



Chapter 3:

A F F E C T E D E N V I R O N M E N T



CHAPTER 3: AFFECTED ENVIRONMENT

INTRODUCTION

The “Affected Environment” chapter describes existing conditions for those elements of the human environment (physical, natural, cultural, and socioeconomic) that would be affected by implementing the actions considered in this *North Cascades Ecosystem Grizzly Bear Restoration Plan / Environmental Impact Statement* (draft plan/EIS). Grizzly bear restoration actions proposed in this draft plan/EIS would be applied within the roughly 6.1 million acre North Cascades Ecosystem (NCE) grizzly bear recovery zone as described in the NCE chapter of the U.S. Fish and Wildlife Service (FWS) *Grizzly Bear Recovery Plan* (FWS 1997). The recovery area is made up of 85% federal land; therefore, the discussion of the affected environment primarily focuses on those resources that may be affected within the North Cascades National Park Service Complex (park complex), Okanogan-Wenatchee National Forest, and Mt. Baker-Snoqualmie National Forest. In addition to the NCE grizzly bear recovery zone, bears that move outside the primary restoration area could be subject to additional management depending on the regulatory provisions in the *Endangered Species Act* (ESA) section 10(j) experimental population designation, if such a designation is made. It is difficult to predict where bears might move; therefore, areas outside the NCE are described generally for resources that could be affected by bear movements and behavior or associated management actions.

GENERAL PROJECT SETTING

The NCE constitutes a large block of contiguous habitat that spans the international border but is isolated from grizzly bear populations in other parts of the United States and Canada. The U.S. portion of the ecosystem is bounded roughly by the Okanogan Highlands and Columbia Plateau on the east, Snoqualmie Pass to the south, the Puget lowlands to the west, and the Canadian border to the north (figure 3). As noted above, roughly 6.1 million acres within the NCE is designated as the NCE grizzly bear recovery zone (FWS 1997). The recovery zone encompasses all of the park complex, which makes up 11% of the recovery zone, along with most of Okanogan-Wenatchee National Forest and Mt. Baker-Snoqualmie National Forest, which together make up 74% of the recovery zone. Private lands account for an additional 10% of the recovery zone, while state lands make up the remaining 5% (figure 3). References to the NCE in this draft plan/EIS apply specifically to the NCE grizzly bear recovery zone unless otherwise noted.

The park complex encompasses 680,925 acres of public land within the NCE, including 501,115 acres within North Cascades National Park, 116,867 acres within Ross Lake National Recreation Area, and 62,907 acres within Lake Chelan National Recreation Area. The park and the two national recreation areas are managed jointly as the nation’s only National Park Service (NPS) complex. Elevations within the park range from about 350 feet to over 9,000 feet (NPS 2007a). The landscape is characterized by rugged topography consisting of glaciated peaks interspersed with numerous stream and riverine systems. Vegetation ranges from alpine tundra in the higher elevations to dense forest in the lower elevations.

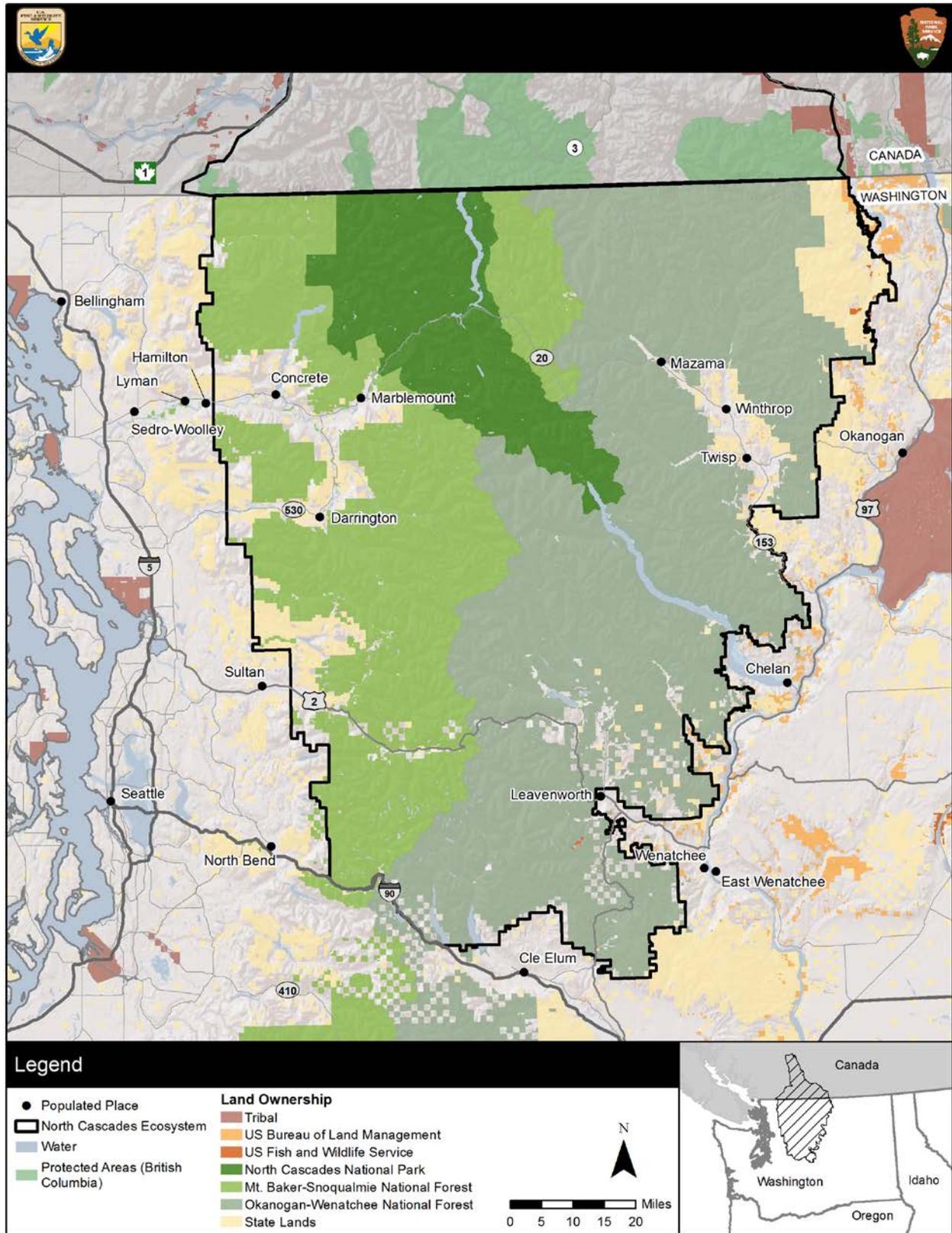


FIGURE 3. NORTH CASCADES ECOSYSTEM

The park complex shares boundaries with Okanogan-Wenatchee National Forest and Mt. Baker-Snoqualmie National Forest, whose lands make up approximately 74% of the NCE, as well as provincial parks and Crown lands to the north in British Columbia. Okanogan-Wenatchee National Forest encompasses more than 4 million acres on the east side of the Cascade Crest and stretches south from the Canadian border to the Goat Rocks Wilderness—a distance of about 180 miles. The eastern edge of the forest extends into the Okanogan highlands, south along the Okanogan and Columbia Rivers, and to the Yakima River valley. Because of this wide geographic range, the forest is very diverse, extending from high, glaciated alpine peaks along the Cascade Crest through heavily forested areas, to arid shrub-steppe at its eastern edge. Elevations range from below 1,000 feet to over 9,000 feet (USFS 2016h). Mt. Baker-Snoqualmie National Forest encompasses 1,724,229 acres on the west side of the Cascade Crest, extending south 140 miles from the Canadian border to the northern boundary of Mount Rainier National Park. The forest ranges from under 100 feet in elevation to over 10,000 feet, extending from glaciated alpine peaks along the Cascade Crest through alpine meadows and lakes to lower-elevation old growth mixed-conifer forest (USFS 2016i).

Over 94% of the park complex is part of the legislatively designated Stephen Mather Wilderness (NPS 2012b). To the east of the park complex, Okanogan-Wenatchee National Forest includes two wilderness areas: Pasayten Wilderness Area that runs along the eastern boundary of Ross Lake National Recreation Area and Lake Chelan-Sawtooth Wilderness Area, which is adjacent to the eastern boundary of Lake Chelan National Recreation Area. Glacier Peak Wilderness Area, which encompasses parts of Okanogan-Wenatchee National Forest and Mt. Baker-Snoqualmie National Forest, adjoins most of the southern boundary of Lake Chelan National Recreation Area and the South Unit of North Cascades National Park. Mt. Baker-Snoqualmie National Forest extends along the western boundary of the park complex and includes two other wilderness areas: the Noisy-Diobsud Wilderness (situated between North Cascades National Park and Baker Lake) and the Mount Baker Wilderness farther north. These two wilderness areas are adjacent to parts of the north unit of North Cascades National Park (NPS 2008a). The Henry M. Jackson and Wild Sky Wilderness areas adjoin the Glacier Peak Wilderness on the southwest. Two other wilderness areas, the Alpine Lakes Wilderness and the Boulder River Wilderness, make up an additional 0.4 million acres of wilderness that are not contiguous with the areas listed above. The Stephen Mather Wilderness, in combination with adjacent U.S. Forest Service (USFS) wilderness areas, constitutes over 2.2 million acres of contiguous wilderness. This is the largest block of designated wilderness in the state of Washington and one of the largest in the contiguous 48 states (NPS 2012b).

WILDLIFE AND FISH

Management actions associated with grizzly bear restoration activities could impact other wildlife species as a result of the use of aircraft or other vehicles and equipment during release and subsequent monitoring of grizzly bears. Certain wildlife and fish species could be affected by the presence of grizzly bears in the ecosystem as a result of predation or competition for resources. Wildlife and fish species present in the NCE that could be affected, including special-status species, are described on the following pages.

Grizzly Bears

Population Status

The grizzly bear (*Ursus arctos horribilis*) is federally listed under the ESA as “threatened” in the NCE, although the most recent review of its status indicated that uplisting this population to “endangered” was warranted but precluded by higher priority listing actions (FWS 2016a). That review also found that a population of grizzly bears may no longer exist in the NCE and that active restoration may be used to reestablish a population (FWS 2016a). The grizzly bear is listed as “endangered” by the State of

Washington. The FWS, in its environmental impact statement (EIS) for grizzly bear recovery in the Bitterroot Ecosystem (BE), defines a minimal existing grizzly bear population in the following way:

a grizzly bear population is defined by verified evidence within the previous 6 years, consisting of photos within the area, verified tracks and/or sightings by reputable scientists or agency personnel, of at least two different female grizzly bears with young or one female seen with different litters in two different years in an area geographically distinct from other grizzly bear populations. Verifiable evidence of females with young, to be geographically distinct, would have to occur greater than 10 miles from the nearest non-experimental grizzly bear population recovery zone boundary (FWS 1993a).

Research from the Cabinet-Yaak Ecosystem (CYE) of northwest Montana and northern Idaho indicates the average home range size of an adult female grizzly bear, when converted to a circle, has a radius of approximately 10 miles (Kasworm and Servheen 1995).

There have been few confirmed sightings of grizzly bears in recent decades in the NCE on either side of the international border. The most recent confirmed observation within the U.S. portion of the NCE was in 1996, south of Glacier Peak (IGBC NCE Subcommittee pers. comm. 2016). The only direct evidence of reproduction during the past 25 years was a confirmed observation of a female and cub on upper Lake Chelan in 1991 (Almack et al. 1993). Efforts to obtain grizzly bear hair samples during 1998 (BC Ministry of Environment, cited in Romain-Bondi et al. 2004), 1999–2000 (Romain-Bondi et al. 2004) and 2010–2012 (Long et al. 2013) detected only 1 female grizzly bear. Approximately 23% of the U.S. portion of the NCE was sampled, along with parts of the British Columbia border parks. Surveys focused on remote sites within high quality grizzly bear habitat. During 2010 and in 2012, a grizzly bear (most likely the same individual) was detected at a site in Manning Park, British Columbia, by a remote camera designed to lure wolverines for research purposes. This site was less than 20 miles north of the international border. Hair samples confirmed it as a male grizzly bear. During 2015 a series of photographs of a grizzly bear were taken roughly 10 miles north of the border and approximately 19 miles east of the 2010 sighting. No accompanying hair samples were collected; therefore, it is unclear if this grizzly bear was the same individual detected in 2010 and 2012 (Hamilton pers. comm. 2016b). These are the only detections of grizzly bears in the NCE during the past 10 years. Based on the information gathered to date in the NCE, there is no evidence to support the conclusion that there is a population of grizzly bears in the ecosystem, as defined above.



Photo Credit: Dave Molenaar

Foraging grizzly bear

Historical Population. The NCE historically supported a substantial grizzly bear population, according to records compiled by Bjorklund (1980), Sullivan (1983), Almack et al. (1993), and others. Bjorklund (1980) summarized and mapped 16 historical (prior to 1950) and 14 recent (1950–1980) grizzly bear observations in the NCE; however, he did not distinguish between confirmed and unconfirmed observations. More reliable results come from Sullivan (1983), who interviewed 346 people claiming to observe grizzly bears in the NCE. He estimated that the sum of these attestations amounted to approximately 100 individual human-grizzly bear encounters spanning 130 years. At the height of the fur

trade from 1820 to 1860, the Hudson's Bay Company documented 3,788 grizzly bear hides shipped from trading posts in the North Cascades region, and the last documented grizzly bear killed in the area was shot in Fisher Creek in 1967 (Sullivan 1983). In addition to records of pelts, other evidence of historical grizzly bear presence in the NCE is found in writings about Native Americans, early USFS history, and the archaeological record (Underhill 1945). Lastly, five Holocene archaeological sites in eastern Washington have produced grizzly bear remains that could be evidence of prehistoric grizzly populations in the nearby mountains of the NCE (Lyman 1986). These earlier accounts indicate that grizzly bears existed historically throughout the Cascade Mountains and likely inhabited the coastal regions of Washington and Oregon (Almack et al. 1993).

Current Bear Numbers. To estimate the current number of grizzly bears in the NCE, scientists have relied on statistical analyses of data obtained from a variety of field techniques. During an evaluation of the NCE from 1986–1991, Almack and others confirmed resident grizzly bears in the NCE using a combination of documented observations, live capture surveys, and self-activated camera surveys (Almack et al. 1993). While the live capture and self-activated camera surveys yielded no grizzly bears, the documented observations that were considered to be “confirmed” or “highly reliable” suggested that at the time of the study, the NCE harbored a small number of grizzly bears.

As discussed above, no confirmed grizzly bear observations have been documented in the U.S. portion of the NCE since 1996, although a few grizzly bear occurrences have been verified in the Canadian portion of the NCE during the same time period. Although few grizzly bears have been directly detected by biologists, Romain-Bondi and others (2004) estimated the relative density and population size of grizzly bears in a 1,448 square mile study area (11% of the entire ecosystem) through DNA hair-sampling techniques and a comprehensive statistical analysis of regional and national grizzly bear datasets. Using data from the NCE and six other grizzly bear management areas, they developed a series of regression models relating catch per unit effort to density. The model that best fits the data estimated densities between 0.03 and 0.71 grizzly bears per 38.6 square miles, with a mean estimate of 6 grizzly bears for the study area (90% CI: 3-11). However, their regression models included only a single grizzly bear detection in the NCE, about 15 miles north of the border in British Columbia, relative to catch per unit effort in two other ecosystems with low grizzly bear population densities.

Habitat Suitability

The first iteration of the FWS *Grizzly Bear Recovery Plan*, published in 1982, identified the need to evaluate the NCE to determine its suitability as a grizzly bear recovery area. Almack et al. (1993) initiated the 5-year ecosystem evaluation in 1986 (FWS 1993a). Four studies have evaluated portions of the NCE for grizzly bears (Agee et al. 1989; Almack et al. 1993; Gaines et al. 1994; Lyons et al. 2016). These studies all conclude that the NCE has suitable habitat essential for the maintenance of a grizzly bear population.

Habitat Studies. Agee et al. (1989) used geographic information system (GIS) software to compare historical grizzly bear sightings to land cover types in their study area to determine which land cover types grizzly bears prefer (table 3). Their results showed that grizzly bear sightings were positively correlated with whitebark pine (*Pinus albicaulis*), subalpine larch (*Larix lyallii*), and subalpine cover types, inferring that these are the preferred habitat types of grizzly bears. However, it should be noted that these relatively open habitat types offer better visibility than most, which could have biased the sighting database; it must also be noted that whitebark pine is not a common habitat type throughout the NCE and may not be as important for grizzly bears in this ecosystem as it is in others where it is more prevalent (IGBC NCE Subcommittee pers. comm. 2016). The Interagency Grizzly Bear Committee (IGBC) NCE Subcommittee had two separate research teams (Almack et al. 1993; Gaines et al. 1994) evaluate an area encompassing over 10,000 square miles of the NCE for suitable grizzly bear habitat. The survey area

included all of the park complex and most of Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. Each team evaluated the survey area for viable grizzly bear habitat using common criteria including the presence, abundance and diversity of grizzly bear foods; habitats of seasonal importance and their distribution; and delineation of human activities (i.e., roads, habitation, timber harvest, recreation, etc.). In addition to these criteria, Almack et al. (1993) evaluated the study area for grizzly bear habitat according to the seven characteristics identified by Craighead, Sumner, and Scags (1982): space, isolation, denning, safety, sanitation, vegetation types, and food.

The results of these surveys were presented to a technical review team, which ultimately determined based on the available data that the NCE could support a viable grizzly bear population of 200 to 400 individuals (Servheen et al. 1991). More recent work has estimated a mean carrying capacity for grizzly bears in the NCE between 250 and 300 grizzly bears using a suite of spatially explicit, individual-based population models that integrate information on habitat selection, human activities, and population dynamics (Lyons et al. 2016). Table 3 shows habitat rankings recommended by the IGBC NCE Subcommittee (2001) for use in the evaluation of core areas in grizzly Bear Management Units (BMUs) in the NCE.



Photo credit. A. Braaten

Potential grizzly bear habitat in Park Creek Valley

TABLE 3. RECOMMENDED HABITAT RANKINGS FOR USE IN THE EVALUATION OF CORE AREAS IN GRIZZLY BEAR MANAGEMENT UNITS IN THE NORTH CASCADES ECOSYSTEM

| Ranking | Early Season | Late Season |
|--------------------------|-------------------------------|-----------------------------------------|
| Highest Priority | Montane meadow* | Alpine/subalpine meadow ^{a, b} |
| | Shrubfield ^a | Shrubfield ^a |
| | Deciduous forest ^a | Wet forest open ^a |
| | Riparian forest ^b | Montane meadow ^a |
| | Wet forest opening | High elevation forest |
| | Dry forest | Riparian forest |
| | High elevation forest | Dry forest open |
| | High elevation forest open | Deciduous forest |
| | Wet forest | Wet forest |
| | Alpine/subalpine meadow | Dry forest |
| Low elevation shrub/herb | High elevation forest open | |
| Lowest Priority | Dry forest open | Low elevation shrub/herb |

Source: IGBC NCE Subcommittee 2001

^a Indicates vegetation types that were used significantly more than others.

^b Indicates vegetation types that were moved higher on the priority list based on differences between grizzly bear and black bear habitat use.

Foods and Vegetation Types. Munro et al. (2006) described the general pattern of foraging by grizzly bears in west-central Alberta. Upon emergence from dens in early spring, grizzly bears dig for roots before beginning to hunt ungulates in late May and early June. Avalanche chutes, common on the west side of the Cascades, have been identified as important spring food sources for grizzly bears in a number of studies (McLellan and Hovey 2001; Waller and Mace 1997; Ramcharita 2000; Serrouya et al. 2011). Avalanche chutes provide spring and summer forage species as well as potential avalanche mortalities (carrion) in the spring (Waller and Mace 1997). As herbaceous vegetation begins to green up, the predominant food items include grass-like plants and forbs. Grizzly bears shift to eating berries as they become available later in the summer. At the end of the berry producing period, grizzly bears again shift to consuming roots and ungulates prior to reentering their dens (McLellan and Hovey 2001).

Kasworm et al. (2014) presented grizzly bear food data from the CYE, which has a Pacific maritime climate and may be indicative of potential grizzly bear food habits in the central and west side of the Cascade Mountains. Huckleberry (*Vaccinium* spp.) appears to be an important component of diet. Data were collected over several years, using both isotope analysis on hairs and scat. Isotope analysis showed a highly variable use of meat (8% to 97% of diet), while meat was found in many scats in some months (40% of dry matter in April and May) including fall (carrion). Overall, mammals and shrubs (berries) constituted 64% of total dry matter annually. In a diet study of grizzly bears in several western ecosystems, researchers found that adult male grizzly bears were more carnivorous than any other age or sex class, with diets composed of around 70% meat (Jacoby et al. 1999). Other sex and age groups of grizzly bear displayed diets similar to black bears living in the same areas reflective of diets described by Kasworm et al. 2014 (Jacoby et al. 1999).



Photo Credit: Matthew Rochetta

Grizzly bear foraging in regenerating forest

Almack et al. (1993) and Gaines et al. (1994) used Landsat multispectral scanner imagery and field observations to produce vegetation cover maps of the study area according to vegetation structure (e.g., forest, shrub, barren rock, etc.) and community composition. The teams also identified 124 plant species known to be grizzly bear foods through an exhaustive review of sighting reports, scat analysis, and studies conducted on grizzly bears south of Alaska. Analysis of the vegetation maps indicated that 100 of the 124 identified plant species exist in the study area, and every vegetation cover type contained some plants that were on the list. The teams also mapped ranges of wildlife prey species known to occur in the study area. Salmonid species were more abundant in streams on the western slope of the NCE and ungulates were dispersed relatively evenly throughout the study area. These results led both teams to conclude that sufficient vegetative grizzly bear foods are readily available in the NCE, and the occurrence of wildlife prey species can sustain a grizzly bear population (Almack et al. 1993; Gaines et al. 1994).

Grizzly Bear Source Populations

Basic criteria for grizzly bear source populations would require populations to be located in areas with a similar food economy to the NCE. Additionally, these populations must be large and stable enough that they would have the ability to sustain the loss of individuals. Source populations likely to supply grizzly bears for release include populations in south-central British Columbia, Canada and in the Northern Continental Divide Ecosystem (NCDE) (see figure 4).



FIGURE 4. LIKELY GRIZZLY BEAR SOURCE POPULATIONS

South-Central British Columbia. In 2012, there were approximately 15,000 grizzly bears in British Columbia (MFLNRO 2012). The current range of grizzly bears in British Columbia has been divided into 56 grizzly bear population units (GBPUs) that delineate individual grizzly bear populations for conservation and management (MFLNRO 2012). GBPU boundaries at the edges of grizzly bear distribution in the province represent the “occupied/unoccupied” line. This line was drawn to reflect the known and predicted distribution of resident adult females. Transient males, particularly subadults, are occasionally sighted in unoccupied areas. However, these lines are the expected limits of areas regularly inhabited by grizzly bears. They are also used for setting land-use priorities during strategic land-use planning. Each GBPU has been assigned a conservation status of either Threatened or Viable. The objective for the nine Threatened GBPUs in British Columbia is population recovery to prevent range contraction and ensure long-term population viability. The objectives for the remaining 47 viable GBPUs includes maintaining current population abundance and distribution, and providing sustainable harvest and viewing opportunities where appropriate.

One of the potential source areas for grizzly bears is the Wells Gray region of British Columbia. This region includes nine protected areas in the Cariboo Mountains and Shuswap Highlands located in the northern Columbia Mountains. These protected areas create the fifth largest system of contiguous protected area in British Columbia (MacHutchon 2004). This area is entirely within the Fraser River watershed, and the interior wet-belt ecosystems contains a variety of wildlife and fish; however, bears do not have access to Pacific salmon. Habitat types include valley bottom riparian corridors; lakes and rivers; avalanche chutes; wetlands; alpine and subalpine areas; and old growth spruce, hemlock, cedar, fir and pine forests (MacHutchon 2004). The habitat is largely unfragmented with few roads.

Wells Gray and Trophy Mountain parks are both closed to grizzly bear hunting. In 2012, they were estimated to support a population of 317 grizzly bears (MFLNRO 2012). The agencies assumed that 20%–30% of the bear population is subadult, which equates to approximately 28–43 subadult bears in any given year. Wells Gray Park is ecologically most similar to the NCE. Both areas contain large amounts of Englemann Spruce-Subalpine Fir areas, which seem to be more productive in terms of food in the NCE. This suggests that the release sites would have the same or more available food than the source area. The capture and relocation of grizzly bears from this area is consistent with its overall management that expressly supports it so long as the population is able to withstand the reduction in population.

Northern Continental Divide Ecosystem. As described in chapter 1, the NCDE includes the Bob Marshall Wilderness Complex and Glacier National Park in northwestern Montana, and adjacent areas in Canada. The NCD recovery zone encompasses approximately 9,600 square miles of northwest Montana (Dood, Atkinson, and Boccadori 2006). The NCDE extends south from Canada, west into the Flathead and Mission valleys, and east to the Rocky Mountain Front. Approximately 90% of the recovery zone is in federal, tribal, or state ownership, with only 10% on private lands (Dood, Atkinson, and Boccadori 2006). However, the majority of bear-human conflicts and bear mortality occur on private lands. Grizzly bears in the NCDE occupy approximately 14,500 square miles of habitat that includes Glacier National Park, parts of the Flathead and Blackfoot Indian Reservations, parts of five national forests (Flathead, Helena, Kootenai, Lewis and Clark, and Lolo), Bureau of Land Management lands, and a large amount of state and private lands (Dood, Atkinson, and Boccadori 2006). However, Glacier National Park serves as the center of the population. Glacier National Park, as a largely undisturbed core of the larger ecosystem, contains many areas accessible only by foot or horse (NPS 1999). The area is characterized by extremely diverse habitats, much of it being heavily forested, mountainous, and a largely roadless wilderness and similar food economy as the NCE.

The grizzly bear population in this ecosystem numbers approximately 1,000 animals and continues to grow each year with an average rate of increase of approximately 3% (FWS 2015a; Costello et al. 2016). Grizzly bear population densities are estimated in Glacier to be approximately 30 bears per 386 square

miles, similar to reports from the Wells Gray area of British Columbia (Kendall et al. 2008). Grizzly bears in the NCDE also primarily eat plant matter, with adult and subadult females eating 100% and 94% plant matter, respectively, whereas 66% of a male bear's diet was plant matter (Jacoby et al. 1999).

The NCDE is managed based on a zoning approach. The primary conservation area is managed as a source area where the objectives are continual occupancy by grizzly bears and maintenance of habitat conditions that are compatible with a stable to increasing grizzly bear population. The objective in Zone 1 is continual occupancy by grizzly bears, but at expected lower densities than inside the primary conservation area. Together, the primary conservation area and Zone 1 comprise the area within which population data are collected and sustainable mortality limits apply.

In Management Zone 2, the objectives are to maintain existing resource management and recreational opportunities and allow agencies to respond to demonstrated conflicts with appropriate management actions. Public lands in Zone 2 are managed to provide the opportunity for grizzly bears, particularly males which are more likely to disperse long distances, to move between the NCDE and adjacent ecosystems. Conflict grizzly bears would only be removed from the NCDE by management as a last resort.

Management Zone 3 primarily consists of areas where grizzly bears do not have sufficient suitable habitat for long-term survival and occupancy. Management emphasis is on conflict response.

Other Wildlife and Fish

Mammals

Seventy-five mammal species in 21 families are found in the North Cascades. This section focuses on those species that may be affected by the restoration of grizzly bears or the activities necessary for their restoration.

Predator-Prey Interactions. Grizzly bears are omnivores that primarily feed on vegetation (FWS 2011a); however, they do have the potential to affect prey species in the NCE. A grizzly bear's diet consists of about 90% vegetable and insect matter; however, they scavenge and occasionally prey on ungulates in addition to ground-dwelling rodents that they actively dig out of dens or burrows. Research has documented the importance of local concentrations of ungulates as a potential source of protein for grizzly bears (IGBC 1987). In many locations, animal matter may not constitute a major annual diet item, but may be seasonally significant to grizzly bears (Mattson, Blanchard, and Knight 1991; Gunther and Haroldson 1998).



Photo credit: A. Braaten

Female deer with fawns near Stehekin in North Cascades National Park

Several species of ungulate occur in the NCE, including mule deer (*Odocoileus hemionus*), black-tailed deer (*Odocoileus hemionus columbianus*), mountain goats (*Oreamnos americanus*), bighorn sheep (*Ovis canadensis*), elk (*Cervus elaphus*), and moose (*Alces alces*). Mule deer and black-tailed deer numbers have declined somewhat since the historic highs in the mid twentieth century, but populations in the ecosystem remain robust. In more recent decades, populations have fluctuated largely in response to

winter severity but have remained relatively stable over the last 15 years. On the east slope of the Cascades in Okanogan, Chelan, and Northern Kittitas counties, the state estimated the mule deer population in 2015 at approximately 47,000 animals (WDFW 2016a). The total deer population in the NCE east of the Cascade crest likely exceeds 50,000 when white-tailed deer numbers in Okanogan and Chelan counties are added (Fitkin pers. comm. 2016). Deer numbers on the west side of the Cascades are lower, but still significant.

Mountain goat populations have declined relative to estimated historic levels. Estimates of the state population number approximately 2,815 animals, with about 635 goats within the NCE (Rice 2012). Bighorn sheep populations are generally stable in the NCE. The ecosystem and immediately adjacent wildlands support approximately 1,000 sheep in 6 herds spread along the eastern edge of the ecosystem (WDFW 2016b).

After successful augmentation in 1946, 1948, and between 2003 and 2005 from eastern and western Washington, the North Cascade elk herd peaked at about 1,400 to 2,000 elk in 1984 and then sharply declined to around 1,300 elk in 2002 (WDFW 2002). WDFW currently estimates the elk herd between 1,170 and 1,379 animals, an increase of 5%–7% annually (WDFW 2016a). The Colockum elk herd inhabits the southern portion of the NCE and in 2013 had an estimated population of 5,700 individuals (WDFW 2013b). Currently, WDFW estimates the Colockum elk herd to be between 5,500 and 6,500 animals (WDFW 2016a).

Moose in Washington colonized the northeastern portion of the state from neighboring British Columbia and Idaho. Moose were undocumented in Washington prior to the 1930s and were rare prior to the 1960s. Moose had become resident in northeastern Washington by the 1970s; the first hunts occurred in the 1970s. While moose populations are now well established in the NCE and likely increasing in number, no population estimates are currently available for this area (WDFW 2015).

Other potential prey include marmots, pika, and ground squirrels. Hoary marmots (*Marmota caligata*) are common in subalpine and alpine habitats, whereas pikas (*Ochotona* spp.) are common on mid to high elevation talus slopes (NPS 2016a), and Columbian ground squirrels (*Urocitellus columbianus*) are locally abundant in mid to upper elevation open meadows in the northeast portion of the NCE (Fitkin pers. comm. 2016).

Interspecific Competition. Some species of predator in the NCE may compete with grizzly bears for prey or other resources. The species most likely to compete or interact with released grizzly bears include gray wolf (*Canis lupus*), coyote (*Canis latrans*), fisher (*Martes pennanti*), Canada lynx (*Lynx canadensis*), cougar (*Puma concolor*), bobcat (*Lynx rufus*), and black bear (*Ursus americanus*) (NPS 2016a).

The gray wolf was once present in North America from coast to coast, as far north as Alaska and south to Mexico until it was nearly brought to extinction in the lower 48 states by the 1930s. The species was listed as endangered under the ESA in 1973 (FWS 2015b). Currently it is listed as endangered in the state of Washington and federally listed in the western two-thirds of Washington (Wiles, Allen, and Hayes 2011). Wolves in the eastern portion of the state were delisted as part of the Northern Rocky Mountain Distinct Population Segment. Washington's first resident pack since the 1930s was documented in Okanogan County in 2008 (Becker et al. 2016). At the end of 2015, at least 90 wolves existed in 18 known packs in Washington, 3 of which occupy portions of the NCE. The 18 packs ranged in size from 2 to 8 individuals, with an average of 4.4 wolves per pack. Wolves in Washington continue to inhabit both public and private lands from eastern Washington to the east slopes of the Cascade Mountains, with occasional individuals documented west of the Cascade Crest (Becker et al. 2016).

Wolves are social pack animals that live in a variety of habitats. They are opportunistic carnivores, although they tend to focus on large ungulates like deer, elk, and moose (Wiles, Allen, and Hayes 2011). However, wolves also prey on smaller animals and use carrion. Interspecific competition with grizzly bears has been documented typically associated with prey (i.e., carrion), although wolves have been documented preying on grizzly bear cubs in Yellowstone National Park (Gunter and Smith 2004).

Coyotes are opportunists, both as hunters and scavengers. In Washington, coyotes occupy almost every habitat type from open ranch country to densely forested areas to urban environments. Despite ever-increasing human encroachment and past efforts to eliminate coyotes, the species maintains its numbers and is increasing in some areas. Coyotes eat any small animal they can capture, including mice, rats, gophers, mountain beavers, rabbits, and squirrels, as well as snakes, lizards, frogs, fish, birds, and carrion. They eat some Grass, fruits, and berries during summer and fall. Natural predators of coyote include cougars, bears, and other coyotes (WDFW 2004).

Fishers are medium-sized carnivores in the weasel family that inhabit a variety of forest types, although they commonly use landscapes that are dominated by mid- and/or late-successional forests (Lofroth et al. 2010). Fishers commonly prey on small and mid-sized mammals including mice, voles, shrews, squirrels, snowshoe hares, mountain beavers, and porcupines (Martin 1994; Weir et al. 2005). Fishers frequently use cavities in large live trees, large snags, and large downed logs for rest and den sites (Lofroth et al. 2010, Weir et al. 2012, Aubry et al. 2013), and female fishers require cavities in large live trees or large snags as natal den sites (where kits are born). Fishers were extirpated in Washington in the early to mid-1900s as a result of over-trapping, incidental mortality, and loss of habitat (Lewis and Stinson 1998, Aubry and Lewis 2003). Fisher recovery efforts in Washington include the ongoing reintroduction program in western Washington, which includes portions of the NCE (NPS 2014; Lewis 2013).

In 2000, the Canada lynx was federally listed as threatened but had been protected in the state of Washington as threatened since 1993. Canada lynx inhabit coniferous forests and wet bogs throughout most of Canada, Alaska, and some northern areas in the contiguous United States. This feline species is very dependent on snowshoe hare as their primary food item, and the presence of adequate numbers of snowshoe hare is a key characteristic that defines its habitat. In Washington State, Canada lynx are primarily found in high-elevation forests in the north-central and northeast part of Washington, including subalpine and high elevation mixed conifer zones in the Cascades generally above 3,600 feet. In 2008, the Canada lynx population in Washington was estimated at approximately 87 individuals, with the highest concentration occurring in the Okanogan-Wenatchee National Forest portion of the NCE. However, revised estimates of female home range sizes in 2015 suggest that the carrying capacity for female lynx has declined from 43 in 1996 to 27 in 2014 (Lewis 2016). The naturally fragmented nature of Canada lynx habitat and low availability of suitable habitat outside of the Okanogan region continues to challenge this species conservation and population (Stinson 2001).

Cougars favor dense forests, steep canyons, and rock outcroppings that provide good stalking cover while hunting, while grizzly bears tend to occupy more open habitats. Adult cougars typically prey on deer, elk, moose, mountain goats, and wild sheep, with deer being the preferred and most common prey. Other prey species, especially for younger cougars, include raccoons, coyotes, rabbits, hares, small rodents, and occasionally pets and livestock. A large male cougar living in the Cascade Mountains kills a deer or elk every 9 to 12 days, eating up to 20 pounds at a time and burying the rest for later (WDFW 2005). Grizzly bears in the North Cascades would likely occasionally scavenge cougar kills.

Bobcats are opportunistic predators that prey on a wide variety of animals, including mice, voles, rabbits, gophers, mountain beaver, marmots, fawns, insects, reptiles, birds, and carrion. Rock cliffs, outcroppings, and ledges are important to bobcats; however, bobcats can commonly be found in open fields, meadows, and agricultural areas where brushy or timbered areas are nearby for escape (WDFW 2007a).

Black bears are opportunistic omnivores that feed on grasses, grubs, insects, berries, carrion and human-related foods. They are found in a number of states in the United States as well as Canada. In Washington State, black bears sometimes also damage conifers seeking the sap they produce (Ziegler and Nolte 2001). The statewide bear population has been estimated to be somewhere between 25,000 and 30,000 animals (WDFW 2007b). Black bears live in a variety of habitats, although they are primarily found in forested areas.

Birds

According to the North Cascades National Park species list provided on the NPSpecies database, more than 200 species of birds in 38 families can be found in NCE habitats that range from alpine meadows to low elevation forests and wetlands. Many of these species are abundant or are increasing, whereas a few have had decreasing populations requiring protection. Two protected species, marbled murrelet (*Brachyramphus marmoratus*) and northern spotted owl (*Strix occidentalis*), are listed as threatened under the ESA. Other species include bald eagle (*Haliaeetus leucocephalus*), northern goshawk (*Accipiter gentilis*), sharp-tailed grouse (*Tympanuchus phasianellus*), common loon (*Gavia immer*), flammulated owl (*Psiloscops flammeolus*), Vaux's swift (*Chaetura vauxi*), Lewis' woodpecker (*Melanerpes lewis*), white-headed woodpecker (*Leuconotopicus albolaryvatus*), black-backed woodpecker (*Picoides arcticus*), and pileated woodpecker (*Dryocopus pileatus*). Many migrating, breeding, and wintering species of birds are attracted to the rivers, lakes, and streams in the NCE. One of the largest wintering populations of bald eagles in the continental United States occurs within the Skagit River watershed. Clear, fast-flowing rivers and streams host breeding populations of Harlequin ducks (*Histrionicus histrionicus*) (NPS 2016a).

The NCE is within the Pacific Flyway Corridor, and many migratory species, including raptors, pass through the NCE during their spring and fall migrations (FWS 2016b). More than half of the species breeding in the NCE are migratory species. However, the species potentially affected would be those that may be nesting close to grizzly bear restoration activities, specifically when grizzly bears are released using helicopters.

Fish

According to the North Cascades National Park species list, 28 fish species are considered to be present in the park complex, of which 24 are native. Some of these species, especially salmon and trout, have experienced declining populations, whereas other species are stable or increasing. Some of these species could be potential prey species for grizzly bears, including peamouth (*Mylocheilus caurinus*), northern pikeminnow (*Ptychocheilus oregonensis*), coastal and westslope cutthroat trout (*Oncorhynchus clarkii*), chum salmon (*Oncorhynchus keta*), coho salmon (*Oncorhynchus kisutch*), rainbow trout (*Oncorhynchus mykiss*), sockeye salmon or kokanee (*Oncorhynchus nerka*), mountain whitefish (*Prosopium williamsoni*), bull trout (*Salvelinus confluentus*) and Dolly Varden (*Salvelinus malma*) (NPS 2016a). In addition, Okanogan-Wenatchee National Forest supports runs of Middle Columbia River steelhead (*Oncorhynchus mykiss*) and Upper Columbia River spring-run Chinook (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*), and Mt. Baker-Snoqualmie National Forest supports runs of Puget Sound steelhead and Puget Sound Chinook salmon (*Oncorhynchus mykiss*) (USFS 2015a).

Climate Change

The North Cascadia Adaptation Partnership is a collaborative group with members from USFS, NPS, and the University of Washington that was established in 2010 with the objective to educate the public about the impacts of climate change in the NCE, evaluate the vulnerability of the NCE to climate change, and develop adaptation strategies to climate change based on sound science (Littell and Raymond 2014). USFS analyzed historical climate data in conjunction with global climate models to project what changes

in the climate are likely to occur in the Pacific Northwest. In addition, the Climate Impacts Group at the University of Washington developed datasets of downscaled climate and hydrologic projections to support the vulnerability assessments, which estimated an average regional temperature increase of 2.1°C by 2040 and 3.8°C by 2080. The highest relative increases in temperature are projected to occur during summer months (Littell et al. 2011). While a change in precipitation was predicted, magnitude and direction varied between models. Increases in average temperature are almost certain to decrease the regional snowpack in extent and duration (Elsner et al. 2010; Mote 2003), which may carry substantial implications for species like lynx, wolverine, and other species and their forage or prey, especially cold water fish.

Climate change is likely to alter physical and hydrologic conditions in the NCE in a way that will create shifts in vegetation communities in the area (Littell, Oneil, and McKenzie 2010). Using dynamic models that take into account climate change, current vegetation community composition and plant tolerances, Rogers et al. (2011) predicted shifts in vegetation biomes for three different climate scenarios. The results indicate that alpine tundra may nearly disappear from the NCE and the total area of subalpine forest may decrease.

The effects of climate change on grizzly bears in the NCE are unknown. However, research in Alberta, Canada has shown that higher temperatures and earlier snow melt have contributed to improved food resources for grizzly bears (Nielsen et al. 2013). Grizzly bears historically ranged as far south as northern Mexico and are both habitat and food generalists. Grizzly bears will consume almost anything available including vegetation, living or dead mammals or fish, insects, and human garbage (Knight, Blanchard, and Eberhardt 1988; Mattson, Blanchard, and Knight 1991; Mattson et al. 1991; Schwartz, Miller, and Haroldson 2003). Climate change could also change the habitat as a result in changes in disturbance patterns such as wildfires. However depending on their size and severity, fires may only have short term adverse effects on grizzly bears while providing more long term benefits. For example, “recently burned areas are generally avoided by bears for the first few years after a fire while vegetation recovers, however, following a fire, food resources generally become plentiful and these areas often become highly used habitats by bears” (Lyons et al. 2016 citing Hamer and Herrero 1987 and Apps et al. 2004).

WILDERNESS CHARACTER

The *Wilderness Act* of 1964 established a national wilderness preservation system to be composed of federally owned lands designated by Congress as wilderness areas. By law, these wilderness areas “[...] shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness” (16 USC 1131).

Wilderness character, as described in *Keeping it Wild 2: An Updated Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System*, is a “holistic concept based on the interaction of (1) biophysical environments primarily free from modern human manipulation and impact, (2) personal experience in natural environments relatively free from the encumbrances and signs of modern society, and (3) symbolic meanings of humility, restraint, and interdependence that inspire human connection with nature” (Landres et al. 2015). The qualities of wilderness character are described as follows:

Untrammeled. An untrammeled wilderness is one in which ecological systems and their biological and physical components are autonomous, free from human intervention. By contrast, human actions that restrict, manipulate, or attempt to control the natural world within wilderness degrade the untrammeled quality. Trammeling actions include the removal of nonnative species, intervention in the behavior or

lives of native plants and animals, projects to restore the natural conditions of wilderness, and interference in natural processes and energy flows. These actions may be temporary but, while they are in effect, they affect the untrammelled quality of wilderness.

Natural. A natural wilderness shows minimal effects of modern civilization upon the ecological systems and their biological and physical components. A natural wilderness comprises landforms, soils, waterways, habitats, species, and terrestrial food webs that are largely intact in their natural state and not influenced by human activities and external threats.

Undeveloped. An undeveloped wilderness is an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, with the imprint of man's work substantially unnoticeable. The undeveloped wilderness is impacted by the presence of structures and installations, and by the use of motor vehicles or motorized equipment. These developments are also prohibited by section 4 (c) of the *Wilderness Act*, and are only permissible if they are "necessary to meet minimum requirements for the administration of the area" as wilderness.

Opportunities for Solitude or Primitive and Unconfined Recreation. Opportunities for solitude or primitive and unconfined recreation provide visitors a chance to connect with the natural world, to practice traditional skills, and to have transformative personal experiences. Encounters with other visitors and changes in management that alter visitor recreation behavior can affect opportunities for solitude. Developments that support public recreation decrease the primitive quality of wilderness (as well as the undeveloped quality). Restrictions on visitors in wilderness can reduce the unconfined quality of wilderness.

Other Features of Value. Historic and cultural resources serve as reminders that humans have been using the wilderness for centuries. Preservation, removal, or degradation of these resources can affect this value.

Each administering agency is responsible for preserving the wilderness character of designated wilderness areas. This section describes the designated wilderness areas in the park complex, Okanogan-Wenatchee National Forest, and Mt. Baker-Snoqualmie National Forest. Figure 5 displays the wilderness areas managed by these agencies in the NCE.

Wilderness in the North Cascades National Park Service Complex

The park complex contains 680,850 acres of North America's most spectacular mountain scenery and ancient forests. From its inception in 1968, the park complex was primarily conceived as a wilderness park. Congress established the Stephen Mather Wilderness through the Washington Park Wilderness Bill of 1988, designating 634,614 acres of wilderness across the park complex. An additional 5,226 acres were designated "potential wilderness," contingent on Seattle City Light's plans to implement other hydroelectric projects.

As of 2016, 641,219 acres of designated wilderness exist within the park complex, with another 1,527 acres considered potential wilderness. The only exception to these acres is a corridor 100 feet wide, 50 feet either side of the center of the Cascade and Stehekin River roads. Table 4 shows wilderness acreage on NPS managed land within the NCE.

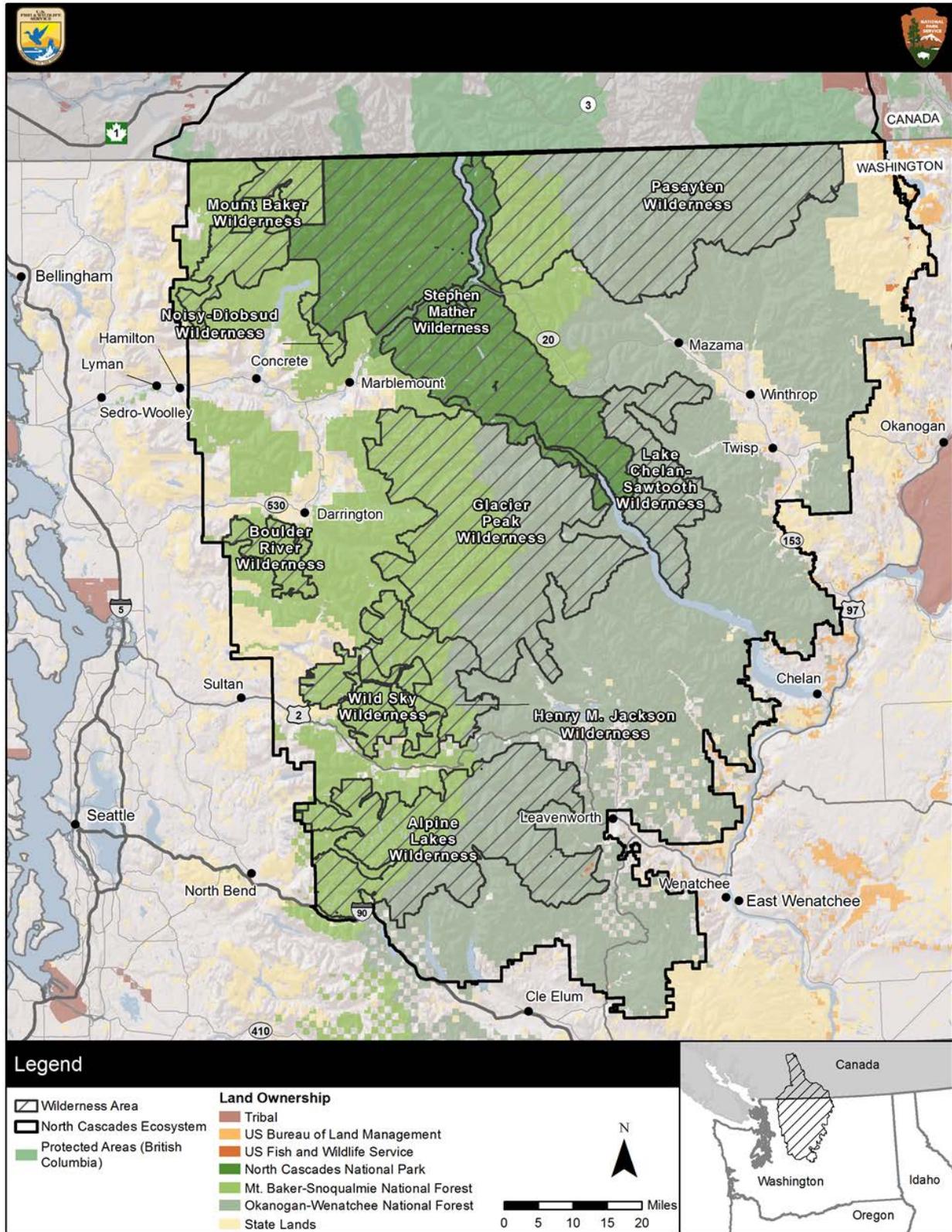


FIGURE 5. WILDERNESS AREAS MANAGED BY THE NATIONAL PARK SERVICE AND U.S. FOREST SERVICE IN THE NORTH CASCADES ECOSYSTEM

TABLE 4. WILDERNESS ACREAGE ON NATIONAL PARK SERVICE LAND IN THE NORTH CASCADES ECOSYSTEM

| Wilderness Areas | Acreage | Percent of North Cascades National Park Service Complex in Wilderness |
|--------------------------------------|----------------|-----------------------------------------------------------------------|
| North Cascades National Park | 500,779 | 99% |
| Lake Chelan National Recreation Area | 56,223 | 89% |
| Ross Lake National Recreation Area | 84,217 | 73% |
| TOTAL | 641,219 | 94% |

Source: North Cascades National Park GIS 2016

The current condition of wilderness character within the Stephen Mather Wilderness is described below.

Untrammelled

The Stephen Mather Wilderness is generally unhindered and free from most human manipulation. The park participates in a number of actions that may trammel wilderness, but are implemented in an effort to protect other qualities of wilderness character. Actions mainly include fire suppression and non-native fish management, but also include wildlife management, hazard tree management, and research activities (NPS 2014).

Fire suppression is chosen as a management action when the fire threatens life, improvements, or is determined to be a threat to natural and cultural resources. The act of suppressing the fire, regardless of how many acres have burned, is a direct attempt to control the natural world (NPS 2007a).



Photo Credit C. Brindle

Bowen Ridge in autumn in the Stephen Mather Wilderness Area

Ninety-one mountain lakes (excluding small ponds) within the wilderness have historically been stocked with non-native fish by the Washington Department of Fish and Wildlife (WDFW) as part of its recreational fishery program. Under the 2008 *Mountain Lakes Fishery Management Plan*, removal of reproducing populations of fish and cessation of fish stocking occurs in some lakes. Both stocking and removal of fish is a direct manipulation of otherwise autonomous wildlife, and therefore degrades the untrammelled quality of wilderness character (NPS 2011a). The *North Cascades National Park Service Complex Fish Stocking Act* (2014) authorizes the NPS to stock fish in some of the high mountain lakes, with stipulations.

One unauthorized action that has occurred within the wilderness was the development of a large-scale (5 acres) marijuana plantation. Damage included cutting and limbing of trees to clear the grow sites, terracing of the land, impounding of creeks and installation of irrigation systems, spreading of chemical fertilizers, harassing and trapping wildlife, construction of living quarters and fences, and the spreading of garbage and human waste. This type of action, though small in size, is the most egregious example of an unauthorized action causing trammeling in wilderness (NPS 2011b). The site was dismantled in 2008.

Natural

Although generally in good condition, natural ecological systems inside the Stephen Mather Wilderness have been, and continue to be, affected by conditions and actions beyond the wilderness boundary. For example, fourteen threatened or endangered amphibians, birds, fishes, flowering plants, insects, and mammals are found in the wilderness, which have been historically impacted by human actions outside of wilderness (FWS 2016c).



Photo Credit: A. Braaten

Boston Basin Meadows

Non-native and invasive species can be found throughout the wilderness. Non-native species are those that have been intentionally or accidentally introduced to wilderness by humans or their activities. Invasive species are those that are not only non-native, but also negatively impact the environment. These species threaten the natural processes of the Stephen Mather Wilderness in that they have the potential to outcompete native species and create monocultures in once diverse habitats. Out of approximately 1,675 vascular and non-vascular species in the wilderness, at least 232 of them are non-native and 40 are invasive (NPS 2014; NPS 2011b). While there are no known mammals, reptiles, or amphibians that are non-native or invasive species to the wilderness, the barred owl, a species native to the eastern United States, can be found in the wilderness. As the barred owl has expanded westward, evidence indicates that they are displacing, hybridizing with, and even killing northern spotted owls (Wiens, Anthony, and Forsman 2014). Six non-native fish species are found in the mountain lakes of wilderness (NPS 2014).

Air quality is generally good in the wilderness. Research focusing on atmospheric pollution deposited in snow, from fog, and in surface water shows that the wilderness is receiving mercury and pesticide pollution from sources adjacent to the park complex, as well as from across the Pacific Ocean (NPS 2011b). A wide range of pollutants have been found in vegetation samples. Polychlorinated biphenyls and pesticides have been found in lichens, and mercury and organochlorine compounds have been found in fish tissue.

Water quality is generally good in the Stephen Mather Wilderness. However, Newhalem Creek is listed by Washington State as not meeting state water quality standards for instream flows (NPS 2011b). Little research has been conducted on soils in the Stephen Mather Wilderness. Human-caused soil disturbance or erosion does however occur at a localized scale, usually around trails that are snow-covered well into summer or in campsites where bare ground disturbance has increased over time. Soil crusts in wilderness are generally in good condition (NPS 2011b).

The impact of climate change on natural processes is also a growing concern within wilderness. Impacts include decreased snow cover, glacial retreat, decreased summer stream flow, increased frequency and magnitude of floods, increased stream temperature, increased wildfire potential, rising tree line, changes in phenology, and longer growing seasons.

Undeveloped

The undeveloped quality of the Stephen Mather Wilderness is generally good; however, the wilderness contains a number of administrative and recreational structures that impact this quality of wilderness character (NPS 2014). These facilities include signs, historic fire lookouts, shelters/cabins, toilets, radio repeaters, snow telemetry monitoring stations, a temporary road (the last mile of Thornton Lakes Road), approximately 100 designated camps with site markers, and a system of over 350 miles of designated trails containing culverts, bridges, puncheon, rock and log-lining, and other historic and non-historic constructed features. There are also a number of permanent research and monitoring plots (NPS 2014).

Motorized equipment and vehicles, such as chainsaws and helicopters, are also used for administrative purposes, which negatively impact the undeveloped qualities of the wilderness. Between 2011 and 2014, the park complex has averaged approximately 142 flight hours over wilderness (Braaten pers. comm. 2016). The flights are often staged outside of wilderness at the Marblemount Ranger Station, Newhalem gravel pit, Diablo Lake Overlook, Ross Lake Overlook, Colonial Creek Boathouse, Hozomeen, Cascade Pass Trailhead, Bridge Creek trailhead, Canyon Creek trailhead, Swamp Creek gravel pit, or the Stehekin Airstrip (NPS 2014). A large percentage of the flights are with smaller, lightweight helicopters such as a McDonald Douglas MD500D or 530F. In addition to NPS administrative use, non-NPS aircraft such as military, commercial, and private sector aircraft fly over the wilderness annually. Two air tour operators exist at the park complex, primarily for the purposes of transportation to and from Stehekin over Lake Chelan; however, few of these flights traverse wilderness (NPS 2014).

Opportunities for Solitude or Primitive and Unconfined Recreation

Opportunities for solitude within the Stephen Mather Wilderness are abundant. Local topography, dense vegetation, and spacing of campsites and trails within the wilderness provide a sense of remoteness from the sights and sounds of other people and human development (NPS 2014). Night sky visibility is excellent at lower elevations but diminishes at higher elevations where light pollution becomes visible from the Seattle-Tacoma and Vancouver metropolitan areas. The natural soundscape is in relatively good condition, though noise intrusions occur from aircraft, motorboats, highway traffic, and NPS administrative activities. Aircraft noise can be heard throughout the wilderness at any time of day, but motorboat and highway noise drops significantly during nighttime hours. The source of NPS-generated noise typically includes chainsaw use to support trail maintenance activities, equipment used to maintain roads near the wilderness boundary, and aircraft used to support fire management, trails, search and rescue, and other administrative activities (NPS 2014). Human-caused sounds also raise the natural ambient levels more during the daytime hours than at night. Even when the contribution of human-caused sounds are removed to produce ambient levels at backcountry locations, the natural ambient levels are high. Acoustic monitoring results provide a clue for why this might be: flowing water and wind are frequently audible. Their presence is the likely cause for high natural ambient levels in the Stephen Mather Wilderness (NPS 2008b).

Opportunities for primitive and unconfined recreation are reduced by a number of facilities that decrease self-reliant recreation and policies that place limits on use and activities within wilderness, such as the backcountry permit system, group size restrictions, limitations on the use of campfires, food storage policies, and restrictions on capacities for designated campsites. While some of these facilities and policies adversely impact opportunities for primitive and unconfined recreation, they can also increase opportunities for solitude by dispersing visitors throughout the wilderness.

Three areas of classification are used to define and describe opportunity class in the Stephen Mather Wilderness: (1) trailed/established camps, (2) crosscountry I, and (3) and crosscountry II.

They are classified based on the type and amount of use; accessibility and challenge; opportunity for solitude; current resource conditions; and management uses. These areas of classification are described in detail below (NPS 1989):

Areas in the frontcountry are open to fire use in established campgrounds, and stock use is limited to all-purpose trails. Day-hiking visitation is often high, with some overnight visitors passing through en route to their final destinations. Most areas are within one to three hours' hiking time from a trailhead on trails maintained to standard specifications. Frontcountry visitor education efforts of all types are used. In more isolated areas like McGregor Mountain and Easy Pass, the opportunity for solitude is high. Presence of park staff is generally high, with a 90% chance of meeting a ranger in the higher use areas. Visitor education in the form of trail guides or interpretive talks may be available. Impacts from camping and other activities are rehabilitated.

Trailed/established camp areas receive moderate day use and moderate camping use. Camping is restricted to designated sites and party size is limited to 12. Fires are restricted to camps where fire grates are provided; all other camps are personal stoves only. Stock parties are limited to 6 people and stock. Access to major destination areas is from two hours' to several days' hiking on trails maintained to standards. Opportunity for solitude ranges from low where day use and camping overlap, to high at campsites several days distance from the trailhead. Presence of park staff is moderate, with a 25%–50% chance of meeting a ranger or trail crewmember. The number of visitors per camp varies by the size of the camp. They range from 1 to 7 sites in a camp, and a limit of 4 to 12 people. Visitor education is extensive at permit-issuing stations and during on-site contacts. Use limits are based on the number of sites within a camp and the number of tent pads per site. There are 86 established camps, with an average number of two campsites. If all the camps were full, they would accommodate 870 visitors.

Crosscountry I zones include popular climbing routes and bivouac sites. These receive about 75% of all climbing activity in the park complex. Some routes were semi-constructed, while others were established through repeated use and flagged by climbers traveling to climbing areas. This area receives minimal day use and moderate to high camping use, both at designated sites and in crosscountry zones. In Lake Chelan National Recreation Area, stock use is permitted in Dee Dee Lakes, Rainbow Ridge, Rennie, Purple, and Triplet Lakes crosscountry zones. Visitors must camp at least a half mile from maintained trails and one mile from established camps. Subalpine meadows are closed to camping. Fires are prohibited. Party size is limited to 12, and the number of parties is limited in some areas of heavy use. Horse parties are limited to a combination of 6 visitors and stock. Access is at least a two-hour hike on non-maintained routes ranging from easy hiking to technically difficult, requiring knowledge and skills in route-finding and mountaineering.

Opportunity for solitude is moderate to high in crosscountry I zones. Presence of park staff is high in areas of high use. The opportunity for meeting a ranger is from 25% to 90%, depending on the area and day of the week. Designated sites, where present, are maintained to the same standards as trailed/established camps but with minimal developments. These standards are described in the *1989 Stephen Mather Wilderness Management Plan*. Visitor education is extensive both at permit-issuing stations and in the field. Backcountry permits are required for all overnight stays, and climbers are encouraged to sign in and out on a climbing register. No mechanical tools for maintenance are used in wilderness without advance written request for a variance. Aircraft may be used for emergencies and, to a limited extent, for administration of the area. Administrative use is limited to a period before July 4 and after Labor Day, and during the weekdays of Monday through Thursday.

Crosscountry II zones represent about 90% of the wilderness and are the most pristine, with little evidence of human presence. They receive little to no day use. Fires, stock use, and camping in meadows are prohibited. Wilderness permits are required for all overnight stays, and parties are encouraged to sign

in and out on the climbing register. Visitors must camp at least a half mile from maintained trails and one mile from established camps. Party size is limited to 6 party members, and the number of parties may be limited in some areas. Access is more than six hours from a road trailhead, maintained trail, or climbers' route. Routes are minimally visible or non-existent, and require knowledge of route-finding and/or require skills in mountaineering. Opportunity for solitude is high. Presence of park staff is low, with less than a 10% chance of contact. Human impact is not acceptable for camps or routes. Impacted sites are rehabilitated and/or closed. Signing is not permitted in crosscountry II zones.

Other Features of Value

The other features of value in the Stephen Mather Wilderness include historic (e.g., fire towers) and pre-historic cultural resources. These resources are generally in good condition. More than 8,500 years of human presence on the landscape offers a glimpse into the distribution of people across a high mountain environment over centuries of ecological changes in climate and topography. In addition, the wilderness has been, and continues to serve as, an ongoing object of scientific study, offering outstanding opportunities to understand vegetation, wildlife, fire ecology, geology, and water resources.

United States Forest Service

Wilderness areas on USFS land in the NCE span a multitude of environments and elevations ranging from low, open, grassy slopes to timber stands of all ages and varied species; from subalpine and alpine areas to the rugged and rocky mountain peaks. Wilderness areas in each national forest contain a vast number of lakes, and the mountains afford many challenges for rock climbing, mountaineering, and crosscountry travel. They also provide many opportunities for solitude. A wilderness designation carries with it some limits as to the kinds and amount of uses permitted—which differ considerably from restrictions outside of wilderness—and are described in the following subsections. Table 5 shows the wilderness acreage within the NCE on Okanogan-Wenatchee National Forest and Mt. Baker-Snoqualmie National Forest. Pasayten Wilderness and Lake Chelan-Sawtooth Wilderness are managed by Okanogan-Wenatchee National Forest. Mount Baker, Noisy-Diobsud, Boulder River, and Wild Sky are managed by Mt. Baker-Snoqualmie National Forest. Glacier Peak, Alpine Lakes, and Henry M. Jackson are jointly managed by both national forests.

TABLE 5. WILDERNESS ACREAGE ON U.S. FOREST SERVICE LAND IN NORTH CASCADES ECOSYSTEM

| Wilderness Area | Acreage | Percent of Okanogan-Wenatchee National Forest / Mt. Baker-Snoqualmie National Forest in Wilderness |
|-----------------------------------|------------------|----------------------------------------------------------------------------------------------------|
| Mount Baker | 119,522 | 6.9% |
| Noisy-Diobsud | 14,451 | 0.8% |
| Boulder River | 49,161 | 2.9% |
| Wild Sky | 106,909 | 6.2% |
| Glacier Peak ^a | 566,057 | 9.9% |
| Alpine Lakes ^a | 391,988 | 6.8% |
| Henry M. Jackson ^a | 103,297 | 1.8% |
| Pasayten ^b | 531,539 | 13.3% |
| Lake Chelan-Sawtooth ^b | 153,057 | 2.7% |
| TOTAL | 2,035,981 | 35.6% |

Source: Rohrer pers. comm. 2016.

| Wilderness Area | Acreage | Percent of Okanogan-Wenatchee National Forest / Mt. Baker-Snoqualmie National Forest in Wilderness |
|-----------------|---------|----------------------------------------------------------------------------------------------------|
|-----------------|---------|----------------------------------------------------------------------------------------------------|

- ^a Jointly managed by Okanogan-Wenatchee National Forest / Mt. Baker-Snoqualmie National Forest. Approximately 51% of the jointly managed wilderness areas are found on Okanogan-Wenatchee and 49% on Mt. Baker-Snoqualmie. Percent wilderness calculated by total acreage of both forests.
- ^b Percent wilderness calculated based on 4 million acres (USFS 2011a).

Okanogan-Wenatchee National Forest

The Okanogan and Wenatchee National Forests were administratively combined in 2000, creating Okanogan-Wenatchee National Forest. The forest is managed under the previously existing forest plans for Okanogan National Forest and Wenatchee National Forest. As such, this section contains information from the 1989 *Okanogan Final Land Management Plan* and the 1990 *Wenatchee Final Land Management Plan*, except where noted (USFS 1989).

Okanogan-Wenatchee National Forest encompasses approximately 4 million acres, with more than 1.5 million acres of wilderness within its borders (USFS 2016j). Two areas of classification are used to define and describe opportunity class in Okanogan-Wenatchee National Forest wilderness: (1) pristine/trail-less areas; and (2) primitive/trailed areas.

Pristine/trail-less areas are characterized by an extensive unmodified natural environment where natural processes are not measurably affected by the actions of visitors. Visitors have the most outstanding opportunity for isolation and solitude, free from evidence of human activities and with very infrequent encounters with other visitors. Visitors have outstanding opportunities to travel crosscountry using a maximum degree of primitive skills, often in an environment that offers a high degree of challenge and risk.

Primitive/trailed areas are characterized by an unmodified natural environment with a minimum of on-site controls and restrictions, and where present, controls are subtle. Facilities are only provided for protection of wilderness resource values. Materials for facilities are native, where possible, and are always natural in appearance. Visitors have a low to high opportunity for isolation and solitude, with various levels of evidence of past human activities. Encounters with other users also range from low to high. Access ranges from no trails to well-defined trails.

Approximately 2,855 miles of trail are found in wilderness on Okanogan-Wenatchee National Forest. These trails are not open to motorized or mechanical use, but are generally open to both hiker and stock use. Visitor use on trails and in wilderness ranges from extremely light in the more remote areas, to heavy along major trails and favored attractions. Most visitor use occurs from July through October. Camping, hiking, horseback riding, hunting, and fishing are the primary activities, with the latter two activities accounting for 25% of visitor use in wilderness.

Two vacant sheep allotments exist in the Pasayten Wilderness, while portions of one vacant sheep allotment exist in the Lake Chelan-Sawtooth Wilderness. However, no grazing permits have been recently issued in either of these wilderness areas. Mineral-related activities are occurring in the Pasayten Wilderness and Lake Chelan-Sawtooth Wilderness. Administrative sites are located at Spanish Camp, Stub Creek, and Pasayten Airport, all of which are found in the Pasayten Wilderness. The U.S. Geological Survey maintains a snow survey cabin near Freezeout Creek and a stream gauging station in Andrews Creek within the Pasayten Wilderness. There are remnants of old trapping

cabins scattered across the Pasayten Wilderness; these structures are in various stages of deterioration and may have historical significance.

Most wilderness areas are in a stable or improving trend relative to wilderness character (USFS 2011a). However, there are a number of challenges to management. Natural processes have been disrupted by activities such as fire suppression, fish stocking, non-native plant diseases, and the spread of weeds. A number of areas are easily accessed and receive heavy use. Many of these areas are known for crowding and, in some locations, physical impacts such as the proliferation of campsites are becoming worse. Use of the internet and global positioning systems (GPSs) is resulting in social trail development in formerly pristine locations. In some locations, inappropriate or prohibited uses are occurring such as snowmobile trespass across wilderness boundaries (USFS 2011a).

Mt. Baker-Snoqualmie National Forest

Mt. Baker and Snoqualmie National Forests were administratively combined in 1974, creating the Mt. Baker-Snoqualmie National Forest. Mt. Baker-Snoqualmie National Forest encompasses 1,761,644 acres, with over 840,000 of these acres consisting of wilderness. Five areas of classification are used to define and describe opportunity class in Mt. Baker-Snoqualmie National Forest wilderness: (1) transition; (2) trailed; (3) general trail-less; (4) dedicated trail-less; and (5) special (USFS 1990).

The transition class includes system trails that have a travel-way worn to mineral soil over long distances, and is characterized by having a large proportion of day-users, often mixed in with overnight and long distance travelers. This area is usually adjacent to trailheads and extends into the wilderness a distance that is typically traveled in one day by a hiker. This class includes areas accessed by trail, around lakes, or other attractions used by people or pack stock, within the day-use influence area. The class extends at least 500 feet on either side of a trail, and it may be wider around lakes or heavily used areas. The length of this trail class is established for each trail depending on ease of travel, distance from trailhead outside wilderness, and destination attractions inside wilderness. Length is generally 3 to 5 miles inside the wilderness boundary. If the day-use activity occurs entirely outside wilderness, the trail has no transition. The trailed class includes all managed system trails. It extends beyond the transition class. This class extends at least 500 feet on either side of the trail, but may be wider around lakes or heavily used areas.

The general trail-less class includes areas not falling into the other classes. It attracts very low use because of a relative lack of trails or destination spots. The area is unmodified, and user-made trails are not encouraged but may exist. If obvious user-made trails become well established or are causing resource damage, consideration is given to their reconstruction to protect the wilderness resource from further damage. Reclassification from general trail-less to trailed requires a supplement to the Forest Plan, which includes full public involvement. This class is available for new trail construction or relocation of existing trails to protect resources or meet other objectives by dispersing use. If this should occur, the trail is constructed to no higher than “more difficult” or “most difficult” standards.

The dedicated trail-less class is managed exclusively as a trail-less area, and user-made trails are not permitted. It may include popular attractions accessed only by crosscountry travel. Human impact and influence is minimal; therefore, user restrictions may be necessary to ensure that trail-less experiences remain. Dedicated trail-less areas are of a size that allow for a meaningful experience and can be reasonably protected for the experiences and remoteness identified. Generally, the class is at least 1,000 acres in size, and contains whole drainages out of sight and sound of trails, or areas outside the wilderness.

The special area class intends to provide for significant changes in standards or other management guidelines for unique areas. Areas that qualify for special area designation include congressionally

acknowledged areas, areas of significant cultural or historic value, areas with special considerations, and areas with limited management options to deal with unique situations. Areas do not qualify for this class for administrative convenience in dealing with overuse. The class is rare and does not exist in many wilderness areas.

Mt. Baker-Snoqualmie National Forest has 635 miles of trails in wilderness, the majority of which are found in the Glacier Peak Wilderness. A quarter of this mileage consists of trails in the transition class (USFS pers. comm. 2016g). Hiking accounts for 41% of wilderness use. A majority of this hiking is day-use, a reflection of the accessibility of the wilderness. Another 34% of wilderness use comes from climbing, fishing, hunting, nature study, horse use, and miscellaneous activities. Camping accounts for the remaining 25% of wilderness use (USFS 1990).

Many current and potential conflicts of use exist in Mt. Baker-Snoqualmie National Forest wilderness areas. One of the most severe is overuse at specific locations. Campsite inventories completed in 2013 identified a total of 1,847 sites within wilderness, some of which may be overused (USFS pers. comm. 2016g). Roads and major highways near the wilderness boundary provide easy access, leading to overuse at some sites. Other conflicts include off-road vehicle and snowmobile use overlapping from the Mount Baker National Recreation Area into the Mount Baker Wilderness, military aircraft noise in Alpine Lake Wilderness, Glacier Peak Wilderness, and Mount Baker Wilderness, and historical use of Mount Baker by large climbing parties.

VISITOR USE AND RECREATIONAL EXPERIENCE

The restoration of grizzly bears to the NCE has the potential to affect visitation levels and recreational uses in the park and national forests. Restoration actions could also affect commercially guided backcountry recreation such as mountain climbing, horse packing, and other guided uses. The term backcountry refers to primitive, undeveloped portions of parks and/or forests, some of which may be designated “wilderness” (NPS 2015d). Backcountry activities offer greater opportunities for solitude along with greater challenges (including interactions with wildlife). The term front county may refer to areas near well-developed trails, sites with picnic tables, areas proximate to ranger stations and/or visitor centers, and designated campgrounds (i.e., those with fireplaces, water pumps, and/or bathrooms). Visitors can partake in both front country and backcountry activities throughout the NCE.

Visitor Use in the North Cascades National Park Service Complex

The park complex attracts approximately 826,000 visitors per year, the majority of whom visit Ross Lake National Recreation Area (772,579 in 2015). Lake Chelan and North Cascades National Park attracted 32,186 and 20,677 visitors respectively in 2015 (NPS 2016c). In June, July, and August 2015, recreation visits to Lake Chelan and North Cascades National Park totaled 15,100 (3,277 in June; 6,297 in July; and 5,526 in August) (NPS 2015e).

In the past decade, no visitor surveys have been conducted for the North Cascades National Park or the Lake Chelan National Recreation Area. A visitor survey was conducted for Ross Lake National Recreation Area in 2007 (NPS 2007b). According to that survey, the average party size for all visitors to Ross Lake National Recreation area was 3.2 people, and 51.1% of parties included two people. Almost two-thirds (63%) of all visitors who stayed overnight spent one or two nights, and 92% of overnight visitors spent between one and four nights. Of visitors who did not stay overnight, visitors for whom Ross Lake was the primary destination stayed an average of four hours, while incidental visitors stayed approximately two hours. The average for all visitors was three hours. The North Cascades Visitor Center near the town of Newhalem along State Route 20 is one of two main visitor centers within the park

complex. Golden West Visitor Center, which is the visitor contact point for the Lake Chelan National Recreation Area, is the other main visitor center.

According to NPS, backcountry visitation in the park complex in the summer of 2015 was higher than average due to low snowpack. Visitors must obtain backcountry use permits for overnight camping and adhere to additional rules and regulations when visiting backcountry areas. Popular activities include hiking, mountaineering, rock climbing, whitewater rafting, and wilderness camping. Among visitors to the backcountry, 77% were Washington State residents; 19% were residents of other states; 3% were residents of British Columbia, Canada, and 1% were residents from other areas (2015). The average group size for backcountry visitors was three people (NPS 2015e).

Visitor Use of National Forest Lands in the North Cascades Ecosystem

The national forests within the NCE attract many visitors per year. In 2010, Mt. Baker-Snoqualmie National Forest and Okanogan-Wenatchee National Forest attracted 3,363,000 national forest visits. Of these areas, Mt. Baker-Snoqualmie National Forest attracted 1,995,000 national forest visits, and Okanogan-Wenatchee National Forest attracted 1,368,000 national forest visits (USFS 2016a).

According to a FY 2010 USFS Visitor Use Report for the Okanogan National Forest, almost one-quarter of visits come from people living within 25 miles of the forest. However, more than one-third of visits are from people who live more than 200 miles away (USFS 2011b). The USFS also produced a Visitor Use Report for the Wenatchee National Forest, analyzing data from FY 2010. According to that report, approximately 45% of visits come from people who reside within 50 miles of the forest, while 40% of visitors live between 75 and 200 miles away (USFS 2011c).

Most visits to Okanogan National Forest last less than 5 hours. However, the average is more than 20 hours, indicating that some visitors stay significantly longer. A majority (63%) of visits come from people who frequent the forest no more than five times annually (USFS 2011b).

According to 2010 data provided by Mt. Baker-Snoqualmie National Forest, the average group size for forest-wide visitors was 3.47 adults and 2.63 children under the age of 17. The average number of adults in groups visiting backcountry areas was 2.75, while the average group size for adults visiting front country areas was 2.85 (Plumage pers. comm. 2016a)

Recreation on Federal Lands within the North Cascades Ecosystem

Recreational use of federal lands in the NCE is estimated to be 8 million recreation visitor days per year. Most of this use is associated with dispersed recreation rather than developed campgrounds or wilderness areas (figure 6). Almost 1 million recreation visitor days occur annually in wilderness areas; however, visitation is not equally distributed, and some areas receive much higher recreational use than others. The majority of the trails in the NCE occur in wilderness and roadless areas. Recreation also occurs on lands managed by the State of Washington, although state lands make up a relatively small portion of the NCE. As noted by Almack et al. in 1993, recreational use data for these areas are not readily available.

Both the NPS and USFS encourage and sustain a diverse and balanced spectrum of quality recreation opportunities within the NCE. Recreational activities enjoyed by visitors to both national park and national forest lands include hiking, backpacking, biking, birding, boating, fishing, hunting (on forest lands and within the NPS national recreation areas only), swimming, horseback riding, and mountain and rock climbing. Several of these activities are described in further detail below.

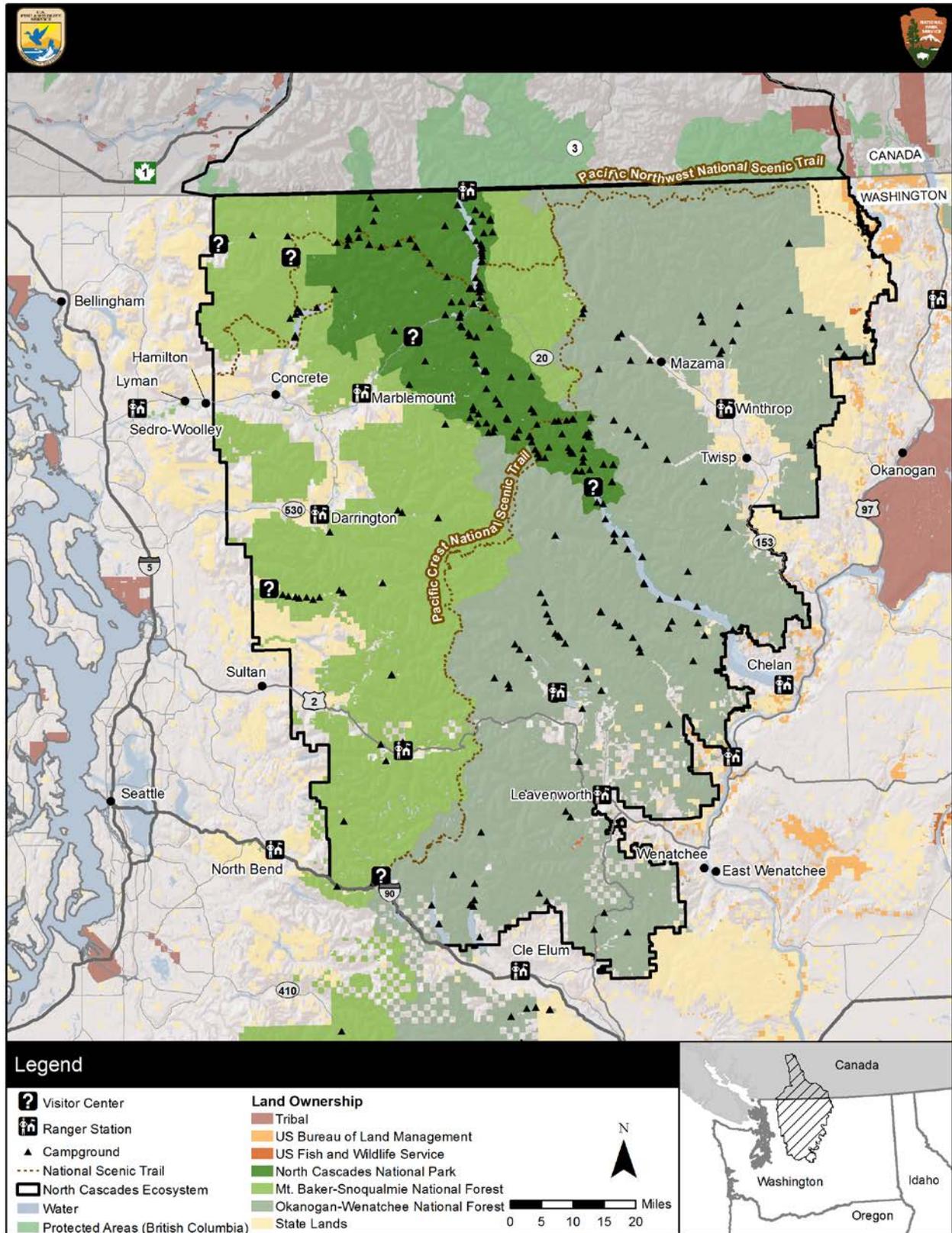


FIGURE 6. RECREATIONAL OPPORTUNITIES IN THE NORTH CASCADES ECOSYSTEM

Guided Recreation

North Cascades National Park issued 75 permits for guided activities during 2013–2014. The majority of these permits (54 permits or 72%) were issued to companies and individual enterprises that provide guided backpacking (including mountaineering and paddling). Nine permits were issued for guided rafting and fishing. Stock packing and day hiking accounted for one and two permits, respectively (Oelfke pers. comm. 2016).

Mt. Baker-Snoqualmie National Forest currently administers over 270 outfitting and guide permits, authorizing over 8,600 service days. However, current permitted outfitting and guiding represents less than 1% of total annual non-ski recreation visits to the forest (Plumage pers. comm. 2016a).

On a yearly basis, Okanogan-Wenatchee National Forest administers approximately 55 priority-use outfitting and guiding permits and 15 temporary permits. Approximately 25,000 service days are used annually, including both priority and temporary use service days. The most popular activities are those involving stock use (i.e., trail rides, pack trips, and wagon rides) (Rohrer pers. comm. 2016).

Camping

The park complex offers a full range of camping experiences, including traditional automobile access camping, boat-in camping, and wilderness/backcountry camping. There are six automobile access campgrounds in the park complex and 25 total boat-in campgrounds between Diablo Lake, Ross Lake, and Lake Chelan (NPS 2015f).

These boat-in camping areas have anywhere from 1 to 22 individual campsites, while the automobile access camping areas range from 1 to 142 individual campsites. Boat docks are present at 3 boat-in camping areas at Diablo Lake, 19 boat-in camping areas at Ross Lake, and 3 boat-in camping areas at Lake Chelan.

Within North Cascades National Park alone, there are 140 backcountry campsites available; all require permits. In June, July, and August 2015, there were 18,648 total backcountry overnight stays within the North Cascades National Park alone (3,451 in June; 7,711 in July; and 7,486 in August) (NPS 2015f). During the same time period, there were 15,216 total backcountry overnight stays in the Ross Lake National Recreation Area (2,587 in June; 6,940 in July; and 5,689 in August) and 3,678 total backcountry overnight stays in the Lake Chelan National Recreation Area (1,223 in June; 1,397 in July; and 1,058 in August) (NPS 2015f).

More than 150 campgrounds and picnic areas are located in Okanogan-Wenatchee National Forest, including group camping areas, dispersed/undeveloped camping areas, and RV camping areas (USFS 2015b). Mt. Baker-Snoqualmie National Forest features 27 designated campgrounds (USFS 2015b).

Hiking

The Washington Trails Association lists 626 hikes in the North Cascades region, which they define as an area inclusive of Mount Baker, the North Cascades Highway (Route 20), the Mountain Loop Highway, Methow/Sawtooth, and Pasayten (Washington Trails Association 2016). The NPS estimates that approximately 400 miles of trails are located in the park complex. Sixty-seven designated trails range significantly in both length and level of difficulty. For example, the Skagit River Loop is a 1.8-mile round trip trail that follows the river and is suitable for all skill levels. By contrast, the Sourdough Mountain Trail is a 10.4-mile roundtrip trail, described as one of the most strenuous hikes in the park and

appropriate for experienced hikers only. It features steep climbs and passes through forest and then meadow communities before arriving at the fire lookout.

There are more than 1,500 miles of designated hiking trails in Mt. Baker-Snoqualmie National Forest and more than 800 miles of trails in Okanogan National Forest (National Forest Foundation 2016). Two National Scenic Trails pass through the recovery area: the Pacific Crest Trail and the Pacific Northwest Trail. The Pacific Crest Trail begins at the Canadian-U.S. border and runs southward through North Cascades National Park, Mt. Baker-Snoqualmie National Forest, and Okanogan-Wenatchee National Forest (USFS 1982). It is one of the original National Scenic Trails established by Congress in the 1968 *National Trails System Act*. The Pacific Northwest Trail passes through the Pasayten Wilderness and other parts of Okanogan-Wenatchee National Forest on the east side of the NCE, and through the Mt. Baker Wilderness and other parts of Mt. Baker-Snoqualmie National Forest on the west side of the NCE. The 63-mile segment that passes through North Cascades National Park and Ross Lake National Recreation Area is a designated National Recreation Trail (NPS 2016d). First proposed in the early 1970s, the Pacific Northwest Trail was designated by Congress as one of eleven National Scenic Trails in the *Omnibus Public Lands Management Act* of 2009.

Climbing

The numerous peaks and glaciers within the NCE present a variety of climbing opportunities, including classic mixed mountaineering routes, intricate glacier travel, sport climbing, bouldering, and scrambling. At 10,781-feet, Mount Baker is the third highest summit in the State of Washington and the most heavily glaciated mountain in the Cascade Range (USGS 2016a). Summit attempts are made year-round, although the warmer months (May–August) are much more popular, given better weather conditions. Of the 8,600 service days, approximately 6,500 of these days are authorized for guides leading trips on Mount Baker for climbing, avalanche training, and other snow related activities. Service days are defined as a day or any part of a day on National Forest System lands for which an outfitter or guide provides goods or services, including transportation, to a client (USDA 2014). There are another documented 4,500 days of use by guides, schools, and civic groups on Mount Baker who are awaiting permits. Within Okanogan-Wenatchee National Forest, popular climbing peaks include: Bonanza Peak, Silver Star Mountain, Black Peak, Mount Fernow, Mount Maude, Seven-Fingered Jack, Gardner Mountain, and North Gardner Mountain (Terry 2015).

Fishing and Water-Based Recreation

The fresh, cold, and often glacially fed lakes, rivers, and streams of the NCE provide ideal habitats to support healthy fish populations, including northwest salmon and steelhead, several species of trout, and a variety of warm-water fish (NPS 2009). Within the park complex, there are dozens of fishing areas; the most notable are Ross Lake, Diablo and Gorge Lakes, and the Stehekin River. The park complex also includes 62 mountain lakes containing introduced fish. These include Lower Thornton, Monogram, McAlester, and Rainbow Lakes.

The WDFW notes high lake trout fishing as a popular activity and lists dozens of high altitude lakes within the national forests, including Kachess Lake, Galena Chain Lakes, Slide Lake, Lake Jauns, and numerous others (WDFW 2016c). Lower altitude fishing spots include Keechelus Lake and Cle Elum Lake as well as many rivers (WDFW 2016c). Boating, swimming, whitewater rafting, water-skiing, jet-skiing, parasailing, kayaking, canoeing, rowing, and tubing are also popular activities on some of the lakes and rivers within the NCE. Motorized boating is permitted in Okanogan-Wenatchee National Forest in four ranger districts (USFS 2016b). Whitewater rafting is permitted in rivers that traverse both Mt. Baker-Snoqualmie National Forest and Okanogan-Wenatchee National Forest. Popular permitted rivers include the Methow, Wenatchee, Sauk, Skagit, Skykomish, Suiattle, and North Fork Nooksack. The

rafting season typically runs from late March to early August. The U.S. Department of Agriculture website lists 16 guides/outfitters for whitewater rafting in Mt. Baker-Snoqualmie National Forest (USFS 2016c).

Winter Sports

Cross country skiing, snowmobiling, and other winter sports opportunities are available in partnership with Methow Trails, Okanogan Valley Nordic Ski Association, Highlands Ski Club, and the Okanogan County Snowmobile Advisory Board. The USFS manages ski/snowboard areas at Crystal Mountain (Lake Chelan 2016), Mount Baker (USFS 2016f), Stevens Pass, the Summit at Snoqualmie, Mission Ridge, Echo Ridge, and Loup Loup Ski Bowl. Skiers accounted for 634,000 national forest visits in the NCE in 2010. Mt. Baker-Snoqualmie National Forest had the most ski-related national forest visits (443,000), followed by Okanogan-Wenatchee National Forest, which had 191,000 skiing-related visits. Dog sledding, snowmobiling, and heli-skiing are also permitted in Okanogan-Wenatchee National Forest (Rohrer pers. comm. 2016).

Other Activities

Within the NCE, the most favored horseback riding trails are located in the southeast section of the park complex, along Bridge Creek (Pacific Crest Trail) and throughout the Lake Chelan National Recreation Area. West side stock trails include the East Bank Trail, the west side of Ross Lake and Big Beaver Trail, and the Thunder Creek Trail (NPS 2016e). Both Mt. Baker-Snoqualmie National Forest and Okanogan-Wenatchee National Forest offer more than 100 horseback riding trails and designated areas (USFS 2016d). The WDFW issues hunting permits for both National Forests, Lake Chelan and Ross Lake Recreation Areas, and several game management units within the NCE (USFS 2016e). Permit holders are allowed to hunt several animals that could be affected by grizzly bears: deer, elk, bighorn sheep, coyote, raccoon, rabbit and hare, and wild turkey (WDFW 2016d).

PUBLIC AND EMPLOYEE SAFETY

Various safety concerns could result from implementation of the alternatives described in this draft plan/EIS. These concerns would apply to park and national forest visitors; local residents; and NPS, FWS, WDFW, and USFS employees and volunteers. Grizzly bear restoration activities would need to be conducted in a manner that would ensure the safety of visitors, employees, local residents, and volunteers.

Public and Employee Safety in the North Cascades National Park Service Complex

North Cascades National Park provides bear safety information on its website and also posts signage and provides interpretive materials at park visitor centers (NPS 2015g). This information was initially generated with a focus on black bear management, but similar safety information and guidance would apply to grizzly bears. To date, no incidents of visitor or employee injury as a result of interaction with bears have been reported in the park (Braaten pers. comm. 2016).

The park provides a list of safety precautions to reduce the risk of negative interactions with bears. These include instructions on safe hiking protocol; proper camp sanitation, cooking, and food storage procedures; proper procedures for camping with pack animals; proper procedures for boat camping; and proper responses to bear encounters. The safety precautions promoted by the park also help to achieve a fundamental goal of the NPS: to keep the wildlife in the protected areas of the NCE wild and neither attracted to nor dependent on people (NPS 2015g).

The NPS requires proper storage of food and other attractants (Title 36 CFR chapter 1, section 2.10(d) and section 2.2(a)(2)) anywhere within park boundaries. Visitors obtaining permits for backcountry camping receive information about storage, safety, and wildlife concerns as a part of the permitting process. Bear-resistant food storage canisters are available for loan at the Wilderness Information Center in Marblemount; visitor contact stations in Sedro-Woolley and Glacier; and the Golden West Visitor Center (Braaten pers. comm. 2016). Many of the developed campgrounds are equipped with bear-resistant trash receptacles, and NPS is currently in the process of replacing all standard trash receptacles at campgrounds with bear-resistant units (Braaten pers. comm. 2016). Some developed campgrounds, including all boat-in campgrounds, are also equipped with food storage lockers (NPS 2015g). In addition, some of the backcountry campgrounds are equipped with poles or wires, provided for hanging food out of the reach of bears (NPS 2015g). Many backcountry campgrounds are not equipped with bear-resistant infrastructure; however, when campsites are moved or upgraded they are designed to have separate cooking and food storage areas roughly 100 feet from tent pads (Braaten pers. comm. 2016).

The park encourages reporting of bear interactions, and implements a number of procedures to respond to conflict bears (bears that have become habituated to humans or conditioned to human foods). Typically the response to a negative interaction between a visitor and a conflict bear could involve the following (Braaten pers. comm. 2016):

- Finding and removing or securing a bear attractant (always done).
- Increased public outreach efforts in areas where human-bear conflict has been reported, by means of signage and increased visitor interaction with interpretive, wilderness, and law enforcement staff (always done).
- Campground closures; temporary (2–4 week) closures have been used previously in some backcountry areas (rarely necessary).
- Use of aversive conditioning and/or on-site release if the bear returns (infrequently done; it is not typical for a bear to return once an attractant has been removed). The NPS has obtained assistance from the WDFW's Karelian Bear Dog program to provide aversive conditioning to black bears frequenting front-country areas (Braaten pers. comm. 2016).
- Relocation of conflict bears. Relocation is very rarely used and occurs only when no other options are available. Relocations are less effective and lead to higher mortality rates than remediating the source of the problem and employing on-site releases (Clark et al. 2002, 2003; Landriault et al. 2009).

National Forest Lands

WDFW has primary responsibility for bear management and conflict bear response on National Forest land. WDFW implements a number of ongoing efforts to educate the public about bear safety, including providing bear safety information and materials on the agency website and community engagement by district biologists and assistant biologists. WDFW also maintains online system for collecting dangerous wildlife incident reports and makes enhanced efforts to promote bear safety when notified about specific incidents, such as bears near schools or neighborhoods (Gardner pers. comm. 2016).

The WDFW works with property owners and renters, homeowner and neighborhood associations, schools, and others living and working in bear country, to educate them about bears and bear biology, and to remove attractants to prevent bears from foraging for food on these properties. As communities continue to expand into bear habitat and the wild-urban interface increases, it is expected that some bears and other wildlife will use developed sites. Bears which are not foraging for human foods or exhibiting dangerous behaviors, but are in proximity to houses, schools, parks, and/or other public areas can be

successfully and preemptively encouraged to avoid human activity by use of on-site releases, less-lethal ammunition and specially-trained Karelian Bear Dogs. Conflict bears may receive aversive conditioning via the same methods. On-site releases of conflict bears are highly effective when attractants have been secured, and this method is used when and where possible. The removal of attractants is critical to the success rate for both non-conflict and conflict bears. A list and map of nearby gateway communities is provided in the “Socioeconomics” section following this section.

Relocation is used when a bear is captured in areas where there is no clear route from the point of capture for the bear to move to appropriate bear habitat or wilderness areas. Under WDFW policy, there are designated release areas for relocation of bears, which are determined by the WDFW Wildlife Program. Karelian bear dogs are used at the point of release when bears are captured and relocated to condition the bear and for WDFW employee safety (Gardner pers. comm. 2016).

In addition to the efforts undertaken by WDFW, the USFS provides safety information on various subjects, including bear safety, at the forest headquarters and district ranger stations. Signs placed at developed campgrounds and most trailheads provide information on bears, how to keep a clean camp, and how to behave in the event of a bear encounter. All employees, contractors, permittees, outfitters and guides are required to store food, garbage and other attractants using proper bear-resistant techniques. Employees are responsible for providing information to the public on proper storage techniques for food and garbage. Information on public safety tips and warnings is provided on the forest websites and at times is covered during weekly radio interviews. If a bear is frequenting a campground, trailhead, or other National Forest facility where it is frequently being encountered by humans at close range, USFS notifies and works cooperatively with WDFW to resolve the conflict. In some instances, temporary closures of campgrounds have been enforced until a conflict bear is captured by the WDFW or moves on (Rohrer pers. comm. 2016).

SOCIOECONOMICS

It is possible that grizzly bear restoration in the NCE could result in socioeconomic impacts within the NCE and the surrounding region. The regional economic context for these potential impacts is described below. The region of influence (ROI) for this socioeconomic analysis includes the seven counties that fall within the boundaries of the NCE, since any impacts associated with grizzly bear restoration within the NCE are most likely to be perceptible in these counties. In addition, these seven counties represent the area within which the primary and secondary economic impacts of the project are likely to occur. Furthermore, NPS defines gateway regions that are impacted by parks as communities located within 20 miles of a park, which this seven-county ROI encompasses. The seven-county ROI includes Chelan, King, Kittitas, Okanogan, Skagit, Snohomish, and Whatcom counties. While these counties contain several larger cities, including Bellingham, Everett, Seattle, and Wenatchee, the NCE is located in a predominantly rural area away from large urban areas. The area that covers the NCE comprises approximately 52% of the total land area of the ROI. In addition, information on the state of Washington is presented below to provide overall context associated with areas within and adjacent to the NCE where bears may move.

Human Activity in the Region of Influence and Influence on Bears

Almack et al. (1993) and Gaines et al. (1994) mapped out areas of human activity in the NCE including roads, timber operations, livestock grazing, population centers, campgrounds, and other recreation areas (e.g., ski areas, air strips, etc.). Both studies found that the majority of the NCE (68%) was free of open roads; only small portions of Okanogan-Wenatchee National Forest were grazed (11% for Okanogan and 3% for Wenatchee); and a small percentage (4%) of the area in the NCE was within a large zone of

influence around population centers and other areas. Almack et al. (1993) concludes that the level of human activities within the NCE at the time of the study did not preclude the recovery of a viable population of grizzly bears. A 2016 grizzly bear carrying capacity modeling report by Lyons et al. (2016) similarly concludes that the current level of human activities within the NCE, notably the influence of roads, would still allow for the restoration of a viable population of grizzly bears.

Population

Table 6 provides the total population count for the State of Washington and for each of the counties within the ROI. Between 2000 and 2013, the population of the ROI grew by 15.4% from approximately 2.75 million to 3.2 million people, comprising a little less than half the state's total population (U.S. Census Bureau 2013). King County was the most populated county in the ROI between 2000 and 2013, representing 60.8% of the total population of the ROI on average, annually, between 2009 and 2013.

TABLE 6. TOTAL POPULATION

| Geographic Area | 2000 | 2013* | % Change 2000–2013 |
|------------------------|-------------|--------------|---------------------------|
| Washington | 5,894,121 | 6,819,579 | 15.7% |
| ROI | 2,752,393 | 3,175,527 | 15.4% |
| Chelan | 66,616 | 73,047 | 9.7% |
| King | 1,737,034 | 1,974,567 | 13.7% |
| Kittitas | 33,362 | 41,291 | 23.8% |
| Okanogan | 39,564 | 41,143 | 4.0% |
| Skagit | 102,979 | 117,641 | 14.2% |
| Snohomish | 606,024 | 724,627 | 19.6% |
| Whatcom | 166,814 | 203,211 | 21.8% |

Source: U.S. Census 2013

* These numbers represent average, annual statistics from 2009 through 2013.

The majority of the population base of the ROI lives closer to Puget Sound and urban areas such as Bellingham, Mount Vernon, Everett, and Seattle. The NCE and the immediately surrounding areas are sparsely populated, as indicated by figure 7, which shows the population density of the NCE and the surrounding area.

Gateway Communities

Gateway communities are those cities and towns that are geographically close to the NCE and derive some measurable economic benefit from tourism and related activities within the NCE. For the purposes of this document, these communities are generally located within approximately 20 miles of the NCE (figure 8).

Gateway communities differ from other communities within the State of Washington largely because of their relationship with the park complex, Mt. Baker-Snoqualmie National Forest, and Okanogan-Wenatchee National Forest. Some of these communities have a history of tourism, while others are a stop for travelers en route to destinations within the NCE. Historically, a number of these communities relied on agriculture, timber, and mining, but have shifted their focus to tourism and related activities against the backdrop of the current economic landscape. That is, these historic industries are less lucrative and/or less available given changes in resource demand, technology, and growing dependency on non-local resources (WA State Employment Security Department 2016).

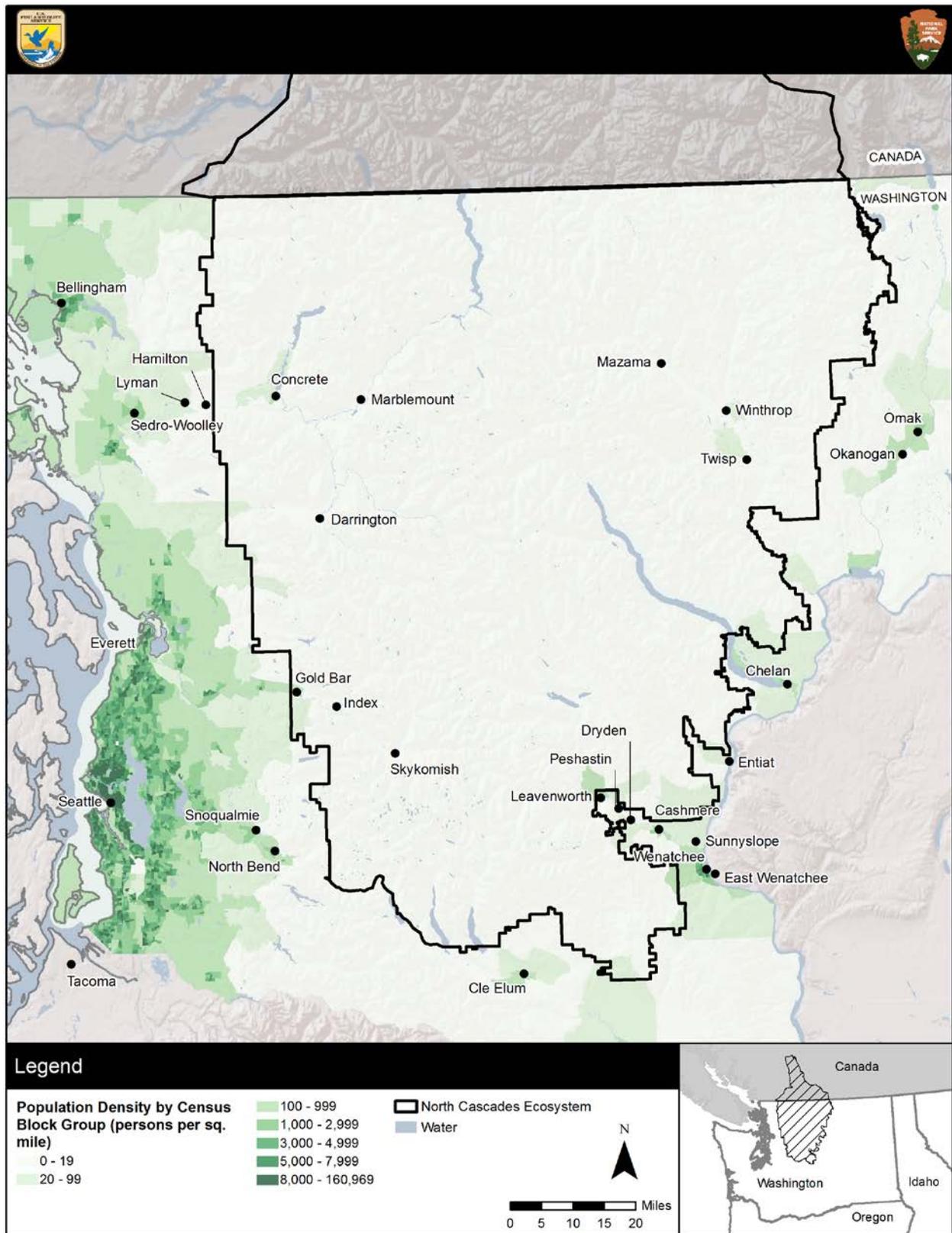


FIGURE 7. POPULATION DENSITY IN THE NORTH CASCADES ECOSYSTEM

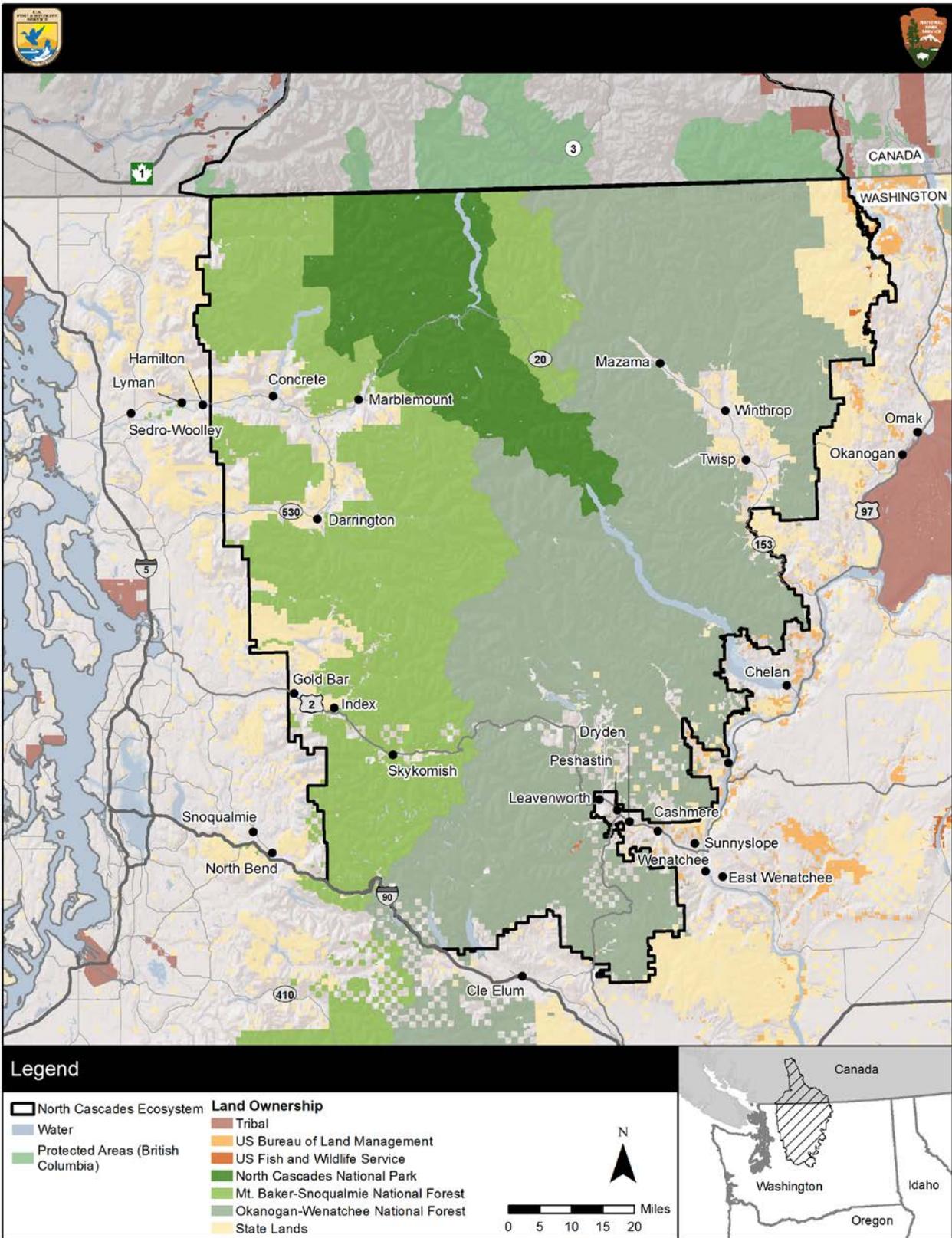


FIGURE 8. GATEWAY COMMUNITIES IN THE NORTH CASCADES ECOSYSTEM

Table 7 provides a list of gateway communities within the ROI, and respective population counts.

TABLE 7. POPULATION OF GATEWAY COMMUNITIES IN OR ADJACENT TO THE NORTH CASCADES ECOSYSTEM

| Name | Population (2010-2014) |
|----------------|------------------------|
| Cashmere | 3,118 |
| Chelan | 3,890 |
| Cle Elum | 1,872 |
| Concrete | 705 |
| Darrington | 1,347 |
| Dryden | N/A* |
| East Wenatchee | 13,403 |
| Entiat | 1,259 |
| Gold Bar | 2,328 |
| Hamilton | 301 |
| Index | 196 |
| Leavenworth | 1,965 |
| Lyman | 438 |
| Marblemount | 203 |
| Mazama | N/A* |
| North Bend | 5,951 |
| Okanogan | 2,552 |
| Omak | 4,845 |
| Peshastin | N/A* |
| Sedro-Woolley | 10,540 |
| Skykomish | 133 |
| Snoqualmie | 11,087 |
| Sunnyslope | 3,572 |
| Twisp | 919 |
| Wenatchee | 31,925 |
| Winthrop | 394 |

Source: U.S. Census Bureau 2013

*Note: *Note: The Census does not provide population data for the towns of Dryden, Mazama, or Peshastin in the state of Washington. Population statistics are presented as the annual average population between 2010 and 2014.

Tourism

Travel spending in Washington State generated \$1.8 billion in local, state, and federal tax revenues in 2011 (Dean Runyan Associates 2012). This spending includes dollars spent on gas, lodging, photography, hunting, horseback riding, camping, or food services. Nearly 200,000 jobs are supported in Washington State as a result of outdoor recreation spending. A total of about 122,600 jobs, or about 62%, are from

expenditures associated with outdoor recreation on public lands (Earth Economics 2015). As described in the “Visitor Use and Recreational Experience” section, both Mt. Baker-Snoqualmie National Forest and Okanogan-Wenatchee National Forest offer horseback riding and stock trails and designated areas (USFS 2016d). The WDFW issues hunting permits for both national forests and Lake Chelan and Ross Lake Recreation Areas, which include several game management units within the NCE (USFS 2016e). Tourism spending associated with hunting and horseback riding supports local jobs and income in the ROI.

An NPS report shows that there were 769,837 visitors to the park complex in 2014, and that these visitors spent \$33,534,400 in gateway communities near the park complex (NPS 2015h). That spending supported 416 jobs in the local area and had an aggregate benefit to the local economy of \$40,582,400. According to the report, most park visitor spending was for lodging (30.6%) followed by food and beverages (20.3%), gas and oil (11.9%), admissions and fees (10.2%) and souvenirs and other expenses (9.9%) (NPS 2015h). Spending segments differed markedly in the amount of spending per party. In general, visitors from outside the local area spent more than those from the local area. Visitors on overnight trips away from home typically incur lodging expenses (hotel or campground fees), whereas those on day trips do not. Overnight visitors also generally need to purchase more food and fuel during their trip than those on day trips (NPS 2015h). Many people use State Highway 20 as a route to travel east to west through the mountains, coincidentally passing through the park complex, and being counted as visitors.

Agriculture and Livestock Grazing

There were 9,396 farms in the ROI in 2012. This represents approximately one quarter of the total number of farms in the State of Washington (37,249) in that year. Washington had approximately 14.7 million acres of land dedicated to farming in 2012, while the ROI had approximately 1.8 million acres or 12.2% of the state’s total acreage (USDA 2012). Within the NCE, agricultural operations exist along low-lying valley bottoms and consist primarily of irrigated pasture land, alfalfa, wheat, some corn, and other feed crops in western areas and fruit orchards along the eastern border of the ecoregion (USGS 2016b).

In 2012, there were 11,861 cattle and calf farms in the State of Washington with 1,162,792 head of cattle. Within the ROI, there were 3,004 cattle and calf farms with 221,884 head of cattle in that same year. Net cash farm income from operations equaled \$147.5 million in 2012 in the ROI, compared to \$1.75 billion for the State of Washington. The average net cash farm income from operations per farm in the ROI was just under \$17,000. This is approximately one third of the average net cash farm income from operations per farm in the State of Washington (~\$47,000) (USDA 2012).

As of 2015, 773,788 acres of land were actively leased for cattle and sheep grazing on Okanogan-Wenatchee National Forest. Leases were distributed among six ranger districts: Methow Valley, Tonasket, Entiat, Wenatchee River, Cle Elum, and Naches. The majority of the acreage under lease for grazing within the NCE (320,044 acres) was in the Methow Valley Ranger District. The Chelan District has nine grazing allotments, but they are all currently vacant (no permit). Most of the acreage leased on Okanogan-Wenatchee National Forest was for cattle grazing. The annual grazing fee in 2015 was \$1.69 per animal unit month (AUM). One AUM is defined as the amount of forage required to feed an animal unit for 1 month. Fees for 2016 were \$2.11 per AUM. There are no grazing leases on Mt. Baker-Snoqualmie National Forest.

The 2015 Okanogan-Wenatchee Allotment Information Sheet reported that on national forests within the NCE, there are 4,151 AUMs of permitted sheep and 47,686 AUMs of permitted cattle grazing. Currently 4,100 ewe/lamb pairs graze and there is authorization for 4,552 cow/calf pairs to graze during the summer on National Forest Service allotments within the NCE. No livestock are present within the park complex. Figure 9 details agricultural leases located within the NCE.

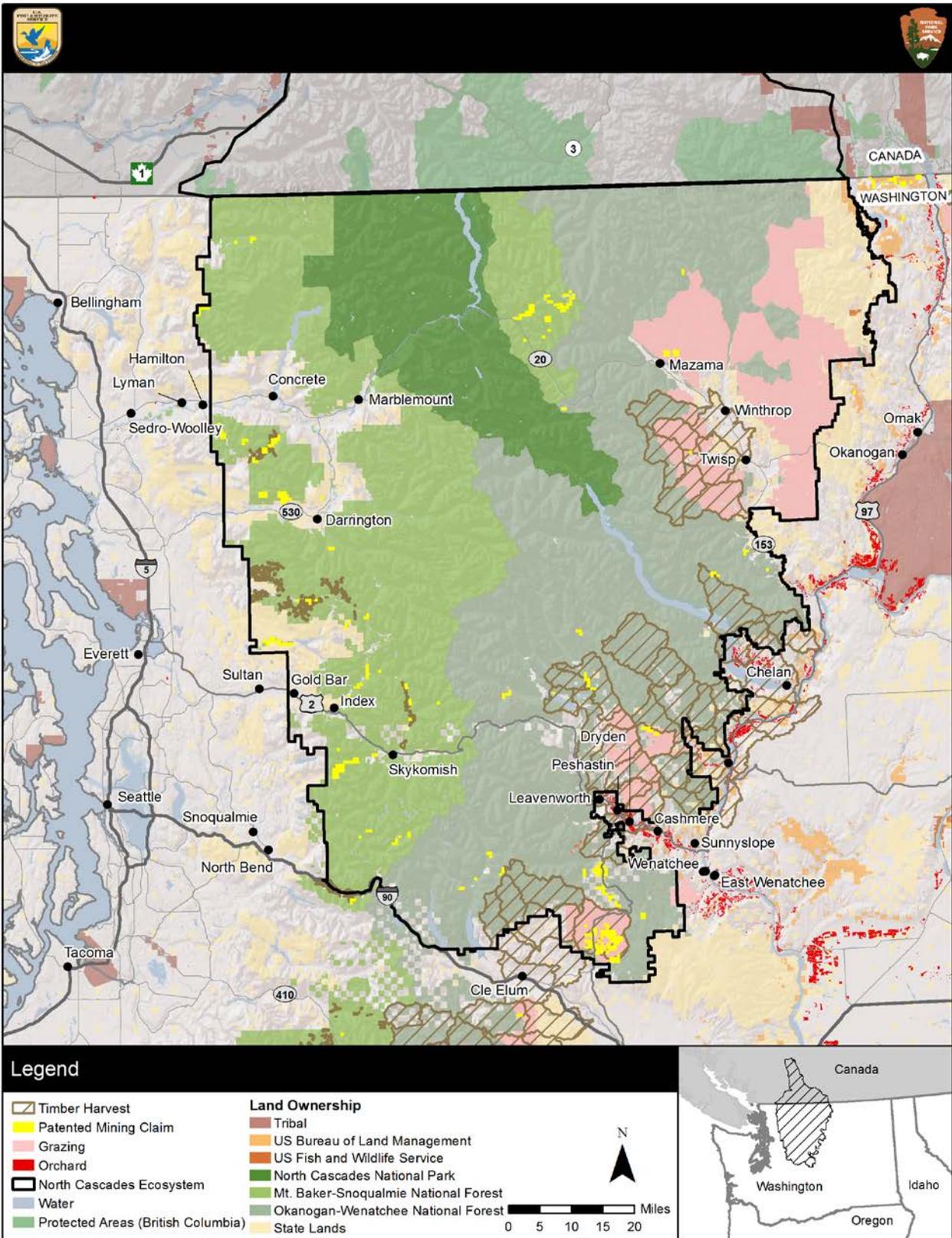


FIGURE 9. ECONOMIC ACTIVITY IN THE NORTH CASCADES ECOSYSTEM

Timber Harvest

Since 2010, the annual volume of timber harvested within Mt. Baker-Snoqualmie National Forest has varied from a low of approximately 7.2 million board feet to a high of approximately 17.7 million board feet, averaging approximately 10.2 million board feet per year. Annual timber sale values, over the same time period, reached a low of \$236,420 and high of \$1,965,025, averaging \$920,768 per year. Based on USFS projections, approximately 8.0 million board feet of timber is estimated to be harvested in 2016. Timber harvest activity on these lands will include thinning and regeneration of early seral forest habitat (Plumage pers. comm. 2016a). In the 10-year period between 2006 through 2015, the annual volume of timber harvested within Okanogan-Wenatchee National Forest varied from a low of 22.3 million board feet in 2014 to a high of 54 million board feet in 2008, averaging 39.4 million board feet per year. Annual timber sales over the same period reach a low of \$689,954 in 2015 and a high of \$3,266,667 in 2006 (Rohrer pers. comm. 2016).

Timber harvest occurs to a greater extent on private lands at lower elevations along the periphery of the ecosystem, rather than on federal lands. This is due in part to conservation policies and federal endangered species protection. According to U.S. Geological Survey, there has been a general decline in logging activity since 1992 (USGS 2016b). Figure 9 details timber harvest leases located within the NCE. Additionally, a number of private companies have timber operations located within or close to the northwestern NCE, including Weyerhaeuser, Sierra Pacific Industries, Hampton Lumber Company, and Merrill and Ring.

Mining

Locatable minerals are those minerals which, when found in valuable deposits, can be acquired under the General Mining Laws of 1872 (as amended). Examples of locatable minerals occurring on Mt. Baker-Snoqualmie National Forest include copper, gold, molybdenum, tungsten, olivine, chromite, nickel, zinc, silver, lead, and uncommon varieties of limestone, gemstones, and other minerals having unique and special values (Plumage pers. comm. 2016b).

Mt. Baker-Snoqualmie National Forest has a history of mining, dating back to the late 1800s. A total of 148,187 acres within the forest have a moderate to high potential for development of locatable minerals (USFS 1990). There are currently approximately 207 unpatented mining claims (Plumage pers. comm. 2016b) on the forest, with the majority of these being located in the Middle and North Fork Snoqualmie, Finney Block, Sultan Basin, and the Twin Sisters area. Approximately 60 unpatented mining claims are within grizzly bear core habitat (Plumage pers. comm. 2016b).

There are more than 13,000 mining claims on Okanogan-Wenatchee National Forest, covering more than 250,000 acres. Mineral resources on Okanogan-Wenatchee National Forest include but are not limited to asbestos, coal, copper, geothermal, gold, iron, lead, limestone, oil and gas, sand and gravel, silver, stone, and zinc. Additionally, more than 375,000 tons of sand, gravel, and stone are mined on Okanogan-Wenatchee National Forest annually (Rohrer pers. comm. 2016). Figure 9 details mining claims with the NCE.

ETHNOGRAPHIC RESOURCES

Archaeological evidence from the northern Cascades indicates that the area has been occupied for more than 9,600 years (NPS 2012c). Evidence for long-term use of the Cascades comes from the Cascade Pass archaeological site, the oldest radiocarbon dated site (9,600 years ago) in the park complex and the oldest known alpine site in the state of Washington (NPS 2011c). It is also evident in the Ross Lake area where hydropower development has led to more intensive archaeological research than in other interior areas of

the Cascades (NPS 2012c). Although there are few recorded sites within the interior, likely due to limited survey efforts, this area of the Cascades was important for Native American people who relied on the ecosystem for resources and was likely heavily used on a seasonal basis. Okanogan-Wenatchee National Forest has documented more than 2,500 heritage resources on its lands. These resources include seasonal hunting, gathering and fishing camps as well as large permanent villages associated with past Native American people. The archaeological record on the national forests supports the use of the Cascades as far back as 9,000 years ago with permanent villages being established 2,000–3,000 years ago.

Native American people inhabited the Cascades when Euro-American people arrived in the 1800s and continue to reside in and/or utilize resources within the area up to the present day. In 1855, two treaties were negotiated by Governor Isaac I. Stevens, the Treaty of Point Elliot and the Treaty with the Yakama, in order to move the tribes onto reservations (Boxberger 1996). Governor Stevens had been directed to consolidate the tribes on as few reservations as possible; therefore, the reservations created through these treaties are often occupied by a confederation of tribes (Boxberger 1996). Both of these treaties include a “subsistence clause,” which allowed the signatory tribes to fish at all “usual and accustomed places” and to hunt and gather on “open and unclaimed lands” that had been ceded to the U.S. government as part of the treaty (Boxberger 1996). The Confederated Tribes of the Colville Reservation are the only tribe not covered by either of these treaties. Instead, they were recognized through an executive order in 1872.

The descendants of the peoples who traditionally used the northern Cascades prehistorically and historically now reside within the following tribes: the Confederated Tribes of the Colville Reservation, the Lummi Nation, the Muckleshoot Indian Tribe, Nooksack Indian Tribe, Sauk-Suiattle Indian Tribe, the Swinomish Indian Tribal Community, the Snoqualmie Tribe, the Stillaguamish Tribe of Indians, the Tulalip Tribe, the Upper Skagit Tribe, the Yakama Indian Nation, Suquamish Tribe, and the Samish Indian Nation. These tribes retain important ties to the northern Cascades either through continued use of the lands for traditional practices (e.g., hunting and fishing, ceremonies, etc.) and/or through connections to the land that are documented in oral histories that continue to be important for tribal practices. All treaty tribes retain rights to hunt and gather on their ceded lands where it is consistent with existing management. Also, the NPS has recently changed its regulations to allow all federally recognized tribes to gather plants for traditional use following the development of an agreement between the park and tribe (81 *Federal Register* [FR] 45024–45039, 2016).

Ethnographic resources are defined as “landscapes, objects, plants and animals, or sites and structures that are important to a people’s sense of purpose or way of life” (NPS 2016f). These resources are defined by the community to which they are important. The tribes that maintain connections to the northern Cascades have documented ethnographic resources within North Cascades National Park and the Ross Lake and Lake Chelan National Recreation Areas. These types of resources are likely present within USFS lands but the USFS does not use the same terminology; instead they are likely documented as heritage resources or traditional cultural properties. Previous research indicates that other ethnographic resources, such as traditional gathering, hunting and fishing areas, or areas of spiritual or ceremonial use, are also likely present within the northern Cascades (Boxberger 1996; Ford 1993).

In addition to the types of resources above, ethnographic resources can include animals that are important to a community’s way of life, such as those that serve a prominent role in oral histories and continuing cultural traditions (e.g., are hunted for meat and hides or to obtain parts important for ceremonies). The grizzly bear is an important part of tribal culture and history in the Pacific Northwest, and it is anticipated that the grizzly bear itself is an ethnographic resource to the Native American people who maintain connections to the northern Cascades. Therefore, the decline or restoration of grizzly bears would likely affect these people in various ways. While the tribes that reside on the west and east sides of the range are culturally different, the grizzly bear is considered important by each group. This importance is documented in the archaeological record, via ethnographic resources, and in the oral histories of the tribes

(Clark 1963; Collins 1974; Ford 1993; Hallowell 1926; Hill-Tout and Maud 1978; Lyman 1986). Grizzly bears were hunted for food, pelts, and ritual objects (e.g., claws and teeth) and were important for tribal ceremonies (Ford 1993; Hallowell 1926). Additionally, the importance of the grizzly bear is reflected in traditional place names within the NCE.

The skeletal remains of grizzlies have been identified in the archaeological record of eastern Washington. A 1986 study by Lee Lyman identified grizzly bear skeletal remains in five archaeological sites that dated from 9000 Before Present to as recent as 850 Before Present. Some of these remains were found in archaeological sites outside of what is considered the traditional territory of the grizzly bear (Lyman 1986). Lyman notes that in more recent period, the Native American groups living in eastern Washington hunted both black and grizzly bears for meat and hides but that the grizzly bear was considered important for ceremonial purposes (Lyman 1986). Therefore, the bones may have been obtained within the traditional territory of the grizzly bear and transported to other places. That remains were only found in five sites does not mean that the grizzly bear was not used by Native American people elsewhere; instead it is likely related to the amount of archaeological research conducted in some areas and the unlikelihood that faunal remains were preserved within the record.

The importance of the grizzly bear to Native American people is documented in ethnographic literature. A 1926 dissertation on the importance of the grizzly bear to Native people in the Northern Hemisphere relies on ethnographic information to detail how people hunted grizzly bears, the linguistics associated with the animal, and ceremonies that featured the grizzly bear, to name a few topics (Hallowell 1926). This research detailed the importance of the grizzly bear to the people of the Northwest coast as well as the interior Columbia Plateau area (Hallowell 1926). Not only does this research provide information on the use of grizzlies at the time that Euro Americans came in contact with Native Peoples, it also includes discussions on the portrayal of grizzlies in oral histories within each geographic area. The grizzly bear features prominently in several Northwest Native American oral histories, some of which have been published (see Hill-Tout and Maud 1978 and Clark 1963) and others which have been gathered during oral history projects like that completed by Western Washington University between 1963 and 1973 (Archives West 2016).

The most important sources of information on ethnographic resources are the tribes themselves. The presence of ethnographic resources and the potential impacts of the proposed alternatives on those resources are determined by the tribes that continue to use the area. The FWS and NPS have initiated consultation with the tribes listed above regarding this project and consultation is ongoing. A letter was sent to every federally recognized tribe in Washington State. The potential safety impacts on tribal members hunting or gathering within the NCE are considered to be the same as those for other visitors and are addressed in “Public and Employee Safety.”