

High Elevation Plant Use: Reviewing the impetus for traditional use of natural resources in the Alpine regions of Olympic National Park



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Project Statement

In order to summarize existing information and more clearly represent the connections between plant collection and highcountry use by aboriginal peoples, this report will identify ethnobotanical information related to subalpine and alpine plants found within the boundaries of Olympic National Park. Over the past year, ethnobotanical information has been collected and entered into the National Park Service's Ethnographic Resource Inventory database. This information will provide the foundational information for queries on alpine and subalpine plants. All alpine and subalpine plant resources with documented use values for local tribes will be identified and their uses fully described. Plant resources that occur within Olympic National Park, and for which we have no local ethnobotanical information will be explored by using information on the use of corresponding plants by British Colombian indigenous groups (Turner 1971). The primary objectives of this project are as follows:

1. To outline the relationship between highcountry plants (alpine and subalpine) and varying modes of indigenous resource use (food, medicinal, manufacture). The hypothesis driving this portion of the project is, *"Plant resources are the primary impetus behind forays into the highcountry by indigenous groups that traditionally subsisted on land that is now within Olympic National Park's boundaries"*
2. To explore the feasibility of using a vegetative patch map consisting of resources traditionally used by indigenous groups as a predictive model for locating archeological sites.

3. To summarize information on prehistoric swidden agriculture, and the use of prairie and wetland plants by peninsular indigenous groups (indigenous groups traditionally and currently residing on the Olympic Peninsula).

Section 1: Highcountry Plant Use

A: Alpine and subalpine plants used by indigenous groups on the Olympic Peninsula

Several archeological sites (OLYMPIC 1984) strongly suggest that indigenous peoples living on the Olympic Peninsula ventured into and made temporary camps in the alpine and subalpine regions of the area currently within Olympic National Park's boundaries. However, it is not clear what inspired travel and habitation in the remote and unforgiving interior of the Olympic Mountains. To better understand traditional indigenous highcountry travel on the Olympic Peninsula, this project focuses on the plant economy of such groups. All alpine and subalpine plants occurring within Olympic National Park and connected to an indigenous population by way of traditional use are listed below. The entire suite of qualifying plants, 30 in all¹, is relatively short with 4 plants found at alpine elevations (above 6,000 ft.) and 26 in the subalpine.

The ERI² provides the following information for each plant in the focus group: General habitat, Native group(s) associated with the plant, general use of the plant, specific use of the plant, parts of the plant used, and legendary/sacred status of the plant (if applicable). Information on elevation range, general habitat, general distribution on the Olympic Peninsula, and basic life history characteristics (i.e. perennial, annual, evergreen, etc.) is found in Table 1. Also refer to Figure 1 for a visual outline of the geographical

¹ The ERI contains data on 35 plants that occur at alpine and subalpine elevations (above 3,500 ft.) and are associated with one or more native groups on the Olympic Peninsula. However, five of these plants (*Polystichum munitum*, *Adiantum pedatum*, *Rubus parviflorus*, *Rubus ursinus*, and *Vaccinium parvifolium*) are so rare at such elevations that their inclusion in this discussion would be misleading (Schreiner 2000: personal communication, Tisch 2000: personal communication).

² Sources for the ERI include: Pojar & MacKinnon 1994, Moerman 1998, Turner 1971, Powell & Morganroth 1998, Reagan 1934.

regions displayed in Table 1. Unless stated otherwise, basic ecological profiles for the following plants are borrowed from Pojar & MacMinnon (1994).

Anaphalis margaritace (pearly-everlasting):

A. margaritace, a weedy native, prefers rocky slopes, open forests, and clearings such as meadows, fields, pastures, and roadsides. Reportedly, only the Quileute sought out *A. margaritace*. An infusion of the plant was rubbed onto stiff joints to ease pain, and was also rubbed on open sores.

Crisium edule (Indian thistle / edible thistle)

C. edule commonly grows in moist meadows, clearings and forest openings. Both the Hoh and the Quileute harvested *C. edule* for the green, young shoots, which they ate.

Aquilegia formosa (red columbine):

A. formosa is found in a variety of moist, open and shaded areas; rocky slopes and beaches, forest glades, clearings and roadsides. Red columbine also commonly grows in avalanche chutes and is more abundant patchily at subalpine and alpine elevations than at low and montane elevations (Tisch 2000: Personal communication). The Quileute harvested *A. formosa* exclusively for medicinal purposes. They used the plant (part unspecified in the literature) to encourage scarring of open wounds and made a liniment from ground roots to alleviate soreness in muscles. Also, leaves were chewed and spat on sores.

Allium millefolium* var. *alpicola (common yarrow):

A. millefolium var. *alpicola* occurs on dry to moist, well drained open sites, such as meadows, rocky slopes, gravel bars, roadsides, clearings, and sometimes in open forest. Unique to this suite of plants, common yarrow does not grow at montane or low elevations. The *alpicola* variety of *A. millefolium* is a rare perennial, yet nearly every peninsular tribe used the plant for varying medicinal purposes. The Klallam, Makah, and

Quileute made an infusion from the leaves to ease the birthing process. The Chehalis consumed common yarrow leaves to treat bloody diarrhea and the Makah chewed the leaves as a blood purifier. Both the Klallam and Makah used the leaves to treat colds and related symptoms. The Quileute and Quinault applied a poultice of boiled leaves to rheumatic limbs, and in the case of fever made an eye wash from a decoction of the roots, treated tuberculosis with a decoction of the roots, and took a decoction of the roots and leaves as a general tonic. The Klallam chewed a decoction of the leaves and applied this to sores, and burned seeds as incense. As a side note, *A. millifolium* v. *californica* is found at coastal elevations but probably does not have the same medicinal properties, as does the *alpicola* variety (Tisch 2000: personal communication).

Allium cernuum* var. *obtusum (nodding onion):

A. cernuum var. *obtusum* grows in dry open woods and exposed grassy places, rocky crevices and sandy soils, and is associated with Douglas fir at lower elevations. Several tribes harvested *A. cernuum* var. *obtusum* for medicinal purposes and as a food source. The Hoh, Klallam, Makah, Quileute and Quinault all harvested and ate the bulbs, yet only the Makah and Quinault used the plant medicinally. Both groups made a poultice from the plant (part of plant is unspecified) and applied this to the chest for pleurisy pains. Lewis and Clark noted that wild onions (including *A. cernuum* var. *obtusum* included) were a remedy for flatulence induced by eating camas (*Camassia quamash*) bulbs. As a side note, *Allium crenulatum*, Olympic onion, is absent from all sources cited. This is conspicuously for the plant is easily harvested, very tasty, and more widely dispersed than the nodding onion (ibid).

Chamaecyparis nootkatensis (Alaska yellow cedar):

C. nootkatensis does not grow below 900 m. (3000 ft). Alaska yellow cedar is the oldest growing evergreen tree on the Olympic Peninsula, commonly reaching 1,000 to 1,500 years in age! Both the Quileute and Hoh used *C. nootkatensis* wood to make canoes and paddles, while the Quileute also used the wood for carvings and bows, and used the bark to dye clothing.

Epilobium angustifolium* spp. *angustifolium (fireweed):

E. angustifolium spp. *Angustifolium* is found in moist to fairly disturbed areas, including clearings, roadsides, meadows, thickets, avalanche chutes, along riverbeds, and especially in recently burned over areas. Several tribes used fireweed as a manufacturing material, a medicinal resource, and/or as a food source. The Klallam, Quileute, Quinault, and Skokomish all mixed fireweed fluff with other materials, such as duck feathers or dog hair when weaving cloth or making blankets. Both the Klallam and Quileute took advantage of fireweed's edible quality. The Klallam boiled the roots to make a drink, while the Quileute ate the stems, raw or cooked and sucked the sweet sap out of the stem. The Skokimish took an infusion of fireweed roots to combat tuberculosis.

Arctostaphylos uva-ursi* spp. *uva-ursi (kinnikinnick):

Kinnikinnick grows in sandy and well drained, exposed sites including dry rocky slopes, dry forests and clearings. This low-lying evergreen shrub is rare on the western half of the Olympic peninsula (Tisch 2000: personal communication). Primarily, kinnikinnick was sought after for medicinal and ceremonial purposes. The Hoh, Klallam and Quileute all smoked the leaves as one would smoke tobacco. The practice had both medicinal and ceremonial applications. Reportedly, the Makah harvested kinnikinnick berries as a food source and sold or traded the leaves to other tribes.

Gutheria ovatifolia (western teaberry / slender teaberry):

G. ovatifolia grows in moist forest and especially in bogs. Both the Hoh and Quileute ate the berries fresh and/or stewed them to make a sauce. Western teaberry is quite rare and probably not a primary food type, but rather harvested opportunistically (ibid).

Herecleum lanatum (cow-parsnip):

H. lanatum prefers stream banks, moist slopes and clearings, upper beaches and marshes, meadows, thickets, avalanche chutes, and roadsides. Several peninsular tribes

sought out cow-parsnip as a medicinal, manufacture, and food resource. The Hoh ate the young shoots raw, while the Makah, Quileute, and Quinault dipped peeled stems or fresh petioles in seal oil before consumption. Both the Makah and Quileute used the plant as a tonic (part of the plant unspecified) and the Makah fashioned a heated poultice from cow-parsnip to treat ailments of the eye. Young Makah and Quileute girls twined the large *H. lanatum* blossoms with seaweed to make baskets that served as play items.

***Pinus monticola* (western white pine):**

P. monticola is found from moist valleys to fairly open and dry slopes. The Quileute and Hoh treated coughs with gum from this tree, and the Quinault took an infusion of bark to purify the blood. The Quileute used western white pine wood to fashion fishing plugs, ghost masks, gaming disks, counting sticks, and needles for mat making. They also attached *P. monticola* cones to costumes worn in certain dances. The medicinal quality of *P. monticola* may be better at higher elevations for harsh environmental conditions limit growth which in turn concentrates a given plant's resident chemicals (Tisch 2000: personal communication). This species of pine benefits from fire through serotinous seed dispersal.

***Tsuga mertensiana* (mountain hemlock):**

Mountain hemlock is a subalpine or montane species that is not shade tolerant, though can withstand several months of snow cover and is most common on the western half of the Olympic Peninsula (ibid). Both the Hoh and Quileute used *T. mertensiana* bark as an emetic and in the tanning of hides.

***Rhododendron albiflorum* (white rhododendron):**

White rhododendron is found in moist coniferous forests, wet glades and along streams, but also on dry, relatively well-drained sites. The Skokomish sought after *R. albiflorum* for its medicinal qualities. They treated colds with a decoction made from leaves, applied poultices of chewed bulbs to lacerations, ate the buds to treat an ulcerated stomach, and used a decoction from the buds to treat sore throats.

***Spirea douglasii* spp. *menziesii* (Menzie's spirea / hardhack / steeplebush):**

Menzie's spirea grows along stream banks, in swamps, fens, along lake margins and in damp meadows. Abundance of this *Spirea* species decreases as elevation increases, and in general the plant is more abundant on the west side of the Olympic Peninsula (Tisch 2000: personal communication). The Quileute used Menzie's larkspur stems to string clams for roasting.

***Delphinium menziesii* sp. *Menziesii* (Menzies' larkspur):**

Menzie's larkspur grows on grassy bluffs, vernal grassland, and meadows. Though the Chehalis considered the whole plant to be poisonous, they applied a poultice of stalks and roots to sores.

***Geum macrophyllum* (large-leave avens):**

G. macrophyllum grows in open areas including open forest, and prefers moist soil. Several peninsular tribes used large-leave avens for a variety of medicinal purposes. The Chehalis took an infusion of leaves to prevent conception, while Klallam and Quileute women chewed the leaves during childbirth. The Klallam and Quileute also used the leaves to treat boils and the Quinault applied a poultice of smashed leaves to cuts.

***Lilium columbianum* (Columbia lily / tiger lily):**

L. columbianum is usually found in meadows, thickets, open forest and clearings. Columbia lily is most abundant at montane to subalpine elevations. The Klallam steamed the bulbs and corms before consumption, while the Quileute, Quinault, and Skokomish only steamed and ate the corms.

***Xerophyllum tenax* (beargrass):**

Beargrass prefers open areas. The Chehalis, Klallam, Makah, Quileute, Hoh, and Quinault all incorporated the robust beargrass leaves into their basketry, either as a decoration or as a primary manufacturing material. Reportedly, the Makah supplied their

northern neighbors, the Nootka, with beargrass leaves (Turner 1971). Because of certain ecological conditions in their historic use area (see Figure 2), the Quinault could have harvested beargrass at sea level (Tisch 2000: Personal communication). Beargrass also grows at sea level along the east side of the Olympic Peninsula near Shelton and Hoodspport (Wray 2000: personal communication), thus indicating accessibility at low elevations for the Skokomish.

Vaccinium deliciosum (blue-leaf huckleberry):

V. deliciosum grows abundantly in subalpine and montane meadows, though it is sparse at these elevations in the north region of the Peninsula (ibid). Both the Quileute and Hoh sough out this plant for its delicious berries. The fruit was either eaten raw or stewed and made into sauce.

Rubus lasiococcus (dwarf bramble):

R. lasiococcus is found in forests and open places, such as thickets, clearings and logged areas at montane elevations, and is a common understory plant at subalpine elevations. Dwarf bramble is more common at subalpine than montane elevations. The berries are very small and probably not the targets of foraging expeditions (ibid). However, both the Hoh and Quileute reportedly ate dwarf brambleberries raw or stewed them into a sauce.

Vaccinium ovalifolium (oval-leaf huckleberry):

V. ovalifolium grows in moist coniferous forests, and in openings and bogs. The berries ripen in July (following the ripening of salmonberries at lower elevations) and the oval-leaf huckleberry is distinguished from other *Vaccinium* species by this early fruiting. The Hoh, Quileute, Makah, and Quinault ate the berries raw, steamed them into a sauce, or dried or canned them for future consumption. Alone, the Makah used the leaves in an infusion that was given to mothers after childbirth.

B: Alpine and subalpine plants used by indigenous groups in British Columbia, Canada, that also occur on the Olympic Peninsula.

All of the plants listed below grow at subalpine, or alpine elevations on the Olympic Peninsula, however none receive mention in the ethnobotanical literature on this region. Record of use for each of these plants by Native peoples living in British Columbia, Canada may caulk the relevant gaps in the literature relating to the Olympic Peninsula, and thus further illuminate peninsular high elevation plant use. Resource use, and general habitat information for the following plant species comes from Turner 1971. The elevation range and distribution around the Olympic Peninsula for each plant is also described in Table 1 and Figure 1.

***Acer glabrum* (Douglas maple):**

A. glabrum is a bushy shrub or small tree that grows in habitats that vary from coastal lowlands to dry rocky slopes, but is usually found in open areas. Many BC groups used the wood to make bows, arrows, spear prongs, spear handles, baby swings, combs, throwing sticks, spoons, and other items.

***Lomatium dissectum* var. *dissectum* (fern-leaved desert parsley / chocolate tips):**

Fern-leaved desert parsley grows on dry, rocky slopes only at subalpine elevations and only in the northern region. The Interior Salish ate the roots of young *L. dissectum* var. *dissectum* plants, though the Okanogan used the roots as a fish poison and insecticide.

***Lomatium nudicaule* (pestle parsnip / wild celery / Indian consumption plant):**

L. nudicaule grows on dry, open slopes, in moist meadows and sparsely wooded areas. Native BC groups commonly used pestle parsnip's spicy, aromatic seeds as a fumigant and deodorant.

***Populus tremula* spp. *tremuloides* (quaking aspen):**

Quaking aspen grows on upland slopes, in moist depressions, or in alluvial soils. Eastern BC tribes primarily used quaking aspen in the making of dugout canoes, saddles, tent poles, and meat drying racks.

Juniperous scopularum (rocky mountain juniper):

J. scopularum grows as a branching tree (up to 10 meters), and as a sprawling shrub less than 1 meter high. Primarily, it grows in rocky coastal areas, on dry plains and valleys, and on low mountain slopes. Many BC tribes used *J. scopularum* wood for bow making, and the bark for basketry. Turner (1971) mentions that both the Quileute and Hoh used rocky mountain juniper, however this association is questionable for the historical use areas of these groups do not overlap with the plant's distribution on the Olympic Peninsula.

Abies lasiocarpa (subalpine fir):

Subalpine fir grows in moist subalpine forests and open slopes at or near timberline. Interior BC tribes used *A. lasiocarpa* wood as a building material, and coated their bowstrings and the seams of birch-bark canoes with the pitch.

Hierachloe odorata (seetgrass):

Sweetgrass grows in moist meadows and on slopes. Generally, the grass was used by BC tribes as an air freshener or rubbed on the body and clothing in order to transfer its pleasant, vanilla odor.

Artemisia ludoviciana (western mugwort):

Western mugwort is common in dry meadows. Eastern BC tribes used *A. ludoviciana* as a domestic deodorant and bug repellant.

C: An analysis of plant use in respect to the guiding hypothesis

No shadow of doubt lingers as to whether or not plant resources were and still are an important component of aboriginal energy acquisition agendas, medicinal practices, and the manufacturing of specialized and every day goods. And, as we shall see below, aboriginal people were not constrained by the Olympic Peninsula's challenging topography but rather ventured into and through the mountainous interior for various reasons. What is perhaps more controversial and of considerable interest is not the question if aboriginal peoples utilized the highcountry, but why they did so. The hypothesis guiding this inquiry (*Plant resources are the primary impetus behind forays into the highcountry by indigenous groups that traditionally subsisted on land that is now within Olympic National Park's boundaries*) attempts to answer this question.

Plants were an important part of aboriginal subsistence economies on the Olympic Peninsula (Powell & Morganroth 1998, Pojar & Mackinnon 1994, Turner 1971, Wray 1997), and at least 30 plants used by aboriginal people occur at subalpine and alpine elevations. However, in this case 2 + 2 may not equal 4, or more plainly put aboriginal plant use and aboriginal use of the highcountry may only circumstantially overlap. On a tribe-by-tribe basis, the following discussion systematically evaluates evidence in support of, and contrary to the hypothesis stated above.

The Skokimish (Twana) ancestral region overlaps with Olympic National Park's Hood Canal district. Ethnographic accounts of Twana culture carry a general ignorance of the group's use of the Peninsula's mountainous interior. However, it is noted that Twana men hunted marmot, which they traded to the Lower Chehalis, and in the fall hunted elk in the Olympics. Thus we can assume that the Twana foraged in the highcountry but we can say nothing of plant-specific foraging behavior. Traditionally, the women engaged in most if not all of the gathering, yet it is not known whether or not they accompanied the men on hunting expeditions (Wray 1997)³.

The Makah, who traditionally occupied the northwest corner of the Olympic Peninsula, relied heavily and almost entirely on marine resources (ibid). The Probability

³ Olympic National Park Ethnographic Overview And Assessment, by Jacilee Wray (1997), provides an exhaustive documentation of the available ethnographies involving peoples living on the Olympic Peninsula. Thus, this source was exclusively referenced for ethnographic information relating to foraging behavior.

that the Makah sought out plant resources in the high-country, let alone entered the high-country on regular foraging trips is slim at best.

Traditionally, the Klallam lived along northern, costal section of the Olympic Peninsula. As with the Skokomish, men hunted and fished and women gathered. Typically, only one man per village traveled to the mountains on hunting excursions. However, families were known to camp in the Peninsula's interior.

The people who lived at Indian Creek (a tributary to the Elwha) were considered hunters, and the name of the headman of this village was Hunter John. Contemporary descendents of Hunter John have recollections of camping locations in the mountainous regions of the Elwha. Happy Lake was an established campsite for this Family until the 1930s. Another was located on Hurricane Hill Ridge. This sight was utilized year round by one family that was curing their young son of tuberculosis using traditional medicinal skills (Wray 1997:53).

There are several accounts of Klallam people entering the high country, but nearly all refer to hunting or traveling. The exception is Boston Charlie, a Klallam man who lived at the base of Cat Peak and, assumedly, subsisted on hunted meat, fish and possibly plants, though plant use is not mentioned.

The Quinault were traditionally located on the west side of the Olympic Peninsula. Currently, they harvest around 60,000 pounds of plants per year, yet little is know of their traditional, plant-specific foraging strategies. Record of high elevation resource use exists, but does not greatly illuminate plant use.

At the end of the summer, several families from a village moved into the mountains, following well-established trails that led to favorite locations for hunting, collecting berries, grasses, and bark. Olson (1936) documented that while in the mountains the Quinault set up semi-permanent structures made of bark over a conical framework of poles, or mat-covered lodges. They hunted marmot, beaver, land otters, raccoons, wildcats, rabbits, mink, and wolves. (ibid:86)

For both the Quileute and the Hoh, there is mention of plant use, but none of the species involved occur at subalpine or alpine elevations. However, Wray (1997) states that the Quileute "hiked into the Olympic Mountains to hunt and gather berries (107)".

Chehalis foraging patterns are not discussed in the addressed literature.

Mention of aboriginal resource acquisition in the Olympic Peninsula's mountainous interior primarily focuses on hunting for energetic and commercial gains, and high

elevation plant use is effectively absent. This absence may be a result of biased ethnographic strategies that only focus on male energy capture, or an indication that native peoples living on the Peninsula did not routinely travel to the high country to harvest and possibly process plant resources for food, medicine, or manufacture. However, before making concluding remarks, I think it is prudent to scrutinize the values presented in Table 1 to further assess the probability that plant resources enticed native peoples to utilize the Olympic Peninsula's mountainous regions.

By adopting a rate maximizing stand point, One can qualitatively assume that a resource found closer to the core of a central place forager's⁴ resource use area will be more profitable⁵ for any currency than the same resource found at a further distance because travel, especially over difficult terrain such as the mountainous interior of the Olympic Peninsula, is energy expensive. An imaginary example will further illustrate this relationship. Say a certain plant gives a caloric return of 2,000 calories per hour when harvested at a location that is one hour's walk from the central foraging place. If the forager has to walk four hours to acquire the resource, the energetic costs of acquisition become four times as expensive as they are in the first example and the overall energetic (caloric) return from the resource is thus cut to one fourth the original value. When the forager has to walk for several days to acquire the same resource, as she or he would if the resource was to be collected at alpine or subalpine elevations, the resource's profitability will assumingly drop to undesirable levels (*X. tenax* (beargrass) ^{maybe} is a good case in point from the group of plants previously discussed). This example is very rough and ignores other pertinent currencies such as medicinal, material or ceremonial use value, and seasonal variations in quality; however, I feel that it provides a logical platform from which we can better view high elevation plant use. With this perspective, we can expel all of the plants that are found at low and/or montane elevations *as well as* at subalpine or alpine elevations from the investigation for the probability of their acquisition being the

⁴ Refer to Foraging Theory by D.W. Stephens & J.R. Krebs (1984) for a formal discussion of the primary assumptions and constraints relating to central place foraging.

⁵ In the formal diet breadth model, as discussed in Stephens & Krebs (1984), profitability is a measure of calories captured per unit of time spent foraging and processing (searching and handling) the resource. In this context, I am generalizing profitability so that it applies to calories, medicinal potency, or material worth as functions of time spent foraging.

impetus for forays into the highcountry is greatly reduced by the variance in their profitability.

A quick glance at Table 1. shows that few of the plants discussed in this paper exclusively occur at alpine or subalpine elevations. Only four plants; *A. millefolium* var. *alpicola* (common yarrow), *L. dissectum* var. *dissectum* (pestle parsnip), *H. odorata* (sweet grass), and *A. ludoviciana* (western mugwort) are not found at montane or low elevations. Of this sub grouping, one plant resource, *A. millefolium* var. *alpicola*, is linked to peninsular tribes, while the other three are documented as part of the resource use agenda for native groups who have historical use areas in central and eastern British Columbia. While it is heuristic to speculate about the substitutability of plant utilization between northwestern indigenous groups, concrete evidence is lacking for such relationships involving this particular suite of plants, thus their presence in this report serves an informative rather than indicative purpose.

A. millefolium var. *alpicola* (here forth simply referred to as *alpicola*) was a widely used medicinal for all peninsular groups except for the Hoh and Skokomish. *Alpicola*'s distribution covers much of the Olympic Peninsula's mountainous interior and thus is not regionalized in such a way that would favor one native group's historical use area over another (see Table 1 for distribution, and Figure 1 for historical use areas), which may partly explain the popularity of this resource. As noted above, *alpicola* had many medicinal applications from a general tonic to a treatment for bloody diarrhea to incense, a single plant medicine cabinet if you will. Given that the plant only occurs in the elevation zones of interest to this inquiry, and that it has a relatively high use value (based on the number of medicinal applications and its popularity), *alpicola* appears to be the sole champion for the guiding hypothesis, or is it? Several of *alpicola*'s medicinal applications overlap with those of plants that occur at lower, more accessible elevations and this holds even when we control for affiliated group (see previous descriptions of plant uses), which brings us back to an evaluation of profitability. If a forager acquirers the desired medicinal effect from one plant at a fraction of what it would cost to capture the same effect from another plant, the forager will pursue the more profitable option. Given the elevation requirements of its viable habitat, and the substitutability of some of its medicinal qualities,

alpicola is probably not the more profitable option. (Of course, what is ignored in this claim is the realistic possibility that a medicinal quality present in members of a certain species is not equal at varying elevations (see above description of *P. monticola*). Maybe the tonic made from *H. lanatum* is more potent than the tonic made from *alpicola*? An exploration of the relative trade-offs between such plants would be very insightful; however, such an endeavor exceeds the means and the general focus of this report.)

Another factor that may challenge the distance related reduction in the profitability of a given resource is how the resource's accessibility affects the amount of time spent foraging. Clumped together, a *patch* containing N number of resource X can yield a higher net profitability than N number of resource Xs individually distributed. The logic behind this assumption is fairly simple. Upon encountering a resource patch, a forager's *between* resource search-time greatly decrease as a function of the distance linking individual resources. Less time spent acquiring N amount of resource X translates into greater profitability because time, being the denominator in the profitability equation (currency / cost, or e_i / h_i)⁶ causes profitability to decrease as it increases. As noted above, *A. formosa* is more abundant patchily at subalpine and alpine elevations. If the required travel time to *A. formosa* patches at subalpine or alpine elevations plus the time spent harvesting and processing the resource is less than the total time spent searching for, harvesting, and processing *A. formosa* at lower elevations then we can assume that highcountry patches are more profitable than low elevation spreads of this resource.

Both *alpicola* and *A. formosa* support the driving hypothesis; however, most of the resources discussed in this paper, 28 out of 30, do not. *Alpicola* was exclusively harvested at subalpine and alpine elevations due to the resource's habitat limitations, and *A. formosa* may have been exclusively harvested at alpine and subalpine elevations because of increased profitability due to patchiness; however, it is presumptuous to then conclude that plant resources were the primary impetus for highcountry excursions if the support for this claim falls on just two cases.

⁶ e_i = the expected net energy (or other currency) gained from an individual resource of type *i*. h_i = the expected handling time spent with an individual resource of type *i*. These terms are adopted from Stephens & Krebs (1986) and simplified to meet the purposes of this paper.

Summary:

Aboriginal peoples living on the Olympic Peninsula forayed into the mountainous and harvested plants during such excursions, as is evident by the inclusion of *alpicola* - a plant limited to alpine and subalpine elevations. However, what is not clear or even implied after a careful analysis of the available evidence on plant resource use is the causal connection between aboriginal activity at alpine and subalpine elevations and plant resources included in aboriginal resource use agendas. At this point, the lack of mention of high elevation plant use in the ethnographic literature (Tisch 2000: personal communication, Wray 1997), and the assumed decrease in profitability of plant resources as a function of travel distance required to harvest such plants, with the exception of *A. formosa*, leads one to think of alpine and subalpine plant use as *opportunistic* and not as the primary impetus for high elevation excursions. Further exploration of the relative profitability of plant resources given varying factors such as patchiness, potency, and abundance may overturn this postulation. Until such information is acquired the driving hypothesis, *Plant resources are the primary impetus behind forays into the highcountry by indigenous groups that traditionally subsisted on land that is now within Olympic National Park's boundaries*, remains unsupported.

Table 1: Alpine and Subalpine Plant Resources, Olympic National Park (Use, Affiliation, & Distribution)

RESOURCE	EL	LH	HABITAT	USE(S)	TRIBAL AFFILIATION	RESOURCE DISTRIBUTION: A + SA	RESOURCE DISTRIBUTION: M + L
<i>A. margaritacea</i>	A	P	open	med	Quileute	N, NE-E-C, S	GEN, NW-E, S-SW
<i>C. edule</i>	A	P	open	food	Hoh, Quileute	N, N-E-C-S	GEN, N, E-C-S-W
<i>A. formosa</i>	A	P	open	med	Quileute	NW, N-NE, E-C-S	GEN, NW-E-C
<i>A. millefolium</i> var. <i>alpicola</i>	A	P	open	food, med	Quinault, Quileute, Klallam, Makah, Chehalis	N-NE-E-C	*NOT FOUND AT M OR L
<i>A. cernuum</i> var. <i>obtusum</i>	S	P	open	med, food	Hoh, Quileute	N-NE	NW, NE, N-NE
<i>C. nootkatensis</i>	S	E	forest	man	Hoh, Quileute	NW-E-C-S	NW-NE, S
<i>E. angustifolium</i> spp. <i>angustifolium</i>	S	P	open	med, man	Skokomish, Klallam, Hoh, Quileute	N-NE-C	W-SE, N-NE
<i>A. uva-urs</i> spp. <i>uva-ursi</i>	S	E	dry	med, food	Makah	N-E	NW-SW, NW-E
<i>G. ovatifolia</i>	S	E	open	food	Hoh, Quileute	NW-E-C-S	NW-E-C-S
<i>H. lanatum</i>	S	P	moist	man	Makah, Hoh, Quileute, Quinault	N-E-C-S	NW-S, NW-NE, S
<i>P. monticola</i>	S	E	forest	med	Hoh, Quileute, Quinault	NW-E-C	N-SE, SW, NW-NE, S
<i>T. mertensia</i>	S	E	forest	med, man	Hoh, Quileute	NW-E-C-S	NW-NE-C-S
<i>R. albiflorum</i>	S	D	moist	med	Skokomish	NW-E-C-S	NW-E-C
<i>S. douglasii</i> spp. <i>menziesii</i>	S	D	moist	man	Quinault	C	E-N, N-NE
<i>D. menziesii</i> spp. <i>mensiesii</i>	S	P	meadow	med	Chehalis	N-NE	N-NE, NE
<i>C. sibirica</i>	S	P	moist	med	Quileute	N-C-S	GEN, W-E, S
<i>G. macrophyllum</i>	S	P	moist	med	Klallam, Quileute, Quinault, Skokomish	C	GEN, NW-E-C
<i>L. columbianum</i>	S	P	open	food	Chehalis, Hoh, Klallam, Makah (trade), Quileute, Quinault	NW-E-S	GEN, NW-E, S
<i>X. tenax</i>	S	P	open	man(trade)	Hoh, Quileute	N-E-C-S	E-N, E, S, NW
<i>V. deliciosa</i>	S	D	open	food	Makah, Hoh, Quileute, Quinault	N-E-C-S	S
<i>V. ovalifolium</i>	S	D	forest	med, food	Hoh, Quileute	N-E-C-S	S-N-C-E, NW-E-C-S-SW
<i>R. lasiococcus</i>	S	D	forest	food	Chehalis, Klallam, Quileute, Quinault	NW-E-C-S	N-E, S
<i>A. glabrum</i>			forest	man	BC groups (Not specific)	NW, NE-E	N-SE, NW-E, S *NOT FOUND AT M OR
<i>L. dissectum</i> var. <i>dissectum</i>			dry	food, med	Interior Salish, Okanagan	N	L
<i>L. nudicaule</i>			dry	med	BC groups (Not specific)	N-NE	N-NE
<i>P. tremula</i> spp. <i>Tremuloides</i>			moist	man	BC, Interior and Eastern groups	N	N-NE
<i>J. scopulorum</i>			dry	man	BC groups (Not specific)	N-NE	N, N-NE
<i>A. lasiocarpa</i>			forest	man	BC, Interior groups	N-C-E, N-E-C-S	NE, S *NOT FOUND AT M OR
<i>H. odorata</i>			moist	man, med	BC groups (Not specific)	N, NE	L *NOT FOUND AT M OR
<i>A. ludoviciana</i>			open	med	BC, Eastern groups	N-NE-C	L

Figure 1: Olympic Peninsula – Geographic Regions (Adopted from Buckingham et. al. 1995)

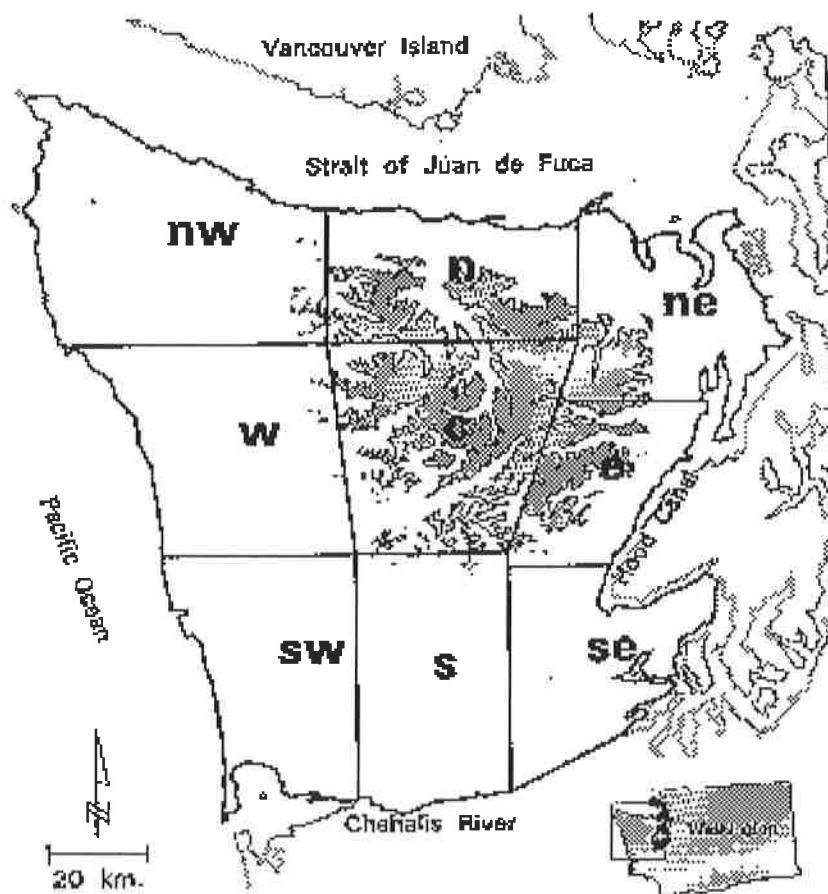
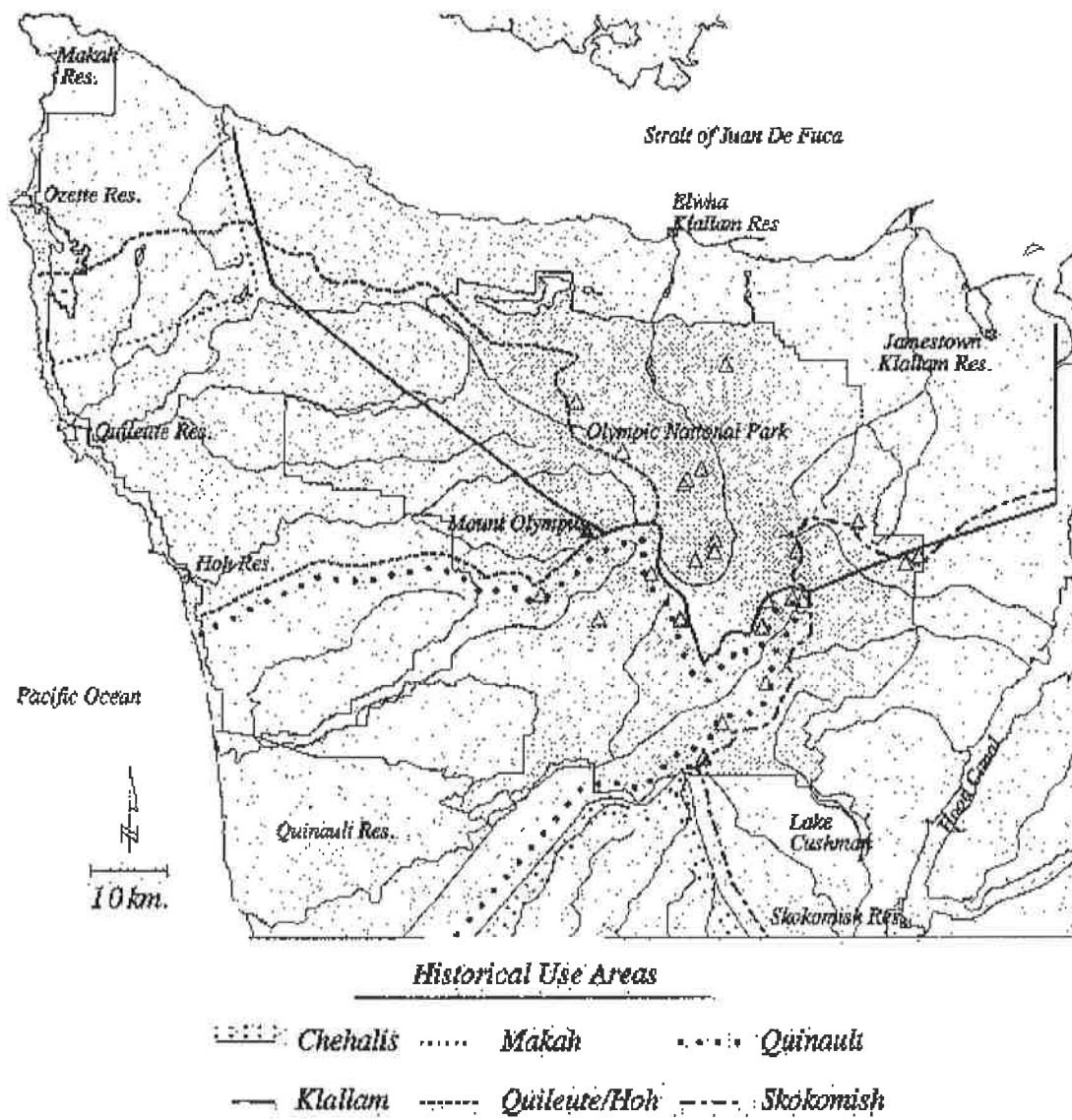


Figure 2: Olympic Peninsula – Historic Use Areas (Adopted from Wray 1997:11)



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