

Chapter 3:
Affected Environment



CHAPTER 3: AFFECTED ENVIRONMENT

INTRODUCTION

The “Affected Environment” describes existing conditions for those elements of the natural and cultural environments that could be affected by implementing the alternatives considered in this *Mountain Goat Management Plan / Environmental Impact Statement* (plan/EIS). These include (1) areas of Olympic National Park and Olympic National Forest on the Olympic Peninsula, from where mountain goats could be removed; and (2) areas in the North Cascades national forests, where mountain goats could be translocated. This Affected Environment chapter is therefore divided into two subsections addressing the affected environment of the Olympic Peninsula in Part One, followed by the North Cascades national forests in Part Two.

On the Olympic Peninsula, mountain goat habitat comprises approximately 150,000 acres of high-elevation alpine and subalpine lands that are free of glacial ice and above 4,675 feet in elevation and within approximately 360 feet of steep rocky slopes (Jenkins et al. 2011a, 2016). Therefore, management activities associated with this plan/EIS would take place primarily above 4,000 feet, but some activity could take place in lower elevation areas during winter months. Management activities associated with alternatives B, C, and D would require multiple staging areas (as described in chapter 2) located strategically on both National Park Service (NPS) and National Forest System (NFS) lands. The discussion of the affected environment is limited to only those resources that may be affected by actions taken in identified mountain goat habitat and surrounding the staging areas (see figure 5 in chapter 2). The natural environment components addressed in this plan/EIS for the Olympic Peninsula include mountain goats, wilderness character, wildlife and wildlife habitat, vegetation, threatened or endangered species, acoustic environment, and soils. The cultural component addressed is archeological resources. Visitor use and experience and visitor and employee safety are also addressed. The influence of climate change on impact topics that may be affected by actions taken in this plan/EIS are described in the appropriate impact topic section in “Chapter 4, Environmental Consequences.”

For the North Cascades national forests, discussion of the affected environment is limited to resources in the Mt. Baker-Snoqualmie National Forest and Okanogan-Wenatchee National Forest, and includes the following topics: wilderness character, visitor use and experience, visitor and employee safety, threatened or endangered species, wildlife including sensitive and management indicator species, and vegetation.

PART ONE – OLYMPIC PENINSULA

GENERAL PROJECT SETTING

Olympic National Park

The park encompasses 922,651 acres of three distinct ecosystems on the Olympic Peninsula: rugged glacier-capped mountains, more than 70 miles of wild Pacific coast, and vast stands of old-growth and temperate rain forest. The park includes one of the largest wilderness areas in the contiguous United States; 95% (876,447 acres) of the park is designated as the Daniel J. Evans

Wilderness, offering visitors a chance to experience the diversity of the park in its natural state. The park includes habitat for more than 1,100 species of native plants, nearly 300 species of birds, and nearly

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65 species of mammals. The isolated peninsula has at least 24 endemic taxa—16 fauna and 8 flora—that are not found anywhere else on earth (NPS 2008a, 2010b).

Olympic National Forest

Similar to the park, Olympic National Forest encompasses a broad diversity of the landscapes present on the Olympic Peninsula, from rain forests to deep canyons to high mountain ridges to ocean beaches. This diverse forest reaches the mid-elevations of the Olympic Mountains and surrounds Olympic National Park. The forest includes 88,265 acres of designated wilderness, all of which lies adjacent to the park boundary (FS 2016a).

MOUNTAIN GOATS

Mountain goats (*Oreamnos americanus*) are native to the alpine regions of North America from southeastern Alaska to Washington, Idaho, western Montana, and likely portions of Oregon (Matthews and Heath 2008). The species was introduced to areas outside of their historical range throughout the 1900s, including the Olympic Mountains of Washington. Over the last century, mountain goats have become established across most of Olympic National Park (Innes 2011; Houston, Schreiner, and Moorhead 1994).

Mountain goats are hoofed mammals known as ungulates. They inhabit high-elevation alpine and subalpine habitats, and are most prevalent in areas with rugged and steep terrain and cool areas with persistent snow. Mountain goats are typically reclusive, but will occasionally approach humans. In some areas where un hunted populations come into repeated contact with humans, mountain goats have become habituated to the presence of humans, allowing people to approach closely and at times approaching people (appendix A; Holyrod 1967). When threatened or alarmed, mountain goats will seek steep rocky areas, often referred to as escape terrain.

Mountain goats have a thick white coat with brown hairs sometimes present. Both males and females have black horns that are approximately 8 to 10 inches long. The body sizes of males and females remain the same for approximately the first 3 years of development. Mature males typically weigh between approximately 210 and 350 pounds, whereas females range from 130 to 165 pounds (Côté and Festa-Bianchet 2003). Mountain goats tend to gain the most body mass each year between early June and mid-September, which is due to changes in fat and protein accumulation from increased forage availability and quality (Festa-Bianchet and Côté 2008; Ellis et al. 2007).

Although they can congregate in large groups of up to 100 animals, mountain goats in most portions of their range occur in small groups that range from two to more than a few dozen animals, composed of adult females (nannies), their dependent young (kids), and occasionally a few associated males and females (WDFW 2016b). Adult males (billies) are usually solitary or found in small groups except during the breeding season (rut) when they seek out breeding females. Within groups, mountain goats have an established hierarchy and a fair amount of intraspecific aggression. Males and females both have sharp horns that can cause severe injury. Consequently, mountain goats have evolved behaviors in which dominance and aggression are communicated through display and aggressive contact is avoided, minimizing the chance for injury (appendix A).

In most situations, female mountain goats are dominant to males, and dominance appears to increase with age. Dominance status has been observed to persist even after horns are lost. The breeding season generally begins in October and extends through December (Geist 1964). Onset of sexual maturity usually ranges from 2 to 4 years of age in females and from 2 to 3 years of age in males. Typically, only the most mature and dominant males breed. Behavior of billies during rut includes pitting and brush

rubbing. Pitting involves a male mountain goat sitting on the ground with an arched neck and head looking toward the ground. The male then paws quickly and vigorously with a front leg, throwing snow and dirt at his belly, hind legs, and flanks creating a rutting pit. This often results in males having a “dirty trousers” appearance of dark patches on flanks, rump, and bellies (Geist 1964). Brush rubbing involves a male standing and rubbing glands located at the base of its horns on shrubs or bunches of grass by brushing the frontal area of its skull from side to side (appendix A). Males attempt to court individual females or females in small bands (groups consisting of multiple mountain goats) (Ellis et al. 2007). After a female accepts a male’s courtship, he may become part of her nursery band (Geist 1964). Nursery bands usually consist of four to five individuals, but many increase to 15 to 20 after young are born (Blood 2000).

The gestation period for female mountain goats usually ranges between 185 and 195 days, with young often being born between May and June. Female mountain goats usually have one kid per gestation period; however, they can produce twins when conditions are favorable. During parturition, females may isolate themselves from other mountain goats. Mountain goat offspring are precocial (able to move freely) within about 45 minutes of birth (Ellis et al. 2007). Young will likely begin to consume vegetation at 1 week old and are weaned at 4 months. After approximately 2 weeks of seclusion post-birth, the mother and offspring return to the nursing band (Côté and Festa-Bianchet 2003; Peek 2000; Festa-Bianchet and Côté 2008; Toweill et al. 2004).

In the Olympic Mountains, mountain goats mostly occupy high-elevation alpine and subalpine vegetation communities at or above treeline, which generally averages approximately 4,750 feet in the central Olympic Mountains (Jenkins et al. 2011a). Specifically, mountain goats spend summer at elevations between 3,986 feet and 5,862 feet and winter on steep south- and southeast-facing rock outcrops and cliffs between 2,680 feet and 5,056 feet. Use of the landscape by mountain goats is largely dependent on forage availability, which is mainly influenced by snow cover or moisture availability. In summer, foraging mountain goats typically occupy alpine and subalpine meadows. In winter, their habitat use is determined by snow depth and hardness, and the amount of palatable vegetation exposed by wind. Male mountain goats may forage below the tree line during winter, where snow accumulation is limited by tree canopy cover (Côté and Festa-Bianchet 2003; Gross et al. 2002; Schreiner and Woodward 1994).



Sub-alpine habitat in Olympic National Park

Mountain goats are generalist herbivores, consuming a variety of herbaceous and woody plants. They will select highly nutritious flowers, seed heads, and growing leaves when available. Moreover, mountain goats consume underground plant structures, including fern rhizomes, roots, bulbs, and tubers. Their summer diet consists of approximately 52% grasses, 30% forbs, and 16% browse of woody plants. In the winter, the mountain goat’s diet shifts to approximately 60% grasses, 8% forbs, and 32% browse (leaves and soft shoots of coniferous and deciduous vegetation). Vegetative genera consumed in these seasons include species in the following genera: *Poa* (grasses), *Agropyron* (grasses), *Festuca* (grasses), *Koeleria* (grasses), *Carex* (sedges), *Mertensia* (forbs), *Salix* (shrubs), *Picea* (spruce), *Abies* (fir), and *Betula* (birch) (Houston, Schreiner, and Moorhead 1994; Côté and Festa-Bianchet 2003).

Some mountain goat populations have distinct summer and winter ranges, whereas others remain in the same area throughout the year. Annual mountain goat home range sizes vary from 2 to 10 square miles. Summer ranges are often larger than winter ranges, as winter ranges can be reduced to less than 1 square mile. Furthermore, migration distances vary from 1 mile to 10 miles (Côté and Festa-Bianchet 2003; Gross et al. 2002; Houston, Schreiner, and Moorhead 1994; Johnson and Lockard 1983).

Natural or man-made mineral sources used by mountain goats provide minerals (e.g., sodium, magnesium, and sulfur) and buffering compounds (carbonates and clays) important to mountain goat nutrition and digestion. Natural mineral sources used by mountain goats may be dry-earth or wet, although mountain goats appear to prefer dry-earth sources. Mountain goats will travel long distances in order to reach these mineral sources, often at the risk of predation (Ayotte, Parker, and Gillingham 2008; Côté and Festa-Bianchet 2003; Ayotte et al. 2006; Rice 2010). There are no known natural salt licks in the Olympic Mountains. Mountain goats therefore seek out human-produced sources of salt (such as sweat and urine) (appendix A). On the Olympic Peninsula, mountain goats normally begin seeking out mineral sources in April to early June and stop in early autumn.

Mountain Goats on the Olympic Peninsula

Approximately 12 mountain goats were introduced to the Olympic Peninsula near Lake Crescent from 1925 to 1929, prior to establishment of the park. By the early 1980s, the mountain goat population in the park had grown to more than 1,000 individuals, with mountain goats occupying most available habitat on the Olympic Peninsula (Jenkins et al. 2012). At that time, the highest density of mountain goats was on Klahhane Ridge and included more than 200 individuals (appendix A). The park implemented a series of live capture operations during the 1980s, removing several hundred mountain goats and reducing the population to less than 400 by 1990. The population was stable at approximately 300 mountain goats from 1994 to 2004; however, in 2011, the population appeared to have started growing at an average annual rate of 4.9% since previous surveys (Jenkins et al. 2012).

In 2011, mountain goat survey methodologies were updated, and the surveys encompassed a slightly larger area. Based on the new survey methods, the 2016 range-wide mountain goat population in the Olympic Mountains is estimated to be approximately 625 goats (Jenkins et al 2016). After adjusting survey results to compensate for the updated survey method, researchers found that the goat population had been growing at an average annual rate of 8% from 2004 to 2016 (Jenkins et al. 2016). Based on the calculated average annual growth rate of 8% from 2004 to 2011, an estimated 725 mountain goats could populate the Olympic Peninsula by 2018 (Jenkins et al. 2016). Of these 725 mountain goats, an estimated 90% would be located either within the park or in areas immediately adjacent to the park (Happe pers. comm. 2015b). The projected distribution of mountain goats in 2018 is shown in figure 5 in chapter 2.

Mountain goat population trends on the Olympic Peninsula appear to be consistent with the hypothesis that climate influences mountain goat populations differently depending on precipitation. Mountain goats increased primarily in the western Olympic Mountains during the period of low snowpack during the 1990s until recently, supporting the idea that mountain goats were formerly limited by severe winter weather on the west side of the Olympics. In contrast, mountain goat abundance in the eastern and southern Olympic Mountains did not increase in response to the milder conditions. It is possible that recent low winter snowpack, which benefited the mountain goat population in the western Olympic Mountains, may have limited the mountain goat population in the dry eastern Olympic Mountains. A strong correlation was identified between April snow depths and mountain goat reproductive rates in the following year in the Klahhane Ridge area of the eastern Olympic Mountains. This is likely related to the availability and nutrient content of green forage, which is dependent on snowfield persistence in subalpine areas during summer months. A lack of available, nutrient-rich forage likely impacts the nutritional condition of mountain goats (Jenkins et al. 2011a).

Given that the current and projected distribution of mountain goats in the project area overlap with many areas of high visitor use, there is high potential for mountain goat-human interactions. The nature of mountain goat-human interactions in the park can vary widely, ranging from benign (observing goats from several hundred feet away across a ridge) to extremely hazardous (appendix A). Details pertaining to specific mountain goat-human interactions are discussed further in the “Visitor and Employee Safety” section of this chapter.

WILDERNESS CHARACTER

The Wilderness Act

The purpose of the *Wilderness Act* of 1964 is “to secure for the American people of present and future generations the benefits of an enduring resource of wilderness.” The act defines wilderness as an area “where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain,” and “an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation. “The act also states that wilderness is to be “protected and managed so as to preserve its natural conditions.” Wilderness “generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable,” and has “outstanding opportunities for solitude or a primitive and unconfined type of recreation” (section 2(c)). Wilderness areas, according to the *Wilderness Act*, are to be “devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use.”

To ensure an enduring resource of wilderness, the *Wilderness Act* (section 4(c)) prohibits certain uses within wilderness: “there shall be no temporary road, no use of motor vehicles, motorized equipment, or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within such area.” The exception for utilizing these prohibited uses is only if they are “necessary to meet minimum requirements for the administration of the area.”

NPS *Management Policies 2006* require all management decisions affecting wilderness to be consistent with the minimum requirement concept. This concept is a documented two-step process to determine if administrative actions, projects, or programs proposed by the park with the potential to affect wilderness character, resources, or the visitor experience are necessary for administering the area as wilderness, and if necessary, how to minimize impacts related to implementation of the proposal (NPS 2006).

Wilderness Character

The primary management mandate of the *Wilderness Act* for the federal agencies administering wilderness is to preserve the wilderness character of the area (Use of Wilderness Areas, section 4(b)). This legal requirement is also addressed in section 2(a) of the *Wilderness Act*: “a National Wilderness Preservation System...shall be administered...so as to provide for the protection of these areas, the preservation of their wilderness character.” In addition, section 4(b) states that while administering the “area for any other purposes for which it may have been established,” the agencies are directed to preserve the wilderness character of an area.

Defining Wilderness Character

Wilderness character is not explicitly defined in the *Wilderness Act*. An interagency effort to provide direction related to wilderness character monitoring was developed, and lately updated in the document *Keeping It Wild 2: An Updated Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System* (Landres et al. 2015). The definition for wilderness

character found in *Keeping It Wild 2* is derived from the statutory definition of wilderness in section 2(c) of the *Wilderness Act*.

Wilderness character, as described in *Keeping It Wild 2* (Landres et al. 2015), is “a holistic concept based on the interaction of (1) biophysical environments primarily free from modern human manipulation and impact, (2) personal experiences 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. Taken together, these tangible and intangible values define wilderness character and distinguish wilderness from all other lands.”

Wilderness character is a holistic concept based on the interaction of (1) biophysical environments primarily free from modern human manipulation and impact, (2) personal experiences 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.

The Five Qualities of Wilderness Character

According to *Keeping It Wild 2*, the conceptual definition of wilderness character cited previously is linked to a practical meaning of wilderness character by using a framework of “qualities,” based on the *Wilderness Act*. Together, the qualities represent the primary tangible aspects of wilderness character. They link the statutory definition of wilderness to both on-the-ground conditions in wilderness and the outcomes of wilderness stewardship. Monitoring the condition of these qualities over time assesses how attributes of wilderness character may be changing and whether the agencies are ensuring that wilderness character is preserved.

Four of the wilderness character qualities apply to all wilderness areas: untrammeled, natural, undeveloped, and solitude or primitive and unconfined recreation. A fifth quality, other features of value, may or may not exist within a wilderness. The five qualities of wilderness character are described below (Landres et al. 2015).

Untrammeled

An untrammeled wilderness is essentially one that is unhindered and free from the intentional actions of modern human control or manipulation.

The untrammeled quality is preserved or sustained when actions to intentionally control or manipulate the components or processes of ecological systems inside wilderness (e.g., suppressing fire, stocking lakes with fish, installing water catchments, or removing predators) are not taken. The untrammeled quality is further degraded by actions that intentionally manipulate the biophysical environment (e.g., 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).

The wildness and untamed nature of the Olympic Mountains was renowned for many years before the area was established as a national park. The area has been called wilderness long before its congressional designation as such, and its untrammeled quality was valued and emphasized before the adoption of the term by the writers of the *Wilderness Act*. To this day, the Daniel J. Evans Wilderness has remained largely unhindered and free from modern human control. Although Native Americans have lived in the wilderness for thousands of years and we do not fully understand the influence they had on the landscape, the wilderness of the Olympic Peninsula has received very little noticeable anthropogenic manipulation.

Natural

A natural wilderness is one where ecological systems are substantially free from the effects of modern civilization.

The natural quality is preserved when there are only indigenous species and natural ecological conditions and processes, and may be improved by controlling or removing non-indigenous species or by restoring ecological conditions. The natural quality is degraded by human-caused change to the natural environment (i.e., human-caused effects on plants, animals, air, water, ecological processes, etc.).

All of the Daniel J. Evans Wilderness lies within Olympic National Park, thus the natural ecological conditions, processes, and indigenous species described under the natural resources issues and impact topics described in this plan/EIS also apply to the natural wilderness character quality. These topics include wildlife, wildlife habitat, vegetation, threatened or endangered species, soils, and the acoustic environment.

Various anthropogenic factors are affecting the Olympic ecosystem and thus affect the natural quality of wilderness character. These include habitat fragmentation from logging on surrounding lands; the poaching of cedar, salal, and moss; and commercial fisheries that affect anadromous fish on their way back to spawn in wilderness areas. Wolves were extirpated in the early 1900s, which would have had top-down effects on the abundance and distribution of their primary prey of elk, as well as indirect influences on faunal and floral communities at lower trophic levels. The establishment of the park in 1938 offered protection for the mountain goat population by no longer allowing hunting to occur, resulting in goats continuing to damage vegetation including endemic and rare alpine plants and soils.

While mostly found in frontcountry sites, a number of nonnative invasive plant species are found within the wilderness, such as Canada thistle (*Cirsium arvense*) and Herb-Robert (*Geranium robertianum*). Most park nonnative plants are perennials that are particularly persistent and difficult to eradicate, and could disrupt native plant communities. While the seed of nonnative plants can be dispersed by wind and wildlife, human clothing and equipment are also vectors for dispersal. Other visitor activities that may affect the natural quality of wilderness character include stepping on fragile high country vegetation that can impact plant communities for a century or beyond, and harvesting or trampling of intertidal organisms that can damage marine nurseries. Such actions are not unusual within wilderness areas on the Olympic Peninsula.

Undeveloped

An undeveloped wilderness is essentially one without permanent improvements or the sights and sounds of modern human occupation.

The undeveloped quality is preserved or sustained when modern structures, installations, habitations, motor vehicles, motorized equipment, or other mechanical transport is not used in wilderness. It is improved when these prohibited uses are removed or reduced.

The first well-documented expeditions by Euro-Americans to the Olympic Peninsula did not occur until the late 18th century. It was not until the late 19th century that the first pioneers began to more thoroughly explore and settle the Olympic Peninsula. Occupation and modification of land now within the wilderness was mainly small-scale or short-lived. With the establishment of Olympic National Park, the area was managed largely as wilderness keeping development limited; no roads were constructed that bisect the mountainous core of the wilderness. Thus, the development remains largely unnoticeable over most of the wilderness areas on the Olympic Peninsula.

Ranger stations and associated tent platforms, administrative cache boxes, research equipment, and other installations are found throughout the wilderness. While Olympic ranger patrols, trail maintenance, and resource monitoring and scientific research are important for responsibly managing the wilderness, the associated structures are evidence of modern human occupation and influence. The administrative use of motorized equipment and mechanical transport for management activities, although permitted when it is the minimum requirement, in turn degrades the primitive nature of wilderness areas through the development, occupation, or modification of the land by humans.

Solitude or Primitive and Unconfined Recreation

Wilderness provides outstanding opportunities for recreation in an environment that is relatively free from the encumbrances of modern society, and the benefits and inspiration derived from self-reliance, self-discovery, physical and mental challenge, and freedom from societal obligations.

The solitude or primitive and unconfined recreation quality is preserved or improved by management activities that reduce visitor encounters, reduce signs of modern civilization inside wilderness, remove agency-provided recreation facilities, or reduce management restrictions on visitor behavior. The solitude or primitive and unconfined recreation quality is degraded by sights and sounds of human activity (solitude), and by facilities that decrease self-reliant recreation and management restrictions on human behavior (primitive and unconfined).

The ecological diversity of wilderness areas in Olympic National Park and Olympic National Forest provides an array of wilderness-supported opportunities. Within rainforest valleys, along coastal beaches, by high mountain lakes, and on glacier-covered peaks, visitors can experience solitude, a deep connection with nature, discovery, and revitalization, escape the constraints of society, and enjoy personal challenge and self-reliance.

Trailheads leading into wilderness areas on the Olympic Peninsula lie within a 5-hour drive of more than 10 million people, yet despite this accessibility to millions of people, opportunities for solitude are readily available. The vastness of the wilderness allows visitors to spend part of a day or several weeks hiking, backpacking, riding stock, skiing, or snowshoeing. For many visitors, the opportunity of watching wildlife in its natural setting enhances the feeling of solitude, which includes viewing exotic mountain goats.

Both easy and challenging hiking trails into the wilderness areas require graduated self-reliance, based on the route selected and an individual's skill. The general lack of facilities within the wilderness for visitor convenience and comfort also requires visitors to depend on their own self-sufficiency and resourcefulness.

Development is expanding into the foothills outside the park and national forest, continuing to modify the scenic vistas looking out from the wilderness. Lights from surrounding urban areas affect the night sky in wilderness, and overhead aircraft, whether military, commercial, or administrative flights, are an ongoing reminder of civilization. The numbers of researchers and research installations in the wilderness impact the solitude of visitors. Bridges, toilets, and technology reduce opportunities for self-reliance. Designated campsites, signs, and other recreational infrastructure in the wilderness areas on the Olympic Peninsula protect valuable park resources but simultaneously confine recreational experiences.

Other Features of Value

This quality captures important elements or “features” of a particular wilderness that are not covered by the other four qualities, and are truly unique and essential to the character of that wilderness.

The *Wilderness Act* states that wilderness “may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.” Typically, other features of value occur in a specific wilderness location, such as archeological, historical, or paleontological features; some, however, may occur over a broad area such as an extensive geological or paleontological area, or a cultural landscape. This quality is preserved when these “other features of value” are preserved. The other features of value quality is degraded by deterioration or loss of integral site-specific features of value.

The designated wilderness areas on the Olympic Peninsula have been part of the homeland to native peoples for much longer than it has been considered “wilderness,” and Native Americans have lived on the Olympic Peninsula for at least 14,000 years. Eight tribes continue to recognize a relationship to the park based on traditional land use, origin, beliefs, and ethnographic landscapes: the Lower Elwha Klallam Tribe, Jamestown S’Klallam Tribe, Port Gamble S’Klallam Tribe, Skokomish Indian Tribe, Quinault Indian Nation, Hoh Tribe, Quileute Nation, and Makah Tribe. While native ties to this land are ancient and the designation of the area as wilderness is a modern concept, the relationship between Native Americans and wilderness areas is an important component of the area’s cultural heritage. Thus, ethnographic resources associated with Native American tribes represent the other features of value within the wilderness areas. Ethnographic resources, according to *NPS Management Policies 2006*, are the cultural and natural features of a park that are of traditional significance to traditionally associated peoples (NPS 2006a, section 5.3.5.3). Plants and animals, landscapes, and spiritual aspects that are fundamental to the culture of the surrounding tribes are vital elements of the park’s wilderness character.

Impacts on ethnographic resources in the wilderness include illegal harvest, high visitation in sensitive areas, park operations, rising sea levels, and other natural events such as floods and fires that could threaten ethnographic resources and their associated sites. However, ethnographic resources were dismissed from detailed analysis (see chapter 1), and so this characteristic is not analyzed in chapter 4 of this EIS.

Wilderness in Olympic National Park

Olympic National Park was established in 1938 to protect diminishing herds of Roosevelt elk, safeguard disappearing old-growth forests, and preserve its wilderness conditions (NPS 2008a; Wilderness.net 2016).

The 1964 *Wilderness Act* requires that federal land management agencies conduct studies on roadless areas within their jurisdiction for possible wilderness designation. A *Proposed Wilderness/Final Environmental Impact Statement for Olympic National Park* was completed in 1974 that proposed 96% of the park as wilderness. The wilderness recommendation was sent to congress and a Senate bill was introduced but never acted on. In accordance with agency policy, the proposed lands were managed as *de facto* wilderness. In 1988 the Washington State congressional delegation introduced legislation for large portions of all three national parks in the state to be designated as wilderness areas. On November 16, 1988, President Ronald Reagan signed the *Washington Park Wilderness Act* (PL 100-668) into law, designating 876,669 acres, approximately 95%, of Olympic National Park, as the Daniel J. Evans Wilderness (formerly the Olympic Wilderness) and another 378 acres as potential wilderness additions (NPS 2008a). In 2012, the *Quileute Tsunami Protection Act* transferred park lands, including approximately 222 acres of the Daniel J. Evans Wilderness, to the Quileute Nation. The 876,477 wilderness acres remaining still encompass about 95% of the park (figure 8). The Daniel J. Evans

Wilderness is extremely diverse, with glacier-covered mountains, subalpine lakes and meadows, heavily forested glacier-carved river valleys, old-growth coniferous forests, and a stretch of wild Pacific Ocean coastline (NPS 2014a). Day hiking and backpacking are popular activities in the Daniel J. Evans Wilderness, and the park trails and campsites are the most conspicuous human disturbance to the wilderness. There are 611 miles of maintained trails and more than 1,300 campsites, and the Pacific Northwest National Scenic Trail traverses 140 miles through the park, passing east to west through the heart of the wilderness. A variety of structures are maintained for the purpose of wilderness management, primarily along trail corridors or in camp areas. This includes four ranger station cabins, several temporary ranger station tents, 18 shelters, over 80 toilets, and other facilities such as radio repeaters and research equipment.

The Daniel J. Evans Wilderness has some of the highest overnight use of any NPS managed wilderness or backcountry area. With 17,197 parties, 49,777 visitors and 105,645 user nights (i.e., the number of visitors multiplied by the number of nights that visitors stay in wilderness) in 2015, wilderness overnight use has steadily increased since 2011. The interior of the park accounts for approximately 52% of the overnight wilderness use. Coastal wilderness use accounts for 48% of overnight wilderness use, its popularity largely due to the uniqueness of the experience which provides year-round, snow-free access to rare ocean coast wilderness.

Wilderness in Olympic National Forest

The Olympic Mountains have been described as wilderness since the 19th century. In the early 1900s, development of the wilderness began with construction of trails, shelters, and ranger stations for administrative use by the US Department of Agriculture (USDA) Forest Service (NPS 2008a). However, it was not until 1984 that the *Washington State Wilderness Act* created five wilderness areas in the Olympic National Forest. These five wilderness areas include the Buckhorn Wilderness, 44,258 acres; Colonel Bob Wilderness, 11,961 acres; Mount Skokomish Wilderness, 13,015 acres; The Brothers Wilderness, 16,682 acres; and Wonder Mountain Wilderness, 2,349 acres (FS 1990).

The smallest wilderness area in the national forest, Wonder Mountain, is the most primitive because it has no high-use camping areas and no trails within its boundaries. This is largely due to its rugged terrain and dense vegetation. The second smallest wilderness, Colonel Bob, has two major camping areas within its boundaries. With only 13 miles of rugged trail, the wilderness largely attracts rock climbers and has very little utility for pack and saddle stock. The Mount Skokomish and The Brothers Wilderness areas have 17.9 miles and 16.3 miles of trails, respectively. The Mt. Ellinor Trail in the Mount Skokomish Wilderness is one of the most popular trails in the national forest (Shaw 2011). High levels of camping use in these areas is mostly limited to the lakes and the Duckabush River corridor.

The Buckhorn Wilderness is the largest wilderness area in the national forest. With 68.7 miles of trail, easy accessibility, significant opportunities for pack and saddle stock use, and open meadows for off-trail camping, the Buckhorn Wilderness has the most visitation of all five wilderness areas. It is traversed by the Pacific Northwest National Scenic Trail and popular use areas in Buckhorn include Camp Handy, Marmot Pass, and Camp Mystery (Shaw 2011).

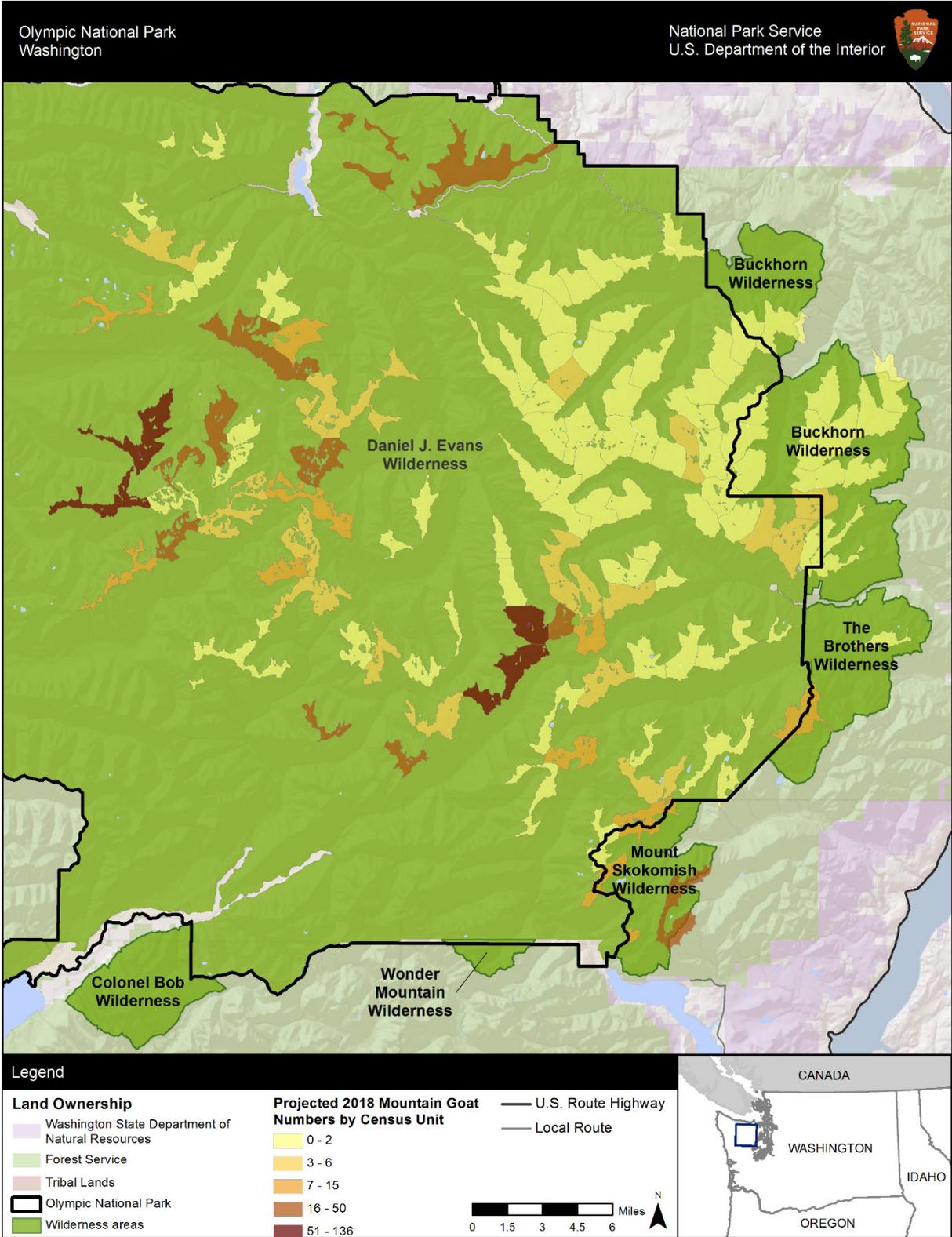


FIGURE 8. WILDERNESS IN OLYMPIC NATIONAL PARK AND OLYMPIC NATIONAL FOREST

WILDLIFE AND WILDLIFE HABITAT, INCLUDING SPECIAL-STATUS SPECIES

Wildlife in Olympic National Park and Olympic National Forest

Wildlife populations on the Olympic Peninsula have been largely shaped by geographic isolation of the peninsula. In addition to the mountain goat, the golden-mantled ground squirrel, wolverine, and pika are examples of species that were naturally excluded from the peninsula (Houston, Schreiner, and Moorhead 1994). From dense, mixed-conifer forests, to the subalpine meadows rock slopes, the park is home to a variety of fish, birds, and other wildlife throughout these diverse habitats (NPS 1995). It is estimated that there are approximately 300 avian, 65 mammalian, 13 amphibian, 29 freshwater fish, and 4 reptilian species on the Olympic Peninsula (NPS 2008a). Wildlife within park boundaries and on some adjacent Olympic National Forest lands benefit from the added protections associated with wilderness designations (as described in the “Wilderness Character” section of this chapter). These wilderness areas provide protection to ecological systems and their biological and physical components (NPS 2008a).

Although mountain goats occur primarily within subalpine and alpine terrestrial communities, all but two staging areas (Hurricane and Deer Park) would be located at lower elevations. As a result, this section focuses on those wildlife species that could occur in either the park or surrounding national forest, and could be affected by mountain goats and all associated activities necessary for mountain goat management.

Competition between mountain goats and other wildlife species most likely occurs, despite a lack of scientific data showing specific evidence. Houston, Schreiner, and Moorhead (1994) suggest that modification of vegetation communities by mountain goats on the Olympic Peninsula likely affects the distribution or abundance of other wildlife species, especially other ungulates and small mammals.

Endemic Wildlife Species

The diversity of wildlife within the project area includes several endemic (found nowhere else) species and subspecies (NPS 1995). Endemic species that occur in mountain goat habitat on the Olympic Peninsula include Olympic marmot (*Marmota olympus*), Olympic yellow-pine chipmunk (*Tamias amoenus caurinus*), Olympic snow mole (*Scapanus townsendii olympicus*), Olympic pocket gopher (*Thomomys mazama melanops*), and Olympic ermine (*Mustela ermine olympica*). The Olympic torrent salamander (*Rhyacotriton olympicus*) and Olympic grasshopper (*Nisquallia olympica*) have the potential to occur at lower elevations near staging areas (Houston, Schreiner, and Moorhead 1994, NPS 2008a; Piper pers. comm. 2016a). Further information about the Olympic marmot and Olympic pocket gopher can be found in the “Special-Status Wildlife Species” section.

Mammals

The diverse landscape of the Olympic Peninsula provides for a variety of life history strategies. Small mammals may spend their lives within an area of only a few hundred yards, whereas cougars (*Puma concolor*) and black bears (*Ursus americanus*) may travel hundreds of miles in search of mates, food, or new home ranges. Some species, such as the Roosevelt elk (*Cervus elaphus roosevelti*), migrate seasonally, descending from mountain meadows as snow accumulates. Other species, such as the snowshoe hare (*Lepus americanus*), can remain in their mountain habitat year-round (NPS 2015b).

There are 65 mammal species found within the park and neighboring lands, several of which occur in the project area, including Roosevelt elk, whose presence was a primary factor in the establishment of the park. Other native mammals that may occur in the project area include black-tailed deer (*Odocoileus hemionus columbianus*), black bear, cougar, bobcat (*Lynx rufus*), mountain beaver (*Aplodontia rufa*), and snowshoe hare. The Douglas squirrel (*Tamiasciurus douglasii*) is common in subalpine areas and could potentially be present in the project area. Mammals that are unlikely to occur in subalpine or alpine areas, but that may occur near staging areas, include raccoon (*Procyon lotor*), spotted skunk (*Spilogale gracilis*), and a variety of other small mammal species such as moles, bats, and voles (NPS 2008a, 2015b; Piper pers. comm. 2016a).



Columbia black-tailed deer are common in Olympic National Park

Interspecific resource competition between mountain goats and other ungulate species including Roosevelt elk and black-tailed deer may occur, although additional data is needed to verify this potential relationship. Competition among mountain goats, Roosevelt elk, and black-tailed deer only potentially occurs during summer months due to their overlapping high-elevation summer ranges. Although researchers have speculated that modification of plant communities by mountain goats might affect distribution of other small mammals including the Oregon vole (*Microtus oregoni*), deer mouse (*Peromyscus maniculatus*), and yellow-pine chipmunk (*Tamias amoenus*), the limited nature of surveys was acknowledged, and the results may only reflect habitat preferences of those small mammals (Houston, Schreiner, and Moorhead 1994).

Birds

There are approximately 300 bird species known to occur within the park and the adjoining lands. Common species with the potential to occur in the project area, particularly near staging areas, include American crow (*Corvus brachyrhynchos*), common raven (*Corvus corax*), varied thrush (*Ixoreus naevius*), American robin (*Turdus migratorius*), winter wren (*Troglodytes hiemalis*), Steller's jay (*Cyanocitta stelleri*), gray jay (*Perisoreus canadensis*), ruffed grouse (*Bonasa umbellus*), sooty grouse (*Dendragapus obscurus*), belted kingfisher (*Megasceryle alcyon*), and a variety of warblers, woodpeckers, kinglets, sparrows, and other neotropical migratory birds (NPS 2008a; Piper pers. comm. 2016a).



Common ravens are a widespread habitat generalist on the Olympic Peninsula

According to the *North Coast and Cascades Network Landbird Monitoring Report*, bird

populations in the Pacific Northwest are threatened by a variety of factors. Forest management practices discourage the development of old-growth conditions in conifer forests. Alpine and subalpine habitats are being threatened by visitor impacts and ecological changes resulting from alterations in natural fire regimes and climate change. When considering these threats to avian habitats in the Pacific Northwest, the diverse landscape of the Olympic Peninsula and the protection of its habitats is essential to preserving the region's bird diversity (Siegel, Wilkerson, and Kuntz 2008).

Reptiles and Amphibians

Reptiles that may be present within the project area, particularly near staging areas, include the northern alligator lizard (*Elgaria coerulea*), common garter snake (*Thamnophis sirtalis*), and northwestern garter snake (*Thamnophis ordinoides*), and rubber boa (*Charina bottae*). Amphibians that may be present within the project area include the tailed frog (*Ascaphus* spp.), red-legged frog (*Rana aurora*), cascade frog (*Rana cascadae*), northwestern salamander (*Ambystoma gracile*), western red-backed salamander (*Plethodon vehiculum*), and Van Dyke's salamander (*Plethodon vandykei*) (NPS 2008a; Piper pers. comm. 2016a).

Special-Status Wildlife Species

The Olympic Peninsula contains a variety of habitats suitable for special-status species. A discussion of species protected by the *Endangered Species Act* (ESA) can be found in the "Threatened or Endangered Species" section. NPS *Management Policies 2006* also require that potential effects of agency actions on state or local listed species be considered. Because NPS does not designate species with special conservation status, the following discussion covers wildlife species of concern that have been given special designation by the State of Washington or by the USDA Forest Service, and could be affected by interactions with mountain goats or activities associated with mountain goat management on the Olympic Peninsula. Vegetation species that have received a special designation are discussed in the section "Vegetation, Including Special-Status Plant Species."

Washington State Species of Concern

Wildlife species with the potential to occur within the project area on the Olympic Peninsula that are given special conservation status by Washington State are shown in table 6.

TABLE 6. STATE-LISTED WILDLIFE SPECIES IN OLYMPIC NATIONAL PARK

Common Name	Scientific Name	Federal Status	State Status
Bald eagle	<i>Haliaeetus leucocephalus</i>	Delisted	Sensitive
Olympic pocket gopher	<i>Thomomys mazama melanops</i>	No	Threatened
Olympic marmot	<i>Marmota olympus</i>	No	Candidate
Fisher	<i>Pekania pennanti</i>	No (proposal to list was withdrawn on April 18, 2016)	Endangered

Sources: USFWS 2015a, 2016a; WDFW 2015a; NatureServe 2015b; NPS 2007.

Bald Eagle (*Haliaeetus leucocephalus*). The bald eagle is listed as a sensitive species in the State of Washington. It was delisted from the ESA in 2007 due to species recovery (USFWS 2015b). Most eagles that breed in the northern United States migrate south for the winter. Feeding home ranges can be quite large, depending on proximity to food sources and abundance of food. Breeding habitat includes areas close to water bodies, which reflects the availability of primary food sources such as fish, waterfowl, or

seabirds. Nests are usually located in tall trees or on pinnacles or cliffs near water. In western Washington, most eagles begin to incubate their eggs by the third week in March, and young hatch by late April (Stinson, Watson, and McAllister 2001). Young typically fly at 10 to 12.5 weeks, remaining in the care of adults for several weeks after fledging (USFWS 2016a; NatureServe 2015b). Management activities associated with this plan/EIS that could impact this species might include staging areas in proximity to bald eagle habitat and associated helicopter overflights; however, primary bald eagle habitat is located along the coast and in the lower reaches of rivers downstream of staging areas (Happe pers. comm. 2015b).

Olympic Pocket Gopher (*Thomomys mazama melanops*). The Olympic pocket gopher is listed as threatened by the State of Washington. This subspecies of Mazama pocket gopher was reviewed for federal ESA listing in 2012 but was not federally listed because the US Fish and Wildlife Service (USFWS) determined that the primary threat, the encroachment of woody species into Olympic pocket gopher habitat, was not quantified by any data (USFWS 2013). However, because the subspecies range is entirely within the boundary of Olympic National Park and they are believed to be declining (USFWS 2013), the NPS began an inventory of this species in 2015, although results are not yet available (Happe pers. comm. 2015b). This small mammal burrows in the soils of alpine and subalpine meadows, openings in subalpine forest, and open subalpine areas with scattered trees (USFWS 2016a; NatureServe 2015a). Management activities associated with this plan/EIS might take place in Olympic pocket gopher habitat (Happe pers. comm. 2015b).

Olympic Marmot (*Marmota olympus*).

The endemic Olympic marmot is listed as a candidate species by the State of Washington. Although its range is small and localized to the Olympic Mountains, and localized populations experienced declines and extirpations in the 1980s, overall populations have remained stable since 2007. The declines observed are likely due to predation by nonnative coyote (*Canis latrans*) and tree encroachment into meadow habitats (Griffin et al. 2008, NatureServe 2015a). This burrowing mammal is almost completely restricted to Olympic National Park and inhabits subalpine and alpine meadows and talus slopes near timberline. Many colonies are located on south-facing slopes, where food availability is greater due to earlier snowmelt. The Olympic marmot grazes on a wide variety of grasses and forbs, accumulating body fat for the winter (NatureServe 2015a). Olympic marmots are known to hibernate for seven to eight months annually, and occupy restricted home ranges during summer months while they are active.



The Olympic marmot is an endemic species on the Olympic Peninsula

Research has indicated that plants favored by mountain goats in the Klahhane Ridge area were also used by Olympic marmots (Houston, Schreiner, and Moorhead 1994). Effects of herbivory, by Olympic marmots and mountain goats both, were shown to reduce the occurrence of palatable forb species and to increase the occurrence of unpalatable species. Research has suggested that high densities of mountain goats do not result in the competitive exclusion of Olympic marmots; however, Olympic marmots occur primarily on the periphery of areas that are most intensively used by mountain goat, which does not provide a good measure of interspecific relationships (Houston, Schreiner, and Moorhead 1994).

Although overall populations of Olympic marmot have remained stable, reports of declining populations in the park prompted research by the University of Montana beginning in 2002. This research showed that Olympic marmots had disappeared from many long-occupied sites and that there had been no colonization of new sites. Additional research showed that the population continued to decline by about 10% per year at still-occupied sites through 2006, when the total population of Olympic marmots was estimated to be fewer than 1,000 individuals. At this time, it was confirmed that the primary threat to the population was predation by coyotes. A monitoring program for the Olympic marmot population in the park was initiated in 2010 to assess the declining population more closely. The NPS will analyze data collected since 2010 in 2016 (NPS 2015c). Management activities associated with this plan/EIS might take place in Olympic marmot habitat.

Fisher (*Pekania pennanti*). The fisher is listed as endangered in the State of Washington; the proposal to list the West Coast Distinct Population at the federal level was recently withdrawn (USFWS 2016c). This mammal is a member of the weasel family and is active day and night and year-round. They inhabit forests of North America, relying on large trees with cavities, large snags, and downed logs to provide essential den and rest sites. They are a solitary species except during the breeding and denning season. Fishers give birth in late March and early April and give birth to kits in tree cavities. The primary fisher denning period (from birth to weaning) lasts about 10 weeks (NPS 2007; Frstrup, Joyce, and Lynch 2010; USFWS 2016a).

Surveys conducted in the 1990s failed to find any fishers in areas considered to be the best remaining habitat in the State of Washington. Additional surveys in national parks within Washington during the early 2000s failed to find any fishers. The fisher was listed as an endangered species in the State of Washington in 1998 by Washington Department of Fish & Wildlife (WDFW) and a recovery plan was released in 2006. A subsequent feasibility study by WDFW determined that the park and neighboring Olympic National Forest were the best locations for the first fisher reintroduction in Washington (Frstrup, Joyce, and Lynch 2010).

According to the 2014 *Annual Progress Report* for fisher reintroduction in the park, 90 fishers were translocated and released from British Columbia to the park from 2008 to 2010. In 2013, a new research project was initiated to determine the status of fishers on the Olympic Peninsula following release. Individuals observed included representatives from the founding population, as well as new recruits to the population. Data of fisher occurrence continues to be gathered for this effort (Happe et al. 2015). Management activities in staging areas might take place in or near fisher habitat (Happe pers. comm. 2015b).

USDA Forest Service Special-Status Wildlife Species

The USDA Forest Service lists Regional Forester Sensitive species, Olympic National Forest Management Indicator species (FS 1990), and Olympic National Forest Survey and Manage Species (USDA/DOI 2001). These species were evaluated and information about their occurrence and habitats is shown in appendix G.

Regional Forester Sensitive Species. The *National Forest Management Act* (16 USC 1600) requires the USDA Forest Service to maintain viable populations of existing native and desired nonnative wildlife in the planning area (36 CFR 219.19). Guidelines for each planning area must provide for a diversity of plant and animal communities based on the suitability of the specific land area. The USDA Forest Service established a Sensitive Species Program and a Biological Evaluation process (FSM 2672.4) to ensure species population viability. Regional foresters are responsible for identifying and maintaining a list of sensitive species occurring within their region. This list includes species for which there is a documented concern for viability within one or more administrative unit within the historic range of the species (FSM

2670.22, WO Amendment 2600-95-7). These species may require special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for federal listing. This regional list was last updated on January 31, 2008. The USDA Forest Service Manual (FS 2011, FSM 2672.4) requires a biological evaluation to determine potential effects of proposed ground-disturbing activities on sensitive species. This evaluation analyzes the alternatives and discusses the potential effects on the population or its habitat within the area and on the species as a whole, and makes recommendations for removing, avoiding, or compensating for adverse effects.

A list of Olympic National Forest Regional Forester Sensitive species is in appendix G. The Region 6 Sensitive Species List for the Olympic National Forest was evaluated for the occurrence of known populations or habitats capable of supporting these species within the area that could be affected by interactions with mountain goats or activities associated with mountain goat management. Regional Forester Sensitive species with known occurrence or the presence of suitable habitat in the area potentially affected by mountain goats or activities associated with mountain goat management are described in appendix G. Thirteen species have known occurrence or suitable habitat present in the project area, including the northern goshawk (*Accipiter gentilis*), peregrine falcon (*Falco peregrinus*), bald eagle, western bumble bee (*Bombus occidentalis*), several butterflies, Olympic grasshopper, Olympic marmot, and Olympic pocket gopher.

Olympic National Forest Management Indicator Species. The Olympic National Forest *Land and Resource Management Plan* (FS 1990) identifies species that are presumed to be indicators of the welfare of other species using the same habitat, and are species whose presence or abundance can be used to assess the impacts of management actions on a particular area. Management indicator species that are present or have the potential to occur within or near the project area include the Pacific marten, pileated woodpecker (*Dryocopus pileatus*), Roosevelt elk, and Columbia black-tailed deer (Piper pers. comm. 2016a). Habitat requirements for these species are described in appendix G. Each of these species has the potential to occur within the national forest in the project area.

Survey and Manage Species. “Survey and Manage” are a set of standards and guidelines associated with the 1994 *Record of Decision for Amendments to USDA Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (called the Northwest Forest Plan). They are documented in the January 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. These standards and guidelines are applicable to USDA Forest Service and Bureau of Land Management lands in western Washington, western Oregon, and northwestern California and are intended to reduce or eliminate (mitigate) potential effects from agency actions to just over 300 flora and fauna species including mosses, liverworts, fungi, lichens, vascular plants, slugs, snails, salamanders, great gray owl, and red tree voles. These Survey and Manage species are assigned to one of six categories based upon the relative rarity of the species, the practicality to conduct pre-disturbance surveys, and the understanding of association with late-successional or old growth forests. The only Survey and Manage species identified by the USDA Forest Service were mollusks, which are not expected to occur in the project area or would not be disturbed by activities associated with mountain goat management.

VEGETATION, INCLUDING SPECIAL-STATUS PLANT SPECIES

Vegetation in Olympic National Park and Olympic National Forest

Vegetation on the Olympic Peninsula is extremely diverse due to its elevational and climatic variety. Terrestrial ecosystems include several forest types, generally classified by their elevation as coastal, temperate rain forest, lowland, montane, or subalpine forests. Alpine shrubland and grassland communities occupy higher elevations at or above tree line, which is approximately 5,250 feet on the more humid west side of the Olympic Peninsula and approximately 6,200 feet on the drier east and north sides. Within the summer range of mountain goats, vegetation communities range from subalpine meadows and herbaceous communities to scree and rock areas with little vegetation. In these areas, substrate stability and soil moisture are the primary factors in determining plant community distribution (NPS 1995).

Several plants found in the Olympic Mountains exhibit notably disjunct distributions. For example, western hedsarum (*Hedysarum occidentale*) occurs on the Olympic Peninsula, on Vancouver Island, British Columbia, and in the mountains of Idaho; least-bladdery milkvetch (*Astragalus microcystis*) occurs on the Olympic Peninsula and from northeastern Washington into Idaho, Montana, and British Columbia. The least-bladdery milkvetch occurs in only one or two locations in the subalpine and alpine zones in the dry northeastern Olympic Mountains (Houston, Schreiner, and Moorhead 1994).

Endemic Vegetation Species

As with wildlife, vegetation communities in the project area have been shaped by the geographic isolation of the Olympic Peninsula resulting in several known endemic species, including Cotton's milkvetch (*Astragalus cottonii*), Olympic bellflower (*Campanula piperi*), Flett's fleabane (*Erigeron flettii*), Olympic rock mat (*Petrophyton hendersonii*), Olympic Mountain groundsel (*Senecio neowebsteri*), Olympic cutleaf synthyris kittentails (*Synthyris pinnatifida* var. *lanuginosa*), and Olympic violet (*Viola flettii*) (NPS 2008a). These species occur in mountain goat habitat and some are likely to occur near staging areas (Copass pers. comm. 2015).

Vegetation Zones on the Olympic Peninsula

Vegetation patterns on the Olympic Peninsula reflect environmental gradients of moisture and temperature. Moisture increases from east to west, and from lower elevations to higher elevations, and depends on the direction a particular slope faces. Most of the Olympic Peninsula below 4,900 feet is considered coniferous forest. The wide variety of plant communities are classified into six vegetation zones based on the dominant tree species of the potential climax forest. Additionally, there are subalpine and alpine zones that are not classified by dominant tree type. These zones are presented in table 7 and figure 9 (NPS 2008a). Mountain goats occur primarily within the subalpine and alpine terrestrial communities and also occur within the mountain hemlock (*Tsuga mertensiana*), or subalpine fir (*Abies lasiocarpa*) vegetation zones; therefore, management activities associated with the action alternatives would be concentrated in these vegetation zones. Staging areas are located in the subalpine fir zone and at lower elevations in the Douglas-fir (*Pseudotsuga menziesii*) zone and western hemlock (*Tsuga heterophylla*) zone. Vegetation zones of the Olympic Mountains are described in table 7.

TABLE 7. VEGETATION ZONES OF THE OLYMPIC PENINSULA

Vegetation Zone	Elevation	Description
Sitka spruce zone	Typically below 590 feet on the west side of the park.	Occurs in the wettest and most humid regions on the west side of the Olympic Peninsula. Common shrubs include salmonberry (<i>Rubus spectabilis</i>), salal (<i>Gaultheria shallon</i>), vine maple (<i>Acer circinatum</i>), red huckleberry (<i>Vaccinium parviflorum</i>) and Alaska huckleberry (<i>Vaccinium ovalifolium</i>) (NPS 2008a).
Western hemlock zone	Elevations extend from about 490 feet to 2,000 feet on the west side of the park and from sea level to 3,900 feet on the east side of the park.	Western hemlock is the climax dominant tree species; sub-climax Douglas-fir is widespread. Common shrubs include salal, vine maple, Oregon grape (<i>Mahonia nervosa</i>), red huckleberry, Alaska huckleberry, salmonberry, and rhododendron (<i>Rhododendron macrophyllum</i>) (NPS 2008a).
Pacific silver fir zone	Throughout the interior of the park, generally at middle elevations.	Pacific silver fir (<i>Abies amabilis</i>) dominates in this zone. Characterized by relatively cool and moist conditions. Common shrubs include Alaska huckleberry, red huckleberry, salmonberry, fool's huckleberry (<i>Menziesia ferruginea</i>), salal, and Oregon grape.
Mountain hemlock zone	Generally above 3,600 feet.	Occupies the snowier western slopes of the Olympic Mountains. Common tree species include mountain hemlock and subalpine fir. Pacific silver fir also present. Shrubs, forbs, and sedges dominate meadows (Houston, Schreiner, and Moorhead 1994). Common shrubs include Alaska huckleberry, oval-leaf huckleberry (<i>Vaccinium ovalifolium</i>), bog huckleberry (<i>Vaccinium uliginosum</i>), white rhododendron (<i>Rhododendron albiflorum</i>), mountain ash (<i>Sorbus sitchensis</i>), fool's huckleberry, and red heather (<i>Phyllodoce empetriformis</i>) (NPS 2008a).
Douglas-fir zone	Middle elevations in the northeastern corner of the park.	Occupies the driest sites in the northeastern Olympic Mountains. Common shrubs include kinnikinnick (<i>Arctostaphylos uva-ursi</i>), Oregon grape, serviceberry (<i>Amelanchier alnifolia</i>), oceanspray (<i>Holodiscus discolor</i>), baldhip rose (<i>Rosa gymnocarpa</i>), creeping snowberry (<i>Symphoricarpos mollis</i>), and salal (NPS 2008a)
Subalpine fir zone	Generally above 3,900 feet.	Occupies the drier northeastern portion of the Olympic Mountains. Vegetation patterns characterized by tree clumps interspersed with park-like areas with low tree density and meadows (NPS 2008a). Dominated by subalpine fir with components of lodgepole pine (<i>Pinus contorta</i>), Pacific silver fir, mountain hemlock, or whitebark pine (<i>Pinus albicaulis</i>) (Houston, Schreiner, and Moorhead 1994).
Subalpine and alpine zones	Generally above 4,900 feet. Dominated by grasses, forbs, sedges, cushion or mat-forming dwarf shrubs.	Vegetation varies from sedge, grass, or forb dominated meadows with trees to rocky alpine areas where vascular plant cover is quite low (Crawford et al. 2009). Meadows often dominated by showy sedge (<i>Carex spectabilis</i>). Drier sites often contain spreading phlox (<i>Phlox diffusa</i>). Ericaceous heather meadows contain pink mountain heather (<i>Phyllodoce empetriformis</i>), Merten's mountain heather (<i>Cassiope mertensiana</i>), and blueberry (<i>Vaccinium deliciosum</i>). Communities found at higher elevations have the highest occurrence of endemic or species of concern in the park (Copass pers. comm. 2015).

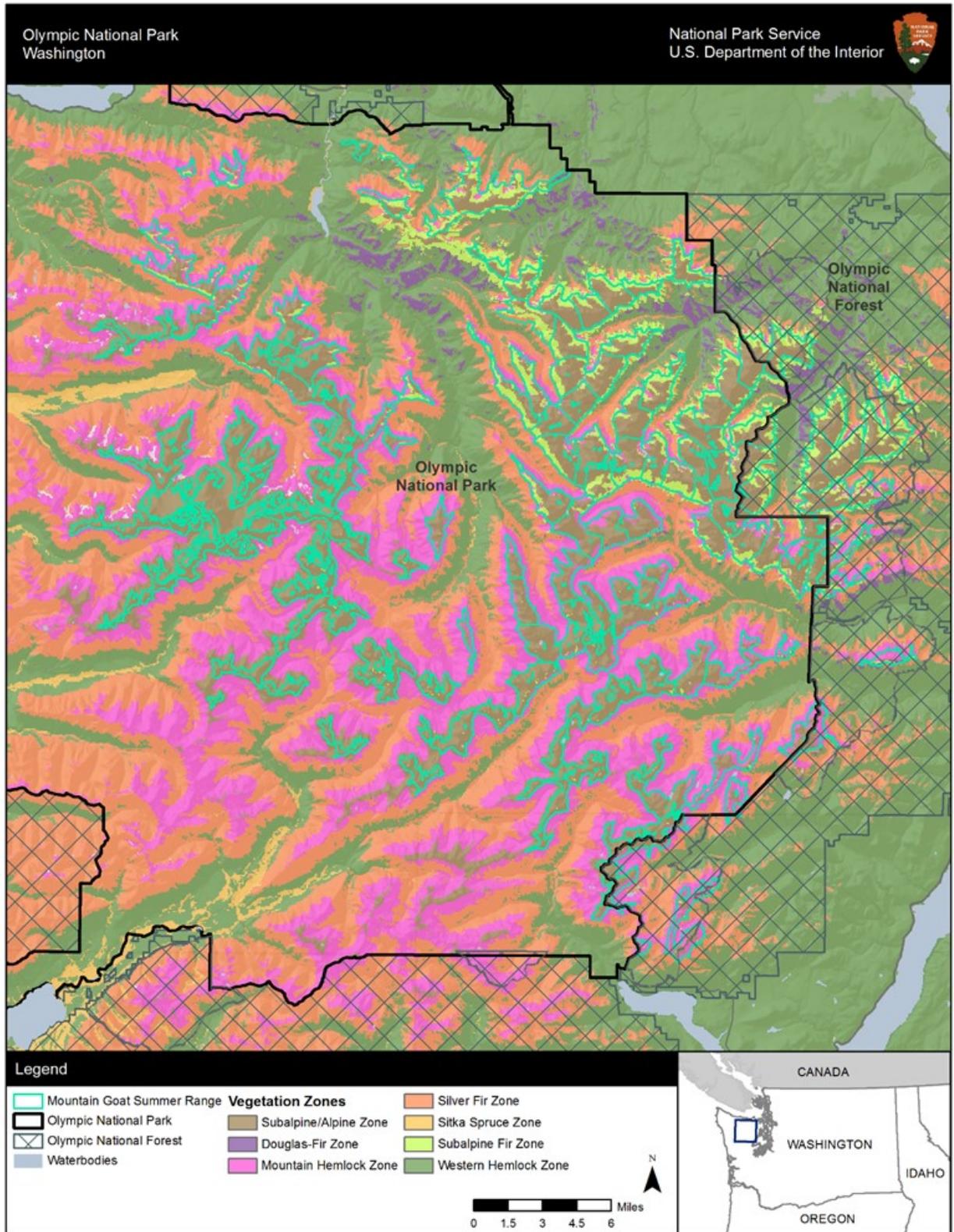


FIGURE 9. VEGETATION ZONES ON THE OLYMPIC PENINSULA

Herbivory of Vegetation at Olympic National Park

Research conducted in mountain goat summer range indicates considerable evidence of herbivory in subalpine and alpine vegetative communities. Primary herbivores include mountain goats, Roosevelt elk, deer, Olympic marmots, chipmunks, pocket gophers, voles, mountain beaver, and snowshoe hare. Studies conducted when mountain goat populations were at their peak levels found evidence of mountain goat presence on all study plots examined. Evidence of mountain goat herbivory was encountered twice as often as evidence of any other herbivores in almost all plant community types. Signs of elk, deer, and marmots were regularly noted around study plots. Evidence of other species was encountered infrequently when compared to evidence of ungulates (Houston, Schreiner, and Moorhead 1994).

Efforts to determine which herbivore consumes a specific plant species is difficult due to lack of direct observation. Evidence of herbivores (pellet groups, tracks, wallow or bedding sites, grazing, and trails) in the vicinity was used to infer the species likely responsible for grazing. Olympic marmots appear to extensively use mesic grassy communities and communities containing *Carex spectabilis*; deer grazed mainly in the mesic grassy, *Saussurea* forb, and tall sedge (*Carex-Lupinus*) communities; and elk were most often observed using the *Valeriana* forb (*Carex-Valeriana*) and tall sedge communities. Mountain goats seem to select rock outcrops and cliffs rather than specific plant species. This reinforces the interpretation that summer range selection by mountain goats is based more on physical habitat requirements than on plant communities (Houston, Schreiner, and Moorhead 1994).

Vegetation in Olympic National Forest

All of the vegetation types described for the park are also found in Olympic National Forest. Overall, the national forest occupies a lower-elevation area than the park; therefore, the preponderance of vegetated communities within the national forest are representative of those typically occupying relatively lower elevations, such as the western hemlock zone, Pacific silver fir zone, and Sitka spruce zone (figure 9). Staging areas in the Olympic National Forest proposed for mountain goats would be located in areas within the western hemlock zone and Douglas-fir zone. These areas would be likely to require clearing and grading in order to establish suitable sites for translocation activities.

The Olympic National Forest plan as amended by the Northwest Forest Plan sets forth vegetation management guidance for the forest, including management of old growth forest habitats as well as management for harvest of timber products (USDA/DOI 1994).

The Olympic National Forest plan incorporates the Record of Decision (ROD) for the Pacific Northwest Region Invasive Plant Program (FS 2005), which supplants the *Pacific Northwest Region Final EIS for Managing Competing and Unwanted Vegetation*, dated December, 1988. Management direction in the ROD includes invasive plant prevention and treatment/restoration standards intended to help achieve stated desired future conditions, goals, and objectives. The management direction is expected to result in decreased rates of spread of invasive plants, while protecting human health and the environment from the adverse effects of invasive plant treatment (FS 2005).

Special-Status Vegetation Species

The Olympic Peninsula contains a variety of habitats suitable for special-status plant species. A discussion of species protected by the ESA can be found in the “Threatened or Endangered Species” section. Because NPS does not designate species with special conservation status, the following discussion covers vegetation species of concern that have been given special designation by the State of

Washington or by the USDA Forest Service, and could be affected by interactions with mountain goats or activities associated with mountain goat management on the Olympic Peninsula.

Washington State Species of Concern

As of August 2015, plant species with the potential to occur within the project area that are of special concern to the state are outlined in table 8 (WDNR 2014; USFWS 2016a).

TABLE 8. STATE-LISTED PLANT SPECIES IN OLYMPIC NATIONAL PARK

Common Name	Scientific Name	Federal Status	State Status
Cotton's milkvetch	<i>Astragalus australis</i> var. <i>cottonii</i>	No	Threatened
Triangular-lobed moonwort	<i>Botrychium ascendens</i>	No	Sensitive
Tall bugbane	<i>Cimicifuga elata</i>	No	Sensitive
Royal Jacob's ladder	<i>Polemonium carneum</i>	No	Threatened
Olympic cut-leaf synthyris	<i>Synthyris pinnatifida</i> var. <i>lanuginosa</i>	No	Threatened

Sources: NPS 2008a; WDNR 2015; NatureServe 2015c

Cotton's Milkvech (*Astragalus australis* var. *olympicus*). Cotton's milkvech, also known as Olympic Mountain milkvech, is an endemic species that is designated as threatened by the Washington Department of Natural Resources (WDNR 2015). Its conservation status is considered globally imperiled according to NatureServe (2015c). Cotton's milkvech is a perennial herb that blooms in July and August and it occurs on dry talus slopes and open, rocky crests at approximately 4,600 to 5,600 feet. Because it grows within mountain goat habitat, it is believed to be threatened by exotic mountain goats, which trample the native vegetation (NatureServe 2015c). It is possible that management activities associated with this plan/EIS could take place within habitat for this species, which includes mountain goat habitat as well as Deer Park and Hurricane staging areas (Copass pers. comm. 2015).

Triangular-Lobed Moonwort (*Botrychium ascendens*). This species, also known as upward-lobed moonwort, is designated as sensitive by the State of Washington (WDNR 2014). Its conservation status is considered globally vulnerable and imperiled within Washington State according to NatureServe (2015c) and WDNR (2015). This is a small, perennial fern that generally occurs in lower montane coniferous forests (NatureServe 2015c). It is possible that management activities associated with this plan/EIS could take place in proximity to habitat for this species (Copass pers. comm. 2015).

Tall Bugbane (*Cimicifuga elata*). Tall bugbane is designated as sensitive by the State of Washington (WDNR 2015). Its conservation status is considered globally secure, but vulnerable within Washington State according to NatureServe (2015c) and WDNR (2015). This species is a coarse perennial herb that is found in moist, shady woods primarily at lower elevations; particularly, north-facing slopes in mature Douglas fir (*Pseudotsuga menziesii*) and bigleaf maple (*Acer macrophyllum*) forests (NatureServe 2015c). It is possible, but unlikely, that management activities associated with this plan/EIS could take place in proximity to habitat for this species (Copass pers. comm. 2015).

Royal Jacob's Ladder (*Polemonium carneum*). Royal Jacob's ladder, also known as great polemonium, is designated as threatened by the State of Washington (WDNR 2015). Its conservation status is considered globally vulnerable, and imperiled within Washington State according to NatureServe (2015c) and WDNR (2015). This species is a perennial herb that occurs in woody thickets, open and moist forests, prairie edges, and roadsides from northern Washington to the San Francisco Bay Area of California

(NRCS 2015). It is possible that management activities associated with this plan/EIS could take place within habitat for this species (Copass pers. comm. 2015).

Olympic Cut-Leaf Synthyris (*Synthyris pinnatifida* var. *lanuginosa*). Olympic cut-leaf synthyris, also known as featherleaf kittentails, is designated as threatened by the State of Washington (WDNR 2015). Its conservation status is considered globally secure, but critically imperiled within Washington State according to NatureServe (2015c) and WDNR (2015). It is endemic to the Olympic Peninsula with known occurrence in the Hood Canal and Dungeness-Elwha watersheds. This species typically occurs in dry, rocky areas in cushion-plant communities of high elevations (NatureServe 2015d). It is possible that management activities associated with this plan/EIS could take place within habitat for this species, which includes mountain goat habitat as well as Deer Park and Hurricane staging areas (Copass pers. comm. 2015).

USDA Forest Service Special-Status Vegetation Species

Olympic National Forest also lists plant species under their special-status species program. Species identified by this program were evaluated and are identified in appendix G. Appendix G includes a general habitat description and notes about whether the species or its habitat is present in the project area. Species and their habitats identified as occurring in areas where mountain goats or mountain goat management activities could occur include Regional Forester sensitive plant species. No management indicator or survey and manage designated plant species were identified.

THREATENED OR ENDANGERED SPECIES

Threatened or Endangered Wildlife

Table 9 shows the federally listed wildlife species with the potential to occur within the project area on the Olympic Peninsula (WDFW 2015a; USFWS 2016a) and to be affected by actions taken under the alternatives considered.

TABLE 9. FEDERALLY LISTED WILDLIFE SPECIES IN THE OLYMPIC PENINSULA PROJECT AREA

Common Name	Scientific Name	Federal Status	State Status
Birds			
Northern spotted owl	<i>Strix occidentalis caurina</i>	Threatened	Endangered
Marbled murrelet	<i>Brachyramphus marmoratus</i>	Threatened	Threatened

Sources: USFWS 2015a, 2016a, 2016c; WDFW 2015a; NatureServe 2015a; NPS 2007

Northern Spotted Owl (*Strix occidentalis caurina*). The northern spotted owl is listed as threatened under the ESA and as endangered in the State of Washington. The USFWS has indicated that it will be assessing whether to change the ESA status from threatened to endangered (Buchanan 2016). Northern spotted owl home ranges contain extensive acreage of old-growth forest, which is required to meet habitat needs. The project area includes critical habitat and potential habitat for northern spotted owl, primarily in lower elevations of major drainages (figure 10). Characteristics of northern spotted owl habitat include moderate to high canopy closure, a multilayered, multispecies canopy dominated by large overstory trees; a high incidence of large trees with large cavities, broken tops, and other indications of decadence; numerous large snags; heavy accumulations of logs and other woody debris on the forest floor; and considerable open space within and beneath the canopy. For the purpose of analysis, northern spotted owl breeding season in Washington is broken into two periods: early breeding season is March 1 through

July 15, and late breeding season is July 16 through September 30. Most pairs do not nest every year, nor are nesting pairs successful every year. Incubation lasts about 30 days and young leave the nest at about 5 weeks. After leaving the nest, young depend on their parents until they are able to fly and hunt on their own. During the first few weeks, the adults often roost with young during the night (NPS 2008a; USFWS 2016a; NatureServe 2015a; Buchanan 2016).

Over 80 northern spotted owl territories in the NPS and USDA Forest Service portion of the project area have been studied for approximately 22 years. A 2014 workshop analyzed data collected from several demography studies conducted from 1990 to 2013. This analysis estimated a range-wide rate of population decline of 3.8% per year and a 3.9% annual decline for the Olympic Peninsula. NPS monitoring sites detected northern spotted owl pairs at three sites and single northern spotted owls at three sites, which represents the lowest number of sites with detections for any year of the study. Competition with the barred owl (*Strix varia*) appears to be the primary threat to the conservation of northern spotted owls in protected areas (Gremel 2014; Dugger et al. 2016).

The interior of the park has approximately 494,000 acres of forested areas considered potential northern spotted owl habitat. This represents the largest contiguous block of suitable nesting habitat remaining within the listed range of northern spotted owls. However, lower elevations of this habitat are being invaded and almost exclusively used by nonnative barred owl, which displace northern spotted owls because they are slightly larger and more aggressive (NPS 2008a). Management activities associated with this plan/EIS include one staging area (Sweets) that is very close to potential habitat for the northern spotted owl (Happe pers. comm. 2015b). The two southern staging areas proposed in Olympic National Forest, Mt. Ellinor and Hamma Hamma, occur within areas mapped as critical habitat for the northern spotted owl (Piper pers. comm. 2016c).

However, all potential staging areas in the national forest were evaluated by wildlife biologists with USDA Forest Service, NPS, and WDFW to ensure that they would not occur adjacent to suitable habitat for northern spotted owl. The field review found that the characteristics and configuration of the forest surrounding the Hamma Hamma and Mt. Ellinor staging areas do not provide habitat that is suitable for northern spotted owl (Piper pers. comm. 2016b).

Marbled Murrelet (*Brachyramphus marmoratus*). The marbled murrelet is listed as threatened, both federally and at the state level in Washington. This small seabird lives primarily in the near-shore marine environment, but nests in old-growth forests 50 or more miles inland. Suitable nesting habitat for murrelet consists of old-growth coniferous stands that are multilayered with moderate to high canopy closure. Potential habitat of this type occurs along the major drainages in lower elevations of the project area, overlapping the potential habitat for northern spotted owls (figure 10). Marbled murrelet will occasionally nest in younger stands if remnant large trees or deformities provide large enough limbs. For the purpose of analysis, the nesting season is broken into two periods: early nesting season from April 1 through August 5, and late breeding season from August 6 through September 23. Nestlings fledge in 27 to 40 days (NPS 2008a; USFWS 2016a; NatureServe 2015a).

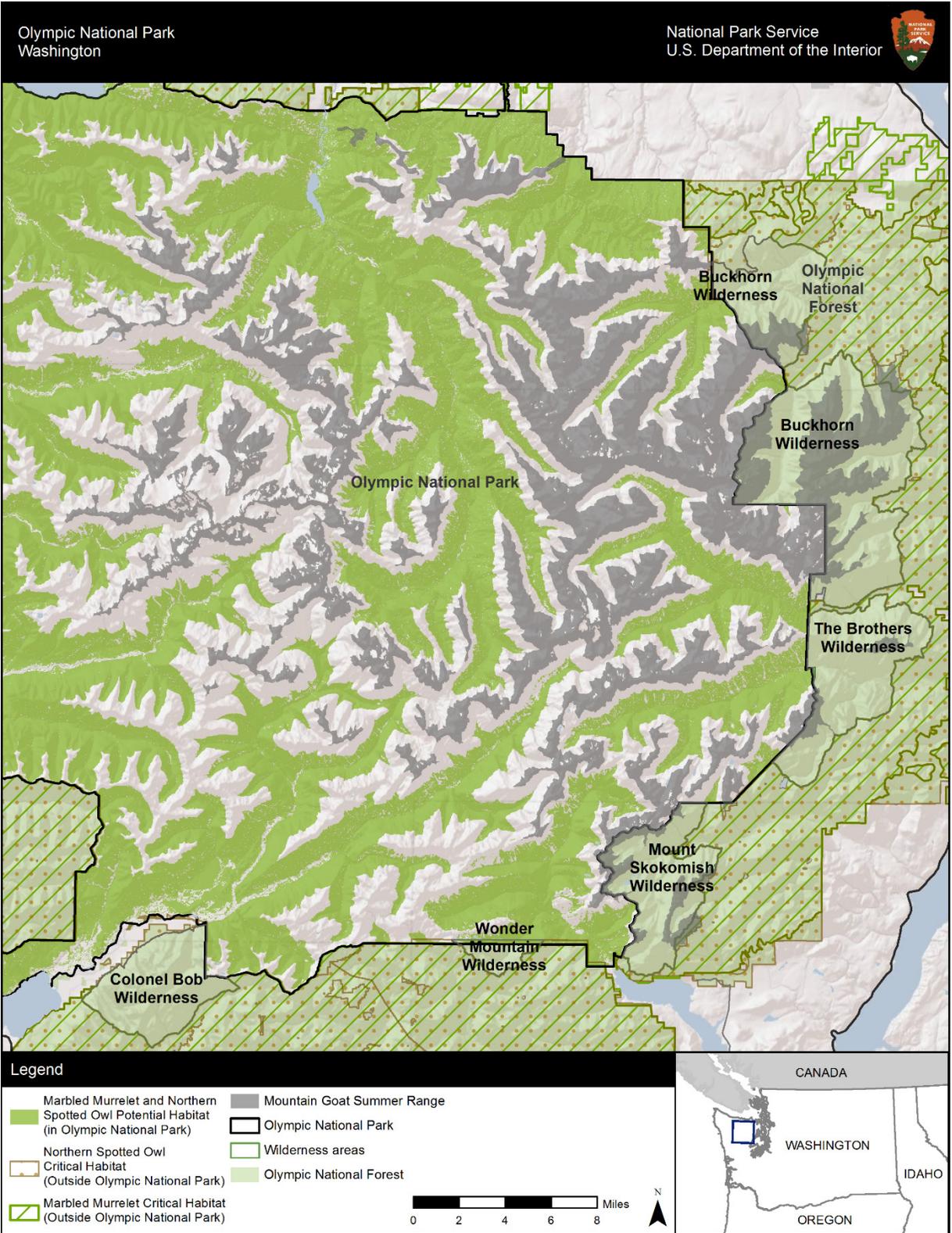


FIGURE 10. CRITICAL HABITAT AND POTENTIAL HABITAT FOR NORTHERN SPOTTED OWL AND MARBLED MURRELET ON THE OLYMPIC PENINSULA

Within the project area, marbled murrelet occur within all major drainages below approximately 4,000 feet. Audio-visual survey efforts for nesting marbled murrelets have found occupied stands up to approximately 3,800 feet on the east side of the Olympic Peninsula and up to approximately 3,500 feet on its west side (USFWS 2009). Approximately 453,000 acres of forested area within the park are considered suitable nesting habitat, representing the largest contiguous block of suitable nesting habitat remaining within the listed range of marbled murrelet in the lower 48 states. The park is located in two different marbled murrelet recovery zones (Zone 1: Puget Sound, and Zone 2: Western Washington Coast Range) with the line between the two zones bisecting the park from northwest to southeast (NPS 2008a). Currently, no research on the marbled murrelet is being conducted in the park. Management activities associated with this plan/EIS might include use of the Sweets staging area, which is close to potential habitat for the marbled murrelet (Happe pers. comm. 2015b).

Marbled murrelet nesting habitat in the Olympic National Forest is 259,731 acres. Similar to the national park, marbled murrelets in the forest are within Conservation Zones 1 and 2. Management activities associated with this plan/EIS include use of staging areas in the forests that are within habitat for the marbled murrelet (Piper pers. comm. 2016c).

Critical Habitat. Areas of habitat that are necessary for the survival of threatened and endangered species are designated by USFWS, to prevent activities that may “destroy or adversely modify” critical habitat for a listed species (USFWS 2016d). Because the park is 95% designated wilderness, which inherently provides protection to northern spotted owl and marbled murrelet, no critical habitat for these two threatened species has been defined within the park (Happe pers. comm. 2015a). However, potential habitat within the park has been determined by NPS and partner-agency researchers (i.e., USFWS and USGS) as forested areas below 3,000 feet on the west side of the park and below 4,000 feet on the east side. Critical habitat is designated by USFWS for northern spotted owl and marbled murrelet in the Olympic National Forest outside of wilderness areas. Figure 10 shows critical habitat for northern spotted owl and marbled murrelet on the Olympic Peninsula, which occurs outside of the park, and potential habitat is also shown within the boundaries of Olympic National Park.

The Olympic National Forest contains 386,901 acres of designated critical habitat for the northern spotted owl, of which approximately half are considered suitable habitat. The Olympic National Forest also contains 411,964 acres of designated critical habitat for the marbled murrelet, of which approximately half are considered nesting habitat (Piper pers. comm. 2016c). The Mt. Ellinor staging area and Hamma Hamma staging area are both within Critical Habitat Unit NC02 for northern spotted owl and Critical Habitat Unit WA-06-b for marbled murrelet. However, to ensure that proposed management activities would not occur adjacent to occupied northern spotted owl or marbled murrelet habitat, or suitable nesting habitat for marbled murrelet, these potential staging areas were evaluated by wildlife biologists with USDA Forest Service, NPS, USFWS, and WDFW (Happe et al. 2016). The evaluation resulted in the determination that the habitat surrounding the Mt. Ellinor and Hamma Hamma staging areas is not suitable habitat for northern spotted owls or marbled murrelets (Happe et al. 2016).

Threatened or Endangered Plant Species

As noted in chapter 1, no plant species within the project area on the Olympic Peninsula are federally protected under the ESA. Whitebark pine is the only plant species considered for listing (candidate) that has potential to occur in the project area, but has been dismissed from further analysis due to the lack of potential impacts on it from proposed management activities (USFWS 2016a).

ACOUSTIC ENVIRONMENT

Acoustic resources are physical sound sources, including both natural sounds (e.g., wind, water, wildlife, vegetation) and cultural and historic sounds (e.g., battle reenactments, tribal ceremonies). The acoustical environment is the combination of all the acoustic resources within a given area. This includes natural sounds and cultural sounds, as well as non-natural human-caused sounds. NPS *Management Policies 2006* require NPS to restore and manage park acoustical environments and soundscapes (NPS 2016b). According to the NPS, a soundscape is defined as the “total acoustic environment of an area,” which includes both natural and human sounds (Fristup, Joyce, and Lynch 2009). According to section 4.9 of *NPS Management Policies 2006*, the natural soundscape of a park refers to the combination of all of the natural sounds occurring in the park, absent the human-induced sounds, as well as the physical capacity for transmitting those natural sounds (NPS 2006a).

The acoustical environment is the combination of all the acoustic resources within a given area. This includes natural sounds and cultural sounds, as well as non-natural human-caused sounds.

Natural sounds include sounds that are both within and beyond the range that humans can perceive, and can be transmitted through air, water, or solid materials. Some natural sounds in the natural soundscape are also part of the biological or other physical resource components of the park. Natural sounds are an important park resource and a critical component of the ecological communities that parks seek to preserve. Common natural sounds at Olympic National Park and Olympic National Forest range from bird calls and insect chirps to sounds produced by physical processes, such as wind rushing through leaves on trees, thunder, pouring rain, rivers and waterfalls. Natural sound and the opportunity to experience solitude are valued components of the visitor experience within the park and the national forest. The wilderness qualities of a backcountry experience in particular include the ability of visitors to enjoy uninterrupted solitude and natural sounds.

Noise is generally defined as unwanted or intrusive sound. Noise can adversely affect park resources or values, including but not limited to natural soundscapes, wildlife, wilderness, and visitor experience. Primary sources of human-caused noise in national parks can include cars, buses, and other motorized vehicles, including recreational vehicles and their generators; airplanes and helicopters; and park operations, such as the use of maintenance equipment. Human activities in Olympic National Park and Olympic National Forest generate intermittent noise, including the use of mechanical or motorized equipment, such as chainsaws, during management and maintenance activities; construction activities; overflights conducted as part of wildlife surveys; and visitor use activities (use of motor vehicles, recreational vehicles, people in campgrounds, etc.). In addition to these noise sources, traffic on Highway 101 and military and commercial overflights introduce noise that is carried from outside into the park and the national forest.

The magnitude of noise is usually described by its sound pressure. The A-weighted decibel (dBA) scale is commonly used to describe noise levels because it reflects the frequency range to which the human ear is most sensitive. Throughout this section and the analysis of impacts on soundscapes in chapter 4, all noise levels are expressed in dBA. Sound levels in national parks can vary greatly, depending on location, topography, vegetation, biological activity, weather conditions, and other factors. For example, background sound levels within a typical suburban area fluctuate between 50 and 60 dBA, while the crater of Haleakala National Park is intensely quiet, with levels around 10 dBA (NPS 2015d). Several examples of sound pressure levels measured in national parks using the A-weighted scale are listed in table 10.

TABLE 10. COMMON NOISE LEVELS AND THEIR EFFECTS ON THE HUMAN EAR

Decibel level (dBA)	Sound Source	Noise Level
10	Volcano crater (Haleakala National Park)	Very low
20	Leaves rustling (Canyonlands National Park)	Very low
40	Crickets at 5 meters (Zion National Park)	Low
60	Conversational speech at 5 meters (Whitman Mission National Historic Site)	Medium
80	Snowcoach at 30 meters (Yellowstone National Park)	High
100	Thunder (Arches National Park)	High
120	Military jet, 100 meters above ground level (Yukon-Charley Rivers National Park)	High
126	Cannon fire at 150 meters (Vicksburg National Military Park)	High

Impacts on soundscapes are typically analyzed in terms of natural ambient sound levels and existing ambient sound levels. Natural ambient sound levels are defined as natural sound conditions found in a project area, including all sounds of nature (i.e., wind, water, wildlife, etc.), and excluding all human and mechanical sounds. Existing ambient sound levels are defined as the composite, all-inclusive sound associated with a given environment, including human and mechanical sounds. Existing ambient sound levels for areas that are in or near the project area are shown in table 11. Sound-level data for existing ambient sound conditions were analyzed in terms of the following metrics (Lee and MacDonald 2016):

- **LA_{eq}**: The equivalent sound level determined by the logarithmic average of sound levels of a specific time period.
- **L₅₀**: A statistical descriptor describing the sound level exceeded 50% of a specific time period (i.e., the median sound level).
- **L₉₀**: A statistical descriptor describing the sound level exceeded 90% of a specific time period and only the quietest 10% of the sample can be found below this point.

The data in table 11 represent existing ambient sound conditions for two locations in the park during wintertime, and may not be completely representative of overall ambient sound conditions for the park. For example, ambient sound levels at Hurricane Ridge may be naturally lowered during winter due to the muffling effects of snow cover, and are likely lower due to a reduced visitor presence. Soundscape monitoring data collected for the summer season has not yet been analyzed.

TABLE 11. EXISTING AMBIENT SOUND CONDITIONS IN OLYMPIC NATIONAL PARK, JANUARY–MARCH, 2010

Site Name	Total Days	Existing Ambient					
		Daytime (7 a.m. to 7 p.m.)			Nighttime (7 p.m. to 7 a.m.)		
		LA _{eq} (dBA)	L ₅₀ (dBA)	L ₉₀ (dBA)	LA _{eq} (dBA)	L ₅₀ (dBA)	L ₉₀ (dBA)
Hurricane Ridge	38	38.0	24.4	15.4	38.4	21.8	14.7
Lake Crescent	26	44.8	35.1	31.5	45.1	32.4	28.6

Overall, based on a geospatial model constructed by the NPS Natural Sounds and Night Skies Division, the mean existing ambient daytime sound level at Olympic National Park during mid-summer is estimated to be 33.3 dBA (Wood 2015). At this sound level, the soundscape of the park would be considered relatively intact, although some areas along the coast and around popular visitor areas have higher ambient sound levels. In other words, the project area receives relatively little influence from human-caused sounds and the model predicts that the influence of human-caused sounds averages only 0.8 dBA, ranging from 0 to 13.8 dBA, above natural conditions (Wood 2015). This demonstrates that natural sounds intrinsic to the park are an important component of the park's environment needing protection.

SOILS

Soil development in the Olympic Mountains is predominately driven by the amount of moisture in the soil. Sufficient water is present over most of the Olympic Peninsula to cause both rapid weathering and leaching of nutrients; therefore, the soils tend to be relatively infertile (NPS 2008a). The amount and type of organic matter in the soil is important to soil structure and fertility. Organic matter contains many organically bound nutrients such as nitrogen, phosphorus, and sulfur, which are released slowly in the rooting zone where they are most available. Soil organic matter is also the food base for many animals, and organic matter is important in soil mixing and aeration. In the park, the tendency is for organic material to accumulate on the surface of the soil (NPS 2008a).

Mountain goats primarily reside in fragile alpine soil areas of the park. Alpine and subalpine soils in the Olympic Mountains are young and poorly developed, making them sensitive to disturbance. Alpine and subalpine soils on the Olympic Peninsula are generally acidic with pH values ranging from 4.5 to 5.7 for most soils (NPS 2008a). Soils in the southern and western portions of the park consist of fine-grained volcanic soils, while sedimentary soils from deposition dominate the northern and eastern portions. Metamorphosed and volcanic sediments are often found at higher elevations and in the interior of the park. At lower elevations, soils derived from glacial drift are common (NPS 1995).

Alpine and subalpine soils in the Olympic Mountains are young and poorly developed, making them sensitive to disturbance.

Mountain goats are known to wallow in these soils (NPS 1995; Houston, Schreiner, and Moorhead 1994; Schreiner and Woodward 1994). The typical wallow is flat with exposed mineral soil where surface rocks and vegetation have been removed or eliminated (Houston, Schreiner, and Moorhead 1994). These wallows can range from 32 to 700 square feet in size. Because wallowing removes soil surface layers, the soil has reduced organic matter and associated water-holding capacity, reduced nutrients available for vegetation, increased soil aeration, and increased surface temperature. The soil resulting from mountain goat wallows provides less stability for plant regeneration. These changes to the soil can cause major shifts in plant community composition around wallow edges (NPS 1995).



Mountain goat wallowing in Olympic National Park

Soils in Olympic National Forest

Soils in Olympic National Forest are similar to those found in Olympic National Park (NRCS 2016). However, a few generalizations can be made about the soils in the forest. Surface soils typically vary between gravel, silt loams, and silty clay loams. These soils generally have low bulk densities. The properties of these soils are indicative of the presence of amorphous (structureless) clays, with exception of soils formed from the continental glacial drift, which tend to be gravel to gravel sand loams (FS 1990).

The upland soils in the national forest are well drained and have a thin surface. Subsoils strongly resemble original bedrock materials, with depth and gravel contents varying widely. Glacial and alluvial bottomland soils are generally thicker, with high water retention capacities. Surface infiltration rates are also high. Soils in the national forest remain moist up to 4 months in summer, except in the northeastern corner where the soil moisture regime is mostly xeric (FS 1990).

Sensitive soils are scattered throughout the national forest. These are generally correlated with (1) steep slopes, (2) incised stream channels, (3) unstable bedrock, and (4) water seepage areas. Soils erode primarily via mass movement (landslide) mechanisms (FS 1990).

ARCHEOLOGICAL RESOURCES

The NPS categorizes cultural resources as archeological resources, cultural landscapes, historic structures (which include districts), museum objects, and ethnographic resources. As indicated in “Chapter 1: Purpose of and Need for Action,” the project has been evaluated as having no potential impact on cultural landscapes, historic structures, museum objects, and ethnographic resources. Therefore, these impact topics have been dismissed, leaving only archeological resources. Approximately 1% of the park and 3% of the national forest has been surveyed for archeological resources. Although limited, these surveys indicate that the project area contains both known and unknown archeological resources (Conca pers. comm. 2015a, 2015b). The 2002 NPS Site Estimation Project for Olympic, North Cascades, and Mount Rainier National Parks supports the potential for thousands of additional archeological resources in the sub-alpine areas of the park (NPS 1998).

The subalpine and alpine areas of the Olympic Mountains were used extensively prehistorically and historically by Native Americans (NPS 1995). It is thought that the peopling of the Olympic Peninsula began approximately 14,000 B.P (Matson and Coupland 1995; Schalk 1988; Waters et al. 2011). There are no known sites attributed to the paleoindian occupation of the park or Olympic National Forest. Native Americans living on the Olympic Peninsula today explain that they have been here since time immemorial. Archeological survey and excavation within the park and forest have documented sites dating back nearly 9,000 years (Kwarsick 2011). These sites are generally lithic scatters characterized by shallowly buried stone tools, flakes, and debitage (the remnants of stone tool production). In Olympic National Forest, these sites tend to be located near high mountain lakes, meadows, and along ridge lines (FS 1998). While documented archeological sites from this early period are rare, it is likely that additional early sites are present within the project area.

Middle period sites (6,000–3,000 BP) are less common in the park and forest, but several sites have been documented and investigated that date to this period (Gallison 1994; Samuels 1991; Schalk, Speulda and Conca 1996; Conca 2000). Sites from this period in the park and forest are dominated by lithic scatters, while there are several shell midden sites along the coast that date to this period. Later period archeological sites are well represented across the Olympic Peninsula (Kwarsick 2011). Sites from this period tend to consist entirely of lithic materials and are difficult to date, it is assumed that they date to this period (Kwarsick 2011). These sites are commonly found in the subalpine region of the park; a trend that is likely the same within Olympic National Forest.

The late period (ca. <3,000BP) has been well researched on the Olympic Peninsula (Schalk 1988; Ames and Maschner 1999). While people were focused on maritime resources during this period, the interior of the park including the high country remained important and was used extensively. Archeological sites representing this time period include large coastal villages and towns, resource procurement sites, rock art sites and a large number of flaked stone tool scatters located primarily in the subalpine zone.

Contact between Europeans and Native Americans occurred in 1792 when Captain George Vancouver came through the Hood Canal and noted coastal villages. The Euro-American settlers arrived in the 1860s with a major influx occurring between 1890 and 1895 (FS 1998). These settlers not only set up homesteads but looked inland for timber and mining. Evidence of this use is still present in many parts of Olympic National Forest and these types of historic archeological sites are recorded as cultural resources (FS 1998). Ethnographic accounts document the use of the high country by Native Americans for a variety of reasons, including resource procurement and travel between villages. It is likely that travel in these mountains was limited to the snow-free months (FS 1998).

The presence of early archeological sites and ethnographic documentation indicate the potential for additional archeological sites to be identified within the subalpine and alpine areas of the park. Given the nature of archeological sites in general, and their likelihood of being shallowly buried within the alpine areas of the park, these resources are easily impacted by ground disturbing activities. These activities include trampling or wallowing by mountain goats as well as management activities aimed at managing these animals.

Olympic National Park

There are over 250 archeological sites recorded within Olympic National Park. These represent over 8,000 years of human use and are spread across the entire park from sea level to nearly 7,000 feet in elevation. They include coastal village sites, rock art sites, lithic scatters, historic period sites, and landscape features. Of these, 97 archeological sites are located in the subalpine and alpine vegetation zones used by mountain goats, or above 4,900 feet above sea level. Of these sites 92 are prehistoric, three are historic and two are multi-component sites that consist of both historic and prehistoric cultural materials. Of the prehistoric archeological sites, three are rock shelters, one of which is a pit feature, and the remaining 88 are lithic scatters. While most of these sites have yet to be evaluated for eligibility to the National Register of Historic Places, the majority of them are likely eligible and will be treated as such until an evaluation has been completed.

Olympic National Forest

There are 205 known archeological resources within the Olympic National Forest. There has been minimal archeological inventory specifically within the wilderness areas of Olympic National Forest (Hauge pers. comm. 2016). Only ten archeological resources have been documented within the project area, eight of which are within the Buckhorn Wilderness and two which are outside of wilderness but within alpine and subalpine vegetation zones used by mountain goats, or above 4,900 feet above sea level. These resources include three trails, one trail shelter, one historic site associated within mining and five prehistoric lithic scatters. Only two of these sites, both trails, have been evaluated for eligibility to the National Register of Historic Places; the remaining sites are considered unevaluated.

VISITOR USE AND EXPERIENCE

Because many of the areas that mountain goats inhabit are also popular destinations for recreational visitors in the project area, both in the frontcountry (e.g., Hurricane Ridge) and backcountry (e.g., Glacier Meadows) (see figure 11 for a map of the project area showing visitor use areas), there is a high potential for mountain goat-human interactions (appendix A). Responses to the possibility of seeing mountain goats vary. Some visitors, interested in viewing all wildlife, welcome the opportunity to see the mountain goats, while others ask how to avoid them (Burger pers. comm. 2015).

Visitor Use and Experience in Olympic National Park

Park Visitation and Use

As seen in table 12, in 2015, the park received 3,263,761 recreation visitors and 43,325 backcountry campers. In 2016, visitor numbers are slightly higher, numbering approximately 50,000 more visitors during 2016 than 2015 by the end of November, as numbers for December are not yet available (NPS 2017a). Most people visit the park in the summer months. Recreational visits were highest from June through September with the greatest number in August, which has exceeded 700,000 visitors that month for the past 3 years. The park receives the greatest number of backcountry campers from July through September, with the greatest number in August during 2015 (23,514). In December, the park received the fewest recreation visitors in 2015 (68,935) and the fewest backcountry campers (201) (NPS 2017a).

Annual recreational visitation has remained above 2.5 million people over the past 30 years (1984–2015). The total number of recreational visitors to the park exceeded 3 million annually for the first time in 1992 and that number of visitors has been maintained during most years since then. In 15 of the past 20 years (1996–2015), more than 3 million people visited the park annually. The park received the most visitors in 1997 (3,846,709) (NPS 2017a).

TABLE 12. 2015 MONTHLY VISITATION IN OLYMPIC NATIONAL PARK

Month	Recreation Visitors	Backcountry Campers
January	79,877	254
February	102,766	726
March	110,453	1,153
April	163,263	1,732
May	280,726	4,743
June	550,337	12,606
July	568,820	21,705
August	702,159	23,514
September	391,825	18,981
October	139,783	2,381
November	104,817	591
December	68,935	201
Total	3,263,761	88,587

Source: NPS 2017a



FIGURE 11. MAP OF PROJECT AREA ON THE OLYMPIC PENINSULA SHOWING VISITOR USE AREAS AND FACILITIES

Table 13 shows park visitation at specific locations that occur within proximity to the project area. Lake Crescent is the most popular area for visitors in the park, attracting a total of 1,938,121 people in 2015. The greatest number of people visited Lake Crescent during August (342,627). Another popular area is Hurricane Ridge, which is the location of one staging area, attracting 427,681 visitors in 2015. The greatest monthly visitation (90,078) at Hurricane Ridge occurred during August. Within the project area, the least popular visitor area is referred to as Hoodsport, which is used to access the Staircase entrance near the Mt. Ellinor staging area, attracting only 93,087 visitors in 2015. The greatest number of people visited the Hoodsport area in August (18,257) (NPS 2017a).

TABLE 13. 2015 MONTHLY VISITATION IN OLYMPIC NATIONAL PARK BY AREA

Month	Area			
	Elwha River Valley	Hoodsport	Hurricane Ridge	Lake Crescent
January	1,773	488	6,791	86,130
February	2,516	4,037	10,888	98,629
March	6,497	2,589	10,673	92,869
April	12,620	8,733	13,611	141,310
May	15,121	10,888	36,789	145,886
June	30,066	10,233	67,663	356,486
July	40,630	18,132	88,878	256,664
August	7,890	18,257	90,078	342,627
September	11,660	12,318	59,387	161,199
October	1,812	2,488	24,233	94,400
November	200	2,618	7,631	100,774
December	200	2,306	11,059	61,147
Total	130,985	93,087	427,681	1,938,121

Source: NPS 2017a

A comprehensive visitor survey was conducted at the park from July 7 through 16, 2000, by the Park Studies Unit of the University of Idaho, which found that the most common visitor activities at Olympic National Park were sightseeing/scenic driving (88%); walking on nature trails (77%); enjoying wilderness, solitude, quiet (73%); viewing wildlife (72%); and hiking (71%). Other activities included camping in developed campgrounds, attending ranger-led programs, visiting cultural sites, stargazing, overnight backpacking, fishing, and bicycling. A number of visitors participate in wilderness mountaineering and alpine scrambling. Nontechnical scrambling, glacier travel, and off-trail high-elevation traverses are popular activities. Several concessions and businesses under permit provide recreational services in and around the park, including river rafting, boat rentals, guided wilderness trips, horseback riding, and pack stock and guided trips (NPS 2008a; Van Ormer, Littlejohn, and Gramann 2001). Approximately 23% of visitors indicated they had visited the park more than one time during the 12 months when this survey was conducted in 2000. Approximately 69% spent one day or more at the park. Of those visitors who spent less than one day at the park, 77% spent 1 to 6 hours in the park. Over half of the visitors (62%) said that they spent one or two nights in the park (Van Ormer, Littlejohn, and Gramann 2001). In 2006, there were 82,739 visitor use nights recorded for overnight wilderness use. Favorite areas of the park included Hurricane Ridge, Hoh Rain Forest, Sol Duc, Quinault, Lake Quinault, Lake Crescent, and Rialto Beach (figure 11). Visitors listed these areas as “favorite” because of scenery,

trails, wildlife, natural beauty, a unique experience, and old-growth forest among others (NPS 2008a; Van Ormer, Littlejohn, and Gramann 2001).

Park Facilities and Trails

The park is open 24 hours a day year-round, although some roads, campgrounds, and facilities are open seasonally. There are more than 140 miles of paved and unpaved visitor use roads in the park and approximately 1,500 visitor parking spaces. The main visitor center in Port Angeles is open daily in the summer with reduced hours from fall to spring. It offers information, an orientation movie, nature trails, a children’s discovery room, exhibits, and handicap-accessible exhibits. There are additional visitor centers at Hurricane Ridge and Hoh Rain Forest, and ranger stations at Quinault, Storm King, and Staircase (NPS 2008a). With the



Recreational visitors enjoy the numerous hiking trails in Olympic National Park

exception of Hurricane Ridge Visitor Center, located 1.3 miles from the Hurricane staging area, the majority of these facilities are located outside of areas where mountain goat management activities associated with the action alternatives would take place. The Staircase Ranger Station is located within approximately 4 miles of the Mt. Ellinor staging area (see figure 11 for a map of park facilities and trails).

The park has 13 developed campgrounds and more than 2,000 campsites (figure 11). Of these, 883 are classified as non-wilderness, road-accessible, while 1,300 are classified as wilderness. Some non-wilderness, road-accessible campsites are open year-round, while others close or become primitive with pit toilets and no water during winter months. Wilderness campsites include small designated camps for hikers, group camps for 7 to 12 people, and stock camps. Permits are required for all overnight stays in the wilderness (NPS 2008a).

As described in the “Wilderness Character” section of this chapter, the park wilderness protects opportunities for solitude and for primitive and unconfined recreation. Visitors to the park have the opportunity to connect with the natural world, to practice traditional skills, and to have transformative personal experiences (NPS 2008a). According to the 2008 park *General Management Plan* (NPS 2008a), overnight wilderness use peaked in 1995 with 123,840 visitor use nights (one visitor use night = one visitor for one night) in the Daniel J. Evans Wilderness. In the late 1990s, overnight use decreased by about 30% and by 2003, there were 94,567 visitor use nights. In 2006, there were 83,420 visitor use nights recorded for overnight wilderness use (NPS 2008a).

Numerous diverse trails within the park vary in both length and remoteness, which can be divided into five separate geographic areas:

- Staircase/Dosewallips Trails and Hurricane Ridge/Elwha Trails, which traverse areas where mountain goat management activities would be likely to take place under the action alternatives;
- Quinault/Queets Trails and Hoh/Bogachiel/Sol Duc Trails, portions of which may traverse areas where mountain goat management activities could be detectable;

- Royal Basin, accessed by the Dungeness River Trail, which traverses areas where mountain goat management activities would be likely to take place under the action alternatives;
- Deer Park, where mountain goat management activities would be likely to take place nearby under the action alternatives; and
- Coastal Routes, which are outside of areas where mountain goat management activities would be likely to take place.

About 32 miles of wider paved or gravel nature trails may include educational signs and appeal to more inexperienced hikers or those who may want a short self-guided interpretive hike. There are 611 miles of maintained trails in designated wilderness. The Pacific Northwest National Scenic Trail traverses 140 miles through the park, passing east to west through the heart of its remote wilderness. About 60% of park wilderness trails (approximately 365 miles) are open to stock use (NPS 2008a; NPS 2015a).

Visitor Use and Experience in Olympic National Forest

Olympic National Forest occupies 632,324 acres of land, including approximately 88,265 acres of wilderness areas adjoining the park (NPS 1995). The forest plays an important role in providing developed and undeveloped recreational opportunities on the Olympic Peninsula.

Visitor activities in Olympic National Forest are similar to those described for the park. Common recreational activities for national forest visitors include hiking, backpacking camping, fishing, bicycling, wildlife viewing, auto touring, horseback riding, and hunting. Unique activities such as clam digging, oyster picking, and scuba diving are also available. Recreational opportunities in the national forest also include facilities and areas that have national and regional significance, such as Lake Quinault Lodge (FS 1990, 2016b). During the summer, the USDA Forest Service provides educational interpretive services to the public two to three times per week at Mt. Ellinor and Marmot Pass, which involve speaking with 100 or more visitors per day (FS 2016d).

Habitat used by mountain goats exists in upper elevations on the eastern side of Olympic National Forest, largely within designated wilderness areas adjacent to the park, and projected mountain goat population growth and habitat use are expected to remain concentrated in these areas (see figure 5 in chapter 2). In addition, the Mt. Ellinor and Hamma Hamma staging areas are each located at lower elevations in Olympic National Forest, near trailheads and frontcountry campgrounds. Camping, day hiking, climbing, backpacking, and hunting in these portions of the national forest, on the northeastern and southeastern flanks of the Olympic Mountains, are therefore the most likely visitor uses that could be affected by management activities associated with this plan/EIS.

Wilderness areas in Olympic National Forest receive heavy use from hikers and backpackers. The Buckhorn Wilderness receives the highest visitation of all five wilderness areas, while the smaller Mount Skokomish Wilderness contains the Mt. Ellinor Trail, one of the most popular trails in the national forest (Shaw 2011). Trail counter data for the Mt. Ellinor Trail recorded 10,718 visitors in 2015. The three next most popular wilderness trails, the Mount Townsend Trail, the Tubal Cain Trail, and the Upper Big Quilcene Trail, are all located in the Buckhorn Wilderness. In 2015, these trails received 6,625; 3,689; and 5,135 visitors, respectively (Weinberg pers. comm. 2016). Mountain goat presence is greatest in the Buckhorn Wilderness and Mount Skokomish Wilderness areas (see figure 8). On the Mt. Ellinor Trail in particular, a number of mountain goat-human encounters have taken place and measures such as trail closure, hazing patrols, and other types of interventions have been implemented. These are discussed in further detail below in the “Visitor and Employee Safety” section of this chapter.

Hunting mountain goats, which is prohibited within the park, is permitted in Olympic National Forest. Hunting activities include sport hunting as well as hunting by local tribal members. While the mountain goat population crosses jurisdictional boundaries of the park and the forest, the majority of mountain goats reside in more extensive habitat within the park, where hunting is not permitted.

WDFW manages and regulates hunting on NFS lands and provides information to the public regarding hunting in visitor use areas (FS 2016d). The WDFW 2015–2016 *Big Game Hunting Seasons and Regulations* (WDFW 2015c) provide information on designated hunting areas, hunter responsibilities, and permit requirements. Harvest of mountain goats throughout Washington is subject to a “once-in-a-lifetime” restriction, wherein a hunter is permitted to take only one mountain goat over the course of a lifetime. Hunters may harvest any adult mountain goat with horns greater than 4 inches long (WDFW 2015c). In areas outside of the Olympic Mountains, WDFW discourages hunters from harvesting nannies; however, in the Olympic Mountains, the harvesting of all mountain goats is encouraged because the hunt in the Olympic Mountains is intended to reduce the mountain goat population and reduce instances of conflicts between mountain goats and humans (WDFW 2015c; Harris pers. comm. 2015b).

In 2014, WDFW offered six hunting permits for the Olympic Mountains, two of which were filled. Hunting season dates for 2014 were September 15–25 (for an early season) and September 26–October 6 (late season). In 2015, WDFW again offered six permits, split into two similar season lengths, but encouraged a higher harvest rate by (1) combining two formerly adjacent units (Mount Washington in the south and The Brothers in the north) into a single East Olympic Mountains unit; and (2) making this hunt into a separate hunt type within the WDFW system. The first change was made to allow hunters more choice in where they decided to hunt (because of a relatively smaller number of mountain goats and difficult access in the northern area). The second change was to encourage hunter participation, by removing the loss of preference points hunters may otherwise have for other Washington mountain goat hunting areas should they draw an Olympic Peninsula mountain goat permit but fail to harvest. In spite of these changes, only two mountain goats were harvested in 2015. During the 2016 hunting season, six permits were issued and five of the permit holders were successful in harvesting a mountain goat. It is anticipated that the hunt will continue under the current regulations for the 2017 hunting seasons (Harris 2015b).

VISITOR AND EMPLOYEE SAFETY

Hazards to visitors and employees in the park and the national forest include hazards typical of backcountry recreation, such as injuries from falls and exposure to inclement weather. However, for the purposes of this plan/EIS, this section focuses only on those hazards associated with mountain goat-human interactions and with current and proposed mountain goat management activities.

Hazards Associated with Mountain Goat-Human Interactions

Because many of the areas that mountain goats inhabit are also popular destinations for park visitors, there is a high potential for mountain goat-human interactions on the Olympic Peninsula. These interactions are most likely to occur in areas where mountain goats are habituated to human presence and have become conditioned to seeking salts from humans. The nature of mountain goat-human interactions can vary widely, ranging from benign to fatal. Benign interactions may include casual observation of mountain goats from a distance of several hundred feet, while fatal interactions may occur when mountain goats are in close proximity to visitors. Mountain goats pose a nuisance when they persistently seek salt and minerals from

Mountain goats pose a nuisance when they persistently seek salt and minerals from human urine, packs, and sweat on clothing.

human urine, packs, and sweat on clothing. They have been known to paw and dig areas on the ground where hikers have urinated or disposed of cooking wastewater and chew unattended clothing (appendix A).

Reports of human injuries caused by mountain goats are extremely rare in the Olympic Mountains. In all reported instances, the encounters were with large, mature male mountain goats in areas where there was a history of both habituation and salt conditioning. Two injurious mountain goat attacks have been reported, in 1999 in the Olympic National Forest and 2010 in the park. The 2010 incident in Olympic National Park involved a mountain goat killing a man by gouging his lower thigh/knee area, severing a major artery. This attack occurred after the mountain goat had followed the man for 3/4 of a mile on a trail, in an area with high visitor use and year-round mountain goat occupancy. The mountain goat was later euthanized by park staff (appendix A).

Table 14 summarizes reports of mountain goat-human interactions by area (see figure 11 for a map of visitor use areas). Table 15 summarizes mountain goat-human interaction type and frequency for 2011 through 2013. There were 157 mountain goat-human interactions reported in 2011, 169 in 2012, and 149 in 2013. From 2011 through 2013, there were the most mountain goat-human interactions (189) in the area called High Divide, and 158 at Hurricane Ridge. Only one mountain goat-human interaction was reported in North Fork Quinalt from 2011 through 2013. The majority of mountain goat-human interactions (39.3%) in this 3-year period can be classified as “mountain goat observation,” where mountain goats are generally more than 330 feet away. In a high percentage of mountain goat-human interactions (33.6%) from 2011 through 2013, mountain goats can be classified as “habituated,” where mountain goats allow people within 100 feet but not closer than 20 feet. In these instances, the goats are easily shooed away. While none of the mountain goat-human interactions in this period were classified as “aggressive,” there was one incident with a “conditioned/aggressive” mountain goat in 2011 that resulted in lethal removal of the offending animal. In instances classified as aggressive, the mountain goats make contact with a person or corner a person, making egress impossible. Similarly, a small percentage (0.2%) of interactions from 2011 through 2013 can be classified as “conditioned/aggressive,” where mountain goats aggressively seek salts. In these instances, the mountain goats may exhibit threat postures when encountered on trails, and they will not respond unless aggressively hazed (NPS 2013b).

Safety Considerations Associated with Current Mountain Goat Management at Olympic National Park

Several management actions that are currently used for managing mountain goats, including aversive conditioning, animal marking, and lethal removal of hazardous mountain goats, present certain safety concerns related to mountain goat behavior during these operations and potential for injuries.

Management operations associated with mountain goat management could involve the use of helicopters in uneven, high-elevation terrain as well as the use of firearms in backcountry areas. These management methods could result in impacts on visitor and employee safety.

Aversive Conditioning

When animals are openly frequenting an area where a number of people are present, an attempt may be made to scare or frighten the animal with aversive conditioning or hazing techniques. Hazing techniques include noise stimuli (sirens, compressed air horns, cracker shells) and contact stimuli (thrown rocks, use of a slingshot, paintballs, or rubber projectiles or bean bags fired from specialty shotgun ammunition). If hazing is used, park personnel must take into account the safety of uninvolved bystanders and employees during hazing actions (appendix A).

TABLE 14. REPORTS OF MOUNTAIN GOAT-HUMAN INTERACTIONS IN OLYMPIC NATIONAL PARK BY AREA

Area	Number of Reports		
	2011	2012	2013
Bailey Range	0	7	0
Dosewallips	2	4	0
Duckabush	1	0	4
East Fork Quinault	2	1	1
Elwha River Valley	5	2	3
Grand Valley	12	11	0
High Divide	60	65	54
Hoh	6	2	4
Hurricane Ridge	48	55	55
North Fork Quinault	1	0	0
O'Neil Pass Area	2	1	2
Royal Basin	7	0	1
Staircase/Skokomish	11	21	25
Total	157	169	149

Source: NPS 2013b.

TABLE 15. FREQUENCY AND TYPE OF MOUNTAIN GOAT-HUMAN INTERACTION IN OLYMPIC NATIONAL PARK

Observation Type	Reported Mountain Goat-Human Interactions by Year			
	2011	2012	2013	Average
Mountain Goat Observation. The mountain goat is generally greater than 330 feet away.	39.5%	40.8%	37.6%	39.3%
Habituated. The mountain goat lets people get within 330 feet, but not less than 20 feet. It is easily shooed away.	38.2%	23.7%	38.9%	33.6%
Habituated and Starting To Be Conditioned. The mountain goat occasionally follows people on trails and visits campsites while people are present. It is not easily shooed away. There are no aggressive postures in males.	12.7%	33.6%	19.5%	21.9%
Conditioned. The mountain goat is persistent in following people and seeking salts. It repeatedly visits campsites. The mountain goat is hard to haze. There are some aggressive postures in males.	8.9%	1.8%	4.0%	4.9%
Conditioned/Aggressive. The mountain goat aggressively seeks salts. It exhibits threat postures when encountered on trails. It will not respond unless aggressively hazed.	0.6%	0.0%	0.0%	0.2%
Aggressive: The mountain goat attacks a person. It makes contact or corners people, making egress impossible.	0.0%	0.0%	0.0%	0.0%
Total Number of Reports	157	169	149	158

Source: NPS 2013b.

Animal Marking

If a mountain goat (or a group of mountain goats is frequenting an area) is a candidate for hazing, or if there has been a series of incidents in an area and there is uncertainty as to which mountain goat is involved, the NPS attempts to mark each animal. There are three levels of animal marking that are available for use in mountain goats: paintballs, ear tags, and radio collars (appendix A). Capture and handling of mountain goats to apply ear tags and attach radio collars presents risks of employee injury from mountain goats that are resisting capture (kicks, bites, injuries from horns); therefore, these activities must be undertaken in a manner to minimize injuries to staff.

Lethal Removal of Hazardous Mountain Goats

Conditioned and aggressive mountain goats may be lethally removed from the park using firearms or other means of humane euthanasia, according to the management continuum presented in appendix B. This has been necessary two times, once during 2010 and again in 2011. Aerial shooting involves the tracking of mountain goats via a small airplane or helicopter. Aerial shooting from helicopters is among the least expensive and the safest management option (as compared to live capture) for park personnel (Houston, Schreiner, and Moorhead 1994). However, helicopter use includes the risk of accidents that could be catastrophic and firearm use can be extremely hazardous, although all personnel will be trained and experienced in this type of operation (Caudell et al. 2009).

Safety Considerations Associated with Mountain Goat Management at Olympic National Forest

Similar to the park, the potential exists for mountain goat-human interactions within Olympic National Forest where mountain goats have become habituated to human presence and have become conditioned to seeking salts from humans. Hazards associated with mountain goat-human interactions in Olympic National Forest are similar to those described for the park. In one instance in the national forest, a man was gored in the thigh after a mountain goat jumped from a rock about 15 feet away. Minutes earlier, the mountain goat had been licking members of the man's group and their packs while they were eating lunch. Mountain goats in Olympic National Forest are concentrated in higher-elevation areas on the eastern portions of the forest and in designated wilderness adjacent to the park boundary (see figure 8). The potential for interactions between humans and mountain goats is therefore greatest in these areas.

Olympic National Forest provides mountain goat-human interaction safety information on its public website and places signs and mountain goat safety information at trailheads (Noble pers. comm. 2016). Olympic National Forest, Olympic National Park, and WDFW collaborated to develop a safety video intended to reduce mountain goat-human conflicts, and WDFW provides a phone hotline and website where visitors can report dangerous wildlife.

Olympic National Forest also encourages visitors to report mountain goat incidents to USDA Forest Service staff and provides a detailed incident report form to record reported mountain goat encounters. Types of encounters to be reported include a mountain goat not moving off trail, acting aggressively, or other events that seem potentially dangerous (Weinberg pers. comm. 2016). A voluntary mountain goat registry is maintained at the Mt. Ellinor Trail, where visitors who have encountered mountain goats can provide information on the nature of the interaction at a self-reporting registration box located at the Upper Mt. Ellinor Trailhead. In 2015, a total of 88 mountain goat-human interactions were reported. In most of these instances, reports indicate that neither the mountain goats nor the humans reacted (i.e., humans watched, took pictures, etc., and the mountain goats did not react). In the 13 circumstances where the visitors made a move (made noise or threw rocks), six of these situations ended in no mountain goat

response, while seven ended in the mountain goat moving away. No threatening responses by mountain goats were reported (FS 2016e).

Since 2012, a number of more active intervention tactics have been implemented to manage mountain goat behavior and minimize negative mountain goat-human interactions. From July, 2012, until September 30, 2012, the Mt. Ellinor Trail was closed to the public due to a reported incident between a hiker and a mountain goat, along with increasingly higher reporting by visitors of unacceptable mountain goat behavior. The closure period provided Olympic National Forest officials time to discuss mountain goat management options with WDFW and to have discussions with park staff concerning how the park works to address mountain goat-human interactions. In addition to ensuring public safety, the closure limited mountain goat exposure to human influence during this period. When the trail was re-opened to the public, USDA Forest Service staff presence on the trail was increased for public education. Small mineral blocks (less than 5 pounds) were placed on three occasions on Mt. Ellinor, outside of wilderness, to draw mountain goats away from trails during peak salt demand. USDA Forest Service staff were provided safety training for the use of bear spray and aversive conditioning, with assistance from national forest biologists and input from WDFW staff. Forest staff conducted over 30 patrols of the Mt. Ellinor Trail in 2012 to monitor mountain goat behavior and to haze mountain goats that approached or remained close to humans. In 2013, Olympic National Forest began recruiting and training mountain goat-human interactions educational interns to patrol high-use trails with mountain goats, such as the Mt. Ellinor Trail, to monitor mountain goat behavior and apply low-level hazing techniques such as yelling and throwing rocks. When necessary, specialized staff have been brought in to apply higher-level hazing (with paintball guns, slingshots, etc.) and attempt to mark animals. Forest staff have continued to conduct hazing patrols on Mt. Ellinor and in The Brothers Wilderness. Additionally, to attract mountain goats away from high human use areas and deter them from approaching visitors to seek salt, small salt blocks have been placed on Mt. Ellinor between 2012 and 2014, but not in 2015 or 2016 (Weinberg pers. comm. 2016).

Mountain goat hunting activities, as described in the “Visitor Use and Experience” section of this chapter, present additional visitor and employee safety risks in Olympic National Forest. These safety risks are largely attributable to the use of firearms during hunting activities. Both the USDA Forest Service and WDFW have regulations governing the use of firearms that are intended to minimize human safety risks. Olympic National Forest regulations prohibit discharging a firearm:

- in or within 150 yards of a residence, building, campsite, developed recreation campsite, or occupied area;
- across or on roads or bodies of water, or where people or property are exposed to injury or damage;
- into a cave; or
- into areas that cause resource damage – e.g., shooting rocks, stumps, or non-game animals.

Areas of the Olympic National Forest are closed to recreational shooting year-round due to proximity to local communities. Violation of these prohibitions is punishable by fine or imprisonment (16 USC 551, 18 USC 3559 and 3571) (FS 2016c). In addition to USDA Forest Service restrictions on firearm use, WDFW requires firearms safety training as part of its hunter safety education requirements. All people born after January 1, 1972, are required to pass a hunter education course to obtain their first Washington hunting license. To receive a Basic Hunter Education certification, students must pass a written test and—in most cases—a field skills test. Washington’s hunter education curriculum includes a required firearms safety component (WDFW 2015d).

PART TWO – NORTH CASCADES NATIONAL FORESTS AREA

PROJECT SETTING

Mt. Baker-Snoqualmie National Forest

The Mt. Baker-Snoqualmie National Forest is one of the most visited national forests in the country. Located on the west side of the North Cascades Mountains, the forest encompasses over 1.7 million acres between the Canadian border and Mt. Rainier National Park (see figure 2 in chapter 1). There are glacier-covered peaks, spectacular mountain meadows and old-growth forests rich in history, and outdoor opportunities. Elevations range from below 500 feet to just under 11,000 feet.

Okanogan-Wenatchee National Forest

The Okanogan-Wenatchee National Forest encompasses more than 4 million acres in Washington State and stretches north to south from the Canadian border to the Goat Rocks Wilderness - a distance of about 180 miles. The forest lies east of the crest of the North Cascades Range, which defines its western boundary. The eastern edge of the forest extends into the Okanogan highlands, then south along the Okanogan and Columbia Rivers, and then to the Yakima River Valley. Because of this wide geographic range, the forest is very diverse - from the high, glaciated alpine peaks along the crest of the North Cascades Range and the numerous mountain ranges extending eastward from the crest, through deep, lush valleys of old growth forest, to the dry and rugged shrub-steppe country at its eastern edge (see figure 2 in chapter 1). Elevations range from below 1,000 feet to over 9,000 feet. Precipitation varies widely, from more than 70 inches along the crest to less than 10 inches at its eastern edge. This greatly affects the forest and vegetation types across the area.

WILDERNESS CHARACTER

The project area for the North Cascades national forests, where mountain goats could be released, includes three designated wilderness areas: Glacier Peak Wilderness, Alpine Lakes Wilderness, and Henry M. Jackson Wilderness. Numerous potential sites for releasing mountain goats in the North Cascades national forests were evaluated by USDA Forest Service and WDFW, with efforts to identify as many non-wilderness sites as possible. However, the abundance of suitable mountain goat habitat within wilderness areas and other site criteria led there to be seven of 12 release sites proposed within wilderness.

As described for the Olympic Peninsula, the *Wilderness Act* requires the USDA Forest Service to preserve the wilderness character of these areas.

Glacier Peak Wilderness (*Wilderness Act of 1964, Public Law 88-577, September 3, 1964*)

The 566,057-acre Glacier Peak Wilderness is located on the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests, and borders the Stephen Mather Wilderness to the north and Henry M. Jackson Wilderness to the south. The *Wilderness Act* of 1964 designated the Glacier Peak Wilderness, and the wilderness was increased in size (10,000 acres) by Public Law 90-544 (October 2, 1968). Glacier Peak Wilderness was expanded by an additional 112,000 acres as a result of Public Law 98-399 (July 3, 1984). It contains a 450-mile trail system including the Pacific Crest National Scenic Trail, which traverses its west and north sides.

Glacier Peak Wilderness is characterized by heavily forested streams, steep-sided valleys, and rugged glacier-covered peaks. Various species of wildlife inhabit the area and include deer, bear, and mountain goat. Numerous creeks cut through the valleys from their sharp drainages. This wilderness area also includes more than 200 lakes, many of which are unnamed and difficult to access.

Alpine Lakes Wilderness (*Alpine Lakes Management Act of 1976, Public Law 93-367*)

The Alpine Lakes Wilderness was designated in 1976. A 22,000-acre addition to the wilderness was approved by congress as part of the *National Defense Authorization Act* for Fiscal Year 2015 (Public Law 113-291, December 19, 2014), expanding the wilderness to a total area of 414,701 acres on the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. The wilderness is located between Snoqualmie and Stevens Passes in the North Cascades Range, including the sub-range called the Wenatchee Mountains. The Alpine Lakes Wilderness is characterized by sawtooth ridges, sharp summit spires, glacial valleys, and hundreds of glacially excavated lake basins. Small glaciers persist in the Stuart Range and along the high crest between Chikamin Peak and Mount Daniel.

Because of the unique position of the Alpine Lakes Wilderness, straddling the crest of the North Cascades Range and the resulting variation in elevation and precipitation, a range of vegetation communities are represented from west to east. Numerous hiking trails provide access to the wilderness, including a portion of the Pacific Crest National Scenic Trail. Given its proximity to the Seattle metropolitan area and scenic qualities, the area receives high visitor use, especially where there is easy access from Interstate 90 and Highway 2.

Henry M. Jackson Wilderness (*Washington State Wilderness Act of 1984, Public Law 98-339, July 3, 1984*)

The United States Congress designated the Henry M. Jackson Wilderness in 1984 and it now has a total of 102,910 acres on the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. The Henry M. Jackson Wilderness is bordered by the Glacier Peak Wilderness to the north and the Wild Sky Wilderness to the southwest. Extending for more than 20 miles along the north-south trending crest of the North Cascades Mountains, this wilderness area is characterized by deep glacial valleys spreading out east and west from the crest. Snow often accumulates to a depth of 20 feet at higher elevations, and remains well into summer, eventually melting into the more than 60 lakes scattered throughout the area. Henry M. Jackson Wilderness shares its northeast border with the much larger Glacier Peak Wilderness. Thirty-two miles of the Pacific Crest National Scenic Trail bisect the wilderness.

WILDLIFE, INCLUDING SENSITIVE AND MANAGEMENT INDICATOR SPECIES

Wildlife in the North Cascades National Forests

The areas of the North Cascades national forests where mountain goats from the Olympic Peninsula may be released are home to an abundant and diverse assemblage of native fauna. This section provides an overview of the North Cascades national forests wildlife.

Mammals

There are approximately 75 mammal species found in the North Cascades national forests. Large carnivores that are common but at low abundance include black bear, cougar, coyote, and bobcat. Wolves are recolonizing suitable habitat across the region, from which they were extirpated in the early 20th century, and grizzly bear recovery is being considered across the North Cascades ecosystem (NPS 2017b). Wolverine (*Gulo gulo luscus*) are also present, but at very low abundance. Large herbivores include the black-tailed deer on the west slope of the North Cascades Range and mule deer (*Odocoileus hemionus hemionus*) and white-tailed deer (*Odocoileus virginiana*) on the east slope. Both species of deer are the most common ungulates where they occur in the North Cascades forests. Large herds of elk (*Cervus elaphus nelsoni*) are also present across the southern third of the North Cascades national forests and moose (*Alces alces*) numbers are on the rise, particularly in the northeastern portion of the ecosystem. Small bodied carnivores include red fox (*Vulpus vulpus*), pine marten (*Martes americana*), river otter (*Lutra canadensis*), mink (*Neovison vison*), long-tailed weasel (*Mustela frenata*), and ermine (*Mustela erminea*). Several dozen species of small mammals, including rabbits, ground and arboreal squirrels, mice, shrews, and other rodents are also present, as well as 12 bat species.

At subalpine and alpine habitats used by mountain goat, pika (*Ochotona daurica*) and hoary marmot (*Marmota caligata*) are found among talus slopes or scree fields and foraging in adjacent meadows (NPS 2016c). During summer, after the snow has melted, elk and deer also forage in the same high elevation meadow habitats that are utilized by mountain goats, although they seek security and thermal cover in the adjacent forested habitat rather than the rocky escape terrain favored by mountain goats. Columbian ground squirrels are locally abundant in mid- to upper-elevation open meadows in the northeast portion of the North Cascades ecosystem (Fitkin pers. comm. 2016).

Birds

Over 200 species of birds in 38 families are estimated to occur within North Cascades national forests, with habitats ranging from low elevation forests and wetlands to alpine meadows. In addition to the ESA-listed marbled murrelet and northern spotted owl, there are bald eagle (*Haliaeetus leucocephalus*), northern goshawk, 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 albolarvatus*), 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 North Cascades ecosystem. One of the largest wintering populations of bald eagles in the continental United States is within the Skagit River watershed. Clear, fast-flowing rivers and streams host breeding populations of Harlequin ducks (*Histrionicus histrionicus*) (NPS 2015f). The North Cascades ecosystem is directly within the Pacific Flyway Corridor and many migratory species, including raptors, pass through the area during their spring and fall migrations (USFWS 2016a). Over half of the species breeding in the area are migratory species. However, the species potentially impacted would be those nesting close to mountain goat staging areas or release sites. Due to the lack of the project's impacts on trees or other landscape vegetation, there is no change expected in the habitat components from the action alternatives. Therefore, potential impacts on bird species that are not included as management indicator species, Regional Forester sensitive species, or ESA-listed will not be further discussed in this plan/EIS.

Fish

Fish present in the North Cascades national forests include 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*), and Dolly Varden (*Salvelinus malma*) (NPS 2015g). In addition, the Okanogan-Wenatchee National Forest supports runs of Middle Columbia River steelhead (*Oncorhynchus mykiss*) and Upper Columbia River spring-run Chinook (*Oncorhynchus tshawytscha*), and the Mt. Baker-Snoqualmie National Forest supports runs of Puget Sound steelhead and Puget Sound Chinook salmon (*Oncorhynchus mykiss*) (FS 2015). This project is expected to have no adverse impact on aquatic resources and there is no change expected to aquatic habitat components from the action alternatives. Therefore, potential impacts on fish will not be further discussed in this plan/EIS.

Amphibians and Reptiles

The North Cascades national forests has a variety of reptile and amphibian species, including snakes, turtles, lizards, frogs, and salamanders. This project is expected to have minimal impact on aquatic or terrestrial resources used by these groups of species and there is no change expected to the habitat components from the action alternatives. Therefore, potential impacts on amphibians and reptiles will not be further discussed in this assessment.

Regional Forester Sensitive Species

The *National Forest Management Act* (16 USC 1600) requires the USDA Forest Service to maintain viable populations of existing native and desired nonnative wildlife in the planning area (36 CFR 219.19). Guidelines for each planning area must provide for a diversity of plant and animal communities based on the suitability of the specific land area. The USDA Forest Service established a Sensitive Species Program and a biological evaluation process (FSM 2672.4) to ensure species population viability. Regional foresters are responsible for identifying and maintaining a list of sensitive species occurring on NFS lands within their region. This list includes species for which there is a documented concern for viability within one or more administrative unit within the historic range of the species (FSM 2670.22, WO Amendment 2600-95-7). These species may require special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for federal listing. This regional list was last updated on January 31, 2008. The USDA Forest Service Manual (FS 2011, FSM 2672.4) requires a biological evaluation to determine potential effects of proposed ground-disturbing activities on sensitive species. This evaluation analyzes the alternatives and discusses the potential effects on the population or its habitat within the area and on the species as a whole, and makes recommendations for removing, avoiding, or compensating for adverse effects as needed.

A list of Regional Forester Sensitive species for the Mt. Baker-Snoqualmie and Okanogan-Wenatchee Forest is in appendix H. Only those species that could be impacted by mountain goat management activities are discussed below.

Mountain Goat. The mountain goat is identified by both the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests as a sensitive species due to the Washington Department of Natural Resources ranking as an Imperiled species (S2) with a high risk of extirpation in the State due to concern of restricted range and few populations. The mountain goat is also a forest management indicator species for winter and summer habitat that includes the alpine and subalpine areas of the North Cascades national forests. Habitat includes cliffs, crags or other extremely rocky areas of mountainous terrain and open alpine meadow areas down to conifer forest habitats.

Mountain goats, a native species to the North Cascades national forests, are considered to have experienced substantial declines in most of the North Cascades forests (Rice and Gay 2010; Rice 2012), although the precise magnitude of the decline is uncertain (WDFW 2015a, 2015b). Mountain goat populations have recovered in some portions of the North Cascades forests, and in 2016, 21 permits for

recreational harvest were offered within 9 hunting units. Recreational goat harvesting was restricted to areas with a recent series of population surveys (Rice, Jenkins, and Chang 2009), and in which the number of goats (excluding kids) averaged more than 100 animals. WDFW policy was to constrain harvest levels to ensure that female mountain goats removed were less than 1.2% of the estimated total of goats of yearling age and above in the hunting area over the most recent 3-year period (WDFW 2015b).

Many mountain goat populations in the North Cascades forests remain small and isolated (WDFW 2015b), and appear unlikely to recover for many decades without reintroduction and/or augmentation. Without recovery in these areas, long-term genetic and demographic health of mountain goats in the North Cascades national forests cannot be ensured.

Harlequin Duck. The harlequin duck is found in swift, moving streams (rivers and creeks), with adequate pool habitat for foraging and brooding. The duck can be found along such river ecosystems throughout the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. Mountain goat management activities at staging areas could disturb nearby nesting ducks.

Wolverine. In Washington, wolverines occur in alpine areas down through forested zones to the lower edge of forests. Generally, they are most common in alpine and subalpine zones of the Cascade Range, but will sometimes descend into valleys, particularly in winter where large game may be available (Aubry, McKelzey, and Copeland 2007). Reproductive den sites (sites where kits are born and raised prior to weaning) typically consist of long, complex snow tunnels that may be associated with large structures, such as fallen trees or boulders (Aubry, McKelzey, and Copeland 2007). Wolverines forage on carrion but are capable of killing their own prey, and in many areas are believed to be dependent on ungulates as a major food source. Due to their low abundance and preference for high-elevation habitat that is being affected by climate change, the wolverine has been proposed for ESA-listing for many years and has been determined as “warranted, but precluded” for listing by the USFWS. The status of the wolverine with regard to the ESA is currently under review by the USFWS, and thus wolverine will be discussed further in the “Threatened or Endangered Species” section (USFWS 2016b).

Management Indicator Species

These species are those selected under the Mt. Baker-Snoqualmie, Okanogan, and Wenatchee Forest Plans (USDA 1989, 1990a, 1990b), as amended, which are presumed to be an indicator of the welfare of other species using the same habitat, and is a species whose condition can be used to assess the impacts of management actions on a particular area. A list of these species can be found in appendix H. Only those species potentially impacted by mountain goat management activities are discussed in this section.

Mule Deer (*Odocoileus hemionus hemionus*). Mule deer are an indicator of big game winter range conditions. They are associated with coniferous and hardwood forests with an interspersed of early seral habitat consisting of shrub vegetation for foraging. Mule deer are an edge species and require areas where there is a juxtaposition of cover to escape predators and human disturbance, and open areas for foraging. Mountain goat management activities at staging and release areas, helicopter use, and human presence could disturb nearby mule deer.

Rocky Mountain Elk (*Cervus elaphus nelsoni*). Rocky mountain elk are an indicator of big game winter range conditions. They require a juxtaposition of open- and closed-canopy habitats to provide them with foraging areas in proximity to security cover. Roads and trails and the associated human disturbance have adverse effects on elk, which include loss of habitat, increased energy loss, and vulnerability to mortality (Rowland et al. 2005; Wisdom et al. 2004; Wisdom et al. 2005). The negative impacts of roads and trails increase with the level of human use, and elk will often avoid roads particularly in open habitats and shift

their use to areas of low human activity. Mountain goat management activities at staging and release areas, helicopter use, and human presence could disturb nearby elk.

Survey and Manage Species

“Survey and Manage” are a set of standards and guidelines associated with the 1994 *Record of Decision for Amendments to USDA Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl*. They are documented in the January 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. These standards and guidelines are applicable to USDA Forest Service and Bureau of Land Management lands in western Washington, western Oregon, and northwestern California and are intended to reduce or eliminate (mitigate) potential effects from agency actions on just over 300 flora and fauna species including mosses, liverworts, fungi, lichens, vascular plants, slugs, snails, salamanders, great gray owl, and red tree voles. These Survey and Manage species are assigned to one of six categories based upon the relative rarity of the species, the practicality to conduct pre-disturbance surveys, and the understanding of association with late-successional or old growth forests. No Survey and Manage species are expected to occur in the project area or would not be disturbed by activities associated with mountain goat management, and therefore, are not discussed further.

VEGETATION

Dominant vegetation zones include the western hemlock, Pacific silver fir, mountain hemlock and subalpine fir zones. Under alternatives B and D, mountain goats could be translocated to their preferred habitat at subalpine and alpine elevations in the North Cascades national forests area, and staging areas might be located at lower elevations. Vegetation at mountain goat staging and release sites in the North Cascades national forests could potentially be impacted by mountain goat management activities.

A list of Regional Forester Sensitive plant species with potential to occur in the North Cascades national forests can be found in appendix H. These species are not expected to occur in the project area, because the staging areas are in disturbed areas, and no sensitive plants occur in the alpine areas at proposed release sites. Therefore, these plant species are not discussed further.

THREATENED OR ENDANGERED SPECIES

Threatened or Endangered Wildlife Species

Table 16 shows the federally listed wildlife species with the potential to occur within the project area and to be potentially affected by mountain goat management actions in the North Cascades national forests (WDFW 2015a; USFWS 2016a). The project would not affect ESA-listed fish in the North Cascades forests. No staging or release activities are proposed in or around suitable habitat for fish species, and staging and release activities would not affect aquatic or riparian habitat. These species are not discussed further in this analysis.

TABLE 16. FEDERALLY LISTED AND CANDIDATE WILDLIFE SPECIES IN THE NORTH CASCADES NATIONAL FORESTS

Common Name	Scientific Name	Federal Status	State Status
Birds			
Northern spotted owl	<i>Strix occidentalis caurina</i>	Threatened	Endangered
Marbled murrelet	<i>Brachyramphus marmoratus</i>	Threatened	Threatened
Mammals			
Grizzly bear	<i>Ursus arctos</i>	Threatened	Endangered
Gray wolf	<i>Canis lupus irremotus</i>	Endangered	Endangered
Canada lynx	<i>Lynx canadensis</i>	Threatened	Threatened
Wolverine	<i>Gulo gulo luscus</i>	Candidate (Proposed Threatened)	Candidate

Sources: USFWS 2015a, 2016a; WDFW 2015a

Northern Spotted Owl (*Strix occidentalis caurina*). The northern spotted owl is known to occur in the states of Washington, Oregon, and California, and is listed as federally threatened over the entirety of its range. Although the breeding season varies with geographic location and elevation, northern spotted owls generally nest from February to June (USFWS 2016a).

Northern spotted owls live in forests characterized by dense canopy closure of mature and old-growth trees, abundant logs, standing snags, and live trees with broken tops. Although they are known to nest, roost, and feed in a wide variety of habitat types, northern spotted owls prefer older forest stands characterized by multi-layered canopies of several tree species of varying size and age, both standing and fallen dead trees, and open space among the lower branches to allow flight under the canopy. Typically, forests do not attain these characteristics until they are at least 150 to 200 years old. Loss and modification of nesting, roosting, and foraging habitat due to timber harvesting, land conversions, natural disturbances such as fire and windstorms, and competition with invading barred owl (*Strix varia*), a species native to eastern North America, have led to a decline of northern spotted owls throughout much of their historic range (table 15) (USFWS 2016a).

There is approximately 9,577,969 acres of designated critical habitat in 11 units for the spotted owl in the States of Washington, Oregon, and California. The project area occurs in three spotted owl designated critical habitat units: East Cascades North, West Cascades Central, and West Cascades North (USFWS 2012). Many of the staging areas occur within northern spotted owl designated critical habitat units (USFWS 2012). However, the staging areas are previously disturbed areas and do not contain primary constituent elements of spotted owl critical habitat. Release sites are open areas and do not contain primary constituent elements of spotted owl critical habitat.

Surveys for northern spotted owls in the project area have not been conducted to protocol in recent years. Therefore, any current activity centers near staging areas are unknown. There is no suitable nesting habitat near release sites, but mountain goat management activities at staging areas such as preparation, helicopter use and human presence could disturb spotted owls that may be nesting near the staging areas.

Marbled Murrelet (*Brachyramphus marmoratus*). The marbled murrelet is a small seabird that nests in the canopy of mature, old-growth forests up to 50 miles or more inland. In Washington State, marbled murrelet nesting habitat is located in the Mt. Baker-Snoqualmie National Forest as well as in North Cascades National Park west of the crest of the North Cascades Range (USFWS 2016a). Marbled

murrelet nest from mid-April to late September and have a naturally low reproductive rate, laying only one egg per nest and not all adults nest every year.

The primary cause of marbled murrelet population decline is the loss and modification of nesting habitat in old growth and mature forests through commercial timber harvests, human-induced fires, and land conversions. In the marbled murrelet's marine habitat, oil spills and gill-net fishing also threaten the population. Current estimates indicate that the Washington population continues to decline at a rate of about 5% per year. It is unlikely that population numbers will increase rapidly due to the naturally low reproductive rate and the continued loss of nesting habitat.

There are approximately 3,887,800 acres of designated critical habitat in 101 subunits for the marbled murrelet in the States of Washington, Oregon, and California (USFWS 2016a). The project area within the North Cascades national forests occurs within seven marbled murrelet designated critical habitat subunits: WA-07-d, WA-08-b, WA-09-b, WA-09-c, WA-09-e, WA-10-a, and WA-10-c. While this species has the potential to occur near staging areas, habitat requirements suggest that it is not likely to be a common occurrence. The staging areas are previously disturbed areas and do not contain primary constituent elements of marbled murrelet critical habitat, but surveys for the marbled murrelet have not been completed adjacent to these sites. Release sites are open areas and do not contain primary constituent elements of marbled murrelet critical habitat.

Surveys for marbled murrelet in the project area are limited and have not been conducted according to protocol in recent years. Therefore, any current nests near staging areas are unknown. There is no suitable nesting habitat near release sites, however mountain goat management activities at staging areas such as preparation, helicopter use and human presence could disturb marbled murrelets nesting near the staging areas.

Grizzly Bear (*Ursus arctos*). The grizzly bear is an apex carnivore that was brought to such low levels in the last century that it was listed as a federally threatened species in 1975. The most recent confirmed observation within the US portion of the North Cascades grizzly bear recovery zone was in 1996, when a grizzly bear was observed south of Glacier Peak. 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). Several hair sampling efforts throughout the recovery zone detected one female grizzly bear in British Columbia, a single male grizzly was detected by a remote camera and (also confirmed with a hair sample).

The current number of grizzly bears in the North Cascades Range is unknown. There have been four confirmed detections of grizzly bears in the greater North Cascades region in the past 10 years, all of which occurred in British Columbia. Given the low documented number of grizzly bears, very slow reproductive rate, and other recovery constraints, the grizzly bear in the North Cascades Range was found by the FWS to be warranted for uplisting to endangered status, but the listing was precluded, which means that this recommendation was not carried forward because listings of other species were considered to be higher-priority. Although a very small number of grizzly bears still inhabit the North Cascades Range, the number does not meet the accepted definition for a population (two adult females with cubs or one adult female tracked through two litters). As a result, it is highly unlikely that a viable grizzly bear population exists in the North Cascades Range (NPS 2017b).

While few sightings, historic or present, have been reported for this area, the project area is within the North Cascades grizzly bear recovery zone. The recovery zone was defined in a recovery plan for grizzly bears that was completed in 1982. This plan recommended that the North Cascades ecosystem, which includes portions of the North Cascades national forests area, be evaluated for its potential to support grizzly bears. Results of that evaluation (Almack et al. 1993) determined there to be ample secure habitat

to support a recovered grizzly bear population, and the Interagency Grizzly Bear Recovery Committee formalized the inclusion of the North Cascades ecosystem as a grizzly bear recovery zone (Servheen 1997). Core habitat for grizzly bears is typically 0.3 mile from open roads or high use trails since they naturally tend to avoid areas with roads and associated human activity (Servheen 1997). Because grizzly bears could occur in the North Cascades national forests near staging and release sites, mountain goat management activities such as preparation, helicopter use and human presence could disturb nearby grizzly bears.

Canada Lynx (*Lynx canadensis*). Canada lynx live in mid- to high-elevation boreal forests extending into Washington from Canada and Idaho. Their distribution extends northward throughout most of Canada and Alaska, and eastward across the northern tier of the contiguous United States (WDFW 1993; Lewis 2016). The largest block of suitable habitat within the project area is found along the east slope of the North Cascades mountains in the “Okanogan” lynx management zone (WDFW 1993; Lewis 2016). In 2000, the Canada lynx was federally listed as threatened, but had been protected in the State of Washington since 1993. This feline is highly adapted to prey on snowshoe hares and the presence of adequate numbers of hares is a key characteristic that defines lynx habitat. In Washington, 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 mountains generally above 1,220 meters. The lynx population in Washington now appears to be largely restricted to western Okanogan and northern Chelan Counties, as well as the eastern edges of Whatcom and Skagit Counties, which largely coincides with the Okanogan lynx management zone (Lewis 2016). The area of Washington State currently occupied by lynx is designated as critical habitat (USFWS 2014). There is no lynx critical habitat in the affected environment of the North Cascades national forests area, but there is the potential for lynx to occur in the project area. Mountain goat management activities at staging and release areas such as preparation, helicopter use and human presence could disturb nearby lynx.

Gray Wolf (*Canis lupus irremotus*). The northern Rocky Mountain gray wolf is a habitat generalist and historically occupied most of the western half of the United States. In 2011, wolves in the eastern third of the State of Washington were removed from federal protections under the ESA; however, within the planning area, they remain listed as federally endangered. The North Cascades national forests are included within one of three gray wolf recovery areas in Washington (WDFW 2015d). As of 2015, the minimum known number of wolves in Washington increased by approximately 32% over the 2014 minimum estimate and was composed of at least 90 wolves in 18 known packs (WDFW 2016f; 2015d). Reproduction was documented in 11 packs during 2015 and, as of 31 December 2015, 8 of those packs were considered successful breeding pairs (WDFW 2015d). Wolves inhabit a mix of both public and private lands from eastern Washington to the east slopes of the Cascade mountains, with an estimated mean home range size of approximately 349 mi² (WDFW 2015d).

Three packs are known from the North Cascades national forests, in the vicinity of the mountain goat translocation areas. As of 2015 the pack numbers were Lookout (3 individuals), Loup Loup (6 individuals), and Teanaway (3 individuals). The Teanaway pack territory is just north of I-90, to the east of Snoqualmie summit. Mountain goats could potentially be prey items for wolves. Mountain goat management activities at staging and release areas such as preparation, helicopter use and human presence could disturb nearby wolves.

Wolverine (*Gulo gulo luscus*). The wolverine is not federally listed as threatened or endangered, but is currently a candidate for listing under ESA. In 2014, the USFWS concluded that the factors affecting wolverine were not sufficient for federal protections, but that assessment is currently under review again as a result of legal challenges. Washington State has also classified wolverine as a candidate species for listing, and they are considered a Regional Forester Sensitive species in both the Okanogan-Wenatchee National Forest and the Mt. Baker-Snoqualmie National Forest.

Trapping pressure in the United States and Canada is believed to be responsible for wolverine population declines during the early part of the 1900s and habitat fragmentation and climate change are the primary threats today (Ruggiero et al. 1994). The wolverine still occupies areas in the North Cascades national forests, with limited sightings and historical records, but some recent evidence suggests that their populations could be expanding. In 2015, biologists found signs of the species just a few miles north of I-90, the farthest south that wolverines have been detected since the early 20th century. Wolverines naturally occur at low densities, with individuals ranging over large areas (Johnson and Cassidy 1997) and are sensitive to human activity, particularly near den sites. Wolverines require large areas of high-elevation mountainous terrain, which receive high snowfall that persists into the summer. In fact, persistent spring snow cover (April 15 to May 14) is the best overall predictor of wolverine occurrence in the contiguous United States (Copeland et al. 2010).

In the North Cascades national forests area, wolverines occur in alpine areas down through forested zones to the lower edge of forests. Generally, they are most common in alpine and subalpine zones, but will sometimes descend into valleys, particularly in winter where large game may be available (Aubry, McKelzey, and Copeland 2007). Reproductive den sites (sites where kits are born and raised prior to weaning) typically consist of long, complex snow tunnels that may be associated with large structures, such as fallen trees or boulders (Aubry, McKelzey, and Copeland 2007). Wolverines forage on carrion but are capable of killing their own prey, and in many areas are believed to be dependent on ungulates as a major food source.

The abundance of food and presence of human activity are thought to be more influential on wolverine habitat selection than plant associations or topography (Ruggiero et al. 1994). Since the alpine habitat required by wolverines overlaps with that of mountain goats, it is possible that management activities at staging areas or mountain goat translocation areas could impact this species. Mountain goat management activities at staging and release areas, helicopter use, and human presence could disturb nearby wolverines.

Threatened or Endangered Plant Species

As noted in chapter 1, no federally listed, or proposed threatened or endangered plant species are known to occur within the vicinity of where mountain goats could be translocated in the North Cascades national forests area, and therefore, are not discussed further. However, a list of threatened or endangered plant species found in the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests that was reviewed as part of the biological evaluation process can be found in appendix H.

VISITOR USE AND EXPERIENCE

Lands within the North Cascades national forests area provide a diverse array of recreational opportunities including hiking, backpacking, climbing, horseback riding, boating, backcountry camping, winter sports, and wildlife viewing. Opportunities for hunting, fishing, mountain biking and off-road vehicle use are also available in the national forests. Recreational use of NFS lands in the North Cascades national forests is estimated to be 8 million recreation visitor days per year, mostly dispersed recreation. It is estimated that almost 1 million recreation visitor days occur annually in wilderness; however, these are not equally distributed, and some areas receive much higher recreational use than others. The majority of recreational visits to the North Cascades national forests occur during July through September, during any day of the week, although visitor use is highest on weekend days and holidays.

Because of the close proximity to the Seattle metropolitan area, trails across the North Cascades national forests area receive high visitor use. Popular hiking and backpacking destinations include mountain summits, alpine lakes, and historic fire lookouts. The Green Mountain Lookout near the Buckindy release

site in the Glacier Peak Wilderness is used as an administrative site and not available for public use. Hikers and backpackers access the site from the Green Mountain Trailhead using the 4.25-mile Green Mountain Trail 782. There are campsites along the trail but no other system trails connect to the Green Mountain Trail. Goat Lake, 2,000 feet below the Cadet Lake Ridge release site is a 5-mile hike from the Elliott Creek/Goat Lake Trailhead in the Henry M. Jackson Wilderness. The trail is popular for hiking and backpacking. No trails access the Cadet Lake Ridge release site which is 3/4 to one mile from the lake. No trails directly lead to the Mount Stillaguamish release site, although Stillaguamish Peak is a popular recreation destination nearby. The Perry Creek Trail runs through the Perry Creek Research Natural Area ending at Forgotten Peak. An unmarked user-created trail leaves the Perry Creek Trail and winds toward Stillaguamish Peak.

Release sites proposed under this project are in high-elevation areas with suitable mountain goat habitat. These areas tend to receive relatively low visitor use because of the difficult terrain. However, backpacking and climbing into remote portions of the wilderness does occur and a few sites such as Snowy Lakes, Whitechuck, Kaleetan Peak, and Vesper Peak, are high use. The North Cascades Mountains are often referred to as the “American Alps” by professional climbers because of the rugged approaches, exceptional alpine terrain, and unrivaled scenery. There may also be opportunities to view wildlife in the more remote, higher elevations of the North Cascades national forests, especially given that human activity may be lower and alpine vegetation provides greater visibility than in more forested areas at lower elevations. WDFW identifies Ptarmigan Ridge (between Mt. Shuksan and Mt. Baker in the Mt. Baker Wilderness) and The Enchantments (Alpine Lakes Wilderness) as the most rewarding areas to view mountain goats in the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests, although neither of those locations are within the project area nor included in the release sites proposed under this project (WDFW 2016b).

The 12 staging areas where mountain goats are proposed to be received from the Olympic Peninsula are located near roads or trailheads where visitor use may be high. These areas may also have high scenic value but also experience traffic noise from vehicles or large group gatherings.

VISITOR AND EMPLOYEE SAFETY

Hazards to visitors and employees in the North Cascades national forests include hazards typical of backcountry recreation, such as injuries from falls and exposure to inclement weather. However, for the purposes of this draft plan/EIS, this section focuses only on those hazards associated with potential mountain goat-human interactions and with current and proposed mountain goat management actions.

Some of the areas that mountain goats inhabit are also popular destinations for visitors to North Cascades national forests. In such areas, there is a potential for mountain goat-human interactions. However, as on the Olympic Peninsula, these interactions are most likely to occur in areas where mountain goats are habituated to human presence and have become conditioned to seeking salts from humans. The nature of mountain goat-human interactions can vary widely. In general, mountain goats pose a nuisance when they persistently seek salt and minerals from human urine, packs, and sweat on clothing.

There are occasional reports of aggressive or nuisance mountain goats in the North Cascades national forests. Within the Okanogan-Wenatchee National Forest, conditioned and habituated mountain goats have been documented as problematic in the highly visited sections of The Enchantment Permit Area within the Alpine Lakes Wilderness (in the Okanogan-Wenatchee National Forest) (e.g., Landers 2013). Users of the Ptarmigan Traverse (Glacier Peak Wilderness) have also reported mountain goats in close proximity to camps, seeking out urination sites (Reed pers. comm. 2016). However, the majority of encounters reported to USDA Forest Service staff indicate that mountain goats in the North Cascades national forests generally retreat when humans are present, likely due to past hunting pressure (Reed pers.

comm. 2016). In the Mt. Baker Wilderness, northwest of the project area in the Mt. Baker-Snoqualmie National Forest, there is a relatively large population of mountain goats, but they are not typically observed on the trail and keep to the escape habitat of slopes and ledges off-trail (Richey pers. comm. 2016). In areas of the North Cascades national forests where existing mountain goat populations overlap with sections of the Pacific Crest National Scenic Trail, or highly used visitor areas (e.g., Artist Point Trailhead), mountain goats maintain their distance from humans and negative interactions have largely been avoided.

