	BOTH	12,166	166	12,332	19	475	22,452	35	Upper East Fork Moose Creek
3050101NP2014	NEZ	19,462	2,295	21,757	34	1,185	28,468	44	South Fork Red River
2070601NP2014	NEZ	18,646	38	18,684	29	1,695	23,084	36	Upper Bargamin Creek
3010704NP2014	NEZ	20,507	261	20,768	32	1,145	55,666	87	Pettibone Creek
3020302NP2014	NEZ	18,086	31	18,117	28	0	22,353	35	Upper Meadow Creek
3010601NP2014	NEZ	8,642	0	8,642	14	105	13,552	21	Wahoo Creek
3010604NP2014	NEZ	11,546	86	11,632	18	339	21,329	33	Paradise Creek
3020201NP2014	NEZ	12,118	335	12,453	19	2	20,988	33	Marten Creek
2071104NP2014	NEZ	12,883	25	12,908	20	926	62,113	97	Sheep Creek
3050301NP2014	NEZ	18,792	1,810	20,602	32	994	48,597	76	Upper Crooked River
2090601NP2014	NEZ	17,109	3,333	20,442	32	1,152	35,435	55	South Fork White Bird Creek
3010701NP2014	NEZ	16,089	38	16,127	25	1,294	31,446	49	Goat Creek
3020305NP2014	NEZ	23,986	311	24,297	38	103	38,698	60	Buck Lake Creek
3020206NP2014	NEZ	14,060	155	14,215	22	1,408	46,656	73	Pinchot Creek-Selway River
3010501NP2014	NEZ	18,376	165	18,541	29	84	24,365	38	Upper Running Creek
2070901NP2014	NEZ	16,053	0	16,053	25	97	17,450	27	Upper Crooked Creek
3020106NP2014	NEZ	21,841	359	22,200	35	144	25,900	40	West Moose Creek
2070902NP2014	NEZ	11,372	0	11,372	18	0	17,984	28	Big Creek
2070903NP2014	NEZ	13,880	0	13,880	22	2,144	68,510	107	Lake Creek
2070702NP2014	NEZ	30,828	20	30,848	48	693	36,529	57	Big Mallard Creek
3010606NP2014	NEZ	15,750	52	15,802	25	38	42,923	67	Lower Cub Creek
3020101NP2014	NEZ	10,964	0	10,964	17	239	21,621	34	Headwaters East Fork

LAU 2014 ID	Forest	Forage (acres)	Denning (acres)	TotHab (acres)	TotHab (mi^2)	CUS (acres)	LAU (acres)	LAU (mi^2)	HUC12 Name
									Moose Creek
3050601NP2014	NEZ	24,507	748	25,255	39	50	38,529	60	Upper Johns Creek
3070103CW2014	CLW	21,565	3,764	25,329	40	8	26,831	42	Vanderbilt Creek-North Fork Clearwater River
3070104CW2014	CLW	26,135	2,194	28,329	44	1,282	34,393	54	Lake Creek
3070502CW2014	CLW	20,936	752	21,688	34	0	31,132	49	Middle Weitas Creek
3030506CW2014	CLW	12,449	850	13,299	21	0	28,415	44	Bald Mountain Creek-Lochsa River
3070701CW2014	CLW	34,901	1,478	36,379	57	0	47,337	74	Fourth of July Creek
3030106CW2014	CLW	10,424	121	10,545	16	554	21,853	34	Lower Crooked Fork Creek
3030301CW2014	CLW	16,189	0	16,189	25	3	27,530	43	Walton Creek-Lochsa River
3030208CW2014	CLW	11,460	93	11,553	18	758	18,842	29	Lower Colt Killed Creek
3070202CW2014	CLW	25,851	1,216	27,067	42	535	36,909	58	Gravey Creek
2070603NP2014	NEZ	17,518	183	17,701	28	314	36,647	57	Lower Bargamin Creek
2070402NP2014	NEZ	10,787	19	10,806	17	43	57,001	89	Upper Sabe Creek
3070505CW2014	CLW	15,233	10,053	25,286	40	708	28,685	45	Hemlock Creek
3030602CW2014	CLW	14,960	380	15,340	24	1,447	22,319	35	Hungery Creek
3030504CW2014	CLW	13,333	0	13,333	21	0	32,021	50	Stanley Creek-Lochsa River
3030703NC2014	BOTH	20,613	139	20,752	32	0	21,492	34	Fire Creek
3020203NP2014	NEZ	23,374	168	23,542	37	314	56,478	88	Three Links Creek
3010705NP2014	NEZ	14,152	113	14,265	22	10	46,187	72	Dog Creek-Selway River
3020105NP2014	NEZ	16,527	42	16,569	26	194	21,292	33	Upper North Fork Moose Creek
3020110NP2014	NEZ	13,952	184	14,136	22	143	26,887	42	Lower East Fork Moose Creek

LAU 2014 ID	Forest	Forage (acres)	Denning (acres)	TotHab (acres)	TotHab (mi^2)	CUS (acres)	LAU (acres)	LAU (mi^2)	HUC12 Name
3020104NP2014	NEZ	17,555	48	17,603	28	896	35,689	56	Middle East Fork Moose Creek
3010602NP2014	NEZ	11,162	26	11,188	17	72	23,777	37	Upper Bear Creek
3050102NP2014	NEZ	19,187	4,500	23,687	37	578	44,350	69	Upper Red River
2070707NP2014	NEZ	22,583	17	22,600	35	1,038	49,569	77	Jersey Creek-Salmon River
2071001NP2014	NEZ	24,686	477	25,163	39	1,006	34,901	55	Meadow Creek
2090402NP2014	NEZ	10,916	1,562	12,478	20	190	30,959	48	Fiddle Creek-Salmon River
3020108NP2014	NEZ	28,228	370	28,598	45	1,278	36,396	57	Rhoda Creek
2100403NP2014	NEZ	15,820	638	16,458	26	2,401	56,224	88	West Fork Rapid River
3030401CW2014	CLW	11,254	0	11,254	18	157	13,787	22	Upper Warm Springs Creek
3020401NP2014	NEZ	27,117	98	27,215	43	16	52,601	82	Gedney Creek

Table 5-5. Spatial data layers used for modeling lynx habitat and creating Lynx Analysis Units

Spatial Data	Acronym	File Type	File Name	File Location
Potential Vegetation Types (PVT) Region 1 Classification of Western Montana and Northern Idaho	PVT	raster	zipped file on web	http://www.fs.usda.gov/detail/r1/landmanagement/gis/?cid=fsp5_030918
			cnp_pnv04	T:\FS\NFS\NezPerceClearwater\Project\MultiBasin\Planning\NezClwFPR2012 \GIS\Data\Resource_Specific\Vegetation\PNV_04.gdb
Ownership - NPNF	Ownership	layer	BasicOwnership.lyr	T:\FS\Reference\GIS\r01_nez\LayerFile\Land
Ownership - CWNF	Ownership	layer	BasicOwnership.lyr	T:\FS\Reference\GIS\r01_clw\LayerFile\Land
Activity Polygon - Nez Perce	FACTS	feature class	NEZ_ActivityPolygon	T:\FS\NFS\NezPerceClearwater\Project\MultiBasin\Planning\NezClwFPR2012 \GIS\Data\Resource_Specific\Vegetation\Activities\FACTS.gdb
Activity Polygon - Clearwater	FACTS	feature class	CLW_ActivityPolygon	T:\FS\NFS\NezPerceClearwater\Project\MultiBasin\Planning\NezClwFPR2012 \GIS\Data\Resource_Specific\Vegetation\Activities\FACTS.gdb
Forest activity tables - NPNF	Activity Tables	table	NEZ_ACTV160_2014_02_25	T:\FS\NFS\NezPerceClearwater\Project\MultiBasin\Planning\NezClwFPR2012 \GIS\Data\Resource_Specific\Vegetation\Activities\FACTS.gdb
Forest activity tables - CWNF	Activity Tables	table	CLW_ACTV160_2014_02_25	T:\FS\NFS\NezPerceClearwater\Project\MultiBasin\Planning\NezClwFPR2012 \GIS\Data\Resource_Specific\Vegetation\Activities\FACTS.gdb
Watersheds	HUC12	feature class	HUC12_Watershed_F2F	T:\FS\NFS\NezPerceClearwater\Project\MultiBasin\Planning\NezClwFPR2012 \GIS\Data\Resource_Specific\Hydrology\HUC12_F2F.gdb
Fire Severity by Year	FIRE	feature class	Fire_Severity_by_Year	T:\FS\NFS\NezPerceClearwater\Project\MultiBasin\Planning\NezClwFPR2012 \GIS\Data\Resource_Specific\Fire_Fuels\Fire_History\Fire_Severity.gdb
VMap (existing vegetation)	VMap	feature class	vmap_mid_RA	T:\FS\NFS\NezPerceClearwater\Project\MultiBasin\Planning\NezClwFPR2012

Spatial Data	Acronym	File Type	File Name	File Location
				\GIS\Data\Resource_Specific\Vegetation\CLWNEZ_VMap_v12_R1ALB_Rapid.gdb

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Appendix A: Metadata for PVT

Full metadata available at URL (Accessed 03/10/2014):
http://www.fs.usda.gov/detail/r1/landmanagement/gis/?cid=fsp5_030918

US Forest Service - Region One

Potential Vegetation Type (PVT) Classification of Western Montana and Northern Idaho (2004)

Metadata:

Identification_Information:

Originator: USDA Forest Service, Northern Region

Publication_Date: 10/04/2004

Title: Potential Vegetation Type (PVT) Classification of Western Montana and Northern Idaho (2004)

Geospatial_Data_Presentation_Form: raster digital data

Publication_Information:

Publication_Place: Kalispell, Montana

Publisher: USDA Forest Service, Northern Region

Online_Linkage: *https://fs.usda.gov/Internet/FSE_DOCUMENTS/fsp5_030424.zip*

Description:

Grouping of habitat types into Potential Vegetation Type (PVT) types completed by Jeff Jones, Northern Region, National Fire Plan Cohesive Strategy Team. Habitat types from 3 sources: Cooper, Stephen V., Kenneth E. Neiman, and David W. Rev. 1991. Forest habitat types of northern Idaho: a second approximation. General Technical Report INT-236. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 143p. Pfister, Robert D., Bernard L. Kovalchik, Stephen F. Arno, and Richard C. Presby. 1977. Forest habitat types of Montana. USDA Forest Service General Technical Report INT-34. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 174p. Mueggler, Walter F. and William L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA Forest Service General Technical Report INT-66. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 154p.

Abstract:

Potential Vegetation Types (PVT) mapping units delineate areas having similar biophysical environments (e.g., similar climate and soil characteristics). PVT was modeled from spatially referenced field data having a reference to habitat type (Pfister et al. 1977, Mueggler and Stewart 1980, Cooper et al. 1991). Individual habitat types were aggregated, simplifying our PVT classification to 35 types (24 forest types, 3 shrubland types, 3 grassland types, 1 alpine type, and 4 non-vegetated types). We used a nearest neighbor technique, that extrapolated plot-level data (i.e., points) across the spatial domain by using precipitation, temperature, solar radiation, potential lifeform, elevation, aspect, slope, and soils data.

Purpose:

These data were prepared to supplement other data to assess integrated risks and opportunities at regional and sub-regional scales. Most scientific characterizations of ecosystems or assessments of watersheds can be enhanced by the use of some biophysical strata to help partition the natural variability in ecosystem components that occurs across landscapes. All ecosystem processes are constrained within the limits of their biophysical environment. Thus, PVTs are useful for characterizing terrestrial ecosystems that have similar disturbance processes and subsequent fine-scale patterns (e.g., species composition, stand structure, standing and downed wood, etc.). PVTs are a critical data component needed for modeling disturbance processes and their subsequent effects. We derived the PVT theme specifically to support the following models: Historical fire regimes Current fire severity Fire-regime condition class Fire-behavior fuel models Crown fire behavior Crown bulk density Height-to-crown Stand height Wildlife habitats Weed susceptibility and threat General Limitations These data were derived using field plots from many different sources (e.g., FSVEG, ECODATA, FIA, DNRC) as well as remotely sensed data (e.g., satellite imagery, DEMs). The sampling designs for collecting these data were not intended to sample across environmental gradients. The spatial distribution of field plots was extremely variable. In general, expected accuracy is believed to be much lower in areas where plot data was sparse and relatively higher in areas with concentrated plot locations. These data were designed to characterize broad scale patterns for regional and subregional assessments. Any decisions based on these data should be supported with field verification, especially at scales finer than 1:100,000. Although the resolution of the PVT theme is at a 90 meter cell, the expected accuracy does not warrant their use for analyses of areas smaller than about 10,000 acres (for example, assessments that typically require 1:24,000 data). The data provide a coarse-filter approach to ecosystem assessments. Consequently, not every occurrence of every PVT is mapped; instead, only larger, more generalized distributions of certain types were mapped.

5.2 Wolverine

5.2.1 *Distribution*

The wolverine (*Gulo gulo luscus*) is circumboreal in distribution, occurring in Europe, Asia, and North America (Idaho Department of Fish and Game (IDFG) 2005). In North America, the wolverine historically occurred in Alaska, Canada, the western U.S., the northeastern U.S., and the Great Lake States. Currently, wolverines appear to be distributed as functioning populations in Alaska, Canada, and in two regions of the contiguous United States: the North Cascades in Washington, and the northern Rocky Mountains in north and central Idaho, western Montana, and northwestern Wyoming (Aubry et al. 2007) (Figure 1). Even in the northern U.S. Rockies very little is known about the extent and status of wolverine populations (Aubry et al. 2007).

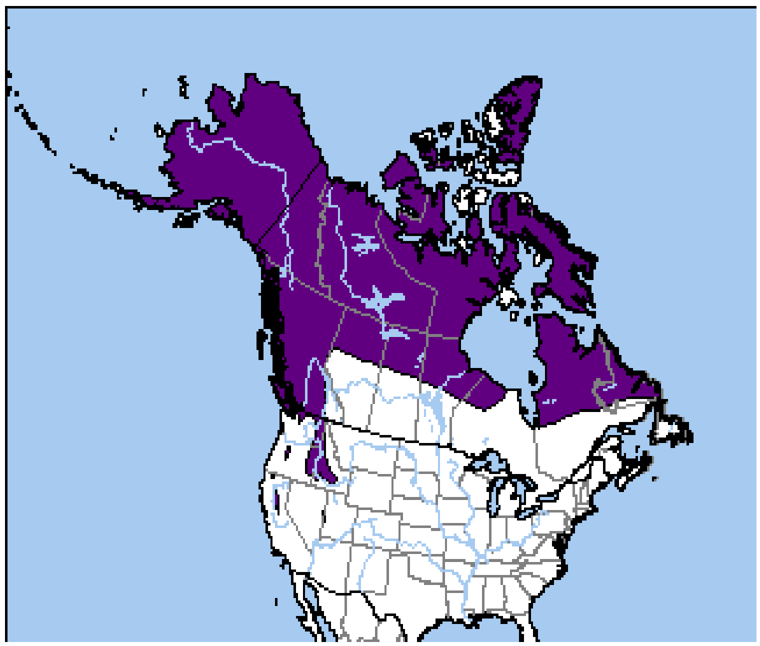

Figure 5-5. Current Distribution of Wolverines (from NatureServe)

Wolverine populations in Idaho are centered in the Selkirk Mountains, Lochsa and Kelly Creek drainages, and in the Smoky Mountain complex of the Sawtooth Mountains (Groves 1987 *in* IDFG 2005).

Wolverine numbers and population trends are unknown for Idaho (IDFG 2005). Population estimates for Canada and Alaska are approximate because no wolverine surveys have taken place at the state or national scale (USDI 2008, p. 12932). Current population level and trends remain unknown for the contiguous United States because no systematic population census exists over the entire current range of the wolverine in the lower 48 states (USDI 2008, p. 12935). There may be approximately 250-300 wolverines in the contiguous US (USDI 2013a p. 7868). Wolverines typically exist in low density populations whose members have notoriously large home ranges (Kucera and Zielinski 1995). Total population size around the world is unknown but probably is at least in the hundreds of thousands (NatureServe 2011). Substantial populations occur in northern Canada and Alaska. Outside of Alaska, Montana and Idaho likely have the largest populations in the United States.

5.2.2 *Life History and Wolverine in Idaho*

The wolverine is the largest terrestrial member of the family Mustelidae. Adult males weigh 20 to 40 lbs. and adult females weigh 17 to 26 lbs. (Banci 1994). The wolverine resembles a small bear with a bushy tail. It has a broad, rounded head; short, rounded ears; and small eyes. Each foot has five toes with curved, semi-retractable claws used for digging and climbing (Banci 1994). Wolverines have large feet and can move relatively easily through deep snow (Inman et al. 2012a).

Wolverines generally select areas that are cold and have persistent spring snow (USDI 2013a p. 7867). Wolverines occupy a variety of habitats, but require large tracts of land to accommodate large home ranges and extensive movements (IDFG 2005, Banci 1994). Individual animals have large territories and can cover large distances in short time periods. Home ranges of adult females in central Idaho averaged 148 mi^2, and annual home ranges of adult males averaged 588 mi^2 (Copeland 1996). Wolverine year-round habitat use takes place almost entirely within the area defined by deep persistent spring snow (Copeland et al. 2010).

Due to their large home range size and habitat needs, this species is rare and uncommon and most likely always has been. Wolverines use higher elevation, steep, remote habitat. Wilderness and roadless lands account for much of the areas wolverines are known to use, although it is unknown if this is due to avoidance of people, or that wolverine tend to choose areas that are not conducive to human development (Copeland et al. 2007). Wolverines appear capable of adjusting to human disturbance (USDI 2013, p. 7880)

The primary habitat during the winter is mid-elevation conifer forest, and summer habitat is subalpine areas associated with high-elevation cirques (Copeland 1996). Summer use of high elevation habitats is related to the availability of prey and den sites. Forest types used by wolverines in central Idaho include whitebark pine, Douglas-fir, and lodgepole pine (Copeland et al. 2007). Montane coniferous-dominated habitats accounted for 70.2% of adult male wolverine locations (Copeland et al. 2007). High elevation habitats are used for relief from heat and denning (Copeland et al. 2007). Wolverines were more frequently found in low to moderately stocked stands of mature timber (Hornocker and Hash 1981). Habitat in the areas wolverines selected was characterized by steep terrain with a mix of tree cover, alpine meadow, boulders, and avalanche chutes (Inman et al. 2012a).

Females give birth to two-three young in late winter to early spring. Young are born in dens dug through the snow to ground level. Dens are located in the upper subalpine zone, at or near treeline and are associated with boulder fields, avalanche debris, or log jams. A source of carrion or other food is usually nearby.

Wolverines appear to be highly selective in choice of natal denning and kit rearing habitat. Denning habitat may be a factor limiting distribution and abundance (Copeland 1996), and the persistence of a snowpack into late spring is a strong determining factor in wolverine presence due to its importance in denning (Copeland et al. 2010, USDI 2013a). Persistent spring snow cover may also be a determining factor in wolverine dispersal and has consequences on gene flow (Schwartz et al. 2009).

Figure 2 depicts those areas of the Nez Perce Clearwater National Forest that tend to have persistent spring snow cover. The map is a composite of the areas with persistent snow as considered by Copeland et al. (2010) and modeled areas that are considered to be primary habitat for wolverine from the Wildlife Conservation Society (R. Inman) (Appendix A). There are approximately 1,892,562 acres of modeled wolverine habitat across the Forests, with 1,042, 181 acres on the Clearwater and 850,381 acres on the Nez Perce. [note: need to add how many of these acres are in roadless, and how many in wilderness, and how it overlaps with the Recreation off road spectrum).

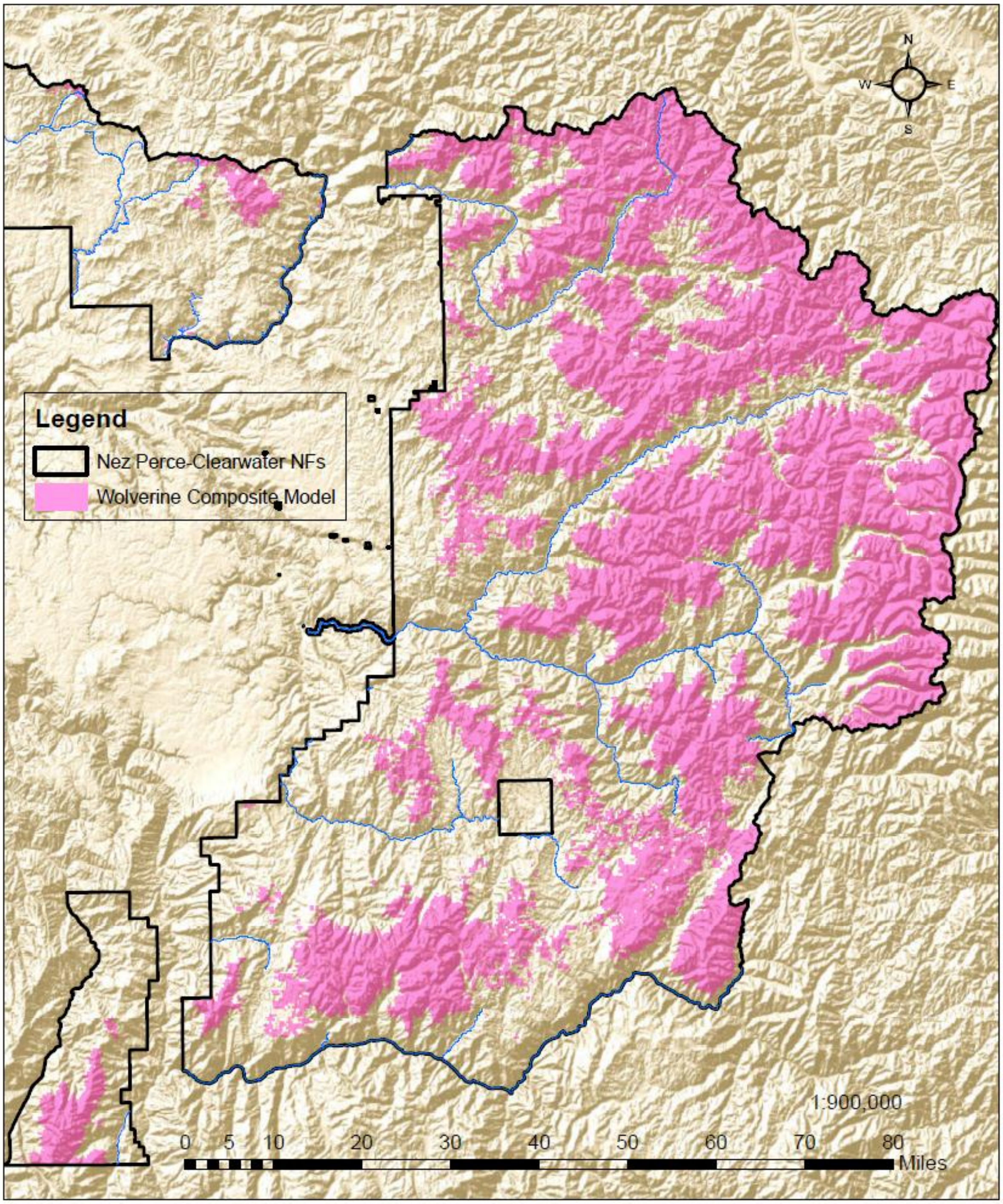

Figure 5-6. Wolverine habitat on the Nez Perce–Clearwater National Forests

Inman et al. (2012b) found a link between persistent snow and wolverine foraging strategy. Wolverines appear to rely on the cold and snow to cache carrion. Cold, structured microsites are used to cache food and this reduces competition from insects, bacteria, and other scavengers for this food source. The authors referred to this as the "refrigeration-zone" hypothesis (Inman et al. 2012b).

In the northern Rockies wolverine natal dens have been found under snow-covered tree roots, logjams, and rocks/boulders (Hash 1987). In central Idaho, Copeland (1996) found natal den sites in boulder talus areas with a north aspect within subalpine cirques. No information is available on den sites on the Forests, however, it is expected that they would be similar to surrounding area den sites.

Wolverines are opportunistic feeders and consume a variety of foods depending on availability. They primarily scavenge on carrion, but also prey on small animals and birds, and eat fruits, berries, and insects (Hornocker and Hash 1981 p. 1290, Banci 1994, pp. 111-113). Wolverine feed upon carrion or ungulates killed by large predators, such as wolves, bears, cougars, and humans or animals that have died from natural causes. The constant search for food keeps them moving throughout their range, daily movements of 20 miles are common. Hornocker and Hash (1981) suggested that food availability is the main factor determining movements and range of wolverines in the South Fork drainage.

Occupying cold, snow covered, and relatively unproductive environments is a common pattern throughout the world-wide distribution of wolverines. By occupying this unproductive niche, it appears wolverines balance acquisition of foraging and denning resources with the reduced risk of predation and interspecific competition associated with these environment (Inman et al. 2012a). One way wolverines do this is by using food caching in cold habitats to survive food-scarce winters that other carnivores cannot (Inman et al. 2012a).

Connectivity between wolverine populations and habitat patches is generally tied to persistent spring snow, and wolverines appear to currently be able to disperse between habitats and through areas where human developments occur (Schwartz et al. 2009, USDI 2013a p. 7879). The available evidence indicates that dispersing wolverines can successfully cross transportation corridors (USDI 2013a on p. 7879).

5.2.3 *Management Direction*

On February 4, 2013, the USFWS published a proposed rule to list the North American Wolverine as a Threatened Distinct Population Segment (DPS) in the contiguous United States, under the Endangered Species Act of 1973, as amended. No critical habitat has been designated for the wolverine. The zone of consistent snow habitat has been modeled and mapped (Figure 2). The wolverine is classified as an S2 species of greatest conservation need. S2 us a statewide ranking assigned by the Idaho Conservation Data Center and indicates imperiled: at risk because of restricted range, few populations (often 20 or fewer), rapidly declining numbers or other factors that make in vulnerable to rangewide extinction or extirpation (IDFG 2005).

5.2.4 *Human Activity and Development*

Loss and fragmentation of habitat may isolate populations, reduce genetic diversity and increase the risk of population extirpation (Copeland and Whitman 2004 cited in IDFG 2005). These risks result from three main factors: 1) small total population size; 2) effective population size below that needed to maintain genetic diversity and demographic stability; and 3) the fragmented nature of wolverine habitat in the contiguous United States that results in smaller isolated "island" patches separated by unsuitable habitats. Loss of persistent spring snow related to climate change is the main factor in loss/fragmentation of wolverine habitat (USDI 2013a p. 7865).

Harvest is considered a factor affecting wolverine survival, with trapping accounting for the greatest number of individuals (Hornocker and Hash 1981, Banci 1994, Krebs et al. 2004, Squires et al. 2007). Although harvest of wolverines is illegal in Idaho, incidental trapping may contribute to mortality.

According to the proposed listing rule, much of wolverine habitat within the contiguous United States is already in a management status such as wilderness or national parks that provides some protection from management, industrial, and recreational activities. Wolverines are not thought to be dependent on specific vegetation or habitat features that might be manipulated by land management activities, nor is there evidence to suggest that land management activities are a threat to the conservation of the species (Federal Register / Vol. 78, No. 23 / Monday, February 4, 2013 / Proposed Rules pg. 7879).

The USFWS concluded, "Our review of the regulatory mechanisms in place at the national and State level demonstrates that the short-term, site-specific threats to wolverines from direct loss of habitat, disturbance by humans, and direct mortality from hunting and trapping are, for the most part, adequately addressed through State and Federal regulatory mechanisms. However, the primary threat with the greatest severity and magnitude of impact to the species is loss of habitat due to continuing climate warming" (Federal Register / Vol. 78, No. 23 / Monday, February 4, 2013 / Proposed Rules pg. 7883).

The proposed listing rule for the wolverine states, "We have determined that habitat loss due to increasing temperatures and reduced late spring snowpack due to climate change is likely to have a significant negative population-level impact on wolverine populations in the contiguous United States. In the future, wolverine habitat is likely to be reduced to the point that the wolverine in the contiguous United States is in danger of extinction" (Federal Register /Vol. 78, No. 23 /Monday, February 4, 2013 / Proposed Rules).

"The primary impact of climate change on wolverines is expected to be through changes to the availability and distribution of wolverine habitat. Within the four States that currently harbor wolverines (Montana, Idaho, Oregon (Wallowas) and Wyoming), an estimated 124,014 km^2 (47,882 mi^2) of wolverine habitat exists. Ninety-four percent (135,396 km^2; 52,277 mi^2) of total wolverine habitat is in Federal ownership with most of that managed by the U.S. Forest Service (Forest Service)".

Wolverines depend on deep snow that persists into late spring both for successful reproduction and for year-round habitat. Wolverine habitat in the contiguous United States, which supports approximately 250 to 300 wolverines, is shrinking and is likely to continue to shrink with increased climate warming (McKelvey et al. 2011). McKelvey *et al.* (2011) provide estimates for the northern Rocky Mountain States (Montana, Idaho, and Wyoming), with an estimated 32% and 63% of persistent spring snow lost for the 2045 and 2085 intervals respectively. Central Idaho is predicted to be especially sensitive to climate change effects losing 43% and 78% of wolverine habitat for the 2045 and 2085 intervals respectively (McKelvey et al. 2011). The USFWS expects wolverine populations to be negatively affected by changes in the spatial distribution of habitat patches as remaining habitat islands become progressively more isolated from each other due to climate changes (McKelvey *et al.* 2011)). Currently, wolverine habitat in the contiguous United States can be described as a series of habitat islands. Some of these groups of islands are large and clumped closely together, such as in the North Cascades, Glacier Park-Bob Marshall Wilderness complex in Montana, and the Greater Yellowstone Ecosystem. Other islands are smaller and more isolated, such as the island mountain ranges of central and southwestern Montana. Inbreeding and consequent loss of genetic diversity have occurred in the past within these smaller islands of habitat (Cegelski *et al.* 2006, p. 208), and genetic exchange between subpopulations is difficult to achieve (Schwartz *et al.* 2009). Climate change projections indicate that, as warming continues, large contiguous blocks of habitat will decrease in size and become isolated to the extent that their ability to support robust populations becomes questionable (Federal Register / Vol. 78, No. 23 / Monday, February 4, 2013 / Proposed Rules pg. 7876). Under the moderate climate change scenarios analyzed by McKelvey et al. (2011) the current wolverine stronghold in central Idaho will become more isolated small subpopulations of family groups, which would require connectivity with other groups to avoid reduced genetic diversity due to inbreeding within a few generations (Cegelski et al 2006). Isolation of wolverines on small habitat islands with reduced connectivity to other subpopulations would impair the functionality of the wolverine metapopulation in the contiguous United States (Federal Register / Vol. 78, No. 23 / Monday, February 4, 2013 / Proposed Rules pg. 7876).

While other threats are minor in comparison to the driving primary threat of climate change, cumulatively they could become significant when working in concert with climate change if they further suppress an already stressed population (Federal Register / Vol. 78, No. 23 / Monday, February 4, 2013 / Proposed Rules pg.7886).

Appendix B. Metadata for the composite wolverine habitat model

Composite model - snow and wolverine primary habitat

File Geodatabase Feature Class

Thumbnail Not Available

Tags

There are no tags for this item.

Summary

Composite layer produced from WCS habitat model output and Copelands snow model.

Description

This layer was produced by taking snow model locations where >=1 year of those surveyed had consistant snow pack during a three week period in this spring and the WCS (Wildlife Conservation Society) wolverine PH (Primary Habitat) layer.

snow >= 1 OR WCS = PH

Credits

Jeff Copeland RMRS (retired), R Inman WCS

Use limitations

Data is not endorsed by USFWS for any use other than as an amalgamation of snow and habitat data. It does not represent USFWS proposed wolverine habitat, and does not infer occupation by wolverine.

Please do not distribute. Contact nick_hardy@fws.gov for more information.

Extent

West	-129.192244	**East**	-100.102186
North	54.119567	**South**	29.047328

Scale Range

There is no scale range for this item.

You are currently using the Item Description metadata style. Change your metadata style in the Options dialog box to see additional metadata content.