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JOURNAL OF NORTHWEST ANTHROPOLOGY

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# BALANOPHAGY IN THE PACIFIC NORTHWEST: THE ACORN-LEACHING PITS AT THE SUNKEN VILLAGE WETSITE AND COMPARATIVE ETHNOGRAPHIC ACORN USE

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**Bethany Mathews**

## ABSTRACT

Archaeological and ethnographic studies in North America have recorded the importance of acorns where they were available to many cultures through resource or trade, but they have not generally been considered an important plant resource in the Northwest. Recent archaeological examination of approximately one hundred acorn-leaching pits on Sauvie Island, Oregon suggests otherwise. Comparison of the Oregon white oak range with ethnographic and archaeological information indicates that acorns were consumed in the oak's range through western Washington, continuing south into the well-documented California acorn cultures.

## Introduction

Test excavations of the National Historic Landmark Site 35-MU-4, the "Sunken Village," have revealed the remnants of over one hundred pit features constructed by Chinookan people on a muddy slough of the Multnomah Channel on Sauvie Island, Oregon. The "Sunken Village was known by generations of artifact collectors and archaeologists for the basketry and other perishable objects found within the aquifer that has preserved these artifacts and features over hundreds of years. Archaeologists have previously identified the site as an acorn storage or processing facility (Newman-Zehendner 1992), which is a well-represented feature in California archaeology, but nearly absent on the Northwest Coast (cf., Ames et al. 1999:43). The abundant pit features on Sauvie Island are evidence of the use of a plant resource that has likely been underestimated on the Northwest Coast in general, and a reminder of the elaborate trade systems of the Lower Columbia region.

## Pacific Northwest Balanophagy

The Oregon white oak (*Quercus garryana*) inhabits the west coast from northeastern Vancouver Island in British Columbia to Los Angeles, California, extending eastward over the Cascade Mountains along the Columbia River (Peter and Harrington 2002:189). It is the only oak native to British Columbia and Washington, and dominates the oak populations of Oregon (Stein 1990:650-651; Agee 1993:352). In California, however, it is one of many nut-bearing trees (most from the genus *Quercus*) which populations utilized for generations as a dietary staple. Balanophagy, the "eating of acorns," is described ethnographically as a unifying characteristic of California cultures (Gifford 1971:301), owing to the abundance of species throughout that region and the development of complex processing and storing techniques. Through living memory, ethnography and archaeology, the process of gathering and preparing acorns is recognized as a vital piece of culture and livelihood for thousands of years in that region.

The typical process of preparing acorns in California, as followed by the Yosemite Miwok/Paiute tradition, involves gathering, drying, shelling, winnowing, and pounding the acorns into flour, followed by leaching the acorn flour with water to remove bitter tannins (Ortiz 1991). Though removing the astringent tannic acid is not necessary when eating acorns in small servings, the leaching process sweetens the acorns, and this would be necessary when consuming varieties other than the white oak, as they have significantly higher concentrations of tannic acid. Leached acorn flour was then prepared as cakes, breads, and porridges (Moerman 2002:461). Though southern California leaching methods are always described as an active process, passive leaching (called such because it is much less labor intensive than the "active" California method) has been recorded in northern California, where the white oak is the dominant oak type. For instance, the Wintu of northwest California leached acorns in swampy grounds through the winter, then removed them in the spring and prepared them by boiling or roasting (Moerman 2002:459). A passive leaching pit site north of San Francisco, dated to between 3370 and 4450 BP, suggests that passive leaching was a technique used in central California before active leaching techniques were widely adopted around 3000 years ago (Eric Wohlgemuth 2008, pers. comm.).

Discussions of the acorn in diets of Northwest Coast peoples range from dismissive (e.g. Gifford 1971:301) to locally limited (e.g. Ames and Maschner 1999:120). On the Northwest Coast the passive leaching method is the only leaching process noted in the few ethnographies that describe leaching, so it seems unlikely that the California acorn flour leaching technique was used much, or at all, to the north. Groups like the Chehalis and Cowlitz of present-day southwestern Washington (Gunther 1973:28; Moerman 2002:461) were noted to have used the passive method, while preparations further north required less processing time, potentially suggesting less of an economic investment. For example the S'Klallam, whose ancestral homeland is encompassed by northwestern Washington, and the Nisqually of the Puget Sound ate acorns with no preparation (raw). The Squaxin of the southern Puget Sound area roasted them on hot rocks before eating (Gunther 1973:28; Moerman 2002:461). This information appears to suggest some importance, but not nearly the same investment as California balanophagy. However, the minimal *comparative* investment should not be confused with local significance. While some of these processing techniques required relatively little investment, the Snohomish and Suquamish are noted to have travelled to the Nisqually valley and camped from August to September to gather acorns and berries, as did people from as far away as the Strait of Juan de Fuca (Norton 1979:187), which suggests considerable energy investment. Additionally, these brief mentions in the ethnographic record have, in one instance other than the Sunken Village excavation, been found to correlate with a high proportion of acorns in the archaeological record. Acorn shell fragments have been excavated in large quantities at *$Q^w$u?g$^w$əs* (45-TN-240), a Squaxin shellfish processing site near Olympia, WA, where acorns greatly outnumber other midden plant food remnants (personal observation 2008). It is unlikely that these are the remnants of rare instances of use which by chance were preserved in a waterlogged environment. The presence of this resource at these sites suggests that acorns were more ubiquitous in middens throughout the Northwest.

Ethnographic and other historic information from the Columbia River area indicate acorns were also a trade resource. Lewis and Clark mentioned that people living near the river, probably the Wishram, said they acquired acorns from people at the Dalles (DeVoto 1997:259). The Wascopam of The Dalles baked acorns in the earth with hot rocks, and then leached them in pits dug near water through the winter. In the spring women were seen on a stream bank, removing acorns from the water. Their acorns were eaten with dried or pounded salmon (Aguilar 2005:77-78).

The Wascopam and Chinook story of Little Raccoon and his grandmother add further strength to ethnographic information. This story about a greedy young raccoon describes five pits of acorns being stored by his grandmother for the winter. Little Raccoon is tired of eating wapato, jerky, and dried fish-eyes, so he sneaks acorns from the acorn pits and in both versions of the story proceeds to get himself into a lot of trouble with grandmother, transforming himself and his grandmother Blue Jay into their current forms. In the Chinook version of the story, grandmother stores her acorns in swampy ground, much like that of the Sunken Village. In fact, the few ethnographic accounts that mention leaching pits frequently mention that the pits are excavated into blue soils, suggesting pits were often located in aquifer locations (Ray 1938:148-151; Hunn 1990:186-187).

In 1847 Paul Kane, an artist and explorer, recorded that acorns were prepared as a delicacy by Chinook, in a way that was "a peculiarly characteristic trait of the Chinook Indian… confined solely to this tribe." According to Kane the preparation, called "Chinook olives" by European explorers, was made by digging a hole in the ground close to the entrance of a house, filling it with a bushel of acorns, then covering the hole with grass and dirt, and depositing urine in the hole for four to five months. Kane writes that the Chinook considered these acorns "the greatest of all delicacies" (Harper 1971:94). Removing tannins with urine would speed up the neutralization of the acids, but would probably require a much more complicated leaching process than that of waterlogged pits. This method could indeed have produced a truly rare and coveted delicacy, but I have argued against the validity of Paul Kane's account from an ethnohistoric perspective (Mathews 2008). Interestingly, a recent recording of a Klamath story to the south substitutes urination for passive leaching as well (Friday 2003:113), but this account, like many others in the decades following Kane's publication, appears to be relying on the above historic description.

It should be noted that while the archaeology and combined ethnographic information discussed in this paper appear to be rediscovering this resource's significance to the Northwest Coast, Chinookan descendant communities actively honor this knowledge in their inherited traditions. Through the tumultuous contact period, the history of acorn gathering is preserved in the Chinuk Wawa (Chinook Jargon) word for acorn, *k'ánawi təqwəla* (Eirik Thorsgard 2008, pers. comm.). The Athabaskan word *tus-xa* is used by the Confederated Tribes of Siletz Indians to refer to acorns that are leached in stream banks for several months to a year, and acorns are still gathered, stored and eaten by people there (Bud Lane 2007, pers. comm.).

## Defining 35-MU-4's Acorn-Leaching Pits

During the limited excavation (2006) and mapping (2007) approximately 100 pit features were recorded in a 125-meter section of the Multnomah Channel slough. These remnant features contained basketry, lithics, wood, bone, and botanical artifacts, which are all believed to be associated with the function of the pit features, or as a result of activity at the site during resource guarding. Beyond examining the surface of the pits at 35-MU-4, one pit feature (Pit P, Transect VI) was completely excavated in 2006 so that a profile could be studied. Many others were sampled, but none offered the same depth of preservation.

The pits recorded at 35-MU-4 were identified on the surface, sometimes because of the presence of acorns, but the more obvious marker of the leaching pits at the surface is a circle of branches protruding from the beach (Fig. 1). Fire-cracked rock, found throughout the surface of the slough, tends to settle on pit depressions and was also used as an indicator, though circular formations of fire-cracked rock proved to be misleading at times. Associated with the pits were over forty wooden stakes, which may have served as markers for the pits on the beach surface, either for identification on the slough after silting, or for ownership purposes (Fig. 2).

### *Acorns*

Acorns are the most abundant botanical artifact associated with the pit features, and were identified as those of *Quercus garryana,* commonly called Oregon white oak (Fig. 3 and 4). For comparison, some contemporary acorns were collected from trees growing on Sauvie Island, which were identified by leaf as the Oregon white oak (Pojar 1994:50). Girth measurements of a few large trees about a mile from the site estimate that a dense oak population has been available nearby for over 700 years (personal observation).

Acorns at Sauvie Island were found complete, or in fragmented parts of the shell and nut. Though a large percent of the acorns were only found in fragments (73%), the fragments generally represent all parts of the acorn. Acorn caps, with three exceptions, were not found in the pits. Although they would have preserved as well or better than the thinner acorn shell in the archaeological record, acorns with caps attached probably would not have been collected, as these would be infested and are known to fall from the tree not because of ripeness but from insect movement. Many acorns were whole (with the nut inside the shell) which means they were being left in these pits on the beach for later use instead of immediate consumption, unlike the numerous hazelnut fragments which appear to have been processed and possibly eaten at the site.

A small portion of the acorn fragments were found completely charred, while most fragments and whole acorns show some mottled marks that appear to be the result of heat, but might also result in part from the leaching process. Cooking the acorns could have killed any insects that had already infested the nuts, and could also have been a means to add flavor. Heating could also have split the shells open, which has been proven to be very beneficial to the rate at which the tannins are leached out (personal observation). Heating would also prevent the acorns from germinating during the storage period, and as Oregon white oak acorns germinate very soon after ripening, this process would avoid the loss of nutrients that would follow germination.

Fig. 1.   Branches protruding from pit base, before fire-cracked rock or silt is removed.


Fig. 2.  A well-preserved wooden stake with intact bark.

### *Western Hemlock*

Twigs protruding from the ground marked pits in a circular pattern on the surface, and the pits were lined from the sides to the base of the pit. Many of the twigs and branches, especially those at lower, less disturbed levels, still had needles attached (Fig. 5). Branches lining the bottom of Pit P (Transect VI) were radiocarbon dated at 1760 to 1880 CE (13 $\pm$ 60 BP) (Fig. 6). The intact needles made it possible to identify the species, but wood cells identification confirmed the species was western hemlock (*Tsuga heterophylla*) (Croes, Fagan, and Zehendner 2009:78), which grows along the coastal areas of Oregon, Washington, and British Columbia (Pojar 1994:30). It may be that this type of branch was selected over other conifers, as the boughs are flat and dense. This would allow water to pass through easily, but protect the store from the mess of the surrounding matrix. Hemlock was also considered an edible plant by many tribes of the Pacific Northwest, which might have led to it being chosen over other conifers (Moerman 2002:571).

### *Charcoal*

Charcoal is found throughout the site at every level of excavation in pit features. Over 5000 thumb-sized or larger pieces were collected from 35-MU-4, with 2500 coming from the half-excavated Pit P. Though charcoal could be the remnants of cooking or wood burning done at or near the site, ash and charcoal are frequently used in leaching processes in California (Gifford 1971:301). As ash speeds up the leaching process, adding oven or hearth remnants to the pits would ensure that the acorns were sweetened by the time they needed to be removed from the pits.

### *Pit Construction*

Pits generally take on a circular shape at the surface, with diameters smaller than a meter. While only a few pits were tested, the depth of a well-preserved pit (Pit P, Transect VI) was 55 cm below the surface. Many pits were badly eroded with only a few centimeters of depth remaining. The acorn-leaching pits are concentrated in a 125-m section of the slough (Fig. 7), where aquifers under the natural levee would have moved water through the buried acorns. The rising water of the Multnomah Channel would have covered the sealed pits after harvest in the fall until early spring (Croes et al. 2009:31). This compares well with ethnographic reports of acorns leaching for several months after harvest. None of the features at 35-MU-4 were intact enough to contain a seal, but it is likely that the pits would have needed to be covered with soil or branches and fire-cracked rock to prevent acorns from floating away in the channel’s waters before they became heavy with saturation.

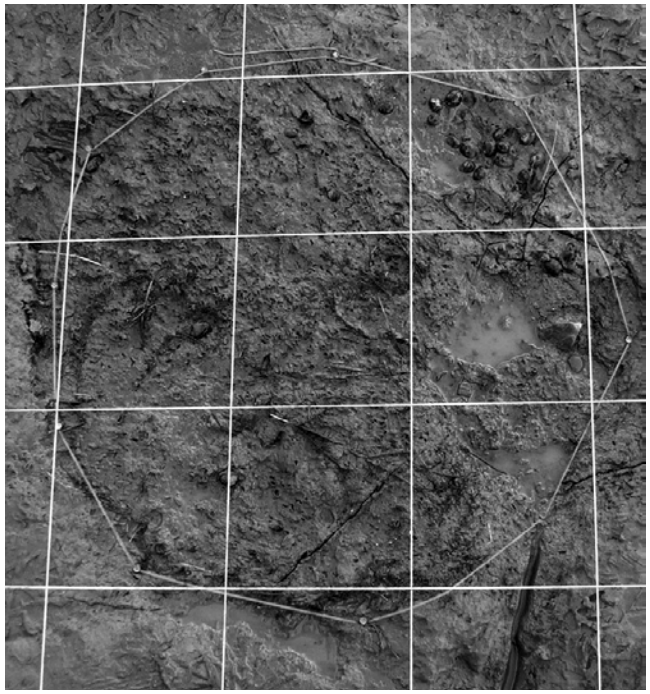

Fig. 3. Example of acorn-leaching pit (Pit A, Transect IV) after silt layer is removed.

Fig. 4. Close-up of Fig. 3 showing acorns, hemlock boughs with needles intact and anaerobic soil.

Fig. 5. In situ hemlock branches and needles near the base of a pit, after silted surface has been washed. Acorns and hazelnuts can be seen in this photo (bottom and top respectively).

Fig. 6. Base of north half of Pit P excavation, exposing the hemlock lining, which $^{14}C$ dated to 1760 to 1880 CE (130 ± 60), indicating the last time this pit was used.

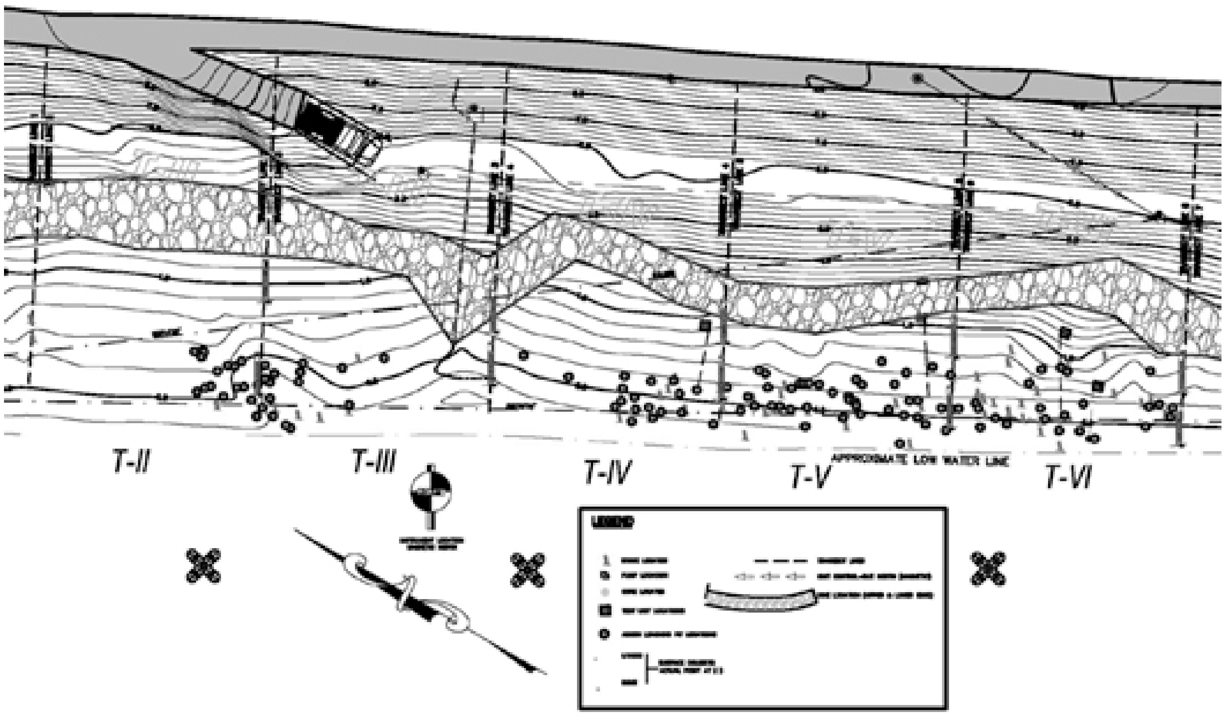


Fig. 7. Map of site from water. “T” marks 25-m transects. The circle figures are pits. Notice the gap in T-III, which was previously excavated for agricultural drainage (Created by Michael Martin, SPSCC).

## Population Estimate

An estimate of the possible human population supported by the acorn-leaching pits on Sauvie Island was made by determining the size of the individual pits, how many acorns they might store, and how many people could be fed by the estimated total of acorns present. Estimates were then compared to historical statistics on populations living near the site of the leaching pits at approximately their time of use, and to California ethnographic information on populations that relied on acorns as a staple food. It should be noted that these figures are nowhere near as exact as the incredible quantitative research completed by Sakaguchi (2009) on Jomon storage facilities in Japan, but these estimates serve as an approximation for understanding the magnitude of this resource.

### *Acorn-Leaching Pit Volume*

The volume of the leaching pits was calculated using Pit P in Transect VI as a model. Pit P was a well-preserved pit and is probably representative of the size of the ancient leaching pits, but could potentially represent several pit digging episodes (Fig. 8). This feature was first measured at the surface, and then a 1 x 1.5 m unit was excavated so that a profile of the pit could be seen. The general shape of the pit can be described as a half-sphere at the bottom, with a cylinder extending the pit to the surface. A formula for the volume of this shape was created by adding these shapes together. The formula for the volume of a cylinder and half sphere is $V = \pi r^2 h + 2/3 \pi r^3$ (based on volume formulas in Percy 1997:107, 409). The surface of Pit P was 84 cm at the widest, and 71 cm at the narrowest area of the pit, which is closely comparable to the average recorded pit surface measuring 82 centimeters by 72 cm. For the purpose of making a conservative estimate, the narrowest diameter of 71 cm was used to calculate the volume of Pit P. Though the cap of the pit has probably eroded to some degree, the bottom of the feature is marked by hemlock boughs lining the pit at 55 cm below surface. This means that the pit originally extended at least 19.5 cm above the half sphere shape. Plugging these numbers into the volume formulas for the pit shape, the total volume of Pit P is found to be about 170,900cm$^3$.

## *Ancient Quercus garryana Acorn Volume*

Similarly, the general shape of the average acorn found at 35-MU-4 is that of a divided sphere joined by a cylinder of the same diameter. The formula for this volume is $V = \pi r^2 h + 4/3 \pi r^3$ based on volume formulas in Percy (1997:107, 409). The average size of acorns leaching at Sauvie Island was found by measuring the length and width of excavated whole acorns. Sixty examples were used to find the average size, which at present is believed to be 2.218 cm long, and 1.610 cm wide. Like the pit volume calculations, these numbers were used in the volume formula and the volume of the average acorn is believed to be about 3.423 cm$^3$.

## *Acorns per Acorn-Leaching Pit*

To estimate how many acorns each pit is capable of holding, the pit volume is divided by the volume of the average acorn. An estimate of volume displacement had to be made to account for the space being displaced by the acorns. Using one liter of Oregon white oak acorns, displacement was found to be about 40%. The volume occupied by the acorns when pits were full would be about 102,540 cm$^3$, meaning that nearly 30,000 average acorns could fit into each pit. The displacement calculation also showed that 120 acorns fit into a one liter container, meaning that about 20,500 might fit into a pit. The rest of the calculations will use 25,000 as an average of the two.

## *Acorn Totals at 35-MU-4*

Using the estimate of 25,000 acorns per pit, and a minimum of 100 pits, there may have been approximately 2,500,000 acorns being processed at the site every winter, if these pits were filled annually. Aside from the uncertainty of consistency of original pit sizes and the possibility of ash or other fill, the biggest potential problem with this figure may be that pits seem to overlap

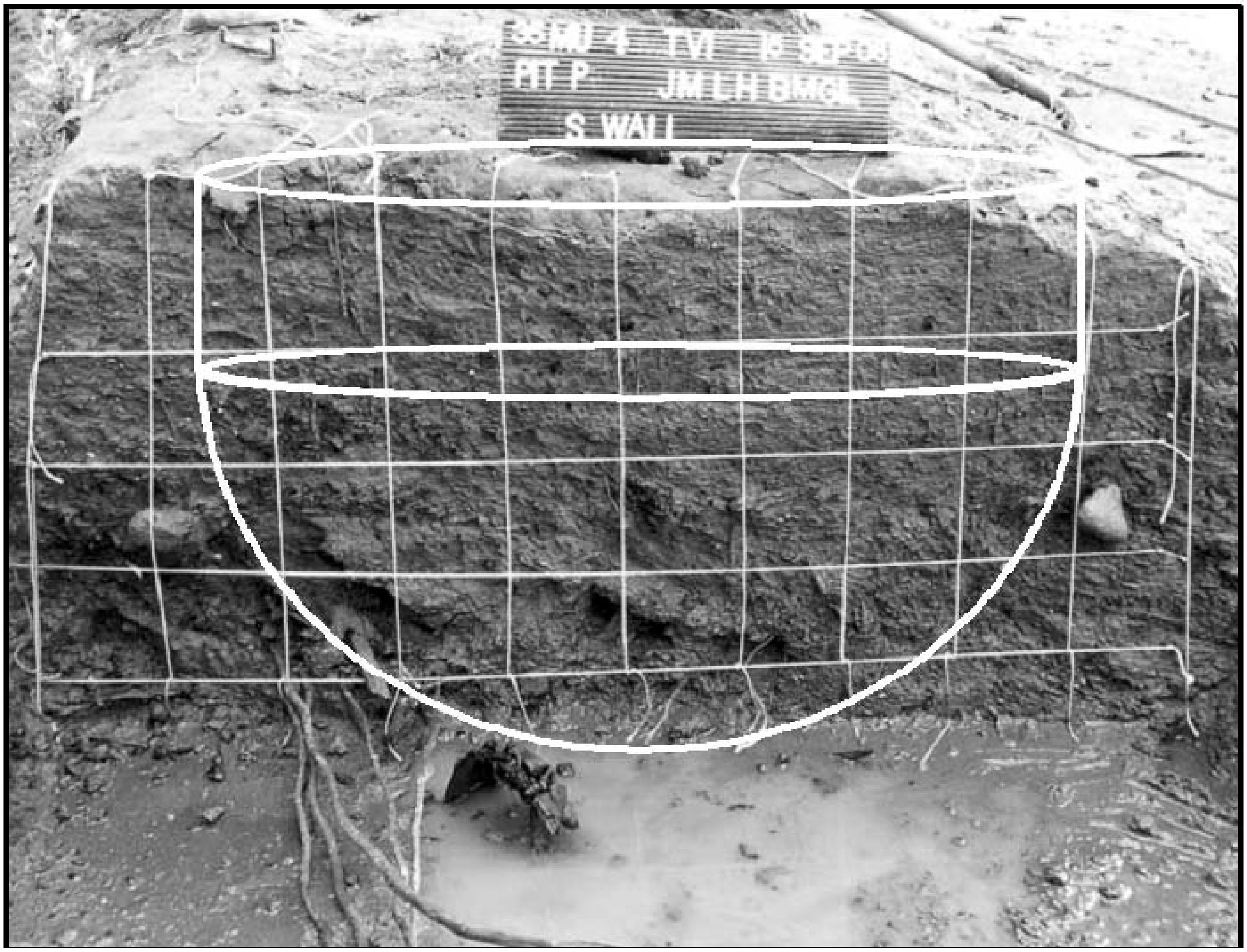


Fig. 8. The volume of the leaching pits was calculated using Pit P in Transect VI as a model. Note the hemlock bough lining and rocks along outer edges. The diagram approximates the extent of the pit.

in places and may not have all been used contemporaneously. However, as far as possible at present, these estimates are conservative. Further research may result in identifying more leaching pits, so I believe it is reasonable to assume that these one hundred or more pits might have been used at the same time.

Large crops are produced every three years on the Oregon white oak, followed by a year of moderate production, and a year of crop failure before the bumper crop year returns (Peter and Harrington 2002:198). Approximately 325,000 acorns can be collected from a hectare of oak grove in the Willamette Valley (south of Sauvie Island), which means that less than 8 ha of oak would have to be collected from to fill these pits during bumper years. A study showed that Oregon white oaks in the Willamette Valley can produce up to 1737 kg of acorns per ha (Stein 1990:1267). The average mature acorn from *Q. garryana* weighs 5.35 gms (Young and Young 1994:292) meaning that about 325,000 acorns can be collected from a hectare of Oregon white oak grove. If the acorns were collected during a moderate production year, it seems likely that the trees needed to fill the leaching pits would be available, given the proximity of oaks today. During a crop failure year, it could be that few pits were utilized on the Multnomah slough.

### *Acorn Nutrition*

To calculate the amount of calories these acorn-filled pits could provide a population, the calories per acorn were multiplied by the possible total amount of acorns. Using the estimate of 4.44 calories per gram, each *Q. garryana* acorn contains about 23.75 calories when consumed raw. Based on data in Young and Young (1992), the average mature acorn from *Q. garryana* weighs 5.35 gms. Though I have not located data for the calories per acorn, other important nutritional values are comparable to the acorns from *Q. lobata,* another white oak, which grow in regions of California with *Q. garryana. Quercus lobata* contains 4.44 calories per gram (Bainbridge 1986; Basgall 1987:25). If the site has 2.5 million acorns leaching for use every year, the Sunken Village pits could have provided over 59 million calories to the group or groups who owned them. About 70% of the Oregon white oak acorn's nutrition is in the form of carbohydrates (Bainbridge 1986), which people in the area might have had a great need for it in the winter or early spring months when the acorns could have been retrieved from pits after leaching.

### *Possible Population*

To understand how many people this calorie figure is capable of supporting, the Mono of California, who represent a maximum of dependence on this food, can be looked to as a model for a minimum population. A group that had 2.5 million acorns available could support 175 individuals who consumed 39 acorns a day for 365.25 days, the equivalent of the Mono staple preparation. According to information in McCarthy (1993), the Mono consumed a preparation of acorns that required as many as 207gms of whole raw acorns a day per person, the equivalent of about 39 *Q. garryana* acorns a day. Consuming 39 acorns a day for 365.25 days would mean that every individual would consume nearly 14,250 acorns annually. A society that had 2,500,000 acorns available, and depended on acorns as a staple food, would at minimum support 175 individuals.

Since we can assume that acorns on Sauvie Island were not relied on for as great a portion of diet as they were in California, the millions of acorns leaching on Sauvie Island would have supported a larger population throughout the year. If acorns supplied only 500 calories to a person per day, the population supported might number over 300 individuals. If the acorns represent a smaller portion of the diet, as is suggested with the "Chinook olives" idea of delicacy, the population estimate grows to such a large number that trade to other communities would have been likely to make use of the acorns throughout the year.

It is interesting to compare these population estimates to the 1805–1806 Lewis and Clark statistics for the area, which recorded populations varying seasonally, increasing in the spring when more resources were available on the rivers than in the outlying areas. For the Multnomah Channel this meant that populations increased from 420 individuals in the fall of 1805, to 970 in the spring of 1806. Along the lower Columbia River, Lewis and Clark statistics nearly doubled from 9800 in the fall, to 17840 in the spring (Boyd 1987:313). This seasonal population increase could coincide with the time when waters on the slough would have receded, and acorns might have been retrieved to support a population that was coming to the area for foods before spring produced abundant resources in their area.

## Conclusions

Historic, ethnographic and archaeological information support the idea that acorns were used as a source of food by people throughout what is now Oregon and Washington prior to European contact. If acorns were not a significant source of nutrition throughout the year, they were at least important seasonally for many groups, and especially for those with access to prairie landscapes. Tribes traveling long distances, camping and trading for acorns demonstrate that this food source was considered to be worth the energy it required to obtain and process it. Observations of passive leaching methods in the Northwest at contact and ethnographic descriptions are fairly wide-spread, though rare. Future understanding of the extent and antiquity of these passive leaching features in the Northwest might explain whether there was a migration of the idea through the northwest to California or vice versa, where the same species of oak is used.

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# ARCHAEOLOGICAL EVIDENCE OF MOUNTAIN BEAVER (*Aplodontia rufa*) MANDIBLES AS CHISELS AND ENGRAVERS ON THE NORTHWEST COAST

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ABSTRACT

Utilization of beaver (*Castor canadensis*) incisors as engraving tools is well documented ethnographically and evident in the archaeological record of the Northwest Coast. Similar use of mountain beaver (*Aplodontia rufa*) incisors has not previously been noted, though use of mountain beaver hides to make robes is reported in the ethnographic record. Modifications to multiple archaeological specimens of mountain beaver mandibles recovered from the late prehistoric/early historic site of Cathlapotle (45-CL-1) in southwestern Washington indicate many of these skeletal parts were used as tools.

## Introduction

Within the Northwest Coast culture area of North America, beaver (*Castor canadensis*; taxonomic nomenclature follows Verts and Carraway [1998]) incisors were often used by indigenous people as tools to carve wood. This use is documented both ethnographically (Ray 1938:135) and archaeologically (Strong 1959:198–199). Holm (1990:604), for example, notes that the "beaver-tooth knife, or perhaps more properly chisel, was the common fine-finishing tool of precontact times" used on wood as seen in Stewart (1981:129). Roll (1974:145) described a sample of 14 "beaver incisor tool bits" from an archaeological context on the southwest coast of Washington. These specimens have associated radiocarbon ages of 980 ± 95 (I-4864) and 1080 ± 110 (I-4863) and their distal ends have been artificially ground "to a convex or flat bevel as compared to the beaver's natural concave surface"; both mandibular and maxillary incisors are included in the sample (Roll 1974:145).

Similar use of the incisors of the much smaller mountain beaver (*Aplodontia rufa*) has not previously been documented in either ethnographic or archaeological contexts. In this work we summarize ethnographically documented uses of mountain beaver and describe archaeological specimens of mountain-beaver mandibles and incisors dating to the late prehistoric–early historic period that display evidence of having been artificially modified and used as tools.

## Mountain Beaver

The mammalian family Aplodontidae is monotypic; it is made up of one genus comprising one species (Verts and Carraway 1998). The family name comes from the Greek words for "simple tooth." The common name reflects the fact that mountain beavers occasionally gnaw the bark and small limbs from trees. Otherwise, this rodent is thought not to be related to the common beaver but rather to be an evolutionarily primitive rodent most closely related to squirrels (Maser 1998). The mountain beaver is today found only in southwestern British Columbia, western Washington, western Oregon, northwestern California, and a portion of eastern California (Carraway and Verts 1993). It is sometimes referred to as a "boomer" because of one of its vocalizations (Maser 1998:127).

Mountain beavers are similar in size and appearance to a medium-sized muskrat (*Ondatra zibethicus*) except the tail is very short (20–40 mm) and well furred. Mean body mass of adults is 800 g and body length is 300–450 mm. The greatest length of a mandible ranges from 41 to 55 mm (Carraway and Verts 1993). A sample of 22 lower incisors from 11 skeletally mature (epiphyses of long bones fused) individuals (6 females, 5 males) gave a mean maximum width of $3.93 \pm 0.17$ mm (range = 3.60–4.20 mm) at the proximal end of the wear facet. For 17 mandibles of nine beavers, some of which are skeletally mature, others of which various long-bone epiphyses are unfused but all are more than half the size of an adult, the average width of the lower incisor is $7.01 \pm 1.22$ mm (range = 4.52–8.94 mm). This is significantly larger than mountain beaver (Student's $t = 11.69$, $p < 0.0001$, two-tailed test). A sample of 13 lower incisors of 8 skeletally mature muskrats (both males and females) gave an average of $2.94 \pm 0.18$ mm (range = 2.68–3.22 mm), significantly less than the average for mountain beaver ($t = 16.27$, $p < 0.0001$, two-tailed test).

Mountain beavers generally live in coniferous forests and riparian habitats. They are fossorial, and their burrow systems produce large entrances approximately 20 cm in diameter. Burrow entrances are surrounded by loose sediment, rocks, and other debris and are quite noticeable. Burrows are often just beneath the ground surface. Mountain beavers are herbivorous and although primarily active nocturnally, they are often active diurnally as well (Maser 1998; Verts and Carraway 1998).

## Ethnographic Utilization

Chinook peoples occupying the lower reach of the Columbia River in Oregon and Washington during the late nineteenth and early twentieth centuries are reported to have "hunted" mountain beaver for food, though the meat was said not to be a favorite (Ray 1938:45, 118). As well, the hides of mountain beaver were more frequently used by the Chinook than those of any other small mammal to make "robes" (Ray 1938:137). People occupying southernmost Puget Sound are also reported to have made robes of mountain-beaver hides, to have eaten their flesh, and to have "caught [them] generally by traps" (Suckley 1860:100). It is reported that mountain beaver were a "chief game animal" of Twana peoples occupying western Puget Sound (Elmendorf 1960:58). The Twana "skinned and roasted whole [mountain beaver carcasses] on a slanting spit fixed in the ground," and used mountain beaver skins to make "robes" (Elmendorf 1960:120, 206). So far as we have been able to determine, there is no ethnographic documentation of the use of mountain-beaver incisors as chisels or engraving tools, nor is there any indication that the bones of these animals were used as tool material.

## Archaeological Materials

The Cathlapotle site (45-CL-1) is located on the north bank of the Columbia River in southwestern Washington. The site was visited by Lewis and Clark in late March 1806, and they reported six very large cedar-plank houses (Moulton 1990:26–30). Archaeological research has thus far identified the remains of 11 houses and associated midden deposits (Ames et al. 1995; Ames and Maschner 1999:110, Fig. 37). Excavations during the 1990s were geared toward sampling areas inside and outside houses and produced a wealth of late prehistoric and early historical period artifacts, features, and associated materials (Ames et al. 1995). Associated radiocarbon ages indicate that the occupation of the site spanned the period AD 1000 to 1850 (Ames et al. 1995), but the vast bulk of the deposits post-date AD 1450, when the town was established (Ames et al. 1999).

We and our colleagues are studying the mammalian remains (Lyman et al. 2002), and thus far over 6000 specimens have been identified to at least the taxonomic family. Represented species include wapiti (*Cervus elaphus*), deer (*Odocoileus* sp.), black bear (*Ursus americanus*), cougar (*Puma concolor*), lynx or bobcat (*Lynx* sp.), red fox (*Vulpes vulpes*), harbor seal (*Phoca vitulina*), raccoon (*Procyon lotor*), mink (*Mustela vison*), river otter (*Lutra canadensis*), muskrat, beaver, and mountain beaver. Some specimens of each of these taxa display butchering marks in the form of striae or cut marks, indicating the taxa were exploited by the human occupants of the site. Our procedures of identification follow standard zooarchaeological practice of consulting comparative skeletons of known taxonomy. Frequencies of faunal remains are reported here as the number of identified specimens (NISP) and the minimum number of skeletal elements (MNE) necessary to account for all specimens (Lyman 1994a, 1994b).

## Mountain-Beaver Remains

All major elements of the mountain-beaver skeleton are represented in the collection (Table 1). Phalanges and other very small skeletal elements such as carpals and tarsals are probably not represented because many of them passed through the ¼ in mesh hardware cloth used to screen sediments. Similarly, very few of these small elements have thus far been identified as representing other mammalian taxa of similar size such as mink and muskrat. In terms of NISP, mountain-beaver mandibles far outnumber any other single skeletal element of this taxon (Table 1), suggesting that differential recovery, differential preservation, differential fragmentation, differential accumulation, and differential deposition of mandibles relative to other major skeletal elements, or some combination of these processes has influenced the observed frequencies of skeletal parts. This pattern of relative abundances of skeletal parts exists when the MNE is considered (Table 2), suggesting that differential fragmentation is not the cause of the relatively high frequency of mandibles. Were fragmentation of mandibles greater than among other elements, NISP values of mandibles would be greater than the NISP of other elements but the MNE of mandibles would not be greater than the MNE of other elements.

Mandibles of mountain beaver are a bit larger overall than humeri, radii, femora, and tibiae of this taxon, but the latter four elements are not so small as to have escaped consistent recovery. Further, fragments comprising less than half of each complete skeletal element were recovered (Table 1). Finally, there is no correlation between the number of complete skeletal elements recovered and the size (maximum dimension) of a complete skeletal element (Table 3; Spearman's rho = 0.44, $p > 0.29$). Whereas maximum size influences the visibility of a skeletal element (Watson 1972), recovery from screens is inversely related to the minimum dimension of a complete skeletal element (Shaffer 1992). This is so because a long bone such as a tibia may be quite visible given its maximum dimension, but its minimum dimension is what allows it to pass through a screen if the bone is set on end. There is, however, no correlation between the minimum dimension of mountain-beaver skeletal elements and their frequency in the collection (Table 3; rho = 0.35, $p > 0.35$). Together, these observations suggest differential recovery is not significantly influencing either the NISP or the MNE frequencies of mountain beaver remains.

TABLE 1

FREQUENCIES (NISP) OF MOUNTAIN-BEAVER AND MUSKRAT REMAINS AT CATHLAPOTLE

| Skeletal element | Mountain beaver | Muskrat |
|---|---|---|
| Cranium | 10 | 7 |
| Mandible | 41 | 33 |
| Isolated incisor | 9 | 1 |
| Isolated molariform | 19 | 6 |
| Scapula | 4 | 1 |
| Clavicle | 1 | 0 |
| Proximal humerus | 7 | 2 |
| Distal humerus | 11 | 3 |
| Humerus | 4 | 1 |
| Proximal ulna | 5 | 3 |
| Radius | 5 | 0 |
| Innominate | 4 | 11 |
| Proximal femur | 7 | 9 |
| Distal femur | 2 | 0 |
| Femur | 4 | 8 |
| Proximal tibia | 1 | 4 |
| Distal tibia | 3 | 2 |
| Tibia | 2 | 4 |
| Calcaneum | 2 | 6 |
| Totals: | 141 | 101 |

None of the mountain-beaver specimens from Cathlapotle displays evidence of carnivore gnawing or digestive corrosion (Lyman 1994c). This suggests that differential preservation of skeletal elements may not be influencing NISP or MNE frequencies. To further evaluate this possibility, it is assumed that the structural densities of mountain-beaver postcranial skeletal parts are similar to those of the phylogenetically related *Marmota* genus of the squirrel family Sciuridae (Lyman et al. 1992). The mandibles of the two taxa are sufficiently different morphologically that it seems inadvisable to include this element in our analysis. There is no correlation between the frequencies of skeletal parts and their structural density (Table 4; rho = 0.07, $p > 0.8$). This observation suggests that differential destruction of skeletal parts is not significantly influencing the frequencies of mountain beaver remains recovered from Cathlapotle.

TABLE 2

FREQUENCIES (MNE) OF MOUNTAIN BEAVER AND MUSKRAT AT CATHLAPOTLE

| Skeletal element | Mountain beaver | Muskrat |
|---|---|---|
| Cranium | 6 | 5 |
| Mandible | 34 | 24 |
| Scapula | 4 | 1 |
| Clavicle | 1 | 0 |
| Humerus | 15 | 4 |
| Radius | 5 | 0 |
| Ulna | 5 | 3 |
| Innominate | 4 | 10 |
| Femur | 11 | 17 |
| Tibia | 5 | 8 |
| Calcaneum | 2 | 6 |

As observed for mountain beaver, both the NISP and MNE frequencies of muskrat mandibles seem inordinately high relative to the frequencies of other skeletal elements (Tables 1 and 2). Differential fragmentation is not the cause (compare Tables 1 and 2). The frequencies of complete muskrat skeletal elements are not correlated with their maximum size (Table 3; rho = 0.44, $p > 0.23$), but are with their minimum size (rho = 0.69, $p = 0.04$), suggesting some sort of recovery bias may be a significant factor. Perhaps the differences in correlation coefficients across the two taxa can be attributed to the fact that five of the nine muskrat skeletal elements are smaller than homologous elements in mountain beaver; only the muskrat elements of the hind limb are larger that those of mountain beaver, but they are not consistently larger in both dimensions (Table 3).

TABLE 3

MAXIMUM AND MINIMUM DIMENSIONS OF SKELETAL ELEMENTS FROM CATHLAPOTLE

| Skeletal | Mountain Beaver | | | Muskrat | | |
|---|---|---|---|---|---|---|
| Element | Frequency | Maximum | Minimum | Frequency | Maximum | Minimum |
| Mandible | 27 | 53.00 | 26.10 | 16 | 50.30 | 19.36 |
| Clavicle | 1 | 30.50 | 5.04 | 0 | 26.24 | 3.94 |
| Scapula | 2 | 41.20 | 19.44 | 1 | 41.00 | 17.28 |
| Humerus | 4 | 45.04 | 15.12 | 1 | 37.28 | 12.56 |
| Radius | 4 | 41.80 | 6.94 | 0 | 41.20 | 5.66 |
| Innominate | 1 | 63.90 | 25.74 | 6 | 75.34 | 28.22 |
| Femur | 4 | 55.06 | 12.74 | 8 | 46.04 | 15.14 |
| Tibia | 2 | 54.80 | 12.70 | 3 | 66.10 | 12.76 |
| Calcaneum | 1 | 13.66 | 8.44 | 6 | 18.12 | 7.70 |

TABLE 4

NISP OF SKELETAL PARTS AT CATHLAPOTLE & *MARMOTA* STRUCTURAL DENSITY

| Skeletal part | Mountain beaver | Muskrat | *Marmota*[a] Structural density |
|---|---|---|---|
| Scapula neck | 3 | 1 | 0.51 |
| Proximal humerus | 11 | 3 | 0.37 |
| Humerus shaft | 13 | 3 | 0.62 |
| Distal humerus | 15 | 3 | 0.62 |
| Proximal ulna | 5 | 3 | 0.99 |
| Proximal radius | 4 | 0 | 0.48 |
| Radius shaft | 4 | 0 | 0.35 |
| Distal radius | 5 | 0 | 0.95 |
| Proximal femur | 11 | 17 | 0.73 |
| Femur shaft | 10 | 12 | 0.70 |
| Distal femur | 6 | 8 | 0.48 |
| Proximal tibia | 3 | 8 | 0.45 |
| Tibia shaft | 4 | 5 | 0.87 |
| Distal tibia | 5 | 4 | 0.56 |
| Calcaneum | 2 | 6 | 0.84 |

[a] Lyman et al. 1992

Muskrat skeletal parts display no evidence of carnivore gnawing or digestive corrosion, and their frequencies are not correlated with the structural density of marmot skeletal parts (Table 4; rho = 0.17, $p > 0.5$). The normed MNE frequencies of muskrat and mountain-beaver remains are not correlated (Fig. 1; rho = 0.44, $p = 0.21$), but note that mandibles, humeri, innominates, and femora tend to be the most frequently represented skeletal elements of both mountain beaver and muskrat (Fig. 1). These are both the largest and the most robust skeletal elements of both taxa, suggesting that a combination of differential recovery and differential preservation has influenced the frequencies of skeletal elements of both taxa. There is, however, strong evidence in the form of human modification of mountain-beaver mandibles which suggests humans may have differentially accumulated and deposited at least the mandibles of mountain beavers.

## Human Modifications to Mountain-Beaver Mandibles

There are several kinds of evidence that indicate humans were responsible for the accumulation of mountain beaver mandibles. First, three mandibles display striae on the ascending ramus (Fig. 2a) that we believe represent butchering marks that resulted from severing the masseter muscle so that the mandible could be removed from the head. None of the muskrat mandibles displays striae, though two muskrat tibiae do. Second, 19 of the MNE of 34 mountain beaver mandibles have had the incisor broken out of the alveolus. This breakage typically comprises fracturing of the medial, or lingual, side of the alveolus (Fig. 2b), which is thinner and thus weaker than the lateral, or labial, side. Less often, a portion of the anterior half of the ventral margin of the alveolus is broken off the mandible. On five specimens, only a portion of the posteriormost alveolus has been broken, as if the proximalmost root wiggled side-to-side on a fulcrum of the anteriormost portion of the alveolus. Twelve mandibles display no damage to the alveolus for the incisor. Third, the coronoid process of nine mandibles was broken off prior to deposition (Fig. 2b); only three mandibles have a complete coronoid process. This fracturing, too, may have been the result of side-to-side pressure. We believe all these kinds of breakage resulted from pressure exerted through the incisor while still set in the mandible as the incisor was used as a graver or chisel. The defleshed mandible would have been sufficiently large and irregularly shaped to have served as a natural handle (Fig. 2).

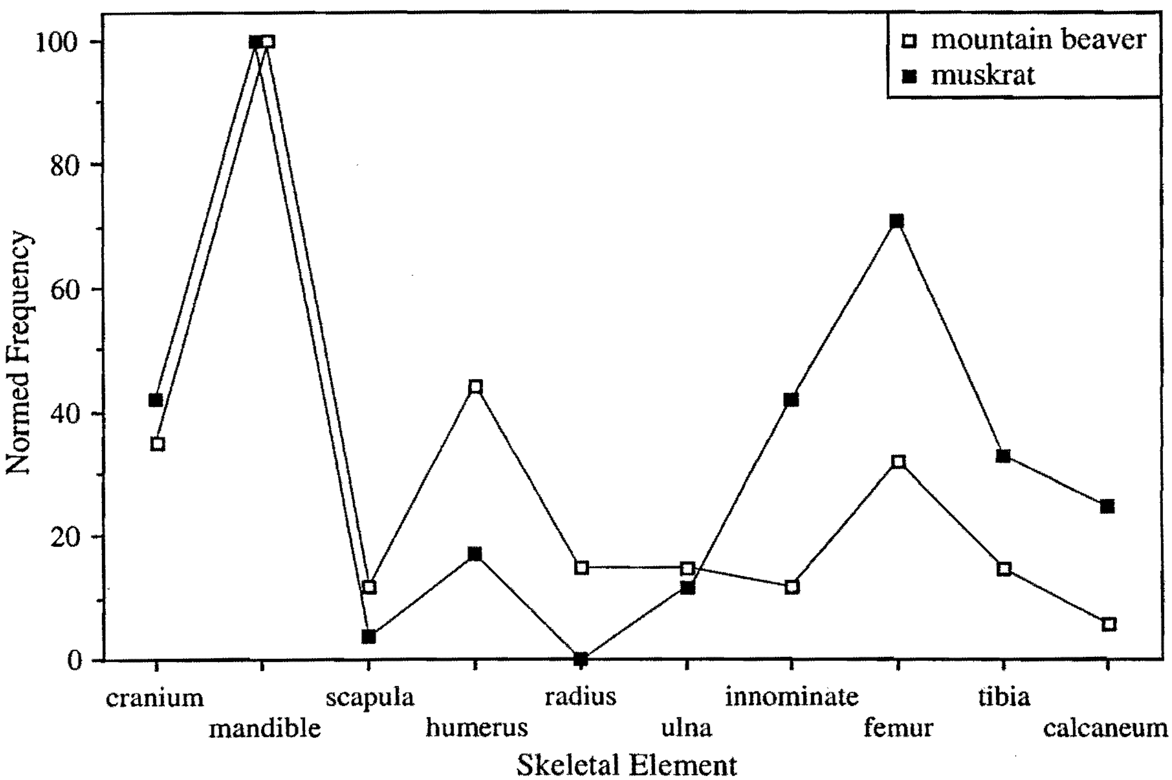


Fig. 1. Relationship between normed MNE frequencies of mountain beaver and muskrat skeletal elements.

The most convincing evidence of human use of mountain-beaver mandibles as chisels or gravers is found in the atypical morphology of a several lower incisors. One incisor is associated with a mandible displaying cut marks, and its wear facet is atypical. The enamel comprising the medial edge of the wear facet has been broken in a manner analogous to a burin spall in lithic technology. This creates a jagged medial edge unlike modern comparative specimens. Further, the distal edge of the incisor tapers from the dentin to the enamel, creating a more obtuse angle on the archaeological specimen than is found in modern comparative specimens. The profile of the edge of the enamel itself on this specimen is jagged relative to modern comparative specimens, indicating microchips of enamel have been broken off. Another mandible with the posteriormost portion of the alveolus for the incisor broken has an incisor the distal end of which is irregularly chipped in an atypical fashion. The distal end of a third incisor set in a mandible is broken, and the incisor of a fourth mandible is broken off near the distal end of the alveolus. All of these examples of unusual damage are attributable to use of these specimens as chisels or engraving tools. Such utilization of mountain beaver has not previously been reported either ethnographically or archaeologically.

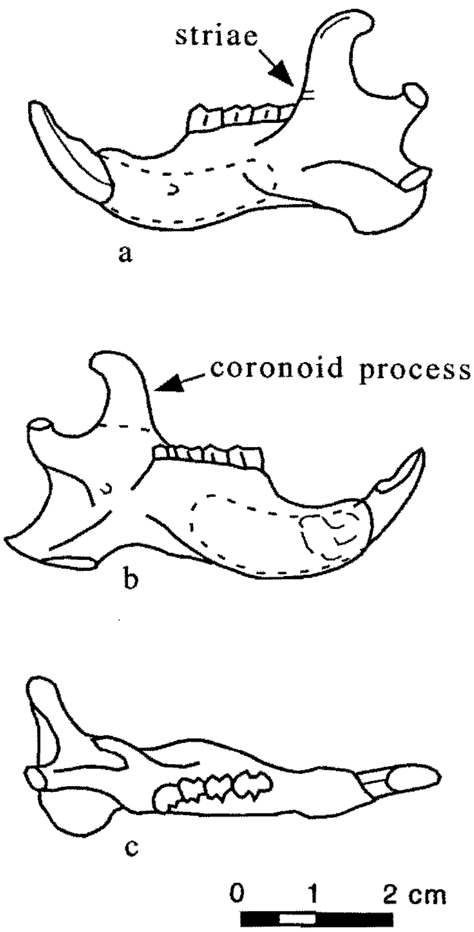


Fig. 2. Mountain-beaver mandible: *a*, lateral view of a left mandible showing striae on Cathlapotle specimen and location of alveolus for incisor (dashed line); *b*, medial view of a left mandible showing location of breakage (dashed line) where incisor is broken out of its alveolus and where coronoid process is broken off Cathlapotle specimens; *c*, dorsal view of a left mandible.

None of the muskrat mandibles displays butchering marks and none of the muskrat lower incisors appears to have been used as chisels or engravers. Further, the muskrat mandibles themselves typically contain the incisor and the alveolus for the incisor is not broken. There is no evidence to suggest lower muskrat incisors set in mandibles were used by the human occupants of the site. It is suspected that muskrat incisors were not used as tools because they were both too small and too structurally weak to withstand the stresses and strains of use.

## Discussion and Conclusion

We perceive a general yet valuable lesson in our study above and beyond our identification of a unique artifact. Ethnographic analogies founded on uniformitarianist assumptions are argued by some to be the major interpretive device available to archaeologists (Watson 1986; Redman 1991). Such assumptions must, however, rest on the additional assumption that the past was no different than the present (Wolverton and Lyman 2000; Lyman and O'Brien 2001). Our identification of a previously undocumented bone/tooth tool among faunal remains did not, as some would have it (Moore 1994), demand a deep knowledge of local ethnographic data. Rather, it required a detailed knowledge of skeletal anatomy, a firm understanding of taphonomy (Lyman 1994c), and a grasp of mechanics and engineering (Hunt et al. 2001).

American Indians occupying the Northwest Coast of North America are well known for the artistic woodworking they produced (Drucker 1965; Carlson 1983). A large portion of the tools they made and used were directed toward woodworking (Stewart 1981). Among the inventory of ethnographically and archaeologically documented woodworking tools is the beaver-incisor chisel. At the late-prehistoric–early historic site of Cathlapotle, mountain-beaver mandibles are found in high abundance relative to other skeletal elements. Many of these mandibles have been modified, and the incisor in four of them displays clear evidence of use damage. On this basis we believe that the relatively small mountain-beaver incisor, still set in the mandible, must be added to the inventory of woodworking tools used by Northwest Coast peoples.

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# JOURNAL OF NORTHWEST ANTHROPOLOGY

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## RESOURCE CULTIVATION ON THE NORTHWEST COAST OF NORTH AMERICA

**Astrida R. Blukis Onat**

ABSTRACT

North American Northwest Coast cultures are described in the context of a hunter and gatherer resource exploitation model. Exploitation models have arisen from an essentially Euroamerican world view and address both the nature and abundance of resources as well as the cultural means used to extract maximum benefit from them for human use. In the context of this model, Northwest Coast hunters and gatherers were able to accumulate a substantial surplus, live in permanent settlements, and develop a stratified society, because they lived in a region with a unique and especially abundant natural environment. An alternate model is proposed here, based on resource enhancement through cultivation. The cultivation model focuses on practices that produce benefit for both resources and humans. It is better aligned to the world view of Northwest Coast peoples. This model can serve as an alternative to the exploitation model for addressing Northwest Coast cultural and resource development.

## Introduction

The Northwest Coast, extending from northern California to southeast Alaska and east to the Cascade Mountains, is generally regarded as originally occupied by Indian groups and cultures with a hunting and gathering subsistence base—albeit of a unique and special variety. The uniqueness of the cultural base is at least in part explained by the environmental setting, which is also unique.

The topography of the region was quite stable during the last 3,000 years, although coastline erosion of the glacially deposited substrate has been continuous and tectonic events have also left impacts. This setting is based in a mild and temperate climate with annual temperatures generally varying between 5° and 20° C (23° and 68° F). The area receives nearly continuous, moderate rainfall under the influence of Pacific currents and winds. In this well-watered situation, extensive and dense forests of hemlock, fir, and redcedar have developed. Within the densely wooded environment, faunal resources are especially abundant at forest ecotonal margins year around. These margins include marine shores, inlets, and bays; fresh water rivers, streams and lakes; and prairies and alpine meadows. The waterways are also rich in resources. Both marine and fresh waters are the seasonal spawning grounds of six large and several small species of anadromous fish. They also are the year around habitat of a number of resident fish, shellfish, and aquatic mammals. Extensive wetlands provide feeding areas for many resident and migratory birds. Both dense forest and the network of forest margins also contain abundant botanic resources.

Of the resources available, salmon, shellfish, camas, and redcedar figure prominently in anthropological descriptions of most Northwest Coast cultures. From the beginning of anthropological studies in the region, there have been attempts to correlate the stratified social structure and settlement patterns to available resources.

## The Cultural Context

The combined ethnographic and archaeological record contains evidence that, within the past 3,000 years, Northwest Coast cultures developed a settlement system that included both permanent and outlying resource procurement communities. Communities included a hierarchy of large, sometimes fortified, settlements. A stratified society with a prominent elite and a slave class was present. Status differences were apparent in the differential distribution of prestige items, which ranged from elaborate wooden art works, special woven clothing, and carved stone sculptures to copper and other exotic materials. The exotic goods indicated an established trade in prestige items. Local industries in copper, some iron, wood, horn, bone, and stone developed, some located at specific manufacturing and trading centers. Trade in prestige items ranged from the coast well inland, as well as to the north and south.

The temporal focus for many of the anthropological studies was the pre-contact and early contact period of the late 1700s and early 1800s. The early historic record also has provided information on the kinds of impacts Euroamerican settlement had on the Indian people and on the region, often with very detailed information about specific locations. It has been customary to use the ethnographic and early historic records to model the regional cultures prior to AD 1500. Until recently, however, archaeological investigation of the contact period has been minimal. That work has now begun to support the location-specific ethnographic and historic record, as numerous ethnographically named places show evidence of archaeological deposits. Archaeologically excavated objects, similar to, and in the tradition of, those located in museum collections dating from the past 300 years, have been found in sites dating to at least 1,500 years in age. Thus, continuity between ethnographic and prehistoric cultures in the Northwest Coast is readily apparent.

The prehistoric cultural developments along the Northwest Coast during the past 3,000 years have been extensively researched and reported (Suttles 1990; Ames and Maschner 1999). Local and regional differences in artifact styles and distributions are apparent in the archaeological record. That record also contains, however, significant continuities and regional similarities. During the past 3,000 years, there appears to have been an appreciable increase in the numbers of sites, site types, and more specialized tools, although the artifact inventories did not functionally change significantly during this time period. Manufactured objects and other artifacts in archaeological sites show a full scale development of anadromous fish trapping and netting, marine shellfish collecting, camas field maintenance, and redcedar utilization.

Given the apparent cultural continuity between the late prehistoric and early ethnographic data, it is curious that there has long been a consensus among regional archaeologists that direct correlation between the ethnographic data and archaeologically recovered data is nearly impossible. I think that this consensus arises from assumptions about what constitutes cultural development as taught in most academic institutions. The inability of archaeologists to connect the ancient prehistoric and more recent recorded Indian histories may be firmly embedded in the considerable differences in world view between Northwest Coast Indian cultures and the academic culture of the investigators recording them.

## Classification, Terminology, and Perspective

The archaeological study of Northwest Coast cultures currently uses an evolutionary and hierarchical approach derived from a nineteenth century European intellectual and scientific base (Childe 1981; Dennell 1983; Harris 1989; Rindos 1989). It assumes cultural evolution progresses from human exploitation of resources through hunting and gathering, to intensive foraging, to agriculture, and finally to industrialization. The hierarchy presupposes that it is the intent of humans to extract maximum benefit from available resources and to progress toward ever greater development, control, and exploitation of additional resources. Examples of the use of this model in North America are the work of Watson (1989), Hayden (1990), and Gremillion (1996). Human benefit is at the core of the model. Both natural and cultural factors are invoked to support rationales for differences in the progression in individual cultures. In this system, domestication of food resources is a necessary precursor for, or at the very least is concurrent with, complex social development.

Most definitions of domestication include some degree of breeding control over botanical and/or faunal resources (Clutton-Brock 1989; Harris and Hillman 1989). Domestication also is invoked wherever the remains of animals and plants characteristic of certain centers of domestication are found. There tends to be the assumption that the idea of domestication is usually imported and involves certain types of animals and plants with very specific characteristics. The animals are all terrestrial mammals; the plants are predominantly cereal grains. A common research topic involves the degree of domestication displayed by certain plants and animals.

As a result of these assumptions, cultures are classified as agrarian or not, based on the presence or absence of a limited number of resources defined as domesticates. The distinction tends to produce what may be called resource "chauvinism." This chauvinism easily leads to the assumption that cereal grains and certain specific terrestrial mammals are measures of levels of economic cultural evolution.

Although it may be possible to use classifications developed in the context of one cultural tradition to examine those of another, the application of the exploitation model described above to Northwest Coast cultural development is problematic. Although it is recognized that the development of complex and stable Northwest Coast cultures is directly tied to the development of regional resources, the cultures are still described in terms of hunting and gathering because the cultural development hierarchy described above does not define any Northwest Coast resources as domesticates. As a result, most regional archaeologists struggle with definitions relating to the resource base; a resource base that contains both plants and animals that were unquestionably impacted, some quite significantly, by cultural practices.

The Northwest Coast Indian perspective contains a developmental hierarchy that is quite different from the exploitation model, and encompasses interactions with resources that are also distinct. In this world view, space and its contents, both living and inert, human and non-human, are contained within the same spectrum. All living and nonliving actors that live within a given place are responsible for each other and for the place in which they live. As expressed in oral history, the modern world was created through interactions among creatures at a time when animals were people and forces of nature were human. Spirits from this earlier time still exert power at specified places and under special circumstances but, in the present, it is important to structure a balance among the inhabitants and elements of the world for mutual benefit and survival. Human knowledge is of significance in cultural assessment and adjustment to changes in the landscape and resource base.

In the Northwest Coast Indian perspective, the world is a place of hierarchies of wealth and knowledge; poverty of knowledge will make for poverty overall. The complex hierarchies that developed in the societies were based on effective shared knowledge, as demonstrated by sharing of collected wealth. This world view structures an individual life, the approach to resources within a known place, and the relationship to the spiritual realm (Blukis Onat 1990, 1994a, 1995a, 1997a, 1999a, 1999b). An individual who follows these traditions will gain prominence and power by virtue of his or her capability. However, the knowledge and wealth must be continually shared for prominence and power to be maintained.

Cultivation is possibly the most appropriate term in English to express this perspective. First, it applies to the improvement and preparation of land by loosening or digging, to planting and tending a crop, and to nurturing and fostering the growth of plants. The manner in which the term can be applied to Northwest Coast resources will be outlined below. Second, the term applies to enhancing human relations by means of education and social refinement. For Northwest Coast Indian status to be maintained, the community of people, place, and resources must be carefully cultivated at all times (Miller and Hilbert 1993). Cultivation applies to enhancement of all interactions between the human and non-human realm. It applies to the totality of cultural interaction, both within a community and without.

## An Alternative Perspective

The cultivation model includes certain elements that I first encountered in Hecker (1982). He introduced the term "cultural control" as more useful than domestication in order to expand the study of human and animal interactions (Hecker 1982:218). He suggested that cultural control was a better term than domestication, since it was a broader-based concept that would cover the wide range of variation in human-animal relationships in a variety of environmental settings. He considered cultural control to have four aspects (Hecker 1982:219):

1. Active and deliberate interference: Cultural control implies active, deliberate interference with the freedom of movement, breeding selection or breeding schedule, and/or structure of a living population. It also implies planning, foresight, and management by a human population.
2. Extended period of control: Cultural control involves maintaining control over the resource for a sufficiently extended period of time that some active care and provisioning, and/or the limited construction of some artificial structures or barriers to contain them, is implied.
3. Control over a population: Cultural control involves control over an entire group or animal herd, as opposed to control over individual members.

4. Accessibility to humans: Cultural control intentionally makes the population more accessible to humans so it is more easily exploited and/or conserved for further and continued use. Increased accessibility is an intended result.

Extending the concept of cultural control from human–animal interaction to human–plant interaction, led me to the cultivation model. The cultivation model applies these four aspects to animals not generally considered to be domesticated—salmon and shellfish—and to plants that are generally not regarded as domesticates—camas and redcedar. One may adapt the list of aspects to address both the ethnographic resource data and data from the archaeological record of the Northwest Coast area for the past 3,000 years. Such an assessment reveals that each of the major resources available to Northwest Coast cultures was subjected to some level of cultural control through human cultivation. The cultivation model also addresses continuity between the archaeological past and contemporary Indian cultures.

*Salmon*

Fish, most specifically the several species of anadromous fish, were basic to the economy of the Northwest Coast. Although the fishery included several different species, the five species of salmon remain the major focus of interest among all Northwest Coast Indian cultures.

1. Active and deliberate interference: Active, deliberate interference with the freedom of movement of anadromous fish was practiced by the construction of several complex and large fish traps in the intertidal zones. Along rocky shores the traps were constructed of stone, on intertidal mud flats they were constructed of redcedar. Traps were built across the mouths of river and at several locations from floodplains to impassable barriers in the mountains. They were constructed at fresh water lakes and along sloughs and streams inland, up to the final spawning grounds. Archaeological remains of intertidal fish traps may be found at several locations in the river deltas of the region. Several in the Skagit River Delta have been documented in historic photographs and through archaeological investigations (Blukis Onat 1999b).

Archaeologists have not truly investigated whether breeding selection or interference with breeding schedule may be present in the archaeological record. Data in the ethnographic record suggest that it was. All ethnographically recorded fish traps had escapement elements so that portions of any spawning run would travel farther up river (Snyder 1951–1954; Blukis Onat 1997a). It is safe to say that human control over escapement constitutes breeding selection. The manner in which escapement was controlled at any given point along a spawning run has not been investigated either ethnographically or archaeologically.

Resource oriented kin networks that ranged from the Puget Sound to the headwaters of any system, facilitated selectivity within the range of any given spawning run (Blukis Onat 1984, 1997a, 1999b). Each tribal group along a spawning drainage took great care in maintaining good relationships with neighboring groups through intermarriage (Snyder 1964; Blukis Onat 1997a). This was consciously done to maximize resources among all groups. Resource knowledge thus was communicated continuously, as families gathered during the fishing season at specific locations.

2. Extended period of control: Sufficient control over the resource was maintained for extended periods of time by the construction of a great variety of large traps. The fish were not only captured by the traps but could also be held therein for several days or weeks. It is

generally considered that salmon capture and processing for storage are strictly concurrent (Schalk 1977:240). However, according to Swinomish fishermen, large intertidal traps were structured for temporary live storage. Along the Skagit Delta margins, the traps were constructed of redcedar posts, slats, rope, net, etc., and covered several acres of intertidal mud flats. These operated as a series of fenced passages and led the fish into a central holding pen. In this manner it was possible to process as much of the catch as necessary to sustain the local human population and to create a surplus. The fish could be extracted from the pens daily, weekly, or at some other interval, depending on the size of the run and available fish processors. One such trap was still in operation near La Conner, Washington until 1976. The remains of a caretaker structure can still be seen not far from shore. The remainder of this and other historically photographed fish traps are now archaeological deposits. Portions of a large prehistoric trap (redcedar posts, slats, and twine) were excavated in La Conner in the process of pipeline trenching in the mid-1970s and again in 1989 (Blukis Onat 1999b).

3. Control over a population: Anadromous fishing was based on the trapping and netting of portions of large schools of fish on a regular and seasonal basis. All of the species of salmon spawn sometime between May and December, with exact times varying with species and latitude. Anadromous trout are available in the winter months. The fishing technology also allowed for the fact that the taste and preservation qualities for the same fish vary according to where and when within the spawning run it is taken (e.g., as fish move upstream, they become leaner and will preserve better and longer). Fish processing is considered a specialist activity. Different techniques were used for differing species of fish and at different locations along the spawning run. Enhancement of procurement range in space and time is an essential aspect of salmon cultivation.

Remains of fish bones, including salmon bones, are ubiquitous in coastal shell middens and are generally well preserved. They are frequently recorded, and sometimes analyzed (Butler 1987; Cannon 1988). However, to make regional assessments of salmon populations, large samples and samples from several kinds of sites would need to be analyzed. This work remains to be done.

4. Accessibility to humans: Trapping of anadromous fish at many locations along a spawning run made that entire population more accessible to human groups all along the spawning route. The resource could then be utilized by several related or allied groups and conserved for further and continued use. The resource was cultivated so as to be accessible to the largest number of people. The Skagit System Cooperative is a modern fisheries management organization patterned along traditional relationships among the tribal groups in the Skagit River drainage (Lane and Lane 1977). It includes four tribes from the Swinomish Tribal Community, resident at the mouth of the Skagit River and on nearby islands; several groups allied as the Upper Skagit on the Skagit River main stem and headwaters; and the Sauk-Suiattle tribe, resident along a major tributary drainage system, the Sauk River.

It appears clear that Northwest Coast fishing involved cultivation of the anadromous fish resource. Although the technology and implements by which the fish were taken in prehistoric times underwent considerable alteration in early historic times, there is a considerable Indian population with an oral history of how the resource was cultivated traditionally (Blukis Onat 1997a, 1999b). That same population is vitally concerned in the current management of the fishery.

*Shellfish*

Marine shellfish were a significant faunal resource in the Pacific Northwest. Most Northwest Coast archaeologists have some experience with shell midden excavation. The evidence for shellfish gathering, the shell midden, has been subject to complex and conflicting interpretations, possibly because each shell midden site is quite different from any other (Blukis Onat 1976a, 1976b, 1980a, 1980b, 1985, 1987a, 1987b, 1995b, 1997b, 1997c, 1997d; Blukis Onat and Larson 1984; Moss 1993, 1998). Few archaeologists have been able to excavate these large and complex deposits to the extent necessary to investigate their development and structure (Ames et al. 1992:277–276). In recent years, both Moss (Madonna Moss, personal communication 1995, 2000) and Stein (1992) have made major efforts to conduct more extensive excavations at known large settlements. However, it will be some time before enough data on a sufficient number of shell midden sites are available for a significant discussion about development of this resource along the Northwest Coast.

Ethnographic data, on the other hand abounds, as was apparent during a series of hearings regarding shellfishing rights brought by Washington State tribes in 1994 (Boxberger 1993; Lane 1993; Wessen 1993; White 1993). From these data it is possible to assess the relationship between Northwest Coast peoples and this intertidal resource in the context of the cultivation model.

1. Active and deliberate interference: The most commonly cultivated shellfish species tend to be fixed geographically. Beaches are generally stratified in terms of the clam species that are available during tidal fluctuations. Shellfish beaches were tended and kept free of debris to enhance the harvest and ease of digging (Stern 1934:47). The population can be structured by selective harvesting of single species and by deliberate movement of shellfish from one beach to another. I have observed Swinomish and S'Klallam people teach their children how to recognize different species from the neck openings visible in the beach sands.

Shell middens are quite different in the proportions of the various shellfish species they contain (Blukis Onat 1976a, 1976b, 1987b). In many shell middens, it is not unusual to find single-species layers of shell. Whether this results from shells discarded as food refuse or shells used for constructing and altering a settlement berm is a question that needs to be addressed at each midden site and within each midden deposit (Blukis Onat 1985).

2. Extended period of control: Clam bed selection was carefully planned, maintenance was managed, and shellfish were periodically, as well as, seasonally harvested (Snyder 1951–1954; Ellis and Swan 1981:48–57). Individual women and their families cultivated the clam beds to assure a continued and optimal supply. Maintenance included keeping the beach clear of debris that would interfere with clam viability. Although structures to contain clams were unnecessary, tended beds were acknowledged as owned. Clams were a basic food resource throughout the Northwest Coast, especially so in case of a failure in a salmon run. They could be collected monthly, during low tides, year around. The optimum times were the lowest tides in July and December.

3. Control over a population: Few shellfish species move at all and not often as an adult population, however, they can be maintained as a population by enhancement of certain ecological zones for maximum productivity (Blukis Onat 1994b). As noted above, clams are

differentially distributed spatially and can be dug selectively. When shoreline environments changed and deteriorated, new beaches were needed and could be enhanced. Several sites recorded on Indian Island, at the northern reaches of western Puget Sound, exhibit changes in shoreline that would impact shellfish resource areas (Blukis Onat et al. 1990). The structure and shellfish content of the adjacent beaches have also changed as a result of shoreline erosion.

4. Accessibility to humans: Prime shellfish beach areas were often adjacent to the main human settlements (Snyder 1951–1954; Blukis Onat 1984, 1994b). This accessibility is regarded as important since shellfish can be stored live for later use. Among the Swinomish this is accomplished by placing the harvested shellfish in loosely woven baskets attached to pilings in nearby marine waters, among the Manhousat people the same thing is accomplished by covering the top of a basket of clams with rocks and leaving it at low tide levels for several days (Ellis and Swan 1981:50). In addition, the shells, when separated from the live animal, had a secondary use in settlement site preparation—as generalized fill prior to house construction, as freshener on earthen house floors, and as drainage materials (Blukis Onat 1985, 1987b; Larson 1987).

*Camas*

There are several plant resources that were cultivated by peoples of the Northwest Coast (Pojar and MacKinnon 1994; Turner 1998). Some of these are only now beginning to be investigated archaeologically (Darby 1996; Deur 1997; Suttles 1997; Turner and Peacock 1997; Blukis Onat 1998). As it is not possible to detail them all, I will focus on one that is found throughout the region, in a variety of environments. Camas (*Camassia sp.*) are flowering herbaceous perennials with large glutinous bulbs that are edible. The flowers of the edible camas are generally blue, however, some may appear nearly white. Camas varieties will grow in open prairies adjacent to shorelines, where temperatures are mild, there is ample moisture, and the seasons are long. Camas also grows in high elevation alpine meadows where there is a very short growing season. It requires ample moisture to bloom but can survive in the near desert environments of the Columbia Plateau.

1. Active and deliberate interference: Camas was actively cultivated and harvested by digging the bulb when in flower or shortly thereafter. The flowering stem, containing seeds of new plants, was left to propagate. The plant was generally harvested in the spring and early summer, and harvesting and planting were part of the same activity (Stern 1934:43). Camas was processed and used much like a cereal grain. It was dried, hulled, sorted, ground into flour, pressed, mixed with other foods, stored, etc.

2. Extended period of control: Camas prairies were maintained by burning on a regular basis to restrict encroachment by brush and trees (Boyd 1999). Colville and Spokan people say that camas fields must be cultivated by regular digging to maintain an optimum harvestable crop, and in some areas, well tended fields that were carefully harvested in the spring, could produce a second crop in early fall (Blukis Onat 2000). Uncultivated fields quickly deteriorated in the quality and quantity of bulbs available.

3. Control over a population: Camas was cultivated in fields owned by individual women and regionally controlled by kin groups (Turner and Efrat 1982:17; Blukis Onat 1989).

4. Accessibility to humans: Camas can grow in a variety of environmental settings. Appropriate locations near settlements were developed and maintained as camas fields or prairies. This included natural levees in marshlands, open meadows along forest margins, and loess covered plateaus in the Columbia Plateau.

Exactly how long the plant has been cultivated or how important it was to prehistoric populations is a matter of great interest. It has been of considerable significance in the ethnobotany of the Northwest Coast (Snyder 1951–1954; Gunther 1945; Turner 1975, 1991; Turner and Efrat 1982). In the ethnographic record, the plant is much better known east of the Cascade Mountains because it still grows in unfarmed grasslands and is still regularly harvested by Indian people.

*Cedar*

Redcedar (*Thuja plicata*) (from here the more popular "cedar" will be used for redcedar) is addressed here because of its special significance to all Northwest Coast cultures. Most spiritual activity is somehow accompanied by products of the cedar tree (Blukis Onat and Hollenbeck 1981). Although not a food resource, cedar was of paramount significance to the cultures of the Northwest Coast, in supporting food resource harvesting as well as settlement structure and transportation. Cedar can be considered the defining material in Pacific Northwest Coast Indian technology (Stewart 1984; Turner 1998).

*Thuja plicata* is a botanical resource predominant in the technology of the Pacific Northwest. Cedar had a wide range of functions, with every portion of the cedar tree used in some manner. Cedar logs served as the framework for fish traps and houses, and were carved out to make canoes. They were carved in the round into poles for totems, grave markers, and other commemorative artworks. Cedar logs were split for large canoes and for house planks, roof boards, and storage boxes for food and other goods. The cedar boxes had the dual qualities of being relatively unbreakable and of possessing some anti-microbial properties. Perhaps this is the reason that clay was never used in the Northwest Coast for food storage containers, even when it was known for lining fire pits and molding small figurines. Cedar bark was shredded for padding, towels, clothing, mats, tinder, and torches. The bark was used to line cooking pits and make canoe bailers. Cedar limbs were used for rope and twine and to construct open baskets. The rope was used in fish traps, the twine for fish nets, and the baskets for clam storage. Cedar roots were used as the base for coiled baskets in which food was cooked and stored. Cedar was used as an aromatic to remove the odor of fish. It was used to dye fishnet. There were many other uses for cedar that cannot be detailed here.

It may be difficult to think of the climax forests of the Northwest Coast as a cultivated resource, but portions of these forests were, in fact, controlled by cultural practices. The fire management that was used to maintain prairies for root crops (Boyd 1999) and alpine meadows for berries (Darby and Blukis Onat 1997) also controlled forest margins and kept heavy underbrush from accumulating for some distance into the forest. Evidence for some of these practices can be seen at "living" archaeological sites made up of culturally modified trees.

Traditions of working with cedar materials were developed to a high degree, since so much of the material culture of any Northwest Coast settlement was made from or constructed of products of the cedar tree (Stewart 1984). Basket makers developed specialties in working with cedar limbs, bark, and roots. Canoe carvers knew how to make watercraft. Carpentry specialists worked with cedar houses and large structures such as fish traps. It is unlikely that the knowledge of how to enhance and maintain the growth of cedar trees, would have been any less extensive than knowledge of how to use cedar. For example, it is a rule among many Indian basket makers that cedar limbs should only be cut from one side of the tree, or the tree might be harmed.

Most recently, it was my privilege to visit a grove of more than 150 cedar trees that showed peeling scars. Mature second growth trees, some cedar some not, were interspersed among both young and 100–300 year old standing cedars and yet older cedar stumps. The peeled trees show at least three types of scars, from short to long, from narrow to wide (Stryd 1997:17). The grove is on a point above the confluence of the Sauk and Suiattle Rivers. It is adjacent to a camas prairie, several longhouse sites, and a cemetery. Sauk Prairie is known as the major settlement of the Sauk people. The prairie separates the grove from the larger forest. From this place on the Sauk River, it is possible to hypothesize that cedar was a cultivated resource:

1. Active and deliberate interference: It appears that the growth of a mixed forest at this location may have been deliberately interfered with in the past. The structure of the forest at this location was limited by human long term foresight and management to produce primarily cedar. This may have been accomplished by simple cultivation to eliminate other trees and by limiting the grove size through burning of the prairie. Such groves were owned and permission to use them had to be obtained (Turner and Efrat 1982:17).

2. Extended period of control: The very life span of a cedar tree would imply an extended period of cultivation. It may be difficult for a society based in enhancing rapid change to understand a tradition that would have been committed to nurturing a select number of trees for several human generations. Traditions related to cedar use are very old in the Northwest Coast and are imbued with spiritual lore that also has considerable longevity (Blukis Onat and Hollenbeck 1981).

Somewhat different qualities of wood, bark, limbs, or roots could be obtained from the cedar tree at each stage of its life (Stryd 1997:99). Young cedars without many lower branches were preferred for harvesting bark (Turner and Efrat 1982:36; Turner 1998:77). Cedars tall enough and wide enough, without a significant number of branches were preferred both for canoe construction and for split planks. A S'Klallam elder informed me that such trees are present where two trees grow to shelter a third from major weather impacts. Such a situation can occur naturally, it could also be enhanced culturally, although it would require several human generations to accomplish.

3. Control over a population: The cedars at the confluence of the Sauk and Suiattle Rivers are clustered as a grove, rather than significant as single trees. The Sauk cedar grove is bounded by two rivers and a prairie that effectively create an artificial barrier that diminishes external impact to the grove from any direction but that maintained by human cultivation.

4. Accessibility to humans: The cedar grove, and peeled cedars in it, is adjacent to and readily accessible to the longhouses that have been documented for Sauk Prairie (Hollenbeck 1987:138–148). This accessibility would make the local trees readily usable in a variety of ways and make conservation for further and continued use easier. The peeled cedars that were observed at the Sauk grove showed more than one type of scar, hence the bark was probably

used for more than one purpose. Both slopes of the point of land above the rivers also contained peeled cedar trees. Portions of the slopes were undercut by small slides, providing exposures where cedar roots could be procured easily.

It is not necessary to regard the entirety of Northwest Coast forests as cultivated, however it would be useful to address the cedar resource in the context of a cultivation model. This most significant Northwest Coast material resource needs to be investigated more extensively at its source, the forest, and not just in terms of the relatively few cedar items that remain in the archaeological record.

## Discussion

In the Northwest Coast, cultivation of resources was being developed for at least 5,000 years and was fully developed by 500 BC Anadromous fish may be found in Northwest Coast sites in immediately post-glacial times. Extensive use of cedar is characteristic of the cultures of the Northwest Coast for the past 5,000 years (Hebda and Mathewes 1984). It is apparent throughout the archaeological literature that fish, shellfish, and camas—as food resources, and cedar—as a material resource, define the resource base of Northwest Coast cultures. Interpretation of the known archaeological data in light of the discussion above invites new perspectives regarding the development of and evidence for basic Northwest Coast cultivated resources.

There is a larger implication within the concept of cultivation as applied to the fishery (salmon and shellfish) resource. For example, the concept of a fishing economy assumes that all species of fish are always a wild or non-domestic resource (e.g., they are not under any human control as defined above). This assumption prevails despite long-standing evidence to the contrary in the Pacific temperate, sub-tropical, and tropical zones of the world (Johannes 1981); despite the fact that a considerable modern aquaculture industry has developed throughout the world, indicating that fish can be managed (Donaldson and Joyner 1983); and despite the fact that a number of plants and animals show virtually no archaeologically detectable difference between wild, managed, or domestic forms (Clutton-Brock 1989).

Another assumption, consequent of the first, is that fishery resources are always secondary resources in cultures possessing some plant or animal domestic resource. This is especially apparent in the archaeological literature of temperate Europe (Blukis Onat 1986; Brinkhuizen and Clason 1986). In contrast, I would like to suggest that certain species of fish and shellfish in the temperate zones of the world have been under cultural control according to the aspects listed by Hecker (1982). This control or cultivation may have been present for a considerable time and has not been accurately assessed. The maintenance and enhancement of the fishery resource continues to be the primary focus of most Northwest Coast cultures today.

In addition to camas, wapato (Darby 1996; Spurgeon 2001a, 2001b, 2002), bracken fern (Blukis Onat 1999b), and many other plants should be re-examined with respect to the degree of cultivation that is actually involved in their development and maintenance (Pojar and MacKinnon 1994). The same applies to at least one animal resource that was under human control, the dog. The dog is considered a domesticated animal in other parts of the world and is used to aid in hunting and in transport. In the Northwest Coast, it was also specifically bred and kept for the production of wool (Glover 1920; Gleeson 1970). The Northwest Coast is the only region in the world that apparently domesticated a dog for wool. Thus wapato, bracken fern, and the dog, to all intents and purposes known and cultivated in other parts of the world, are not regarded as domesticates because the Northwest Coast lacks cereal grains and other animals that define domestication and agriculture.

Considerable prejudice will attend the consideration of cedar as a cultivated resource. Where, in other parts of the world, objects in the material culture inventory were manufactured from a variety of resources, in the Northwest Coast the majority of such objects were made from a single forest product, the cedar, as detailed previously. It was also used in conjunction with dog and mountain goat wool in the weaving of garments and blankets (Gustafson 1980). The roots and branches were used in making baskets and as lashing. Because this resource was abundant, could be used as a building material, and was of great durability in the damp climate, it was apparently unnecessary to develop others. Since every part of the cedar tree was utilized, it is not unlikely that every aspect of the life cycle of cedar trees and cedar forests was also observed and added to cultural lore. Cedar represents spiritual wealth in Northwest Coast lore, it thus represents knowledge as well.

## Conclusion

The emphasis on the unique nature of the Northwest Coast resource base can easily be maintained because the region is environmentally unique. However, the exploitation and hunting and gathering model would better be replaced by a cultivation model. It is a lack of knowledge and information about the resource base, as well as the resource "chauvinism" cited earlier, that caused the Euroamerican settlers and early anthropologists to label Northwest Coast cultures as hunters and gatherers. It may be necessary to subsume an essentially European term—domestication—to the role of only one of several alternate forms of cultivation of resources, in order to allow us to do justice to the prehistory of this region.

In contrast to the anthropological tradition of Northwest Coast cultures as special or unique hunters and gatherers in an especially abundant environment, I propose that they represent cultures with a specific type of locally developed cultivated resources. This development, rather than being based on greater or lesser domestication of cereal grains or terrestrial mammals, was based on human enhancement of both marine and terrestrial resources. It was the nature of the enhancement through cultivation, rather than the specifics of the resource, that provided the surplus resource base to produce a stratified society.

This new perspective is important because it will affect the way that archaeological resources are investigated, in producing research designs, in carrying out field strategies, and in analyzing and interpreting recovered materials. It would better align the archaeological investigations being done with the traditional culture of the descendants of those Northwest Coast ancients who created the archaeological sites.

## Postscript

Since the time this paper was first conceived for the Circum-Pacific Prehistory Conference held in Seattle in 1989, I developed several professional and personal relationships at several Indian communities on Puget Sound. What I have learned in this contemporary context has helped, as much as all the academic research, to slowly arrive at a different way of looking at the prehistory of the region, and by extension to the north and south, the entire Northwest Coast. The preceding discussion is a continuation of the 1989 effort to look beyond contemporary archaeological perspectives.

## ACKNOWLEDGMENTS

I want to acknowledge four elders—Laura Wilbur, Laura Edwards of the Swinomish Indian Tribal Community and Edith Bedal and Jean Bedal Fish of the Sauk-Suiattle Indian Tribe—for taking the time to teach me the basics. I also want to acknowledge their many descendants who are still helping me to learn.

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# PEELED LODGEPOLE PINE: A DISAPPEARING CULTURAL RESOURCE AND ARCHAEOLOGICAL RECORD

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**James T. Clark**

ABSTRACT

Nez Perce, Flathead, and Kootenai Indians utilized tree bark for nutritional, medicinal, and other needs. Specimens of these trees remain in scattered clusters and as isolates along the Lolo Trail systems of the Clearwater National Forrest in north-central Idaho. Over six hundred peeled lodgepole pine trees have been located at nine sites. Isolated examples of peeled western redcedar, ponderosa pine, and whitebark pine were also identified. Standard data for all trees were recorded on forms and in a data base including GPS locations and dates from core samples. With the majority of the trees dead or in advanced maturity, it is essential gather this information now before humans and nature erase their evidence from the landscape.

## Introduction

The practice of peeling tree bark and cambium layers by indigenous peoples of the inland Pacific Northwest has been long established (Bergland 1992). It is not a practice confined to one section of the country or even this continent. Native Americans throughout North America utilized the cambium and bark of trees for a variety of purposes. This practice has also been studied among the Saami in northern Sweden where it has been documented since the seventeenth century.

A study to record the culturally peeled trees that remain along the Lolo Trail system in the Clearwater National Forest was conducted by the United States Forest Service, the Nez Perce National Historical Park, and the Nez Perce Tribe. The study area covers the historic Lolo Trail that winds from Weippe Meadows along the present 500 Forest Road over the Bitterroot Mountains to Lolo Pass and then descends along Lolo Creek to Lolo, Montana (Fig. 1). The trail was used by native peoples, including the Nez Perce, as a route across the mountains to hunt bison on the Great Plains. It was used by Lewis and Clark on their expedition in 1805 and 1806 and also served as the escape route for the Nez Perce in 1877 when they were pursued by General Howard and his command.

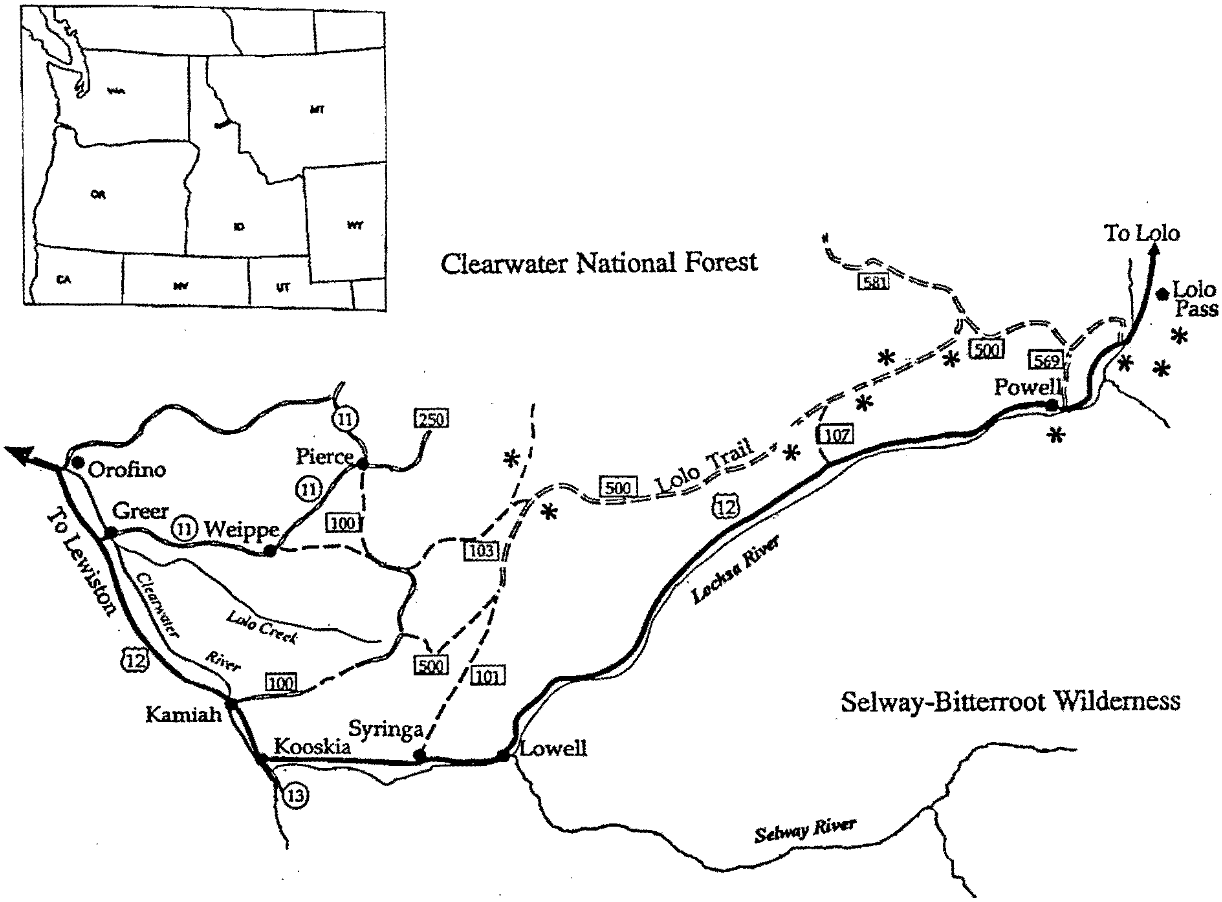


Fig. 1. The Lolo Trail corridor through the Clearwater Forest of Idaho. Stars indicated stands of recorded peeled lodgepole pine.

Culturally peeled trees are found along the entire trail system in varied concentrations from single trees to large numbers grouped around recognized campsites. Species with cultural peels include ponderosa pine (*Pinus ponderosa*), western redcedar (*Thuja plicata*), and whitebark pine (*Pinus albicaulis*). The lodgepole pine (*Pinus contorta*), however, is the most prevalent and often least noticed. While ethnographic literature describes how cambium peels from the lodgepole species are prepared and used, the failure to establish identifying field characteristics has hindered it preservation. This study established guidelines to identify and record culturally peeled lodgepole pine.

## Background

Lodgepole pine represent the largest number of culturally peeled trees found along the Lolo Trail. Over one thousand cambium peeled lodgepole pine have been seen in the Clearwater National Forest which is a higher number than has been seen in any other forest in the Northwest and Rocky Mountain areas. There are three major reasons that explain the lodgepole's dominance over other species with cultural peels.

First, the lodgepole's range includes the higher elevations common on the Lolo Trail while other species that have been peeled live below the ridge tops. For example, western redcedar grow in valley riparian areas.

Second, many of the lodgepole survived early logging and forest fires, both natural and human made. The ponderosa and western redcedar were in high demand by the timber industry and local sawyers routinely cut scarred trees without consideration for the their cultural history. Being in less demand, fewer lodgepole were harvested.

The fire history of the area was also responsible for the destruction of mature ponderosa and redcedar populations adjoining the Lolo Trail. Early Native Americans set fires for several reasons including to facilitate the growth of food plants, to improve forage for horse and game animals, to thin underbrush for hunting, and to reduce the threat of unexpected fire (Barrett 1980). Historically, there were large fires in 1889, 1910, 1919, 1934, and as recently as 2000. After fire or logging, the lodgepole was the first species to return in large numbers.

Third, the lodgepole are easier to cut and peel than other tree species. Peeling them takes less time even in the late summer months when sap flows slowly. In an ethnological study of native peoples on the Columbia Plateau, James A. Teit (1930) compared the tools and processes used to recover the inner bark layers of the ponderosa and lodgepole. He found that the two species required different recovery methods due to each tree's physiology. Teit says (1930:92):

> In the case of black pine trees [lodgepole pine] after the cut had been made, the bark could generally be peeled by hand. In this tree the cambium layer adheres to the trunk, and the scrapers were pressed downward long the latter, removing the cambium in narrow ribbons, which if not eaten at once were collected, along with as much sap as possible, in large spoons or in small bark cups or baskets. In the yellow pine [ponderosa] the process is different, as the bark is much thicker and stiffer, and the cambium layer adheres to the bark, from which, after stripping, it is separated or cut and pried off with a knife-like bone instrument.

The fourth reason for the lodgepole's dominance is that its high nutritional value made it an excellent source of food for humans and horses. There are high concentrations of sugars and proteins in the sieve tubes of the inner bark, particularly in the spring.

Its use as horse fodder was primarily in the many areas along the trail where forage was meager. After the cambium layer was cut from the tree, it was shredded to resemble hay and fed to horses immediately or dried for later use. During the Nez Perce escape in 1877, Private William Connolly (1877) wrote in his diary:

> Our American horses were not used to the fodder of the native Cayuse. We carried no forage. If we should chance upon one of the little mountain valleys where there should be grass, we found it either trampled down by Joseph's ponies

or destroyed in some other way. Many is the time we have cut bark from trees for our horses.

There are early ethnographic references to using lodgepole cambium for human food. In a report entitled "The Botany of Northwest America" that was presented to the North American Boundary Commission in 1863, Dr. D. Lyall (Sturtevant 1919:436) observed:

> Along both sides of the trail in the passes of the Galton and Rock Mountains, many of the young trees of the species Pinus Contorta Dougl are stripped of their bark for a height of six or seven feet. This is done by the Indians during their annual hunting excursions from the Kootenay and Kalispal country to the buffalo plains on the east side of the Rocky Mountains, for the sake of the inner bark which they used for food, . . . [both] in its fresh state, . . . [and] compressed into thick cakes, so as to render it portable.

The Nez Perce were likely responsible for the vast majority of the culturally peeled trees that occur along the Lolo Trail. Although no detailed studies have been found of harvesting lodgepole cambium specifically by the tribe, evidence exists in tribal oral history that Nez Perce routinely made use of the tree. Early oral histories from the Nez Perce identity this trail as one that led them to the bison hunting grounds in Montana. They traversed the path in small groups that often met at traditional stopping points along the trail. It is at these places, like Smoking Place, Indian Post Office, and Packer Meadows, where large numbers of culturally peeled trees remain.

In addition to the Nez Perce, Flathead and other tribes also used the Lolo Trail as a land bridge between the Plains on the eastern side of the Rocky Mountains to the Columbia Plateau, and west to the Pacific Ocean. The groups often shared campsites, traded, and made the trek to hunt bison on the Plains. They practiced the cultural traditions that literally left its mark on trees along the Lolo Trail.

## Field Work

Standard field procedures for this study included conducting pedestrian surveys to flag all culturally scarred trees within a prescribed area, completing data forms profiling each tree, photographing each tree, plotting locations on standard topographic maps, and taking GPS readings and core samples from as many live peeled trees as possible. The ongoing field work was conducted in stages during several summer seasons from 1996 through 2000.

A preliminary assessment of each area evaluated the concentration of culturally peeled trees and established boundaries for each study site before the field survey was conducted. Once the boundary was marked, trained volunteers swept through the study areas flagging all candidate trees as they went. They were followed by an archaeologist who numbered all the flagged trees that met the criteria for a culturally peeled tree and noted their locations on a master map. Questionable trees were rejected and the flagging was removed.

The primary problem in identifying culturally peeled trees is to avoid confusing them with trees that are damaged naturally. Fire damage or rubs from leaning trees can create scars similar to some peeled scars. The most obvious indication of a cultural peel is the presence of tool marks on the scar face (Fig. 2) where an ax or knife was used to free a peel for removal. Cut marks are not always visible, however, because they can be concealed by lobe or scar overgrowth. The natural sloughing of bark layers can also remove all traces of the original cuts.

When a cultural peel cannot be positively identified by cut marks, the survey had to rely on the shape of the scar. Identification by shape is more difficult for lodgepole because this species has a greater variety of scar shapes than is usually found on the ponderosa or western redcedar. Lodgepole scars are not as large as those on the ponderosa nor do they have the predictable rectangular shape as those on the redcedar. Most archaeologists are already familiar with the classic peeled scars of the ponderosa and redcedar and tend to apply those typologies to the lodgepole. Applying the same typology across species often leads to overlooking some cultural peels.

The classic lodgepole shape is generally rectangular with a rounded or squared top (Fig. 3) that could only be created by using a tool, but the shape varies greatly (Fig. 4). Since the cambium was to be eaten, the shape of the peeled bark was not critical to the user. Gatherers simply peeled enough to eat as efficiently as possible. Scars can be pointed on one or both ends. They may be trapezoidal or have pointed extensions. Some trees have more than one scar (Fig. 5); one tree found by the survey had nine or more. In a few cases a scar occurs over an earlier scar creating a scar within a scar (Fig. 6). Variations of one pattern are often repeated in an area where several trees may display scars with the same shape. By association, cut marks on one or more of these scars help verify the cultural source for all of the similarly shaped scars.

Once the scared trees had been located and numbered, teams of two then passed through the area again. By passing through the sites more than once, the teams were less likely to miss a peeled tree, especially in areas of dense undergrowth. On this second pass they photographed and completed a data sheet for each numbered tree. The data sheet (Fig. 7) was designed for recording a standard set of attributes for each tree. In subsequent passes by specialist teams, trees at some sites were located using GPS equipment and core samples for scars on selected trees were obtained for dating.

After field work was completed, field forms were reviewed and selected data from them were entered into a computer file that can be used for further analysis. This file has 12 data fields for each tree including whether alive or dead, scar date, ring count from pith (tree age), diameter at breast height (DBH), number of scars, identification of classic shape, scar width and length, distance from ground, the direction the scar faces, and the scar date. The GPS locations were plotted on maps keyed to location numbers that permit the trees to be relocated using the GPS system.

## Dendrochronological Analysis

The original plans for this study called for having the core samples dated by the Laboratory for Tree-Ring Research at the University of Arizona in Tucson. The Laboratory was unable to date the cores because there was not a single, paramount factor controlling conditions for tree growth in the Clearwater Forest. Such a critical factor, like climatic trauma, that similarly affects the growth of most trees in an area is necessary to allow cross dating between trees. It is frequently missing in temperate forest interiors like those along the Lolo Trail.The dating procedure was revised based on the work of Steve Arno (Arno and Barrett 1988) of the Intermountain Fire Research Laboratory in Missoula, Montana. Using methods Arno developed to date fire scared trees and the "Acu-guage" tree-ring measuring microscope, it was possible to determine reasonably accurate dates for cultural scars on live trees found in the field work.

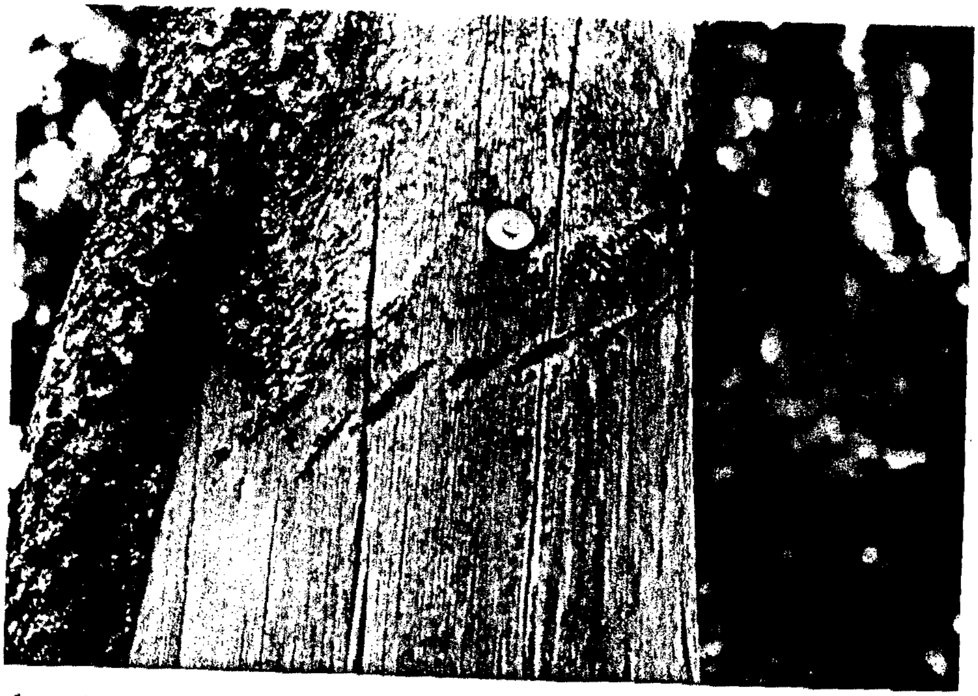

Fig. 2. Tool marks of ax or knife used to remove a peel from tree.

Fig. 3. Classic rounded scar shape.

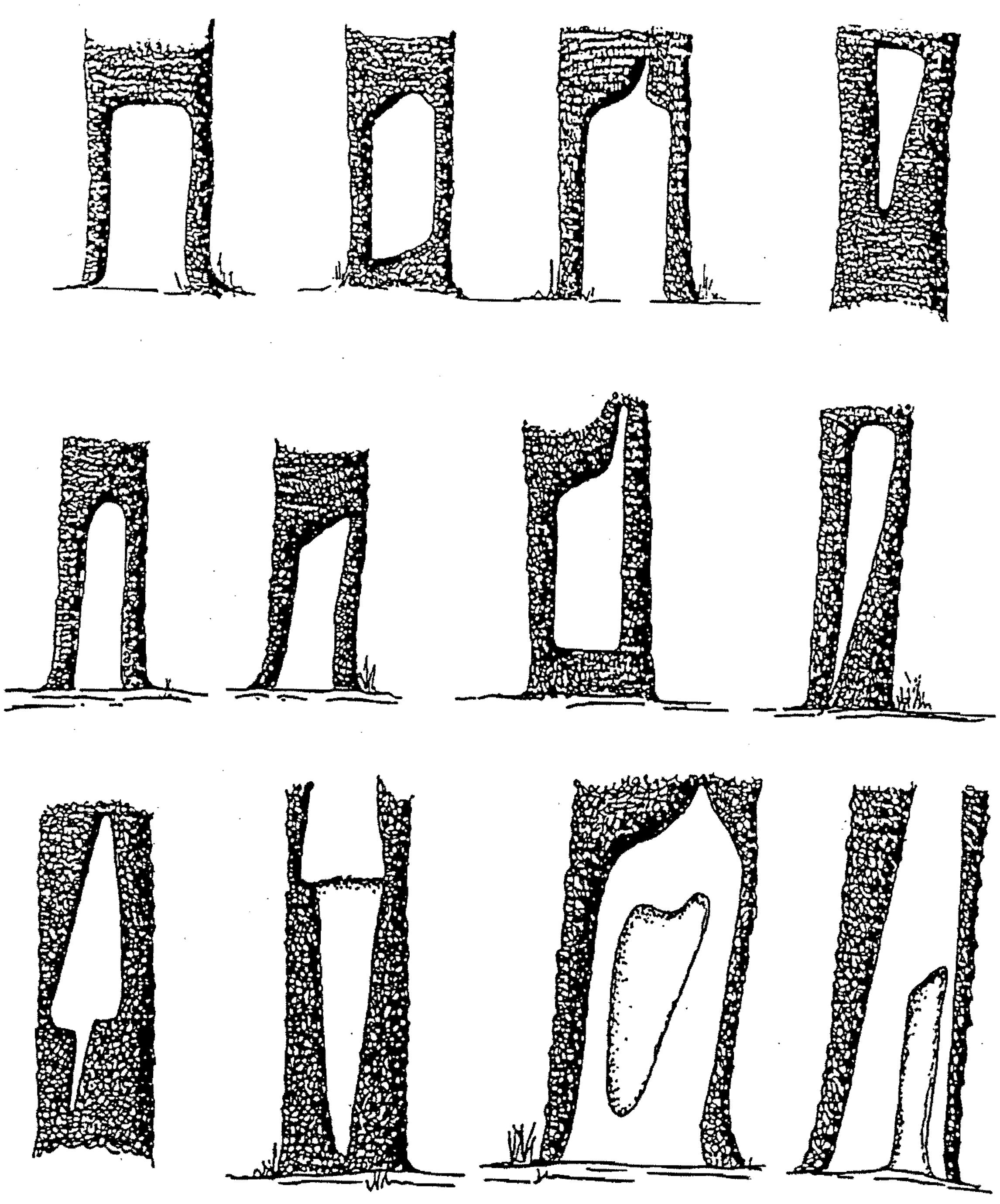

Fig. 4. Variety of peeled scar shapes for lodgepole pine: *a*, classic scar; *b*, squared top and bottom; *c*, peel above cut; *d*, shape above ground; *e*, rounded top to ground; *f*. angled top; *g*, side pull above ground; *h*, V-shape to ground; *i*, tear-drop with V-pull; *j*, center cut pulled up and down; *k*, inner peel with later out peel above ground; *l*, inner peel with later outer peel at ground.

Fig. 5. Lodgepole with multiple scars.

Fig. 6. Scar within a scar.

Culturally Modified Tree Inventory
Clearwater National Forest

Location: ______________ Site Number: _______

Tree Number____________ Scar Width:________ Drawing of Scar Shape
(Show ground and tree trunk)

Dead or Alive Scar Length:________

Species:___________ Distance From Ground:________

No. of CMT Scars:__________ Facing Direction:_______ o or
N. NE. E. SE . S. SW. W. NW.

DBH:______________

Slope of Ground:________ o Cut Marks:_____________

If Taken: Scar Date: _______ Tree ring count: ________

Photo Log : __________

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ADDITIONAL SCARS Drawing of Scar Shape

Scar Number: _______ Distance from Ground: _______

Scar Length : ________ Facing Direction: __________

Scar Width: ________ Cut Marks: ___________

---

Drawing of Scar shape

Scar Number: _______ Distance from Ground: ______

Scar Length: _____ Facing Direction: _____

Scar Width: ______ Cut Marks: _____

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Comments:

Recorder ___________________________ Date __________

Fig. 7. Data sheet for individual peeled trees.

After training by Steve Arno and his assistant Helen Curtis, the coring crews developed an effective procedure for driving the borer through the scar lobe (overgrowth) in order to get as close to the scar tip as possible (Fig. 8). When the core was removed from the borer extractor, it was glued to a ridged tray made of corrugated cardboard sheets or wooden grooved boards. The scar is dated by counting the growth rings and subtracting this number from the current year which is the most recent year of tree growth. Late summer or early fall is the best season to take core samples because new growth for the current year will be well formed. This procedure can only be used for live trees since the last year of tree growth for dead trees is unknown. The age of the tree is determined by boring through to the pith at the tree's center.

Accuracy in dating depends on how close the increment borer can come to the scar tip. The scar tip is the original edge of the scar at the undisturbed bark. It marks the growth ring for the year in which the scar was made. As the tree begins to heal, the lobe grows over the scar, hiding the tip. The person taking the sample must estimate how much of the original scar the lobe has covered in order to place the bore in the right spot and orient it at the correct angle. Sampling a single tree may require several cores and often takes over an hour to locate the scar tip.

Other methods of dating scars by counting growth rings are less effective or acceptable. Driving a core from the center of the scar to the pith and subtracting it from the tree's age to arrive at the date is less accurate. Rings weather away inside the exposed scar, and tree height and growth rates must be estimated. Both are sources of error. The most accurate way of dating scars is to harvest the tree or cut a wedge through the lobe that includes the scar tip. Of course, this method destroys the tree and the cultural resource it bears, and it is illegal on federal land.

Another source of error in the process comes from counting the rings. Light sanding or slicing along the length of the core with a razor blade, wetting the core, and using the tree-ring microscope make the rings more visible and allows the most accurate count. Despite the most painstaking effort in counting, there is a normal margin of error which is reflected in the ranges given for some of the scar dates found in the study.

## Site Findings and Evaluation

Based on its utility and abundance, it is not surprising that the study found an extensive number of peeled lodgepole pine along the highest elevations of the Lolo Trail. A total of 479 lodgepole pine in 8 study areas are entered in the data base. In addition, approximately 150 additional trees were recorded during the summer 2000 field work. Table 1 summarizes the findings for all the sites, but some examples are described in more detail below. The Snowy Summit to Beaver Dam Saddle area is an extended site that spreads along either side of the Lolo Trail for approximately two miles. Scar dates were determined for 14 live trees that range from 1873 to 1901. Scars with two later dates did not appear to be from cambium peels. Without cut marks or typical scar shapes, they may have been caused by fire or falling trees. The extended length of the site suggests that this section of the trail was a traditional resting or camping place for various groups. The close proximity of a modern logging road to peeled trees and the large number of fallen trees with scars indicate that human activity and natural processes have destroyed many cultural scars.

A second site at Indian Post Office provides one of the greatest concentrations of peeled trees in a single study plot with a total of 166 culturally peeled lodgepole pine recorded.

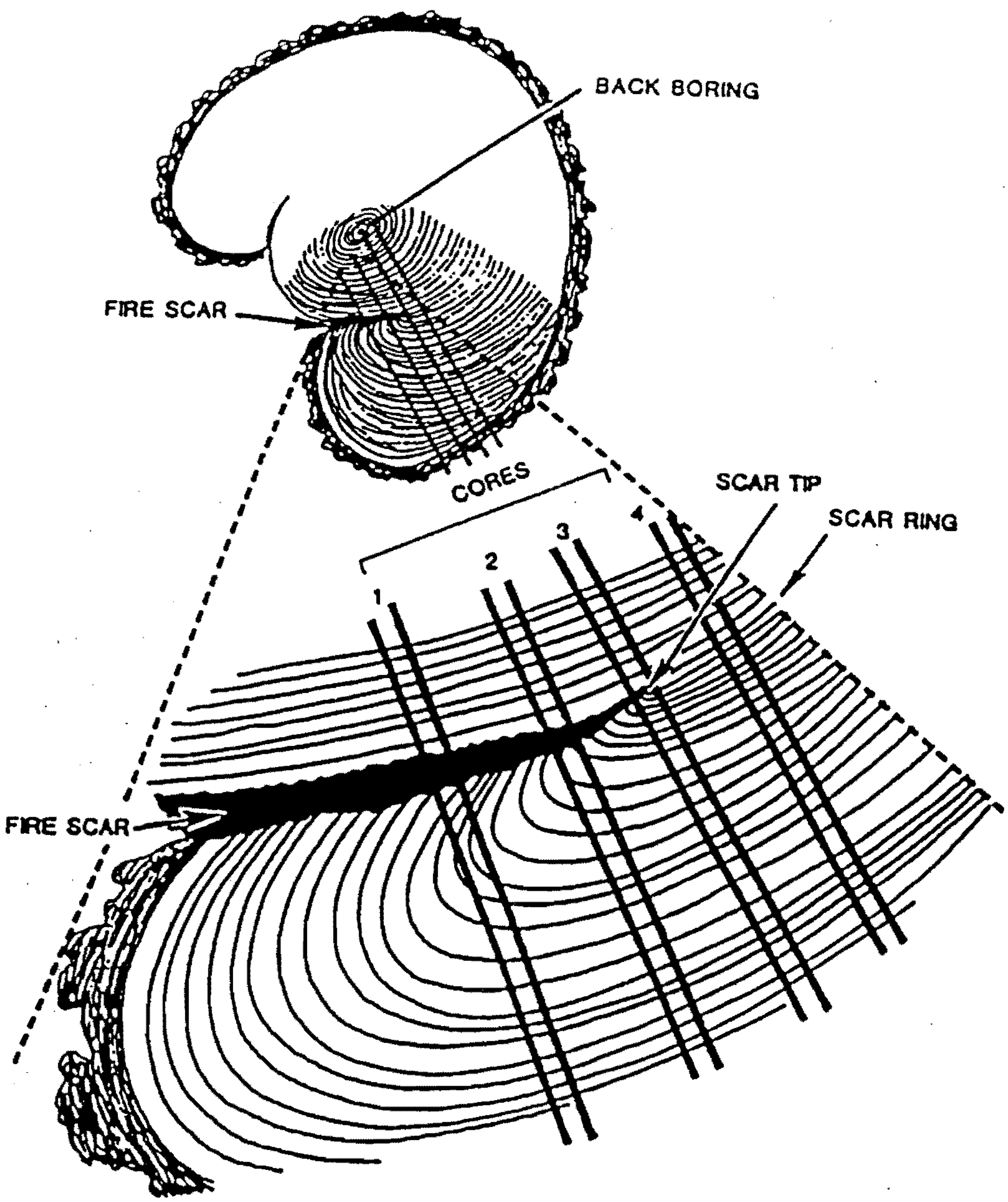


Fig. 8. Scar-boring procedures illustrated on a cross-section of a single scared tree. (After Arno and Barrett 1988.)

Lamentably, a clear cut near the site is likely to have destroyed many other scarred trees. It also has the widest range of dates for scars. Dating from 1739, one of the oldest living peeled lodgepole pine located here, and at 262 years old it is the second oldest lodgepole pine found in our study. The scar on this tree dates from between 1788 and 1801. Scars dated at Indian Post office range from 1788 to 1892. The number and dates of the lodgepole scars indicate that the site was extensively used over a long period.

In contrast, West Cayuse Junction appears to have been used for only a short time. The dates for all three peeled trees on the small site were 1877. These identical dates indicate that the site was possibly a stopping place in the Nez Perce War of 1877.

Some sites have been only partially surveyed with substantial numbers of culturally scarred lodgepole pine remaining unrecorded. Packer Meadows has seen heavy use as a camp site and meeting ground for a succession of native peoples, explorers, trappers, miners, loggers, hunters, firefighters, and tourists from prehistory to the present. A survey of a small area north of Pack Creek in 1997 found 22 trees with scars dates from 1828 through 1912. Additional, ongoing work in another limited area south of the creek in 2000 recorded an additional 150 scared trees. The areas surveyed to date represent only a small part of the total site. An adjacent site at Glade Creek Camp, which is a Lewis and Clark camp, has 99 culturally scared trees recorded with dates from 1840 to 1913. Here too, a substantial part of the site has peeled lodgepole that have not been recorded.

TABLE 1

SITE SUMMARY

| Site | Dates | Site Findings | Possible Interpretation |
|---|---|---|---|
| Snowy Summit to Beaver Dam Saddle | 1873–1901 | 77 trees in groups along 2 miles of trail. Other artifacts found. | Traditional campsite. |
| Pete Fork | 1870–1877 | 49 trees in a small site. | Stopping place in Nez Perce escape. |
| Howard's Camp | 1819–1889 | 53 trees along ½ mile of trail. Other artifacts found. | Traditional campsite before use in the Nez Perce escape. |
| Indian Post Office | 1788–1892 | 166 trees along north edge of clearing. Partial survey. | Traditional campsite. |
| West Cayuse Junction | 1877 | Three trees without an extensive survey. | Possible stopping place in Nez Perce escape, potentially Howard's 21 mile camp. |
| Brushy Ridge | Not dated | Ten trees on high ridge. Partial survey. | Unknown. |
| Glade Creek Camp | 1840–1913 | 99 trees along west side of creek. Partial survey. | Traditional campsite. Lewis and Clark site. |
| Packer Meadows | 1828–1912 | 22 trees north of creek. 150 trees on south side. Other artifacts found included camas ovens. Partial survey. | Traditional campsite with extensive Native American and Euroamerican use. |

## Summary

Nez Perce and Flathead tradition, ethnographic sources, and historical records confirm that clusters of culturally peeled trees occur at traditional stopping places along the Lolo Trail. Native Americans revisited these sites periodically over an extended period until increasing European occupation curtailed regular tribal use in the mid to late 1800s. Culturally peeled trees played an important role in the subsistence of the peoples using this trail system and other trails throughout the Rocky Mountains. By adding to the archaeological and historical record, these trees provide a more complete picture of the past.

This continuing study has surveyed several sites along the Lolo Trail between Idaho and Montana and recorded data for the culturally peeled trees found. Some trees were located using GPS positioning, and selected scars were dated using tree-ring information from cores. All of this information remains in a computer data base as a resource for further research.

Though still incomplete, this survey recorded over 600 trees with scars that dated from 1788 to 1913. The fact that the earliest recorded scar date is 1788 does not mean that peeling lodgepole was a practice limited to the historical period. The dating method used by the study relied on live trees only. The average life span for a lodgepole is about 150 years, thus the trees that may have been peeled earlier are no longer alive. In fact, the lodgepole may have been used much earlier in history.

Unfortunately, within the next 50 years or less, the end of their natural life-spans will result in the death, deterioration, and final disappearance of these living artifacts. For this reason it is imperative that the culturally peeled lodgepole pine be recognized, protected, and managed as long as they remain part of the cultural landscape.

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Jeff Fee, Clearwater National Forest Archaeologist, initiated this study and continues to provide leadership, encouragement, and support for this ongoing work. Steve Arno and Helen Curtis from the Intermountain Fire Research Laboratory provided technical training and use of the microscope for counting the tree-rings. Richard Furman, a volunteer and forester from the State of Idaho, provided technical forestry information for the field work. Ed DiTunno provided GPS support and mapping. The people named here are key individuals among the many volunteers and Forest personnel who contributed time and technical support that contributed to the success of this project. A full list of contributors is on file with the Clearwater National Forest, Cultural Heritage Program.

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# A BIBLIOGRAPHY OF PLATEAU ETHNOBOTANY

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Abstract

While there has been much interest in Native plant use on the Plateau, much of the available information is difficult to find. As a result the researcher may spend considerable time searching through journals, ethnographies, and archaeological reports with meager results. This bibliography is intended to provide researchers with a comprehensive list of sources of information pertaining to Plateau ethnobotany.

The Native peoples of the Plateau made extensive use of plants in their diet, pharmacopeia, and technology. Accounts of plant use are abundant in the ethnographic, archaeological, biological, and historical literature. Unfortunately for the researcher, this information is scattered throughout ethnographic and archaeological reports, journals, magazines, travelogs, books, theses, dissertations, manuscripts, and museum pamphlets and thus is often difficult to find. In light of this problem the authors have assembled this bibliography of Plateau ethnobotany to aid the researcher in the quest for information on Native plant use in the area. The bibliography includes published material from such diverse fields as anthropology, archaeology, botany, chemistry, ecology, forestry, and history, as well as ephemeral material such as pamphlets and government agency reports and unpublished theses, manuscripts, and delivered papers. It is our desire that this bibliography aid future researchers and allow them to make greater use of the hidden literature on Plateau ethnobotany. Additions and corrections are welcome.

The authors thank Roderick Sprague for his help in the preparation of the bibliography format, finding new sources, correcting errors, and providing access to the Pacific Northwest Anthropological Archives, Laboratory of Anthropology, University of Idaho. Special thanks to Nancy Turner for her suggestions and aid in making this bibliography as complete as possible. John Ross also added several new sources. Thanks also go to the anonymous reviewers of the preliminary manuscript.

In the bibliography, brackets are used to indicate specific pages when a minor portion of the publication is pertinent. *NARN* abstracts are listed by the specific page only rather than the inclusive pages of the whole abstract set. The reprint volume by Ford (1986) strangely has no continuous pagination, only that of the reprints. Some major works from surrounding culture areas and reference to a Plateau Chinese archaeological site (Wegars 1988) have been included because they contain important additional or related data.

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# ABORIGINAL COAST SALISH FOOD RESOURCES: A COMPILATION OF SOURCES

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Abstract

Archaeological, ethnographic, and historical sources of dietary information are used to compile a chart of the food resources of the Puget Sound and Straits Salish of western Washington. These sources confirm each other, and together provide a realistic "menu" of food resources.

The determination of prehistoric diet is an important part of a number of fields including subsistence studies, economic studies, ethnobiology, and ecology (Messer 1984). Archaeological, cultural, and historic data can be used to develop a relatively complete "menu" of the Coast Salish of western Washington. This group, which is generally included among those considered part of the "Salmon Culture" (Kroeber 1939) is defined by use of the Salish language in the Puget Sound/Straits of Georgia area of western Washington (including, however, the Chemakuan of the western side of the Sound). An area of ecological and cultural complexity, it included abundant and diverse resources in addition to the annual cyclic appearance of five species of salmon. Many of these foods were used fresh throughout the year, and some were preserved and stored for use especially during the winter ceremonial season.

Most ethnographic and archaeological analyses of the area concentrate on the use of salmon as an economic and dietary staple. These ethnographers, and other anthropologists and historians, often remark on the diversity of the area's resources while returning thematically to the importance of salmon (Kroeber 1939; Drucker 1955; Singh 1966; Elmendorf 1974; Konlande and Robson 1975; Turner 1975; Ames 1981; Keely and others 1982). Recent studies have asserted that the shellfish and plant resources of the Pacific Northwest, and the role of women both in gathering and in processing fish, plants, and shellfish, have been seriously underrated (Norton 1979; Hunn 1981; Turner and Kuhnlein 1983; Belcher 1985; Norton and others 1984; Donaldson 1985).

The food resources presented in the tables were compiled from three sources of data. Archaeological faunal analysis lists, ethnographic accounts, and the journals of early travellers and settlers are used to determine the varied food resources of the Salish, and their year-round availability.

Archaeological data which directly pertain to diet and food resources can be drawn from many sources: human bones, middens and landform changes such as hearths, earth ovens, and trails for access to land resources (Greengo 1983). Preservation of organic materials in the Pacific Northwest, a region of acid soils and heavy rainfall, is generally poor. Human remains from the British Columbia coast have been analyzed for protein sources (Chisholm, Nelson, and Schwarcz 1984; Lazenby and McCormack 1985), a research technique which would be valuable for the Puget Sound area.

Shell middens have been sources of a great deal of data on food species. Faunal analysis lists cite bones of animals, birds, and fish as well as the kinds of shellfish which came from the preserving matrix (Mattson 1971; Campbell 1981; Grabert and Griffin 1983;

Chesmore 1984). Organic remains, particularly those of plants are, however, rare to non-existent except in special cases of wet-site preservation. Archaeological presence of plant food species is mainly inferred from historic and ethnographic records. Since the capture and use of many species of shellfish, bird, fish, and mammal are confirmed through their presence in shell middens, it seems reasonable to assume an analogous use of plant species in the prehistoric past.

Ethnographic reports confirm the use of shellfish, mammals, birds, and fish while adding information on plant foods. The quality of the information depends, of course, on the quality of knowledge of the informants. In a group such as the Salish with division of labor by gender, knowledge of various food sources was also gender-specific, and male informants and investigators may inadvertently produce inherently biased reports. "Other faults in the record spring from the limited number of informants with whom I could productively work. These were all male, and matters concerning female activities were slightingly treated" (Elmendorf 1974:8)

Reviewing the gender ratio of the informants used by the ethnographers cited shows the same bias in most cases: Elmendorf's informants were all senior males; Stern (1934:9) mentions one female and six male informants; Suttles (1951) lists 8 women and 16 men, and his record is noticeably more complete than the previous two. Smith (1940) lists six men and six women and, again, the information is relatively complete. June Collins (1974) used 24 informants, 12 of whom were female, and her information on women's knowledge is also more complete. The ethnographies cited in this paper are primary sources, and are commonly cited by other writers on the Salish.

Observations of the annual cycle of food production and consumption are incomplete, and information must be pieced together from varied sources. Seasonal -round activities served several purposes such as the gathering of food for immediate use, the preservation of food for later use at other times of the year, and the conservation of those resources, especially shellfish, available at winter sites. Social functions such as the opportunity to visit relatives in other parts of the Puget Sound area were also part of this seasonal shift in locations.

Seasonality in food resources is pointed out by the calendric cycle as determined by Ballard (1950:82). The spring and summer "months" are labelled as times of fruit ripening, for example, "time of yellow salmon berries," "time of red elderberries," " time of creeping blackberries," etc., while the fall months are labelled with references to catching and drying of salmon. But the seasonality refers not only to the times when food might be expected to be scarce. The period labelled "blow time," probably around March, is called by his informants: "You'll be hungry all the time," either from a total lack of food or, more likely, from restriction to a few sources of dried or smoked food.

The meal structure of the Salish was highly specific. Fresh foods, and vegetable foods, were to be used equally with preserved foods and various meats and fishes, and certain combinations of foods were also preferred (Smith 1940, 1949). Techniques of preservation included air-drying, smoking, and fermentation (Smith 1940; Rivera 1949; Suttles 1951). The emphasis on fresh foods, together with their availability most of the year, points out the importance of these sources in the Salish domestic economy.

The journals of travellers and explorers and Hudson's Bay Company officers (Wilkes 1845; Brown 1868; Judson 1925; Meany 1957; Tolmie 1963;) although impressionistic, help to confirm patterns of food and land use before the settlement of the Puget Lowlands and the alienation of many highly productive prairies, shellfish beds and salmon streams from the native subsistence economy.

This list is not meant to be either a complete review of all sources of information or an all-inclusive list of all species used by the Puget Sound groups. It is a list of those species which were used for food, whether or not they were used for other purposes. Taxonomic categories can be confusing. European and Salish systems of taxonomy are not parallel. There may be several Salish names for one European species, or several European names may refer to one Salish category. Further work on Salish nomenclature would be of great value. There is also the problem of assigning a Latin name to a species which may be described by several English common names. Currently acceptable classification and nomenclature has been used, although it is worth pointing out that standard reference sources sometimes disagree on particular species designations. The sources used include Carl (1971), and Hitchcock and Cronquist (1973).

The use of a number of sources of data, as illustrated by this list, not only provides a realistic picture of prehistoric Salish diet, but also provides a foundation for the extension of archaeological evidence by analogy. The same kind of research applied to other groups would go far toward presenting a more complete picture of prehistoric Native American diet and resource use.

One other feature of the chart should be noted. In the overwhelming majority of cases the citations include archaeological, ethnohistorical and ethnological sources. In other words, contemporary accounts say the Puget Sound/Gulf of Georgia Salish ate this food, modern informants say the same thing and the archaeological record confirms it. The few cases in which there is no archaeological corroboration are of foods that are unlikely to have left discernible traces in midden deposits; for example, the sea cucumber.

Table 1

Bird Species

| SPECIES | AUTHOR/DATE |
|---|---|
| *Anas*, spp.<br>Surface-feeding ducks | Gibbs 1877; Eells 1889; Smith 1940; Suttles 1951; Mattson 1971; Elmendorf 1974; Richardson 1974; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |
| *Ardea herodias*<br>Great blue heron | Suttles 1951; Elmendorf 1974 |
| *Aythya* spp.<br>Bay ducks | Mattson 1971; Elmendorf 1974; Campbell 1981; Chesmore 1984 |
| *Branta canadensis*<br>Canada goose | Mattson 1971; Elmendorf 1974; Campbell 1981; Chesmore 1984 |
| *Branta nigricans*<br>Black brant | Elmendorf 1974; Chesmore 1984 |
| *Bucephala* spp.<br>Goldeneye, bufflehead | Elmendorf 1974 |
| *Chen hyperborea*<br>Snow goose | Mattson 1971; Elmendorf 1974 |
| *Galliformes*<br>Grouse | Eells 1889; Smith 1940; Suttles 1951; Elmendorf 1974; Campbell 1981 |
| *Gaviidae*<br>Loons | Swan 1857; Eells 1889; Collins 1949; Campbell 1981; Chesmore 1984 |
| *Grus canadensis*<br>Sandhill crane | Elmendorf 1974 |
| *Mareca americana*<br>American widgeon | Elmendorf 1974 |
| *Melanitta* spp.<br>Scoters | Elmendorf 1974 |
| *Mergus* spp.<br>Mergansers | Elmendorf 1974 |
| *Olor columbianus*<br>Whistling swan | Elmendorf 1974 |
| *Podiceps* spp.<br>Grebes | Elmendorf 1974; Campbell 1981 |

Table 2

Fish species

| SPECIES | AUTHOR/DATE |
|---|---|
| *Acipenser* spp.<br>sturgeon | Swan 1857; Gibbs 1877; Smith 1940; Suttles 1951; Richardson 1974; Montgomery 1979 |
| *Clupea pallasi*<br>herring | Eells 1889; Smith 1940; Suttles 1951; Mattson 1971; Elmendorf 1974; Grabert and Griffin 1983 |
| *Hippoglossus stenolepis*<br>halibut | Gibbs 1877; Eells 1889; Smith 1940; Suttles 1951; Elmendorf 1974; Montgomery 1979; Grabert and Griffin 1983 |
| *Hypomesus pretiosus*<br>silver or surf smelt | Eells 1889; Smith 1940; Suttles 1951 |
| *Oncorynchos* spp.<br>salmon, all five species included | Swan 1857; Gibbs 1877; Smith 1940; Suttles 1951; Mattson 1971; Elmendorf 1974; Richardson 1974; Dunnell and Fuller 1975; Grabert and Griffin 1983; Chesmore 1984 |
| *Ophiodon elongatus*<br>lingcod | Gibbs 1877; Eells 1889; Smith 1940; Suttles 1951; Grabert and Griffin 1983 |
| *Pleuronectidae* (family)<br>various soles and flounders | Swan 1857; Eells 1889; Smith 1940; Suttles 1951; Elmendorf 1974; Richardson 1974; Grabert and Griffin 1983; Chesmore 1984 |
| *Raja binoculata*<br>skate | Eells 1889; Smith 1940; Suttles 1951; Elmendorf 1974; |
| *Salmo* spp.<br>trout, steelhead trout | Swan 1857; Eells 1889; Smith 1940; Elmendorf 1974; Richardson 1974 |
| *Sebastodes* spp.<br>rock cod, snapper | Gibbs 1877; Eells 1889; Smith 1940; Suttles 1951; Mattson 1971; Elmendorf 1974; Grabert and Griffin 1983; Chesmore 1984 |
| *Squalus suckleyi*<br>dogfish | Gibbs 1877; Eells 1889; Mattson 1971; Chesmore 1984 |

Table 3

Mammal species

| SPECIES | AUTHOR/DATE |
|---|---|
| *Aplodontia*<br>Mountain beaver | Elmendorf 1974 |
| *Castor canadensis*<br>Beaver | Swan 1857; Eells 1889; Smith 1940; Suttles 1951; Elmendorf 1974; Richardson 1974; Campbell 1981 |
| *Cervus canadensis*<br>Elk | Gibbs 1877; Eells 1889; Smith 1940; Suttles 1951; Elmendorf 1974; Richardson 1974; Campbell 1981; Grabert and Griffin 1983 |
| *Lepus* spp.<br>Rabbit, several species | Smith 1940; Elmendorf 1974 |
| *Lutra canadensis*<br>River otter | Eells 1889 |
| Marmot | Elmendorf 1974 |
| *Ondatra zibethecus*<br>Muskrat | Elmendorf 1974 |
| *Odocoileus hemionus*<br>Blacktail deer | Swan 1857; Gibbs 1877; Eells 1889; Smith 1940; Suttles 1951; Mattson 1971; Elmendorf 1974; Richardson 1974; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |
| *Oreamnos americanus*<br>Mountain sheep | Gibbs 1877; Eells 1889; Suttles 1951; Richardson 1974 |
| *Phoca vitulina*<br>Harbor seal | Swan 1857; Gibbs 1877; Eells 1889; Smith 1940; Suttles 1951; Mattson 1971; Elmendorf 1974; Campbell 1981; Chesmore 1984 |
| *Phocena vomerina*<br>Harbor porpoise | Eells 1889; Smith 1940; Suttles 1951; Elmendorf 1974 |
| *Procyon lotor*<br>Raccoon | Swan 1857; Eells 1889; Smith 1940; Suttles 1951; Elmendorf 1974 |
| *Ursus americanus*<br>Black bear | Swan 1857; Eells 1889; Smith 1940; Suttles 1951; Elmendorf 1974; Richardson 1974 |
| Whale<br>several species | Swan 1857; Gibbs 1877; Eells 1889; Suttles 1951; Elmendorf 1974 |

Table 4

Marine Invertebrates

| SPECIES | AUTHOR/DATE |
| --- | --- |
| *Balanus glandula*<br>Horse barnacle<br>*B. cariosus*<br>Acorn barnacle | Swan 1857; Smith 1940; Suttles 1951; Mattson 1971; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |
| *Cancer* spp.<br>Crab, edible crab<br>*Cancer magister*<br>Dungeness crab | Swan 1857; Eells 1889; Suttles 1951; Elmendorf 1974; Richardson 1974; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |
| *Clinocardium nuttallii*<br>Cockle | Smith 1940; Suttles 1951; Mattson 1971; Elmendorf 1974; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |
| *Cryptochiton stelleri*<br>Chiton | Smith 1940; Suttles 1951; Mattson 1971; Chesmore 1984 |
| "Clam" | Swan 1857; Gibbs 1877; Eells 1889; Richardson 1974 |
| *Hinnites multirugosis*<br>Purple-hinged rock scallop | Grabert and Griffin 1983 |
| *Macoma nasuta*<br>Sand clam | Suttles 1951; Mattson 1971; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |
| *Mytilus edulis*<br>Bay or blue mussel | Swan 1857; Gibbs 1877; Eells 1889; Smith 1940; Suttles 1951; Mattson 1971; Elmendorf 1974; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |
| *Octopus* spp.<br>Octopus | Eells 1889; Smith 1940; Suttles 1951; Elmendorf 1974; Richardson 1974 |
| *Ostrea luridea*<br>Native oyster | Eells 1889; Smith 1940; Suttles 1951; Mattson 1971; Elmendorf 1974; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |
| *Panope generosa*<br>Goeduck | Swan 1857; Smith 1940; Mattson 1971; Elmendorf 1974; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |
| *Pododesmus macroschisma*<br>Rock oyster, jingle | Grabert and Griffin 1983 |
| *Polineces lewissii*<br>Moon snail | Chesmore 1984 |
| *Protothaca staminea*<br>Rock clam | Smith 1940; Suttles 1951; Mattson 1971; Elmendorf 1974; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |

Table 4 (Marine Invertebrates, continued)

| SPECIES | AUTHOR/DATE |
|---|---|
| *Saxidomus giganteus*<br>Butter clam | Smith 1940; Suttles 1951; Mattson 1971; Elmendorf 1974; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |
| *Stichopus californicus*<br>Sea cucumber | Smith 1940; Suttles 1951 |
| *Strongylocentrotus*<br>Sea urchin, sea egg | Eells 1889; Smith 1940; Suttles 1951; Mattson 1971; Grabert and Griffin 1983 |
| *Thais* spp.<br>Whelks | Suttles 1951; Mattson 1971; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |
| *Tresus capax*<br>Horse clam | Smith 1940; Suttles 1951; Mattson 1971; Elmendorf 1974; Campbell 1981; Grabert and Griffin 1983; Chesmore 1984 |
| *Venerupis tenerima*<br>Rock venus | Chesmore 1984 |

Table 5

Plant species

| SPECIES | AUTHOR/DATE |
|---|---|
| *Allium* spp.<br>Onion | Gunther 1945 |
| *Amelanchier*<br>Saskatoon, serviceberry | Brown 1868; Smith 1940; Gunther 1945; Suttles 1951; Elmendorf 1974 |
| *Arctostaphylos uva-ursi*<br>Kinnikinnick, bearberry | Swan 1857; Smith 1940; Gunther 1945; Suttles 1951 |
| *Berberis* spp.<br>Oregon grape | Smith 1940; Suttles 1951; Elmendorf 1974 |
| *Camassia* spp.<br>Camas | Swan 1857; Brown 1868; Gibbs 1877; Eells 1889; Judson 1925; Gunther 1945; Suttles 1951; Elmendorf 1974; Richardson 1974 |
| *Corylus cornuta californica*<br>Hazelnut | Eells 1889; Smith 1940; Suttles 1951; Elmendorf 1974 |
| *Equisetum* spp.<br>Horsetail | Gunther 1945; Elmendorf 1974 |
| *Fragaria* spp.<br>Strawberry | Swan 1857; Brown 1868; Gibbs 1877; Eells 1889; Smith 1940; Gunther 1945; Suttles 1951; Elmendorf 1974 |
| *Fritillaria lanceolata*<br>Rice root | Brown 1868; Gunther 1945; Suttles 1951; Elmendorf 1974 |
| *Gaultheria shallon*<br>Salal | Swan 1857; Brown 1868; Gibbs 1877; Eells 1889; Smith 1940; Gunther 1945; Suttles 1951; Elmendorf 1974 |
| *Heracleum lanatum*<br>Cow Parsnip | Swan 1857; Gunther 1945 |
| *Lilium columbianum*<br>*L. Parviflorum*, Tiger lily | Brown 1868; Smith 1940; Gunther 1945; Suttles 1951; Elmendorf 1974 |
| *Lysichitum americanum*<br>Skunk cabbage | Eells 1889; Gunther 1945 |
| *Oenanthe sarmentosa*<br>Water parsley, wild celery | Swan 1857; Brown 1868; Smith 1940; Suttles 1951 |
| *Osmaronia cerasiformis*<br>Squaw plum, Indian plum | Gunther 1945; Suttles 1951 |
| *Perideridia gairdneri*<br>Wild carrot | Smith 1940; Suttles 1951; Elmendorf 1974 |

Table 5 (Plant species, continued)

| SPECIES | AUTHOR/DATE |
|---|---|
| *Polypodiaceae* spp.<br>Licorice fern | Eells 1889; Smith 1940; Gunther 1945 |
| *Polystichum munitum*<br>Sword fern | Gunther 1945 |
| *Potentilla pacifica*<br>Pacific silverweed | Elmendorf 1974 |
| *Prunus virginiana demissa*<br>Chokecherry | Smith 1940 |
| *Pteridium aquilinum*<br>Bracken or brake fern | Swan 1857; Brown 1868; Gibbs 1877; Eells 1889;<br>Smith 1940; Suttles 1951; Elmendorf 1974; Richardson 1974 |
| *Pyrus diversifolia*<br>Crab apple | Swan 1857; Brown 1868; Eells 1889; Smith 1940;<br>Gunther 1945; Suttles 1951 |
| *Quercus garryana*<br>Garry oak | Brown 1868; Gibbs 1877; Smith 1940; Gunther 1945;<br>Elmendorf 1974 |
| *Ribes divaricatum*<br>Gooseberry | Swan 1857; Eells 1889; Smith 1940; Gunther 1945;<br>Suttles 1951 |
| *Rubus leucodermis*<br>Black cap | Brown 1868; Smith 1940; Gunther 1945; Suttles 1951;<br>Elmendorf 1974 |
| *Rubus macropetalus*<br>Blackberry, dewberry | Swan 1857; Brown 1868; Eells 1889; Smith 1940;<br>Gunther 1945; Suttles 1951; Elmendorf 1974 |
| *Rubus parviflorus*<br>Thimbleberry | Eells 1889; Smith 1940; Gunther 1945; Suttles 1951 |
| *Rubus spectabilis*<br>Salmonberry | Swan 1857; Brown 1868; Gibbs 1877; Eells 1889; Smith 1940;<br>Gunther 1945; Suttles 1951; Elmendorf 1974 |
| *Rumex* spp.<br>Dock | Swan 1857; Gunther 1945; Suttles 1951 |
| *Sagittaria latifolia*<br>Wappato, Indian potato | Swan 1857; Brown 1868; Gibbs 1877; Smith 1940;<br>Suttles 1951; Elmendorf 1974 |
| *Sambucus* spp.<br>Elderberry | Eells 1889; Smith 1940; Gunther 1945; Suttles 1951;<br>Elmendorf 1974 |
| *Shephardia canadensis*<br>Soapberry | Gunther 1945; Suttles 1951 |

Table 5 (Plant species, continued)

| SPECIES | AUTHOR/DATE |
|---|---|
| *Typha latifolia*<br>Cat-tail, bullrush | Swan 1857; Smith 1940; Gunther 1945 |
| *Vaccinium oxycoccus*<br>Cranberry | Eells 1889; Smith 1940; Gunther 1945; Richardson 1974 |
| *Vaccinium* spp.<br>Huckleberry, blueberry | Swan 1857; Brown 1868; Gibbs 1877; Eells 1889; Smith 1940; Gunther 1945; Suttles 1951; Elmendorf 1974 |

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# LOSS, TRANSFER, AND REINTRODUCTION IN THE USE OF WILD PLANT FOODS IN THE UPPER SKAGIT VALLEY[1]

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Abstract

In the process of assimilation and replacement of the Upper Skagit Indians by Euroamerican settlers, the use of many wild plant foods continued whereas others ended. Acceptance or rejection was correlated with whether the settlers were previously familiar with specific plants in their places of origin, patterns of the sexual division of labor, family structure, settlement patterns, ethnocentrism, food color and taste preferences, size and shape of the parts of the plant used as food in relation to concepts of economic value and even agricultural tool technology. Other factors include patterns of international trade and politics, logging practice, and ecological changes in the Upper Skagit Valley. Since 1950 scientific (ethnographic) and popular publications on "native" wild foods have led to a resurgence in interest and use of many wild plant foods in the river valley.

During the past four centuries, hundreds of small-scale societies have become assimilated in varying degrees by expanding European, Asiatic, or African peoples. As a result, vast amounts of empirical knowledge about plant usage which has been amassed over generations have been lost to the indigenous groups, expanding populations, and modern science. In an unfortunately overlooked paper published in 1966, A. P. Moody examined and analyzed some of the consequences of this lost knowledge. In light of Moody's comments, this paper will examine some specific aspects concerning the loss, transfer, and rediscovery of wild food plant knowledge in the Upper Skagit River Valley in the Cascade Mountains on the Pacific Northwest Coast of North America. During the past 150 years, the Upper Skagit Indians have been replaced by American pioneers and European immigrants over most of the valley. The few remaining Upper Skagit Indians are highly acculturated and have become increasingly assimilated into the local white culture. The local Indian Shaker Church with its mixture of Christian and Northwest Coast Indian beliefs and practices has been very important both in preserving a sense of ethnic identity and older customs, especially foodways, and in helping the Upper Skagit adapt to American culture.

Within this framework of ethnic succession the following questions will be examined.

1. Which uses of wild plant food were transferred and which were not transferred to the new peoples?

2. How has the cultural background of the incoming peoples influenced the selection process?

3. What have been the effects of technological and ecological changes brought about by the new peoples?

4. What was the impact of international economic and political forces on indigenous dietary habits?

5. What has been the recent effects of literacy, ethnographic research, modern food faddism, and affluence on local wild plant usage?

*Background*

The North Pacific Coast of North America was and still remains an ecological zone with an abundance of maritime, land-based, and riverine floral and faunal resources found on offshore islands, inlets, coasts, and mountains. In the past, the land was covered by dense, conifer-dominated forests, especially of western red cedar, Douglas fir, spruce, and hemlock. The warm Japanese current, heavy rainfall (1 m-2 m+), and the mild humid summers and winters helped maintain a dense, jungle-like undergrowth of alder, maple, willow, hazel, and other bushes, berries and herbaceous plants, e.g., nettles up to 2-3 m high near streams.[2]

The aboriginal peoples who lived in permanent villages of houses made of split cedar planks had relatively affluent economies that were primarily based upon the salmon which were caught, smoked, and dried for winter consumption. In addition halibut, cod, herring, shellfish, trout, smelt, deer, elk, bear, waterfowl, and even seals and whales were utilized for food. Although plant foods played a secondary role; berries, roots, bulbs, and greens were extensively eaten both fresh and preserved for winter use. Winter life centered around a complex system of religious and secular ceremonial activities.

Specifically, the Skagit River Valley is located east of Puget Sound about 90 miles (145 km) north of the present-day city of Seattle, and 30 miles (50 km) south of the Canadian border. Because of the mountains, the narrow upper valley has a much higher annual rainfall and slightly more severe winters than the lower valley. The Salishan-speaking Upper Skagit Indians consisted of a series of autonomous kin-linked riverside villages, usually located near age-old salmon fishing sites. Though primarily Northwest Coast in culture, the Upper Skagit shared many traits with the Plateau Indians to the east of the Cascade Mountains, e.g., religious practices, little warfare, a more egalitarian social order, and skin clothing, as well as a greater dependence upon hunting and wild plant foods. Much of this was the result of intermarriage, visiting, and trade with the Plateau peoples.

Euroamerican contact and progressive incorporation into a world-wide network of capitalistic enterprise came from three directions: the Russians after the 1730s by way of Alaska; the French, English, Spanish, and Americans by sea after the 1770s; and the American and Anglo-Canadian fur traders by land after 1800. Between 1785 and 1825, over 300 ships are known to have traded along the coastal waters for furs, fish, and other commodities. The trading post as the local center of this new "colonialist network" forced these peoples into an ever expanding system of industrial capitalism which in turn had a definite impact upon their dietary patterns.

Trade near the northern Puget Sound was sporadic until the establishment of Fort Langley on the lower Fraser River in 1827. By the 1840s, Catholic and Protestant missionaries began proselytizing among the Lower Skagit Indians. In 1859 the first pioneers had settled on the Skagit River delta; by 1867, the middle valley; and in the 1880s and 1890s, the upper valley (Collins 1974a:38). During the early decades, most travel up the river was by Indian dugout canoes; later by paddle-wheel steamers, a wagon road, then a railroad and, eventually, by modern surfaced highways.

A knowledge of the regional and ethnic backgrounds of the various waves of settlers is crucial to understanding both the continuities and discontinuities in the changing patterns of wild food plant usage. The earliest settlers were farmers primarily from the New England and Middle Atlantic states via temporary settlements in the American Midwest. This was followed by an influx of people from the hill country of the Carolinas who came as loggers, sawmill workers, and subsistence patch farmers. At the same time, there was a heavy flow of Swedish and Norwegian immigrants into the entire valley. The last population influx included people from Italy, the British Isles, Germany, Greece, and other parts of the United States.

*Traditional Plant Usage*

The gathering and processing of wild plant foods among the Upper Skagit were done primarily by the women and children. Men focused on the higher status and more economically important fishing and hunting. The abundance of food plant resources near the villages enabled the women to easily exploit these. The only exceptions were the late summer "expeditions" to the upland meadows for blueberries. On these occasions, the men would accompany the women and build the temporary shelters and roofed-over drying racks for berries, hunt, and sometimes even help pick blueberries. As they were in small isolated kin groups and away from the village, men could participate without criticism in what would normally be regarded as women's work (Collins 1974a:75).

The basic pattern for berry picking in upland meadows in the late autumn is consistent with those reported elsewhere, especially by Turner along the Northwest Coast. McClellan adds further depth in her discussion for the Inland Tlingit where she notes that this was a time when women were freed from home responsibilities, and thoroughly enjoyed these trips to the uplands. The men picked berries only if they had nothing else to do (McClellan 1975:199-200). Many scholars have commented on the depth of the women's knowledge on food and medicinal plant resources compared to the lack among the men (Teit 1930:453; Suttles 1974; Turner 1974, 1975, 1978, 1979; People of 'Ksan 1980:77-85).

A few years ago in the Time-Life cookbook on the Pacific Northwest, the author, a native of New York, referred to the present-day Pacific Northwest Coast as "... a berry-picker's Eden" (Brown 1970:173). Berries grow in abundance from Oregon north into Alaska during the summer and early autumn months.

Certain species of wild berries (Table 1) were of major importance because of their abundance, flavor, and storability. These were the serviceberry (*Amelanchier florida*), the so-called Oregon grape (*Berberis aquifolium* and *B. nervosa*), salal (*Gaultheria shallon*), wild blackberry or dewberry (*Rubus macropetalus*), wild strawberries (*Fragaria sps.*), blackcap (*Rubus leucodermis*), blue elderberry (*Sambucus glauca*), red elderberry (*Sambucus callicarpa*), and the mountain blueberry (*Vaccinium membranaceum*). The serviceberry was utilized more extensively and was more highly favored among the Upper Skagit than the Lower Skagit because of its greater abundance. All species in this group were both eaten fresh and gathered in quantity by the women and children who because of the abundance of these berries rarely had to travel very far from their home villages. The berries were carried in baskets (with a tumpline on the forehead) back to the village where they were pulped, dried, and stored in cakes for winter use. Pacific crabapples (*Pyrus diversifolia*) were harvested in the late summer, stored with the stems still attached and slowly ripened before being eaten.

## Table 1

### BERRIES AND FRUITS

| BOTANICAL NAME | COMMON NAME | SKAGIT INDIAN USE | SETTLERS' USE | RECENT USE |
|---|---|---|---|---|
| *Amelanchier florida* | Serviceberry | Eaten fresh or mashed and dried for winter | Eaten fresh, occasionally home canned, and for jam and jelly | Eaten fresh, jellies, jams |
| *Berberis nervosa* and *aquifolium* | Oregon grape | Eaten raw or mashed | Jam, jelly, or occasionally homemade wine | Jam, jelly, or homemade wine |
| *Fragaria* sps. | Wild strawberry | Eaten fresh or pulped and dried for winter | Eaten fresh, jam, jelly. Rarely used after 1940 | Occasionally eaten fresh where found |
| *Gaultheria shallon* | Salal | Pulped and dried for winter use and eaten fresh. Leaves for convalescent tea | Eaten fresh. Occasionally for jelly | Eaten fresh. Occasionally for jelly |
| *Osmaronia cerasiformis* | Squaw prune, Indian plum | Eaten fresh where found | Occasionally eaten fresh when found, especially by children. Excesses avoided because of bitter flavor and laxative properties | Very rarely eaten even by children |
| *Pyrus diversifolia* | Wild crabapple | Harvested in bunches in late summer. Ripened in storage and then eaten | Not eaten--too sour. Wood for fuel or tool handles | Not used |
| *Ribes lacustre* | Swamp currant | Bark boiled for tea for women during childbirth. Berries occasionally eaten fresh | Rarely eaten | Rarely eaten |
| *Ribes divaricatum* | Wild gooseberry | Berries eaten fresh--never stored. Roots boiled for sore throats | Occasionally eaten fresh | Rarely eaten fresh, sour taste disliked |
| *Ribes laxifolium* | Trailing currant | Berries eaten fresh, bark boiled for cold medicine (post contact?) | Not used | Not used |
| *Ribes sanguineum* | Red-flowering currant | Berries eaten fresh but not well liked | Not eaten | Not eaten |
| *Rubus leucodermis* | Blackcap | Berries eaten fresh or pulped and dried for winter | Berries eaten fresh or canned for winter. Jam and jelly, commonly mixed with wild blackberries | Frozen for winter, jam, jelly--mixed with wild blackberries |
| *Rubus macropetalus* | Wild blackberry | Berries eaten fresh or pulped and dried for winter. Leaves for tea for stomach troubles | Berries eaten fresh, canned, or made into jam or jelly. By 1930 began to be a major cash "crop" for bakeries, syrup, and jelly. Also frozen by commercial companies | A "cash" crop for jellies, jams, pies, ice cream. Also frozen for home use |
| *Rubus parviflorus* | Thimbleberry | Berries only eaten fresh; tender shoots peeled and eaten in spring and early summer | Eaten fresh where found; children occasionally peeled and ate green shoots. Some jelly--rare | Eaten fresh. Jelly and jam. Home "gourmet" syrup on rare occasions |
| *Rubus spectabilis* | Salmonberry | Berries eaten fresh only; green sprouts peeled and eaten or cooked in earth oven | Berries eaten fresh where found or sugared for dessert | Special home jelly. Eaten fresh from bushes or sugared as a dessert |
| *Sambucus callicarpa* | Red elderberry | Berries steamed, pulped, and dried for winter | Not eaten. Believed to be "poisonous" | Jelly by an occasional individual |
| *Sambucus glauca* | Blue elderberry | Berries steamed, pulped, and dried for winter | Berries for jelly (usually as a substitute for concord grape jelly). Berries for wine occasionally. Bushes often left in fields | Jelly, occasionally wine from berries and the flowers |
| *Smilacina racemosa* | False Solomon's seal | Berries occasionally eaten | Not eaten, believed to be poison | Not eaten, believed to be poison |
| *Vaccinium membranaceun* | Mountain blueberry | Berries pulped, dried, and stored for winter. Eaten fresh | Eaten fresh when in mountains. Rarely canned | Displaced by larger cultivated blueberries. Only eaten by lovers of native food, bikers, and hunters |
| *Vaccinium parvifolium* | Red huckleberry | Berries eaten fresh. Boil bark for tea for colds (post contact?) | Berries eaten fresh | Berries eaten fresh. Increasingly used for home jelly |

A second group were those berries which, though existing in abundance, were for various reasons only eaten fresh. These included the thimbleberry (*Rubus parviflorus*), the salmonberry (*Rubus spectabilis*), and the red huckleberry (*Vaccinium parvifolium*). Both the salmonberry and thimbleberry were considered too soft to dry. The thimbleberry was also regarded as too thin and light especially when dried--it simply took too much time to pick enough of them compared to other berries. Red huckleberries tend to be more thinly distributed than other berries, and grow on rotten logs in heavy conifer forests away from where other berry bushes are concentrated. In terms of time and effort, it was far more advantageous to concentrate on other species. In addition, the tender spring and early summer shoots of the blackcap, salmonberry, and thimbleberry were either peeled and eaten fresh as we eat celery or steamed in an earth oven and eaten with smoke-dried salmon.

A third group were those which were only eaten fresh on sporadic occasions. These included the red-flowering currant (*Ribes sanguineum*) which was not well liked. According to Turner (1975:81), the British Columbia Salish said it tasted insipid. The common gooseberry (*Ribes divaricatum*) was enjoyed but only occasionally eaten because it was not found in abundance. The trailing currant (*Ribes laxifolium*), swamp currant (*Ribes lacustre*), and the berries on the herbaceous perennial, the false Solomon's Seal (*Smilacina racemosa*), were only occasionally eaten. The fruit of the squaw prune or Indian plum (*Osmaronia cerasiformis*), which tended to be bitter and "puckering" if not fully ripe, was only eaten "on the spot" when a bush with fully ripe fruit was encountered. That it was eaten at all was attributed to the fact that it bloomed early in the spring and its fruit ripened long before any wild berries were available.

The bulbs and roots of several plants were important food sources and, following Turner (1975:81), the Skagit techniques of harvesting and plant maintenance can legitimately be discussed as "semi-agricultural." Throughout the entire Skagit Valley, as was true for other coastal regions, there were a series of so-called "prairies" which were periodically burned-over to remove brush and trees, and to encourage the growth and regeneration of economically useful plants such as blackberries and blackcaps as well as the following roots and bulbs: camas (*Camassia quamash*), wild carrots (*Perideridia gairdneri*), and the wild tiger lily (*Lilium columbianum*) (Table 2). As the women dug these roots and bulbs in the prairies with sharpened digging sticks, they also intentionally loosened the soil, removed unwanted plants or "weeds," and replanted the bulbs and roots that they regarded as too immature for food. Each one- to three-acre plot, which was marked at the corners by stakes, was individually owned by a woman and inherited by her daughters even if they married into another village.

There were some variations in harvesting and processing techniques. Camas (with its blue flowers) was dug at the time of blooming because of the danger of confusing it with the deadly death camas (*Zigadenus venenosus*) which had white blossoms. Tiger lilies were marked in the early summer and dug after the stalks had died down. All were dried and stored (Collins 1974a:55). The rhizomes of the bracken fern (*Pteridium aquilinum*) were also used as food. Only those rhizomes that "oozed juice" were roasted, peeled, and eaten. It is not known if the Upper Skagit stored the baked rhizomes as did the Swinomish who lived at the mouth of the Skagit River (Gunther 1945:14).

For the nearby Salishan peoples of southern British Columbia, Turner has provided additional details. She has noted that the plots were cleared of weeds, stones, and brush by controlled burning and the sod was "lifted" with digging sticks to obtain the larger bulbs. Then the smaller bulbs and the sod were replaced. Up to a hundred pounds of bulbs might be steamed at one time in an earth oven, and red alder bark was added to give the camas a reddish color. Tiger lily bulbs were steamed and eaten, bracken fern rhizomes were dug in

Table 2

## ROOTS AND RHIZOMES

| BOTANICAL NAME | COMMON NAME(S) | INDIAN USE | SETTLER'S USE | POST 1960 USE |
|---|---|---|---|---|
| *Camassia quamash* | Camas | Bulb steamed in earth oven and eaten | No use | No use |
| *Lilium columbianum* | Wild tiger lily | Bulb baked or steamed in earth oven and eaten | No use as food. Occasionally transplanted into home flower gardens | No use as food. Occasionally transplanted into flower gardens as an ornamental |
| *Perideridia gairdneri* | Wild carrot, wild carraway, or spring gold | Dug in August. Steamed in earth oven | Never used | Never used |
| *Pteridium aquilinum* | Bracken fern | Roots roasted in ashes, peeled | "Fiddle heads" occasionally eaten in spring by Italian immigrants (asparagus substitute) | Not used, except by occasional individuals |

the late fall and winter, and plots of perennial clover (*Trifolium wormskjoldii*) were cared for in the same manner as those of camas. The rhizomes were dried, stored, and usually baked in the winter.

The techniques involved in the maintenance and utilization of the plots of bulbs on these man-made prairies clearly fall into the basic patterns of agricultural origins by vegetative reproduction as advanced by Carl Sauer, Edgar Anderson, and more recently Jack Harlan. The Skagit Valley, as was true for other areas of the Northwest Coast, was an area of marked diversity of plants and animals; it was wooded; there were certain preadaptive plant gathering skills that seemingly were leading the native peoples into agriculture; and the concept of a "weed" was present. What we do not know, because of events that occurred during the pioneering period, is whether there was hybridization in these disturbed habitats that was leading to increased genetic variation and recombination. Was an independent center for plant domestication evolving here before the arrival of the pioneers (Sauer 1952; Anderson 1954; Harlan 1975:46-48)?

A number of other wild plants are known to have been utilized for food and food preparation (Table 3). Hazelnuts (*Corylus californica*) were cracked and eaten fresh but it is not known if they were stored for winter. Miner's lettuce (*Claytonia sibirica*) was occasionally steamed and eaten although its main use was as a spring tonic or for sore throats. Wild rose (*Rosa nutkana*) hips were minced with dried salmon eggs and a tea was made with the leaves. The tender shoots of the scouring rush (*Equisetum* sp.) were eaten and the tough fibers spat out. The leaves of the broad leaf maple (*Acer macrophyllum*) were used to cover food as it cooked in earth ovens. The black tree lichen (*Bryoria fremontii*), which commonly grows on pine and Douglas fir trees at higher elevations, was gathered in the late summer and steamed into cakes in earth ovens. This usage, which was absent among other nearby coastal peoples, appears to be another example of Plateau influence brought about by marriage into Upper Skagit families (Collins 1974a:55-56; Turner, Bouchard, and Kennedy 1980:10-11; Theodoratus n.d. a, n.d. b). The Upper Skagit, like other coastal peoples, did not utilize mushrooms for food.[3]

*Initial Contact Period*

Even before the settlers began to arrive in the 1850s, European and American influences began to change the social and dietary patterns of the Skagit. As soon as the trading posts and regular ship stops were established, the traditional annual cycle of economic activities began to be disrupted by the need to obtain fur pelts and the desire to be near the new trading posts. Many traditional foods were abandoned in favor of those from the traders, and fewer individuals remained in the villages when many wild foods had to be gathered. Epidemics of introduced diseases such as smallpox, measles, influenza, and venereal diseases depopulated entire villages. All these factors help explain the sketchiness of our data for pre-European foods as well as questioning the time-honored concept of the "ethnographic present."

Metal kettles and frying pans were introduced, and older cooking techniques such as the earth oven and stone boiling in baskets were rapidly abandoned. Probably the most important event in this period was the introduction of the white potato. Its diffusion among the local Indians was the result of an agreement in the early 1830s between the British Hudson's Bay Company and the Russian American Fur Company in Alaska. The former agreed to supply potatoes and other foods to the Russian posts in Alaska in exchange for the exclusive right of the British to trade over what is now British Columbia.

# Table 3

## OTHER FOOD PLANTS

| BOTANICAL NAME | COMMON NAME | SKAGIT INDIAN USE | SETTLERS' USE | RECENT USE |
|---|---|---|---|---|
| *Acer macrophyllum* | Broad leaf maple | Leaves to cover food cooking in pits | Firewood | Firewood |
| *Alnus rubra* | Alder | Sap used as food. Wood as fuel for smoking salmon, canned food dishes, spoons, and platters | Firewood | Firewood, furniture making |
| *Arctostaphylos uva-ursi* | Kinnikinnick | Tobacco substitute | Occasionally smoked by children as "Indian tobacco" | Never used |
| *Equisetum sp.* | Horse tail/scouring rush | Tender shoots eaten, fiber spit out | Occasionally to polish finger nails | No use |
| *Bryoria fremontii* | Black tree lichen | Cooked in earth oven and eaten or cooked and stored for later use | Not used | No use |
| *Claytonia sibirica* | Miner's lettuce, spring beauty | Tea, general tonic for sore throat | Leaves and flowers boiled and eaten as "spinach" in the spring | As "spinach" occasionally |
| *Corylus californica* | Hazelnut | Eat nuts as fresh food or stored for winter | Eaten fresh but declining use after filbert trees became available from nurseries | Rarely eaten except by hikers |
| *Morchello esculenta* | Morel mushroom | Never eaten | Commonly eaten; until recently the only wild mushroom eaten | Increasingly eaten |
| *Rosa nutkana* | Wild rose | Rose hips mixed with dried salmon eggs to enhance flavor. Tea from leaves. Boil roots with sugar for sore throat | Rose hips for tea and | Hips for herb teas medicine. Petals for rose petal beads |
| *Polypodium vulgare* | Licorice fern | Medicinal: demulcent, laxative, expectorant | Rhizomes occasionally eaten by children | Rhizomes occasionally eaten by children |
| *Rhamnus purshiana* | Cascara | Medicinal: bark boiled for a laxative | Laxative. Berries occasionally eaten by children but in moderation because of laxative effect. Commercial crop | Bark as a source of cash income |
| *Urtica lyallii* | Nettle | Tender shoots cooked and eaten. Fiber in mature shoots used for cordage | Not used | Not used |

Potatoes were sent to the Hudson's Bay Company posts in the Puget Sound and to Fort Langley along the Lower Fraser River near what is now Vancouver, British Columbia. There the Indian wives of the company employees were encouraged to plant, tend, and harvest potatoes to fulfill this agreement (Suttles 1951; Wolf 1982:385-386). These women soon began giving gifts of potatoes to their relatives in distant villages along with information on planting and caring for them. The Skagit received their first potatoes from the Nooksak Indians who lived between them and the Fraser River.

When the first missionaries arrived in 1840, they noted that the Skagit and Swinomish were growing potatoes on the prairies where they also harvested and cared for wild bulbs. When the first settlers arrived in the 1850s, they noted that the Indians were cultivating potatoes and garden peas on both the prairies and small garden plots near their houses. Metal shovels and hoes and later horse drawn plows were obtained from the whites and replaced the digging sticks (Suttles 1951:275-276, 280, 283; Collins 1974a:38).

From the Indian viewpoint, a major advantage of potatoes was that, once they were planted, they required very little care thus enabling each family to fish, hunt, and work elsewhere, and in the autumn, return to harvest the potatoes. An excellent example of this in a modern setting is found among the Gitksan in northern British Columbia (People of 'Ksan 1980:99-100).

*Early Settlement and Its Impact on Indian Foods*

The early decades of pioneer settlement had several major consequences on the utilization of the wild food plants among the Indians. The settlers only possessed such hand tools as axes, saws, mattocks, hoes, and shovels to clear the heavily forested land for cultivation. Their initial response was to settle or homestead the natural "prairies" that the Indians maintained, by periodic burnings, for growing roots and berries. Once these prairies had been homesteaded and the land plowed, the natural stands of roots and bulbs were destroyed along with the Indians' plots of potatoes. Those not destroyed by cultivation were decimated by the settlers' cows and pigs (Suttles 1951:280, 1974:59).

Other major factors were the pioneers' legal traditions of land as private property as well as their concepts of theft and trespassing. For the Indians, land was "owned" by the community except for those plots of bulbs and roots to which specific individuals and families inherited rights of usage. Others were free to gather plants or hunt on these plots of land. To the settlers, once you owned or registered your claim to a specific plot of land, you had exclusive rights to it, including movement or travel over it unless specific permission was granted to others.

The Point Elliot treaty in 1855 whereby most Puget Sound Indians ceded their lands to the United States in exchange for reservation lands or specific family allotments, and some vaguely worded hunting and fishing rights, furthered this development. Thereafter, any Indian attempting to obtain wild plant foods on a settler's land was guilty of trespassing and could be evicted and/or jailed, thus effectively ending aboriginal use of many wild plant foods. A few Upper Skagit Indians evaded this by not signing the treaty, and moving to headwater streams where the gravelly soils were of no value to the settlers (Suttles 1951:280; Collins 1974a:32, 1974b:188).

The impact on berrying was somewhat different. The loss of the prairies was more than adequately compensated for by the continually expanding logging activities along the river. After the timber was removed, the debris was burned in order to reduce the hazards of forest fires. Within a few years such burned over areas would produce vast amounts of wild blackberries, blackcaps, etc. This process still continues on mountain slopes.

The restriction of many Indians to reservation lands hindered access to areas rich in wild plant foods, but with the advent of roads, wagons, and, finally, the automobile, they gained renewed access. Also the road and railroad clearings as well as land clearance for farming actually increased the amount of wild berry bushes and vines throughout the upper valley.

White dietary practices also made a major impact on the Upper Skagit Indians who remained. They increasingly took over gardening, especially growing maize, potatoes, carrots, peas, beans, squash, pumpkins, and other vegetables. Most also kept a few chickens and at least one milch cow which led to a minimal amount of haying. During the summer months many became itinerant harvest workers for white farmers throughout the Pacific Northwest. The frying pan, coffee pot, griddle, and kettle became central to their changing diet, e.g., for breakfast, pancakes, fried potatoes and eggs, bacon, coffee, and home canned fruit, and for dinner fried steaks, boiled potatoes, baking powder biscuits (bannocks), coffee, and cake or fruit pies (Collins 1974a:237). Wild blackberries were gathered and canned. Other new fruits such as cherries, apples (as applesauce), cultivated strawberries, plums, pears, peaches, and apricots were also canned in a sugar syrup. The latter two fruits were usually obtained when the Indians were employed as itinerant fruit harvesters in eastern Washington, as peaches and apricots do not grow well in the cool damp climate west of the Cascade Mountains.

*The Emergence of the Folk Pattern*

By the 1900s when large scale homesteading and settlement was in process on the Upper Skagit River, the Indians had long been removed from much of the river valley. Only a small community near the town of Concrete and the few scattered families along the streams in the upper headwaters remained. Interaction with the homesteaders primarily occurred in the late summer and autumn along the river during the salmon fishing and blackberry picking seasons. Before roads were built the flow of inter-ethnic knowledge was facilitated through Indians who transported merchandise in dugout canoes to the upper valley settlers, and by women bartering baskets and smoked salmon. Once the white population became large and the roadways and railroads were built, contact and knowledge flow were reduced even further so that eventually food plant lore was transmitted primarily through inter-ethnic children's' play groups in the neighborhoods where Indians still remained, by Indian men working in mixed ethnic logging crews, or by elderly Indian women aiding settlers in times of illness or personal difficulties.

The pattern of wild plant usage that developed among the early settlers was conditioned by the life styles in their places of origin, attitudes towards American Indians, goals in the new land, settlement patterns, and ecological factors, as well as federal, territorial, and, after 1889, state laws and policies. To these we may also add the impact of commercial logging and salmon fishing and their imported technologies.

In the valley the settlers found many economically useful plants which were either identical or similar to those which they were familiar with in rural New England, the Middle Atlantic states, or the Midwest. The most important and plentiful were the various wild berries such as the blackberry or dewberry, strawberries, blueberries, and huckleberries; abundance of these was furthered by both land clearing activities on the individual homesteads as well as commercial logging activities. Commonly, Indians as well as whites picked berries in the same burned over logged areas.

There were changes in the realm of technology, processing, and eating patterns. The whites introduced the metal bucket with a wire bail which in time even the Indians completely took over. Very commonly these were merely metal lard containers, pipe tobacco cans, or large coffee cans with a hole punched on each side and a copper or soft iron wire bail at the top which was attached to one's belt, through one's overall strap, or by a cord or rope around the picker's neck or waist--thus freeing both hands for picking. Such makeshift pails persisted through the 1930s. Pulping and drying were not taken over by the settlers in that they utilized drying only for tree fruits (apples, pears, and plums) once their orchards began to bear. Also they had no tradition of pulping fruits prior to drying.

For berries, before mason jars were common, a rudimentary form of home canning was practiced on a limited scale--old or empty whiskey or other similar bottles were cleaned out and the washed berries were stuffed down the necks. These were then heated in boiling water and capped or plugged for a vacuum seal and stored in a cool room or "root cellar" until winter. To open this type of container, the person merely struck a sharp heavy blow at the base of the bottle neck, broke it off, emptied the contents in a bowl, and discarded the bottle. There was always a ready supply of bottles from the early saloons as the lumbermen and sawmill workers were heavy drinkers. Some care had to be taken as there was an ever present danger of glass splinters in the food.

By the 1890s only commercially made glass mason jars were used. By this time most settlers had apple, pear, cherry, plum, quince, and even apricot trees as well as strawberry and rhubarb patches. Sugared canned fruit became a standard dessert or dish for meals. Also jams and jellies in small jars sealed with wax were utilized by everyone. Apart from blackberries, blackcaps, huckleberries, and wild strawberries, other wild berries and fruits, especially those that were new to the settlers, were only utilized sporadically in season, and some not at all.

Apart from berries only minimal and/or sporadic utilization of other types of wild food plants was transmitted to the settlers. Wild roots and bulbs were never utilized. Not only were the prairies gone, where they had been most abundant, but the more productive potato thrived in this climate and was grown as soon as clearings could be plowed or spaded. Wild roots and bulbs were rarely if ever used in the settlers' places of origin. As the Indian women used wooden digging sticks, these roots could be worked loose and picked up with little or no damage to the roots, many of which grew in a spreading pattern. However, the settlers primarily used steel shovels and grubbing hoes with sharpened cutting edges that would slice through and chop up the roots. As the settlers' cultivated root crops were compact or grew straight down, there was minimal or no damage when dug. Also the settlers considered the wild roots so small as to be useless and a waste of time to utilize. Finally it simply took too much time to wash and separate the soil from the roots of the small multi-rooted plants, and they could not be peeled.

With the exception of miner's lettuce or spring beauty (*Claytonia sibirica*) which was gathered in the spring, boiled, and eaten as "spinach," very few wild greens were ever used. This plant was similarly utilized in many other rural regions in the United States. The "fiddle heads" of the bracken fern (*Pteridium aquilinum*) were gathered, boiled, and eaten in the late spring--a practice that was common among Italian immigrants there into the 1930s. Occasionally children who played with Indian children, or white fishermen and loggers who were close friends of individual Indian men, learned to peel and eat the tender shoots of the salmonberry and thimbleberry in the spring. Very few children born after 1940 even know these can be eaten.

A few other miscellaneous plants were used as food. If the red squirrels and blue jays did not get them first, wild hazelnuts were gathered and eaten. The roots of the wild licorice fern were occasionally eaten by small boys while playing in the woods. As often as not this was as a reciprocal challenge since it has a bitter taste--a flavor generally disliked by white Americans.

Certain aspects of the value system, social organization, and the new social environment were instrumental in either causing transference or an end to specific wild plant usages in the Skagit Valley during the pioneer era. Already noted was a different set of values in regard to size of plant foods and economic worth. For whites, this was based on a comparison with their larger garden vegetables. If the edible part of a wild plant was smaller than this standard, its desirability diminished in accordance to the degree of smallness. Thus many plants were never even considered worth gathering and using.

For many, the use of or non-use of many wild plant foods was functionally related to certain patterns of social organization and the associated value system. Usually the pioneer settlement pattern consisted of scattered and partially isolated individual nuclear family households as opposed to the small villages of extended kin of the Upper Skagit Indians. The Indian woman always had a support group of affinal and consanguineal female kin, which enabled her to "get away" from the household to participate in other social, religious, and economic activities, whereas the isolated individualistic pioneer woman was, in effect, tied down to the drudgery of the home: cooking, washing, cleaning, child and infant care, and sewing, as well as "guarding" the material goods and equipment in the house. Even if she wished to leave and gather wild food plants, she could not abandon the house or leave her chores undone. It was only after more families arrived, and homes were closer together, that women were able to form cooperative support groups and be freed from "household bondage," but by that time the Indians were rarely present, and little could be learned and transferred across cultural boundaries.

Sexual division of labor and ethnic attitudes also helped restrict the use of wild plants. In American frontier history the gathering of wild greens and medicinals, unless they had a definite commercial value, was usually done by the women in groups (Wyss 1973:79). In the Skagit Valley the men in general did not participate in gathering greens for the kitchen, and women only could if they were found near the house. As there was little contact with Indian women, this knowledge on the local level also died. In addition, there were factors of ethnocentrism. The common derogatory term or label for western Washington Indians was *Siwash* from the French *sauvage* or "savage." For many whites, any activity, especially those of Indian women, fell into this category and was to be avoided if a person valued his or her reputation. Hence one avoided most *Siwash* foods, or "living like a *Siwash*," or even associating too closely with *Siwashes*. Many potentially useful and nutritious foods and even aspects of technology passed away for fear of this label.

Another factor for many plants dropping out of usage was a fear that they were poison--especially if they were different or new to the pioneers. Psychologically, any incident when someone became ill from eating a specific new berry, root, or shoot, or if anyone believed it to be poison, was enough to convince everyone hearing about it to refuse to eat the food. This attitude was also reinforced if that specific wild plant food had an unpleasant taste. An example was the red elderberry (*Sambucus racemosa*). The Upper Skagit and all other Salish peoples ate them but somehow the early pioneers, who prior to their arrival were only familiar with blue elderberries, regarded it as poisonous. Although it grew in abundance, no one would eat them in any form, and even today it is avoided. One writer states that they have a disagreeable flavor (Turner 1974:125) in comparison to blue elderberries, and for this reason some British Columbia tribes do not eat them. Perhaps even more important is that their taste is different from the blue elderberries, and new flavors or even colors of a familiar food are commonly rejected (Gibbons 1962:5-6). One writer recently has stated that the raw berries of the red elderberry are toxic (Dawson, Landsburg, and Riggs 1975:Card 17), and Turner states that the Kwakiutl Indians of British Columbia would only eat the cooked and dried cakes of red elderberries at noon. If eaten in the morning, they would give one a stomach ache (Turner 1974:126). The seeds of the yellow pond lily (*Nuphor polysepalum*) were not eaten; neither were snowberries (*Symphoricarpos albus*). The Skagit regarded them as poisonous although other coastal Indian groups ate them (Turner 1975:241). The tender spring shoots of the nettle (*Urtica lyallii*) were never used by whites seemingly because any plant which caused pain was useless. It is still regarded as an obnoxious and painful weed.

By the early twentieth century when the next two waves of settlers, the Scandinavians and the people from the Carolina hills arrived, the folk pattern of wild plant usage was established. These groups accepted the ways of the earlier settlers and avoided any that might be stigmatized as *Siwash*. The importance of wild berries in the homelands of both groups reinforced the local pattern in the valley. There was some gathering of spring greens by the Carolinians, but primarily those known in or similar to those in Southern Appalachia. Roots and bulbs were ignored as there is no strong traditional use of these in both homeland regions (Wyss 1973; Wigginton 1973, 1975).

By the 1920s some plants were introduced as weeds, or escaped from cultivation and became important sources of food or cash income. One was the dandelion, which remained important as a spring green up to and through the Great Depression years of the 1930s. For Italian immigrants it was a spring staple. Growing affluence after 1940 reduced dandelion greens from the role of a necessity, and its use rapidly declined even among Italian Americans. Two varieties of cultivated blackberry, the Evergreen and the Himalaya, were planted extensively along barbwire fences between and on individual farms. Eventually they escaped from cultivation, and increasingly were found in the edges of fields, clearings, and roadways to the extent that they created almost impassible jungles. In the past, rural families picked and canned large amounts for home use, and made jelly from them. Today they are usually frozen. By the 1930s and 1940s large amounts of these would be picked and sold to agents for local canneries or more recently to freezing plants. These are used for bakery goods, ice cream, jelly, jam, and syrup. Today some caution has to be exerted because bushes along highways and railroad tracks are often sprayed with herbicides. There have been varying opinions as to the preference for one or another of both varieties. Since the Himalaya is sweeter and softer, it was preferred by children as they roamed through fields in the late summer or by families for a fresh dessert. The firmer and sharper flavored Evergreen was preferred by the canneries, and in the home for canning, pies, jams, and jellies.

Apples, and occasionally cherries and plums, have gone feral, thus apples from "wild apple" trees on the public domain or near railroad tracks were and are regarded as belonging to whomever picks and eats them first. They were usually eaten by children while still "green." The end result of this was the inevitable case of diarrhea, or in the local idiom, the "green apple quickstep."

Prior to 1940, any knowledge and utilization of wild food plants that were present had become part of local folk knowledge. Little, if any, of this information existed in print. In the one locally published cookbook issued in 1927, there is only one recipe among the desserts, for "Huckleberry Pie," that could be of New England origin; there are none utilizing wild blackberries or other indigenous plant foods. In this case, the cookbook does not reflect reality on either the rural or town level (Sedro-Woolley Woman's Club 1927).

*Literacy and the Revival of Wild Plant Usages*

In 1945 Professor Erna Gunther, then the Chairman of the Anthropology Department of the University of Washington, published her *Ethnobotany of Western Washington*, a work which was based upon many years of ethnographic field research. Although her data on the Skagit were not as complete as for other groups, they have been supplemented by later work among the Upper Skagit by June Collins (1974a, 1974b), by Wayne Suttles (1970) for the Samish, and by Nancy Turner (1975, 1979) for the closely related Salishan groups in southern British Columbia. Over the years Gunther's work has been reprinted many times, and increasingly has been utilized by regional writers, journalists, nutritionists, and others writing for local newspapers and popular magazines. Also, it is commonly purchased and utilized by individuals interested in local Indian lore or traditions. Through it an increasing amount of knowledge on local Indian plant usage has been reintroduced among people in the Skagit Valley as well as in other localities.

Very few social and cultural anthropologists with the exception of Jack Goody (1968) have ever seriously examined the effects of literacy on a society. Goody has maintained that after literacy and the availability of printed materials, knowledge does not impose itself as forcefully and as uniformly as it does in an oral tradition. With literacy and printed materials, one can pick, choose, and reject knowledge on an individual basis (Goody 1968:28-30, 56, 59-60). This is basically what has happened in the Skagit Valley where most of the focus has been on "dessert" food plants as opposed to other food plants.

More recently there has been a series of other developments that have led to an increased interest in wild plant foods nationally as well as locally. One has been the "faddistic" interest in natural foods, especially those of American Indians, which if eaten will ensure supposedly better health, long life, and a reliance upon nature. There has been an increase in the number of articles and books devoted to this in the Pacific Northwest, and these have led to an increased awareness, and attempts to make use of these foods. This has been reinforced by certain social and economic changes that have taken place in the Upper Skagit Valley during the past generation. Many other industries such as cement production, logging, and farming have declined--a factor that has caused a steady outflow of people who were descendants of the earlier settlers.

On the other hand, an ever-increasing number of retired older people and urbanites have moved into this area either as permanent residents or summer occupants of vacation homes. These individuals have tended to be educationally more sophisticated, and interested in the possibilities of wild plant usage--especially those that can be made into special dishes. They tend to seek these out because of knowledge and choice, and not because of necessity as was the case in the past.

This change here and in and other localities has been reflected in--and stimulated by--a new genre of food-related publications. One example is entitled *Edible Plant Identification Guide* (Dawson, Landsburg, and Riggs 1975) which consists of fifty cards in a folding transparent plastic set of pockets. Each card has a color photograph of a specific wild food plant, and on the back, data as to where it is found, season, how to prepare it, and so on. Many of Nancy Turner's popular ethnobotanical guides for British Columbia fit into this trend. Finally we are seeing the emergence of special cookbooks for Indian foods. An excellent example of this is *Indian Food*, which was published in British Columbia by the Health and Welfare Department, Medical Services Branch, of the Canadian government. Each recipe for a "native food" has been modernized in regard to seasoning and cooking methods. It has been reprinted several times (*Anonymous* 1974). Recently the same agency has issued a set of bar graphs on heavy paper for "native foods." Each graph provides data on that specific food's contribution to the recommended daily intake in percentages for a female teenager as to fat, calories, carbohydrates, protein, calcium, iron, vitamin A, thiamine, riboflavin, niacin, and vitamin C (*Anonymous* 1981-1982). A few copies of this are now present in the Skagit Valley.

## *Conclusions*

In the process of assimilation and replacement of the Upper Skagit Indians by Euroamerican settlers, the use of some wild plant foods continued whereas others ended. One important factor, especially important in the case of wild berries, was whether those specific berries were found and utilized in the homelands of each group of settlers. In other cases acceptance or rejection can be correlated with patterns of the sexual division of labor, family structure, settlement patterns, ethnocentrism, food color and taste preference, size and shape of the parts of the plant used as food in relation to concepts of economic value, and even agricultural tool technology. International trade and politics, as well as logging practices, have influenced or channeled choices, as have the ecological changes associated with land clearance caused by farming and logging. Since 1950, scientific as well as popular publications on "native" and wild plant foods have revived or reintroduced the use of many "native" plant foods among a more urban-intellectually oriented population. This trend in all likelihood will continue, and we will see a greater utilization of native wild plants for food in the future.

## Endnotes

1. These data have been drawn from ethnographies, ethnobotanical studies, local histories, cookbooks, government documents, my own field notes, and my personal experiences from my own early years in the 1930s and 1940s in the Upper Skagit Valley. In those years the elderly people were the original pioneers who arrived in this valley between 1880 and 1910. Much of the credit for editorial work in preparing this paper must be given to my wife Kay Uribe-Theodoratus. This paper was originally presented at the Fifth International Ethnological Food Research conference, 16-20 October 1983, Mátrafured, Hungary.

2. For an excellent analysis of the evolution and ecology of this unique forest region, see Waring and Franklin (1979).

3. The American settlers from New England and the Middle Atlantic states were the first to locally utilize mushrooms as food. Even so, until the 1950s only the morel mushroom (*Morchello esculenta*) was eaten, and many people even then refused to eat it as they believed all mushrooms were "toadstools" and therefore poisonous. Today in the "post pizza era," most people gather and eat the morel as well as an increasing number of other species of local mushrooms.

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# THE ETHNOBOTANICAL IMPERATIVE: A CONSIDERATION OF OBLIGATIONS, IMPLICATIONS, AND METHODOLOGY

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ABSTRACT

The botanical resources of the Pacific Northwest were well understood and thoughtfully managed by Native peoples. These resources provided them with good nutrition, medicine, and material goods. Native peoples' knowledge of the botanical resources has been inadequately and sometimes erroneously reported in the past. Many valuable data have been irretrievably lost. The imperative responsibility for today's researcher is to accurately and adequately record knowledge of botanical resources so that the researcher as well as Native peoples can correctly identify these resources in the field. This paper briefly reviews the ethnobotanical record of the region, corrects a recent error in the record, and outlines field methods which will limit errors in reporting and provide a replicable data base. An important distinction is drawn between recorded data and reported data.

## Background

Plants were the pivotal resources for the Native peoples of the Pacific Northwest, providing them with food, medicine, and material goods. Native peoples perceived as valuable many botanical resources which were overlooked, extirpated, or utilized in a quite different manner by the Euroamericans who entered the region in the nineteenth century. Historians, anthropologists, and other researchers have concentrated primarily on the fishing activities of Pacific Northwest Native peoples, and botanists have largely ignored the aboriginal economic use of Pacific Northwest plants. However, evidence of the importance of these plant resources is replete in the literature of the region. Plants were cultivated, transplanted, and managed through burning and thinning. Rights to these resources were often owned and inherited, and some plots were bounded, marked, cleared, and named (Suttles 1951; French 1965; Calder and Taylor 1968; Turner and Taylor 1972; Collins 1974; White 1976; Norton 1979).

Botanical resources and the knowledge of their properties were the underpinnings of the fishing based portion of the economy of the Pacific Northwest, providing the raw materials for lines, nets, canoes, wiers, and the tools for the capture of faunal resources. All too often these valuable resources have not been accurately or scientifically recorded, with a few notable exceptions (Brown 1868; Gunther 1973; Turner 1973, 1979; Turner and Bell 1971a, 1971b, 1973; Turner, Bouchard and Kennedy 1980).

The plants selected, prepared, and processed for food by the Native peoples supplied them with necessary nutrients not readily available from animal sources. While the nutritional value of these foods has been disregarded or overlooked by the majority of contemporary researchers, analyses show that many of the plant resources would have made valuable and necessary contributions to the diet. Plant foods were indispensable for maintaining healthy, viable populations in the Pacific Northwest; contributing necessary fiber and nutrients to the diet, such as ascorbic acid and iron, which are lacking in the noted staple, salmon (Yanovsky and others 1932; Yanovsky and Kingsbury 1938; Lee and others 1971; Konlande and Robson 1972; Benson and others 1973; Norton 1980; Keeley and others 1981a, 1981b, 1981c).

Knowledge of the properties of indigenous medicinal plants was necessary for the treatment of diseases and injuries. To the casual observer of today, ignorant of Native cultures and accustomed to the dramatic high technology used in current treatments of illnesses such as cancer and heart disease, these remedies often appear crude and ineffective. However, if we examine "modern" medicine as it presented itself at the turn of the century and the first part of this century, we find that many of the remedies used by Native peoples were at least as effective, and often safer, than those then current among Euroamericans.[1] In fact, about 150 indigenous drugs from North America have been official[2] in U.S. medicine at various times since the first edition of *The Pharmacopeia of the United States of America* was published in 1820 (Vogel 1970). Even today in the treatment of several common illnesses, such as colds and influenza, modern U.S. medicine is not much advanced of that traditionally used by Native peoples. Although medicines were (and often still are) closely guarded secrets for religious and economic reasons, many Native consultants have expressed a desire that their medical knowledge be recorded for the benefit of future generations and express interest in the biochemical properties of plants that make them effective (Gill 1980; Turner, Bouchard, and Kennedy 1980). Contemporary researchers must be prepared to collect and record this information both in a scientifically acceptable manner and one which will satisfy the needs of the native peoples who wish to use these medicines.

Besides the above uses, plants were also used for manufacturing the indispensable baskets and boxes used for food storage, the manufacturing of other material items, the construction of dwellings, as sources of dye, for toiletry items and insect repellents, for smoking, and to stupefy fish and deer (Brown 1868; Gunther 1973; Turner 1979; Turner, Bouchard, and Kennedy 1980).

Although a great deal of information on the identity and use of botanical resources can be gained by a through search of the literature and/or interviews with native consultants, much important information concerning these plants has been irretrievably lost, partially through neglect and disinterest on the part of reporters. With renewed and concerned interest by Native peoples in their cultural history it is imperative that the professional record be as free of errors and omissions as possible so that botanical resources can be located and identified in the field. Explicit and inherent in our professional responsibilities to Native peoples is the obligation to " . . . reflect on the foreseeable repercussions of research and publication on the general population being studies" (American Anthropological Association 1971:1). If proper scientific procedures are ignored in the collection and identification of plants used by native peoples then any publications which follow such research will contain errors of fact. It is self evident then that such publications will not only *not* accurately represent the botanical knowledge of the native peoples, but that those errors will represent botanical knowledge which has been "lost." It is imperative that contemporary researchers not misrepresent or mislead native peoples in their search for an accurate understanding of their cultural past. In order to assure adequate and accurate reporting of either historical or contemporary botanical data it is critical that the researcher be properly trained so that recording and reporting errors will be minimized. Ethnobotanical work, like other scientific research, should be replicable, yet failure to follow scientific procedures has produced a number of errors or omissions in the literature which make it difficult or impossible to correctly locate or identify these resources in the field.

The reasons for the lack of attention to adequately describing the botanical resources may partially result from the paucity of such data from archaeological sites. This lack of data may have contributed to the general feeling that botanical resources were insignificant contributions to pre-contact life, both in quantity and quality (Ray 1933; Drucker 1963; Murdock 1967; Suttles 1968; Hunn 1980). Another reason may be that the gathering and preparation of plant material was predominately the work of women, an area not well documented in the anthropological or historical literature. Reasons for inaccuracies in the literature are not easy to understand since scientifically reliable and replicable methods have long been known. However, it is apparent from reviewing the literature that many researchers have not thought it necessary to prepare themselves in botanical methodology before entering the field. A brief review of some of these errors should serve to inform the reader of the pitfalls of inappropriate methodology.

The most common error in the literature concerning botanical resources is the use of an English common name to identify a plant without supplying the correct scientific binomial. These identifications are impossible to verify and must be taken on assumptive trust of the author. Ambiguity of referent and colorful, but inadequate, description are two other errors frequently found in the literature. English common names for plants are generally descriptive terms which may or may not adequately describe some feature of a particular species. It should be noted that they are "common" only to those who use them and are subject to redefinition over time. For example, thimbleberry is the usual English term for *Rufus parviflorus* Nutt. If this term is said to apply to a plant in a particular location and *R.*

parviflorus can indeed be found at that site, then we might assume the author did intend the name thimbleberry to apply to *R. parviflorus*. But what are "partridge-berries," "soap-berries," "crow-berries," shot-berries," "arrowwood-berries," bull-berries," or "wild loganberries"? These all refer to berries used as food by Pacific Northwest peroples, but their referents are now unknown, or worse yet, may ambiguously apply to several species (Gibbs 1877; Curtis 1911; Stubbs 1966; Powell and Woodruff 1976). What is the "artichoke," mentioned only by Curtis, but evidently a food for the Yakima, Kutenai, Wishram, and Chinook (Curtis 1911)? Are Elmendorf and Waterman refereing to the same plant when they write of "bastard fern," "fossil fern," evergreen fern," and "Indian banana"? These plants are all described as growing on logs in damp places in western Washington and having a cluster of edible pods at their base which look like hands placed palm to palm. And what is the food plant that grew in Idaho and had a root as large as a man's forearm (Elmendorf 1960; Stuggs 1966; Waterman n.d.)? or the *x̌ʷa•cx̌ʷac* of the Makah, described only as a "plant similar to celery" (Jacobsen 1979).[3] Collection of specimens and adequate scientific identification would have eliminated any speculation concerning the identify of these plants. As it is, they will remain unknown curiosities in the professional literature.

The failure to collect specimens and identify them scientifically has led to even greater confusion when a number of plants, often from widely separated areas, are lumped under a common English term. Examples found throughout the literature include "fern root," which of course can apply to a number of species, and "Indian celery," which is evidently a term given to plants or plant parts which in some way resemble *Apium graveolens* L. "Licorice-root," "bitter-root," "camas," "couse," "wild rhubarb," "biscuit-root," and "wild onion" may all refer to one or several species depending solely on the training of the researcher. "Wild carrot" has been applied to a number of plants which either had a root or foliage which in some resembled the exotic *Daucus carota* L. Ray (1933) has even identified a "wild carrot" used by the Sanpoil and Nespelem as *D. carota*, while Spier and Sapir (1930) cite two "wild carrots" for the Wishram without identifying the particular species. In western Washington linguistic and ethnohistorical data supported by Turner's field work in British Columbia strongly suggest *Perideridia gairdneri* (H. & A.) Math., or possibly *Lomatium utriculatum* (Nutt.) Coult. & Rose, as the species most likely renamed "wild carrot" after contact.[4] Yet a recent paper, ignoring the ethnohistorical record, names a highly unlikely species as the "wild carrot," *Daucus pusillus* Michx., which Turner has pointed out " . . . is an annual, with only a minute tapprot, [so] it seems unlikely that it was utilized" (Turner 1974:110). Further, upon checking the source quoted we find it suggests *P. gairdneri*, not *D. pusillus*. Fleischer's work reads

> *Daucus pusillus* Michx. (Wild Carrot)
> Carrots were eaten raw or cooked in pits (AB, IC). Carrots are reported to be good for one's health especially after ingesting too much alcohol for they cool the stomach (Turner 1974:8) [Fleischer 1980:204].

Turner's 1974 unpublished manuscript (based on the field work of Dr. Larry Thompson and Terry Thompson) which Fleischer cites actually reads thusly:

> "Wild carrots" (?*Perideridia gairdneri*)-Wild Caraway (the identify is uncertain, and should be checked with an actual speciment)
>
> Wild carrots were gathered in the old days and steamed over rocks in a pit, as were red elderberries. They were said to be good for the health, and cooled the stomach after drinking too much "booze." (More information on this plant and its identity is needed.) [Turner 1981].

Fleischer's work also includes the term "sak$^{w}$q" for this species (End note 4 has linguistic similarities referring to *P. gairdneri*).

Training in proper field techniques, analysis of existing literature, collection of voucher specimens, and careful recording of data would have left us with an unambiguous data base on the botanical resources of the Pacific Northwest. As it is, great care must be exercised in order to extract pertinent and correct data on the use of botanical resources by aboriginal peoples.

## Methodology

One of the most critical factors determining the quality of any scholarly work is the care in which the raw data upon which the work is based are collected. To that end we are preseh ing a set of procedures which will prove useful to anyone contemplating ethnobotanical field work.

Before commencing actual study in the field it is advisable to become as familiar as possible with the culture and environmental setting of the area where the research will be conducted, through a thorough review of the linguistic, ethnohistorical, and botanical literature, and other pertinent materials. Individuals with no prior experience in botany would do well to obtain some formal training in plant taxonomy (and usually plant ecology) prior to starting ethnobotanical research and certainly before beginning field work, as these skills will greatly facilitate data collection and will help insure that no groups of plants having ethnobotanical significance are overlooked. Be sure to familiarize yourself with the manual or manuals which best represent the floral inventory of the area you are about to study. Popular works, while more colorful and readable, do not usually offer keys for identification nor do they adequately list the entire floral communities of any area. Use of a good botanical manual will enable you to make the distinctions which will be necessary in the field. Hitchcock and Cronquist's (1976) *Flora of the Pacific Northwest* is the recognized manual for this area. Since scientific binomials change over time as a result of our increased taxonomic knowledge, you should use a current manual when identifying plant materials, and also check literature data for nomenclature synonomy.

Ideally, you and your consultants will be able to venture into the field to collect your data. When this is the case typical specimens of each plant discussed should be collected, even if the only information obtained is that your consultant does not recognize the plant, or knows of no use for it. The preparation of these specimens will be explained below, but first we wish to discuss some of the types of data that should be collected from your native consultants. When possible, sessions should be recorded on tape or cassettes, as this will facilitate accurate transcription of your data, particularly any native terms referring to the plant.

Data should include the native term(s) for the plant and its various parts. These terms may be several and appear not to have any linguistic relationship to one another. For example, in Nitinat the term for *Heracleum lanatum* Michx. (cow parsnip) leaf-stalks is *quistu·p*, whereas the hollow central stem portion is called *hu·ba·q* (Gill 1980). Having a complete list of terms is especially important when you compare your data with those of other researchers. You should also elicit data concerning the various uses made of the plant, including the season of use, what parts were used, how they were prepared, and where the plants were collected. Be sure to give your consultants the opportunity to mention information you have failed to ask about, and take care not to lead with your questions. For example, one can start with a neutral question like "What can you tell me about this plan?" and they follow with more specific questions. Finally, it is a good idea to check for each plant any previously reported data not touched upon during the current session. Such data may be from an earlier interview with the same consultant, from an interview with another individual, or from the literature. You should also record negative data, such as when a plant is not recognized, or when it is known, but has no use, or; if it brings to memory a plant which was used but does not grow in the area where you are collecting. For instance, while none of the Haida consultants with whom the senior author worked in Alaska could remember a use or name for *Tofielda glutinosa* (Michx.) Pers., the plant did remind one of a "wild onion" which grew on an offshore island and was gathered on special foraging expeditions (Norton 1981).

If it is not possible to make actual collecting trips into the field (often the health of your consultants will dictate against field trips), a somewhat less satisfactory technique is to bring fresh plant materials to your consultants. Be sure to include enough material so that the plant will be recognizable, keeping in mind that the flower may not be the most significant feature for your consultants. Bring enough of large plants to make identification a surety, and try to bring entire plants of the smaller herbaceous kinds. Since these can then be your voucher specimens, it is worth the effort and time it takes.

In some situations even the use of fresh specimens may not be feasible, due to the time of year, etc. In such cases, herbarium sheets may be used, but only with the realization that the potential for error will be much greater than with the use of fresh material due to the loss of characters used by Native peoples to identify plant specimens. Photographs or drawings of plants must be used with extreme caution as they often do not display the plant parts which are the critical significata for Native peoples. Photographs frequently feature the blossoms which are often not recognized as identifying features by consultants. Furthermore, photographs and line drawings of a particular species could be easily confused with similar appearing species.

For collecting and preparing your voucher specimens you will need plastic bags, a trowel or digging stick, clippers or a good knife, paper bags (for mosses, lichens, and some types of fungi), wax paper (for cones, seed pods, small fleshy fungi, etc.), and one or more plant presses; as well as large quantities of old newspapers. A sturdy garden trowel is useful for obtaining underground parts, and hand clippers or a small saw[5] for obtaining branches of wood species. Medium size plastic bags are convenient for transporting specimens, and smaller-zip-lock bags are useful for protecting small, delicate materials. Plants should be pressed as soon as possible after collecting. If it is not possible to press the specimens immediately, they should be kept cool and out of direct sun. Ideally, each specimen will consist of whole plants including roots (if the plant is herbaceous), flowers and fruits (or cones in the case of conifers, and fertile fronds in ferns), and trunk bark if the plant in question is a tree and if the removal of the bark will not cause excessive damage to it. If flowers or fruit are not available during the season of utilization a specimen should be collected anyway and the same population recollected when flowers and/or fruit are present.

Each specimen should be assigned a unique collection number which corresponds with your field notes. Heavy paper tags are useful for labelling specimens with this number so that no confusion arises later. Non-ethnobotanical data that should be collected with the specimen includes the following: (1) the date. (2) the precise location (including state and county), both in terms of township, range, and section numbers, e.g., T31N, R16W, Sec. 22, NE¼ of SE¼ of SE¼, or latitude or longitude if your study area is unplatted, and a description in everyday language, e.g., SE base of Takawahyah (Cannonball) Island, Ozette, (the country name is also best included, especially if it is other than the U.S. or Canada); (3) the habitat should be described briefly, e.g., in beach sand, (4) associated species, and (5) the community type, as precisely as possible.

If a plant press is not available, one may be constructed easily using lattices of wooden strips or sheets of ¼ in. plywood. In either case, the dimensions should be 12 x 18 in. Between these backs place a 12 x 18 in. sheet of corrugated cardboard with the corrugations running width-wise, then a 12 x 18 in. sheet of felt or blotter paper. Next comes the plant specimen which is laid in a folded sheet of newspaper bearing the collection number and date. On top of this is placed another felt or blotter, after which the series is repeated until all specimens have been accommodated, finishing with a cardboard separator and the other press back. The whole set is bound tightly with ropes or belts so that the specimens will be pressed and dry flat. Fig. 1 shows the appropriate layering in a press.

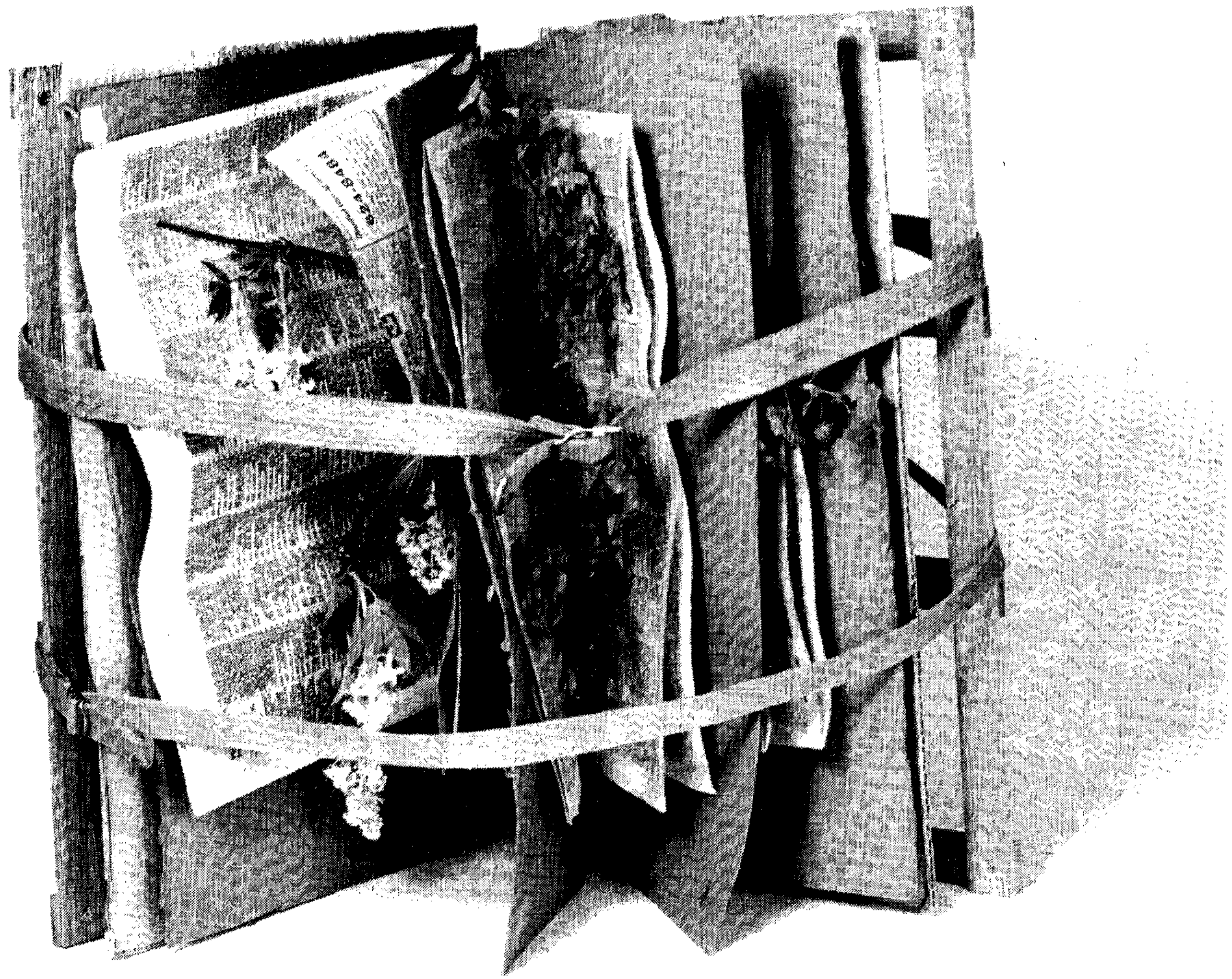

Fig. 1. Expanded plant press showing proper arrangement of wooden backs, cardboard separators, blotters, and specimens.

In general, the faster the material dries the better the preservation. In areas east of the Cascades during the summer this is generally no problem, as the air is hot and dry. However, in damp coastal areas adequate drying can pose a severe problem. If electricity is readily available, warm air can easily be forced through the press, greatly enhancing the drying process. However, with some kinds of plants, especially conifers, too much hot air is disastrous, causing loss of color and extreme brittleness. In more primitive situations heat can be obtained from fire, but great care must be exercised so as not to scorch the press or heat the plants to the point of cooking them.

If the plant specimens are removed from the press before being transported back to the laboratory, they should be left in their newspaper covers and packed securely in boxes so that there is no possibility of the specimens moving or shaking during transit. Care must also be taken so that the specimens are not broken during packing. Placing cardboard separators between sets of specimens can be useful here.

Once the plants are back in the laboratory the next step is to accurately identify any specimens not identified in the field, in consultation with professional plant taxonomists, as is necessary. It is extremely important that correct scientific names be applied to your specimens, including the authority for each name, as many researchers who will be using your data may not have the opportunity or expertise to check the accuracy of your identifications.

Once the plants are correctly identified, labels should prepared on 100% rag paper. The following example can be used as a model:

FLORA OF WASHINGTON
U.S.A.

*Gaultheria shallon* Pursh

Nitinat names: k̓eyicapx̌ = berries
łe·pat = leaves
łe·ptapt = plant

CLALLAM CO.: North side Hobuck Lake, Makah Indian Reservation. T33N, R15W, Sec. 21, SW¼ of SW¼ of SE¼. Seral stand in somewhat disturbed area. Associated species include *Picea sitchensis* (Bong.) Carr. and *Tsuga heterophylla* (Raf.) Sarg.
USES: The fruit are eaten fresh.

Steven J. Gill 580 31.VII.1980
John Thomas

If as is typical, your specimens are to be deposited with a recognized herbarium nothing further need be done to the plants. If you plan to keep the specimens, they should usually be mounted on stiff white paper, such as

Bristolboard, 11.5 x 16.5 in. in size. White glue should be carefully applies to the back side of the plant, the specimen arranged on the herbarium sheet leaving room in the lower right hand corner for the label, and strips of plastic glue applies over stems, etc., to assure firm attachment. Bulky items, such as twigs, cones, etc., can be sewn to the sheet, covering the thread ends and knots on the back of the sheet with gummed packing tape. The specimen sheets next must be treated to kill insect pests that would damage the specimens. Traditionally some chemical process, such as fumigation, has been used for this purpose. Recently, however, several major herbaria have adopted the much safer and more convenient method of freezing the specimens. Extensive experiments and trials have shown that all insect pests likely to cause damage to herbarium materials are killed, at all stages of their life cycle, by freezing at -18°C for 48 hours (Anonymous 1980). After treating for insects the specimens should be stored in folders in insect-proof cabinets or cases. Lichens and mosses are not mounted on paper in most cases, but are generally stores in 6 x 4 in. folded packets made of 100 % rag paper, with labels mounted on the front. An index card may be placed in the packet to keep them from bending.

In reporting your work, you should indicate where your voucher specimens are deposited, and cite appropriate collection numbers for each set of data. This will make your work much more valuable to other researchers, as they will be able to verify your work as needed during the course of their own studies.

At this point we wish to draw a distinction between recorded data, including field notes, voucher specimens, photographs, and tape recordings, and that portion of those data that is reported into the literature. Since reported data, i.e., those which we published, usually consist of only a portion of the recorded data, and are often a synthesis from several sources, we encourage all workers to make arrangements for depositing a copy of their field notes with an appropriate library archive. Provisions can be made for restricting access to the material, etc., as is deemed necessary. This will help to ensure that the data you have so painstakingly collected, but which you do not publish/report because it seems insignificant, incomplete, or unimportant will not be lost to future generations. All recorded data, many of which are irreplaceable, can be of assistance in the continuing research on the cultures of the Pacific Northwest.

## Conclusion

It is our hope that the information we have presented in this paper will assist researchers in avoiding some of the errors and pitfalls evident in previous ethnobotanical studies and in making useful, unambiguous contributions to our knowledge of indigenous utilization of plant resources. We would be pleased to communicate with anyone desiring additional information or assistance with the topics discussed in this paper.

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## End Notes

[1]Commercially available medicines in the United States toward the end of the nineteenth century and in the early twentieth century included such items as glycerite of ozone used for treating tuberculosis; cocaine suppositories for "poverty of nerve force and weakening losses of the generative organs" (Buchanan 1884); and several patent medicines such as "Mrs. Winslow's Soothing Syrup" which often contained opiates or other potent narcotic substances. At the turn of the century it has been estimated that greater than 4% of the population was addicted to narcotics (Anderson 1980). Table 1 lists some of the plants used medicinally by native peoples in the Pacific Northwest and compares with properties recognized in Euroamerican medicine.

[2]An "official" remedy is one listed either in the *U.S. Pharacopeia* or the National Formulary. These are included in the *U.S. Dispensatory*.

[3]The root of this work, *'*$\hat{x}^{w}$*ac--'*, means "crumble" (Makah Language Program files). Swan (1863) records what is probably the same term (*wharts whats* in his orthography) as a "herb [whose] root and leaf stalks [are] eaten." Since the consultant who provided this term has since passed away, and no one else seems to know it, it is unlikely that additional information concerning the identify of this plant or its uses will become available to researchers or to the Makah people.

[4]*Perideridia gairdneri* (H. & A.) Math., *Lomatium utriculatum* (Nutt.) Coult. & rose, and *Daucus pusillus* Michx. all occur in western Washington. The historical and linguistic literature for western Washington offers evidence which strongly suggests *P. gairdneri* was used more widely here as a food and used longer after contact than *L. utriculatum*. *P. gairdneri* was called "wild carrot" by early western observers. No common name was assigned to *L. utriculatum*. *D. pusillus* was not noted as a food nor was it called "wild carrot."

Two early botanists and naturalists in western Washington, Dr. J. G. Cooper and Mr. Robert Brown, were careful to collect and identify indigenous plants by Latin binomials. They also frequently noted the native term and use for these plants. Copper, in 1853-1855, recorded the

**TABLE 1**

Comparison of selected Pacific Northwest Native medicines with properties recognized in Euroamerican medical literature

| Plant species | PNW use | Literature |
|---|---|---|
| *Artemisia tridentata* Nutt. (Big sagebrush) | Wanapum: Leaves used for treating coughs and chest ailments (Gill 1981).<br>Okanagon-Colville: Leaves and branches used to treat colds, sore throats, and tonsillitis (Turner, Bouchard and others 1980). | Antimicrobial properties have been demonstrated for *Artemisia* species (Nickell 1959; Overfield and others 1980), and it is likely that *Artemisia tridentata* contains significant quantities of thujone and isothujone. Thujone reportedly has psychoactive properties (Albert-Puleo 1978), and (-) -3-isothujone is essentially equipotent with delta-9-THC and coedine in its analgesic properties (Rice and Wilson 1976). |
| *Athyrium filix-femina* (L.) Roth. (Lady fern) | Cowlitz: Tea made from rhizomes drunk to ease body pains (Gunther 1973).<br>Makah: Stems used to make medicine to east labor (Gunther 1973). | In European herbal tradition this species has been used to make antihelminthic preparations and ointments for healing wounds (Grieve 1931). |
| *Berberis aquifolium* Pursh | Squaxin: Tea made from roots used as a gargle for sore throats and was drunk in the spring to purify the blood (Gunther 1973).<br>Okanagon-Colville: Used to make eyewash, tonic, and blood purifier, and for bad kidneys (Turner, Bouchard, and others 1980). | Several alkaloids occur in *Berberis* spp., including berberine, which in large doses can prove fatal. In moderate doses berberine has a stimulant effect upon the heart muscle; it has also shown antimicrobial activity (Wood and Osol 1943). |
| *Polypodium glycyrrhiza* D.C. Eat. & *P. hesperium* Maxon *p. vulgare* L.) (Licorice fern) | Makah, Klallam, Wuinault: Rhizomes used cough medicine (Gunther 1973). | Licorice fern has been used as an expectorant in chronic catarrh and asthma (Wood and Osol 1943). |
| *Rhamnus purshiana* DC. (Cascara, chittam bark) | Universally used by Native peoples in western Washington as a laxative (Gunther 1973).<br>Okanagon-Colville: Used as a laxative, for treating rheumatism and arthritis, and as a blood purifier (Turner, Bouchard, and Kennedy). | The berries of *Rhamnus catharartica* L. are used as a strong cathartic, but often cause nausea and severe griping; a syrup made from the berries has been used as a laxative for dogs (Wood and Osol 1943). |
| *Sphagnum* spp. (Spagnum moss, peat moss) | Makah: Dressing for wounds (Gunther 1973).<br>Chinook: Sanitary napkins (Gunther 1973). | During World War I *Sphagnum* spp. were used in place of of absorbent cotton in surgical dressings, and were considered superior to absorbent cotton in several respects (Hotson 1918, 1921a, 1921b; Nichols 1918). |
| *Thuja plicata* Donn. (Western red cedar) | Klallam: Tuberculosis medicine.<br>Lummi: Chew and swallow buds for sore lungs.<br>Cowlitz: Chew buds for toothache.<br>Quinault: Infusion drunk for kidney trouble, and used as a wash for sores of veneral diseases (Gunther 1973).<br>Okanagon-Colville: An infusion of boiled boughs was used as a hair wash to eliminate dandruff and to kill "germs"; people with arthritis and rheumatism would soak in the solution to east pain in their joints (Turner, Bouchard, and Kennedy 1980). | The oil of *Thuja occidentalis* L. has been official in U.S. medicine (Wood and Osol 1943). This species like *Artemisia tridentata*, contains significant quantities of thujone and isothujone. The properties of these two substances are discussed under *A. tridentata*. |

use of the root of *Edosmia Gairdneri* Hook. & Arne (now *P. gairdneri*) as a food by the Nisqually of western Washington and included the Nisqually term for the plant, *s'hoh'got*. In 1865 Brown published an article on indigenous plants of the region and reported the use of the root of *Endosmia Gairdneri* [*sic*] as a food wherever it was found. He included the Nisqually term for it, *s'hoh-gok*. In 1877 George Gibbs reported the use of a "wild carrot" for the Nisqually and gave their term for it, *sha'gak*. Neither Cooper nor Brown called *P. gairdneri* "wild carrot." Since Gibbs (who did much botanical collecting for Cooper, supplying him with specimens, native terms, and uses of plants) assigned the same native term Cooper (and Brown) used for *P. gairdneri* to a "wild carrot" we assume he is referring to *P. gairdneri* instead of its more common term *yampah* has undoubtedly contributed to the confusion concerning *D. pusillus*. The above are the only references found for this region which give information on just which plant, used as a food by the native peoples, came to be called "wild carrot" by non-native observers.

Dr. Cooper noted that the root of *Peucedanum foeniculaceum* Nutt. (now *Lomatium foeniculaceum* [Nutt.] Coult. & Rose) was boiled and eaten. However, *L. foeniculaceum* does not occur as far west as Washington, and Cooper's data probably actually apply to *L. utriculatum* which was common in Puget Sound prairies. He did not include a native term for this plant.

Cooper also mentions that *D. pusillus* is found near Steilacoom but rare near the mouth of the Columbia. Brown reports that the leaves of *D. pusillus* were used by the Indians of California as a specific for rattlesnake bite. Neither report its use as a food.

Later ethnographic reports unfortunately seldom refer to plants by scientific or standardized referents, which casts doubt in many instances as to just which plant is under discussion. However, a number of ethnographers do include native terms for plants. Table 2 gives the native term for a plant reported as "wild carrot," the tribe, ethnographer, and date of ethnography.

None of these later references give any indication of the actual plant used. However, since it appears that the terms used by the natives of this region are all different renderings of the same word, a word which can be linked to *P. gairdneri*, that plant then seems the most likely candidate as an important food of the past as it was also evidently used well after contact. Although *L. utriculatum* is still a possible candidate, the "wild carrot" of western Washington by any other name is undoubtedly not *D. pusillus*.

[5]Small saws such as those found on Swiss army knives are all that is necessary.

TABLE 2

| Term | Tribe | Ethnographer | Date Reported |
|---|---|---|---|
| s'hah'got | Nisqually | Cooper | 1859 |
| s'hah-gok | Nisqually | Brown | 1865 |
| sha'gak | Nisqually | Gibbs | 1877 |
| sha'gak | Nisqually | Curtis | 1911 |
| sha'wuk | Lummi | Curtis | 1911 |
| shi gwak | Snohomish | Curtis | 1911 |
| sa̲quakx | Clallam | Gunther | 1927 |
| cagaq | Twana | Haeberlin and Gunther | 1930 |
| sǎ.'gaq | Twana | Elmendorf | 1960 |
| caqwak | Skagit | Collins | 1974 |
| šáwəq | Nooksack | Amoss | 1978 |
| sak$^{w}$q | Clallam | Fleischer | 1980 |

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# THE ETHNOBOTANY OF THE CLALLAM INDIANS OF WESTERN WASHINGTON[1]

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ABSTRACT

The Clallam Indians of the Olympic Peninsula, Washington, extensively utilized their native plant environment. Data were collected from Clallam consultants and scholarly works. Plant uses, e.g., food, technology, medicine, are discussed. Plant names and general botanical terminology are given in phonetic transcription.

## Introduction

Clallam is a virtually extinct Coast Salish language closely related to the Straits Salish language complex (Suttles 1954:29-31). Clallam is the only Straits Salish language distributed aboriginally on Vancouver Island, British Columbia (around modern Victoria) and along the north shore of the Olympic Peninsula, Washington (Fig. 1).

Clallam ethnography is limited. The main sources are Gunther's publications (1927, 1945). Gunther (1945) is a comprehensive ethnobotany of Salish- and non-Salish-speaking groups in western Washington. Turner and Bell (1971) provide a detailed ethnobotanical account of the Coast Salish Indians of Vancouver Island.

Through the years of acculturation into Euroamerican society, the Clallam have lost their aboriginal ways of life; now, only the elders remember the ways of the past. Even so, elders have, over the years, forgotten a great deal concerning plant uses. Data concerned with the medicinal uses of plants were difficult to obtain from native consultants. The attitude toward divulging knowledge of plant medicine is one of hesitancy, partly due to a fear that the information will be used by unscrupulous individuals venturing to make monetary gains. This guarded attitude is not a recent development, as is seen in Gunther (1927:303).

> . . . practical medicine, which consists of household remedies and cures known only to certain old women, the knowledge of which was carefully guarded by its possessors. Even today, some old women refuse to give this information, saying that they had paid too much for it.

## Clallam Plant Utilization

Clallam ethnobotanical data are from Fleisher (1976), Günther (1927, 1945), and Turner (1974). Inasmuch as data concerning Clallam plant uses are very limited, Turner and Bell's (1971:67-90) ethnobotanical data for the Vancouver Island Salish are quite relevant. As Turner and Bell (1971:95-96) noted: "Over 60% of the 120 plant species listed as being used by the Western Washington Salish were used in a similar or identical manner by the Vancouver Island Salish . . . ."

To facilitate comparison and complementation, Clallam data are organized in the same category arrangement as found in Turner and Bell (1971:66). Appendices A and B list specific Clallam plant names and general plant terms, respectively; English equivalents are given.

### ALGAE (Seaweeds)

*Fucus* sp. (Rockweed), *Ulva lactuca* L. (Sea Lettuce)

Data include only the native term (Appendix A).

*Nereocystis luetkeana* (Mertens) Postels & Ruprecht (Common Kelp)

After drying, the thin stem was used for string (Ann Bennett and Irene Charles:Clallam informants; henceforth, AB and/or IC).

### FUNGI

*Fomes* sp. (Bracket fungus ?)

Data include only the native term (Appendix A).

### EQUISETACEAE (Horsetail Family)

*Equisetum telmateia* Ehrh. (Giant Horsetail)

Two parts were eaten: (1) bulbs, and (2) sprouts of the fertile shoots. Sprouts were harvested in early spring, peeled and eaten raw. The green portion, up to 15-16 inches high, was cut and baked in a steaming pit. The bulbs were collected in spring and during January when they were exposed in clay banks near the ocean and dropped to the beach. The bulbs were steamed or oven baked (Turner 1974:2).

## POLYPODIACEAE (Fern Family)

*Athyrium Filix-femina* (L) Roth. (Lady Fern)

The Lady Fern, if used to cover berries in a basket, would steal them (AB, IC). The literal equivalent of the Clallam term is 'stealing fern'. The shoots were eaten (Gunther 1945:14).

*Dryopteris dilatata* (Hoffm.) Gray. (Wood Fern)

The rhizome may have been used for food. The roots were pounded and the pulp put on cuts (Gunther 1945:14).

*Polypodium vulgare* L. (Licorice Fern)

The roots were eaten raw as cough medicine or eaten baked (Gunther 1945: 13).

*Polystichum munitum* (L.) Kaulf. (Sword Fern)

The rhizome was boiled or baked (Gunther 1945:13). A children's game was played with the leaves; while holding their breath, children pulled off leaflets, one at a time, from bottom to top, while saying "plapla." Whoever pulled off the most leaves without taking a second breath was declared winner (AB).

*Pteridium aquilinum* (L.) Kuhn. (Bracken Fern)

The rhizomes were roasted in ashes, peeled, and eaten (Gunther 1945: 14). The roasted rhizomes were pounded to make flour. Fronds were used to cover berry baskets and to wipe fish before hanging up to smoke (AB).

## PINACEAE (Pine Family)

*Abies grandis* Lindl. (Grand Fir)

The bark blisters were broken and the sap was mixed with hog grease and used as a poultice to draw out slivers (Turner 1974:4). The Clallam term is derived from a verb which means 'to drain (e.g., a blister, boil)'. The literal equivalent of the Clallam term is probably: 'the tree that drains alot'.

*Picea sitchensis* Carr. (Sitka Spruce)

The Marine Drive area in Port Angeles, WA, was referred to as 'the place of many spruce'.

*Pinus monticola* Dougl. (Western Pine)

Data include only the native term (Appendix A).

*Pseudotsuga menziesii* (Mirb.) Franco. (Douglas Fir)

Fir pitch was rubbed on deep cuts (Gunther 1927:304). The bark and wood were important as firewood. The wood was fashioned into spear and harpoon shafts. The pitch was chewed as gum (Gunther 1945:19).

*Thuja plicata* Donn. (Western Red Cedar)

Among other things the wood was used for house planks, house posts, roof boards, and canoes; the bark for clothes, padding for cradles, sanitary pads, towels, and baskets. The limbs were fashioned into rope and small limbs were boiled and the juice ingested for tuberculosis. The root was used for coiled and imbricated baskets: "they are split fine and used for the foundation, then trimmed more carefully for the sewing element" (Gunther 1945:20).

Clams were strung on bark rope for drying. Limbs were burned and inhaled for colds and chewed to prevent catching a sickness, especially when sitting up with a sick person (Turner 1974:4).

*Tsuga heterophylla* Sarg. (Western Hemlock)

The bark was boiled and used to make a reddish-brown dye. Saplings were used for stanchions of a fish trap which was strung across a river. The bark was boiled and licorice ferns were added; the mixture was ingested to stop hemorrhages. Young tips of branches were boiled and the mixture was ingested to treat tuberculosis and to stimulate the appetite (Gunther 1945: 18).

The limbs were cut and placed around rocks in tidal areas as a method for gathering ling cod eggs. After the eggs were deposited on the limbs, they were removed from the water, the eggs shaken off to dry (AB).

## TAXACEAE (Yew Family)

*Taxus brevifolia* Nutt. (Western Yew)

The wood was used to construct bows, arrows, and canoe paddles. The leaves were crushed and boiled in water and ingested for intestinal injury or pain (Gunther 1945:16). The wood was also used to make barbecue stakes and digging sticks (AB).

## ARACEAE (Arum Family)

*Lysichitum americanum* L. (Skunk Cabbage)

The roots were baked and used as a poultice for sores. The softest part of the leaf was held close to a fire and worked soft and put on sores (Gunther 1945:22).

When bears eat the roots, around May, it is claimed that their meat smells strong (Turner 1974:5-6).

## CYPERACEAE (Sedge Family)

*Scirpus acutus* Muhl. (Tule)

The flat leaves were used to construct sleeping and wall mats (Gunther 1945:22).

## LILIACEAE (Lily Family)

*Allium cernuum* Roth. (Wild Onion)

The onions were eaten raw, cooked in pits, or fried with meat in a frying pan (AB).

*Camassia quamash* (Pursh) Greene. (Blue Camas)

The bulbs were gathered and cooked in pits with meat. They were also used to sweeten soapberry whip (Turner 1974:6).

*Lilum columbianum* Hanson (Tiger Lily)

The bulbs were steamed in a pit (AB). The bulbs were gathered in late Fall and buried in a hole, dug in one's house, which was lined with cedar boughs to keep the bulbs fresh (Gunther 1945:25).

*Maianthemum dilatatum* (Wood) Nels. and Macbr. (Wild Lily-of-the-Valley)

The berries were eaten but not relished (Gunther 1945:25).

*Xerophyllum tenax* (Pursh) Nutt. (Bear Grass)

Used for basket construction (AB), it is sometimes dyed yellow with Oregon grape bark (Turner 1974:7).

## ORCHIDACEAE (Orchid Family)

*Goodyera oblongifolia* Raf. (Rattlesnake Plantain)

Women rubbed this plant on their bodies to make themselves more attractive to their husbands (Gunther 1945:26).

## TYPHACEAE (Cattail Family)

*Typha latifolia* L. (Cattail)

Used for basket and mat construction (AB). The fleshy interior was eaten raw or cooked in a pit. An Indian doctor from Yakima, Washington, used a cattail stem as a spirt-catcher while trying to cure an abdominal ulcer (Turner 1974:7).

## ACERACEAE (Maple Family)

*Acer circinatum* Pursh. (Vine Maple)

The wood was split and used to construct baskets (Gunther 1945:7). The sap was eaten fresh or dried (AB).

*Acer macrophyllum* Pursh. (Broad-leaf Maple)

The leaves and bark were scraped, and soaked in water. The mixture was used as a general tonic (Gunther 1927:305). The wood was used for canoe paddles. The bark was boiled in water and ingested for tuberculosis (Gunther 1945:40). The sap was eaten fresh or dried (AB).

## ARALIACEAE (Ginseng Family)

*Oplopanax horridum* (J. E. Smith) Miq. (Devil's Club)

A stick was peeled, cut into pieces, and fastened to a (bass) fishing line. When the line is under water, the pieces release and spin to the surface attracting fish which were then speared. The wood was also fashioned into fishing lures (IC).

## BERBERIDACEAE (Barberry Family)

*Berberis nervosa* Pursh. (Oregon Grape)

The berries were edible but sour. The bark and roots were boiled to prepare a dye for coloring baskets (AB; Gunther 1945:31; Turner 1974:9).

## BETULACEAE (Birch Family)

*Alnus rubra* Bong. (Red Alder)

The wood was used for dishes, utensils, and for firewood (especially for the fires prepared for smoking fish). The catkins were chewed as a cure for diarrhea (Gunther 1945:27). The steminate ament was chewed and spit on sores. The pistolate ament was chewed to help the lungs and stomach. The inner bark was scraped and soaked in water until the liquid turned red; it was then ingested to purify the blood (Gunther 1927:303-304).

The sap was mixed with soapberry whip as a sweetener. The bark was fashioned into an impromtu basket: a lengthwise piece of bark was cut, sewed up the side and sticks put across the bottom; a circular piece of bark was placed over the sticks; a handle was made from an alder limb sticking it in across the bottom (Turner 1974:10).

## CAPRIFOLIACEAE (Honeysuckle Family)

*Lonicera ciliosa* Poir. (Orange Honeysuckle)

The leaves were chewed and put on bruises (Gunther 1945:48).

*Sambucus cerulea* Raf. (Blue Elderberry)

The bark was steeped and drunk for diarrhea. The berries were eaten like red elderberries (Gunther 1945:47).

*Sambucus racemosa* L. (Red Elderberry)

The berries were steamed on rocks and put in a container which was stored in an underground pit dug in the house. The berries were usually eaten in winter (Gunther 1945:47).

*Symphoricarpos albus* (L.) Blake (Waxberry, Snowberry)

The berries were mashed and put on cuts (Gunther 1927:304). The leaves were boiled in water and the liquid ingested as a cure for a cold (Gunther 1945:48).

## COMPOSITAE (Aster Family)

*Achillea millefolium* L. (Yarrow)

Seeds were brought into houses for their fragrance (AB, IC).

The leaves were boiled and the tea drunk for colds and during childbirth; cherry bark was added to the tea. The leaves were chewed and put on sores as a poultice (Gunther 1945:49).

## CORNACEAE (Dogwood Family)

*Cornus nuttallii* Aud. ex. T. & G. (Flowering Dogwood)

The wood was used to make gambling discs (Gunther 1945:42).

## ELEAGINACEAE (Oleaster Family)

*Shepherdia canadensis* Nutt. (Soapberry)

The berries were whipped into a foamy dessert, "Indian ice cream." Sugar is often added to sweeten the whip (AB, IC).

Alder sap or blue camas was added for sweetening when sugar was scarce (Turner 1974:11). Turner and Bell (1971:75) note that the "word 'camas' is actually derived from the Nootka wood meaning 'sweet'."

## ERICACEAE (Heath Family)

*Arbutus menziesii* Pursh. (Madrone)

The leaves were boiled for ten minutes in water to make a milky syrup which was good for the throat (Gunther 1927:305).

*Arctostaphylos uva-ursi* Spreng. (Kinnikinnick)

Prior to the introduction of tobacco into Northwest Indian culture, kinnikinnick leaves were pulverized and smoked. When tobacco was introduced, the kinnikinnick was mixed with tobacco. Yew needles (*Taxus brevifolia*) were often mixed with the tobacco. Yew and kinnikinnick were never smoked together because the mixture was too strong (Gunther 1945:44).

*Gaultheria shallon* Pursh. (Salal)

The berries were mashed and dried in cakes. The cakes were soaked prior to eating and then dipped in oil. The leaves were chewed and spit on burns (Gunther 1945:43).

*Vaccinium ovalifolium* Smith (Blue Huckleberry)

Berries were eaten fresh or dried. Gunther (1945:44) identified this species as being gathered on the Hood Canal (Fig. 1).

*Vaccinium oxycoccus* L. (Bog Cranberry)

This species was picked near Port Townsend, Washington (Fig. 1), and stored in boxes or baskets until soft and brown (Gunther 1945:45). The leaves may have been used to make tea. Confusion exists whether the leaves of the bog cranberry or *Ledum groenlandicum* Oeder (Labrador Tea), which grows with the bog cranberry, were picked (Turner 1974:12).

*Vaccinium parvifolium* Smith (Red Huckleberry)

The berries were gathered and eaten. The bark and leaves were used as medicine for kidney stones (Turner 1974:12).

The native Clallam word for this species is also used as a term of endearment or affection; when used in this sense it occurs with the first person possessive prefix meaning 'my.' Other native terms for berries are also used in this manner, e.g., blue huckleberry, strawberry, thimbleberry, black raspberry.

## FAGACEAE (Beech Family)

*Quercus garryana* Dougl. (Garry Oak)

The acorns were eaten without preparation (Gunther 1945:27).

## GROSSULARIACEAE (Gooseberry Family)

*Ribes divaricatum* Dougl. (Gooseberry)

The berries were gathered and eaten. The inner bark was rinsed in water and mixed with human milk and used as a eyewash (Gunther 1945:32).

*Ribes lacustre* Poir. (Swamp Currant)

Data include only the native term (Appendix A).

*Ribes sanguineum* Pursh. (Red-flowering Currant)

The berries were eaten fresh (Gunther 1945:32).

## LABIATAE (Mint Family)

*Prunella vulgaris* L. (Self Heal)

"The Klallam informant said this is not the true *Self Heal* [sic] whose roots they eat, but its step-brother. The use of kinship forms in regard to flowers is interesting" (Gunther 1945:45).

## NYCTAGINACEAE (Four O'clock Family)

*Abronia latifolia* Esch. (Sand Verbena)

The roots were eaten; informants compared them with sugar beets (Gunther 1945:29).

## ONAGRACEAE (Evening Primrose Family)

*Epilobium angustifolium* L. (Fireweed)

The puffs were mixed with dog hair for weaving cloth. The roots were boiled and drunk; the fireweed sought out the cause of an illness which was then sucked out with a tule (*Scirpus acutus*) (AB).

## RHAMNACEAE (Buckthorn Family)

*Rhamnus purshiana* DC. (Cascara)

The bark was boiled and used as a laxative (Gunther 1945:40). The bark was used as a poultice for wounds (AB).

## ROSACEAE (Rose Family)

*Amelanchier alnifolia* Nutt. (Saskatoon Berry, Service Berry)

The berries were eaten (Turner 1974:14).

*Aruncus sylvester* Kostel. (Goat's-beard)

The roots were burned and the ashes mixed with bear grease. The salve was put on sores that would not heal (Gunther 1945:33).

*Fragaria vesca* L., *F. virginiana* Duchesne., *F. chiloensis* (L.) Duchesne. (Wild Strawberry)

The berries were eaten fresh (AB, IC).

*Geum macrophyllum* Willd. (Yellow Avens)

The leaves were put on boils. After being smashed the leaves were rubbed on cuts (Gunther 1945:37).

*Holodiscus discolor* Pursh. (Ironwood, Oceanspray)

The wood was used for roasting stakes and digging sticks (Gunther 1945: 33).

*Osmaronia cerasiformis* (T. & G.) Greene. (Squaw Plum, Indian Plum)

The inner bark was scraped into water and given to women during child-birth "'to drive the blood out'" (Gunther 1927:304). Limbs were twisted in water, the water then being used to bathe wounds caused by arrows or bullets (Gunther 1927:304).

*Prunus emarginata* Dougl. (Bitter Cherry)

The inner bark was scraped and soaked in water; the liquid was ingested as a cure for consumption (Gunther 1927:304). The bark was used to imbricate cedar root baskets and was put on cuts as a poultice (Turner 1974:14).

The bark was fashioned into twine which was used as fishing line (AB).

*Pyrus fusca* Raf. (Wild Crabapple)

The fruit was eaten after being allowed to soften in baskets. The bark was peeled and soaked in water; the liquid was then used as an eyewash (Gunther 1945:38).

*Rosa nutkana* Presl. (Wild Rose)

The rose hips were eaten to sweeten the breath (Gunther 1945:34).

*Rubus leucodermis* Dougl. (Blackcap, Black Raspberry)

The berries, sprouts, and young leaves were eaten (Gunther 1945:35).

*Rubus parviflorus* Nutt. (Thimbleberry)

The berries were eaten fresh. The sprouts were eaten in spring with dried salmon eggs (Turner 1974:15).

AB commented that this is a term for one's sweetheart "cause they [*the berries*] are so sweet."

*Rubus spectablilis* Pursh. (Salmonberry)

The berries were eaten fresh. Salmonberry and thimbleberry sprouts were prepared by making a bundle of ten to fifteen unpeeled sprouts tied with cattail string. In a steaming pit (hot rocks covered by timber fern fronds, thimbleberry leaves, and pine boughs) the bundles were laid side by side on top of the vegetation. A second layer, with the tops pointing in the opposite direction, was placed down. Then the pit was covered by timber ferns and a cattail mat and steamed. When steamed the sprouts were peeled, the leaves discarded, and the stalks were eaten with salmon eggs (Turner 1974: 15).

*Rubus ursinus* Cham. & Schlecht (Trailing Blackberry)

The berries were eaten. Children were told not to eat the berries while picking them or they would turn into a bear. A Snoqualmie song discusses the origin of this species: wild blackberries originated from the menstrual blood of a young girl who was put up a tree. Her blood fell to the ground and blackberries grew on that spot (Turner 1974:16).

## SALICACEAE (Willow Family)

*Salix sitchensis* Sanson (Willow)

The willow was exploited principally for the bark which was made into string. The bark was also boiled in water and the fluid ingested as a cure for sore throats and tuberculosis (Gunther 1945:26).

*Populus trichocarpa* T. & G. (Black Cottonwood)

The buds were used for preparing eyewash (Gunther 1945:26). The sap was eaten fresh or dried (AB).

## UMBELLIFERAE (Parsley Family)

*Cicuta douglasii* (DC.) Coult & Rose. (Water Hemlock)

After bathing women would rub their bodies with the root to attract men (Gunther 1945:42).

The plant is violently poisonous; a small piece is sufficient to kill a cow (Turner 1974:8).

*Daucus pusillus* Michx. (Wild Carrot)

Carrots were eaten raw or cooked in pits (AB, IC). Carrots are reported to be good for one's health especially after ingesting too much alcohol for they cool the stomach (Turner 1974:8).

*Heracleum lanatum* Michx. (Cow Parsnip)

In spring, young sprouts and flower buds were peeled and eaten (Turner 1974:8).

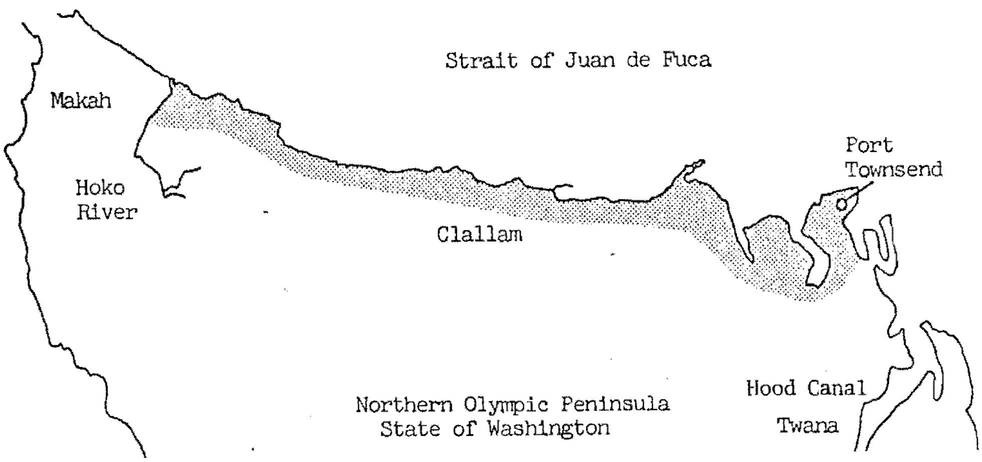


Fig. 1. Clallam distribution.

## Acknowledgments

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I would like to thank all the members of the Clallam Indian Tribe for their patience, cooperation, and friendship. Special thanks go to Ann Bennett, Irene Charles, and Elaine Grinnell for being excellent teachers and lovely people.

## Note

[1]The ethnobotanical data were elicited from Mrs. Ann Bennett and Mrs. Irene Charles. Both of these women are native speakers of Clallam, and experienced linguistic consultants. Mrs. Bennett and Mrs. Charles were totally familar with the plant world of the Olympic Peninsula. Mrs. Bennett and Mrs. Charles were also fluent in American English; this reduces the possibility of misunderstanding that may occur between the anthropologist and the consultant. To prompt the memories of these women and assist them in accurate plant identification I used published sources which clearly identify each plant with common and scientific names, and an illustration, black-and-white, or color photograph.

To insure the accuracy of plant identification and my transcriptions I compared the Clallam forms I elicited with published linguistic material from other Straits Salish dialects, e.g., Sooke, and neighboring Coast Salishan languages.

Published works which were particularly useful in ensuring accurate plant identifications include for example: Muriel Sweet, *Common Edible and Useful Plants of the West* (1962); Thomas M. C. Taylor, *Pacific Northwest Ferns and their Allies* (1970); and, Charles Yocom and Ray Sasmann, *The Pacific Coastal Wildlife Region* (1965).

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# APPENDIX A

## Plant Names in the Clallam Language

Plant species appear in the same order as in the text. Clallam plant names occurring between slash marks, e.g., *Scirpus acutus*, /cənaʔx$^{w}$/ 'tule', are from my field data; underlined names are from Gunther (1945).

| Species | Native Term |
|---|---|
| *Fucus* sp. | /q$^{w}$aqq/ 'rockweed' |
| *Ulva lactuca* L. | /łəq̓əs/ 'sea lettuce' |
| *Nereocystis luetkeana* (Mertens) Postels & Ruprecht | /q̓$^{w}$q̓$^{w}$uʔəŋʔ/ 'kelp' |
| *Fomes* sp. | /pipiʔayqł/ 'bracket fungus' |
| *Equisetum telmateia* Ehrh. | /maʔəx$^{w}$/ 'giant horsetail' |
| *Athyrium Filix-femina* (L.) Roth | /q̓ənq̓ən c̓isiłč/ 'lady fern' |
|  *Dryopteris dilatata* (Hoffm.) Gray | tsa´qwa 'wood fern' |
| *Polypodium vulgare* L. | kla´sǐp 'licorice fern' |
| *Polystichum munitum* (L.) Kaulf. | /scxəyem/ 'sword fern' |
| *Pteridium aquilinum* (L.) Kuhn. | /c̓isiłč/ 'bracken fern' |
| *Abies grandis* Lindl. | /ŋəq̓$^{w}$ŋəq̓$^{w}$əyiłč/ 'grand fir' |
| *Picea sitchensis* Carr. | /c̓c̓ałč/ 'sitka spruce' |
| *Pinus monticola* Dougl. | /saʔsiʔtaʔniłč/ 'western pine' |
| *Pseudotsuga menziesii* (Mirb.) Franco. | /č̓iyaʔč̓iłč/ 'douglas fir' |
| *Thuja plicata* Donn. | /xčaʔčačł/ 'western red cedar'; /syəwiʔ/ 'cedar bark'; /c̓apx/ 'cedar root'; /c̓əʔyuč̓ł/ 'cedar limb'; /xpayʔ/ 'wood (cut, dried)' |
| *Tsuga heterophylla* Sarg. | /sq$^{w}$əciʔyeʔełč/ 'western hemlock' |

| Species | Native Term |
|---|---|
| *Taxus brevifolia* Nutt. | /ƛ̓əŋqɬč/ 'western yew' |
| *Lysichitum americanum* L. | /č̓uʔk̓ʷiʔ/ 'skunk cabbage' |
| *Scirpus acutus* Muhl. | /cənaʔxʷ/ 'tule' |
| *Allium cernuum* Roth. | /q̓ʷəxʷəyəč/ 'wild onion' |
| *Camassia quamash* (Pursh) Greene | /qʷɬuʔiʔ/ 'blue camas' |
| *Lilium columbianum* Hanson | /cakʷčn/ 'tiger lily' |
| *Maianthemum dilatatum* (Wood) Nels. and Macbr. | /ƛ̌iyaʔčays/ 'wild lily-of-the-valley' |
| *Xerophyllum tenax* (Pursh) Nutt. | /ƛ̓uƛ̓/ 'bear grass' |
| *Goodyera oblongifolia* Raf. | <u>swuxkɬa´'ants</u> 'rattlesnake plantain' |
| *Typha latifolia* L. | /kʷuʔət/ 'cattail' |
| *Acer circinatum* Pursh. | /paʔq̓ɬč/ 'vine maple' |
| *Acer macrophyllum* Pursh. | /č̓ɬɬaʔaɬč/ 'broad-leaf maple' |
| *Oplopanax horridum* (J.E. Smith) Miq. | /puqɬč/ 'devil's club' |
| *Berberis nervosa* Pursh. | /sčanɬlč/ 'oregon grape' |
| *Alnus rubra* Bong. | /sqʷuŋiɬč/ 'red alder' |
| *Lonicera ciliosa* Poir. | <u>snana´qwūɬtc</u> 'orange honeysuckle' |
| *Sambucus cerulea* Raf. | <u>tseqwek</u>[u] 'blue elderberry' |
| *Sambucus racemosa* L. | /sc̓iwq̓iɬč/ 'red elderberry' |
| *Symphoricarpos albus* (L.) Blake | /p̓ač̓ɬč/ 'waxberry, snowberry' |
| *Achillea millefolium* L. | /skʷəntaʔyiɬč/ 'yarrow' |
| *Cornus nuttallii* Aud. ex. T. & G. | /kʷatxiɬč/ 'flowering dogwood' |
| *Shepherdia canadensis* Nutt. | /sx̣ʷasəmiɬč/ 'soapberry' |
| *Arbutus menziesii* Pursh. | <u>ko qwexiltc</u> 'madrone' |
| *Arctostaphylos uva-ursi* Spreng. | No Native Term |

| Species | Native Term |
|---|---|
| *Gaultheria shallon* Pursh. | /t̓qeʔiłč/ 'salal' |
| *Vaccinium ovalifolium* Smith | /ŋəc̓inečiłč/ 'blue huckleberry' |
| *Vaccinium oxycoccus* L. | /ƛ̓iʔx̣ʷəyʔsiłč/ 'bog cranberry' |
| *Vaccinium parvifolium* Smith | /pixʷiłč/ 'red huckleberry' |
| *Quercus garryana* Dougl. | <u>q!apūt</u> 'garry oak' |
| *Ribes divaricatum* Dougl. | /t̓amuxʷiłč/ 'gooseberry' |
| *Ribes lacustre* Poir. | /spaʔac̓iłč/ 'swamp currant' |
| *Ribes sanguineum* Pursh. | <u>xuwiˣᵘq!a</u> 'red-flowering currant' |
| *Prunella vulgaris* L. | <u>sintcīqwuxtakē´qwa'itc</u> 'self heal' |
| *Abronia latifolia* Esch. | No Native Term |
| *Epilobium angustifolium* L. | /siʔyəʔiłč/ 'fireweed' |
| *Rhamnus purshiana* DC. | <u>wū´cinūtc</u> 'cascara' |
| *Amelanchier alnifolia* Nutt. | /čəčsinəč/ 'saskatoon berry, service berry' |
| *Aruncus sylvester* Kostel. | No Native Term |
| *Fragaria vesca* L., *F. virginiana* Duchesne., *F. chiloensis* (L.) Duchesne. | /t̓iyuqʷiłč/ 'strawberry' |
| *Geum macrophyllum* Willd. | <u>ngkłał</u> 'yellow avens' |
| *Holodiscus discolor* Pursh. | /q̓ac̓iłč/ 'ironwood, oceanspray' |
| *Osmaronia cerasiformis* (T. & G.) Greene. | No Native Term |
| *Prunus emarginata* Dougl. | /sk̓ʷəc̓əŋiłč/ 'bitter cherry' |
| *Pyrus fusca* Raf. | /qaʔxʷiłč/ 'wild crabapple' |
| *Rosa nutkana* Presl. | /qaʔyəqiłč/ 'wild rose' |
| *Rubus leucodermis* Dougl. | /c̓q̓ʷəʔmeʔełč/ 'blackcap, black raspberry' |

| Species | Native Term |
|---|---|
| *Rubus parviflorus* Nutt. | /t̓eq$^{w}$əmiłč/ 'thimbleberry' |
| *Rubus spectabilis* Pursh. | /ʔaliluʔ, saʔłanəŋ/ 'salmonberry' |
| *Rubus ursinus* Cham. & Schlecht. | /sq̓$^{w}$iʔyayŋx$^{w}$/ 'trailing blackberry' |
| *Salix sitchensis* Sanson. | /sx$^{w}$iʔyeʔiłč/ 'willow' |
| *Populus trichocarpa* T. & G. | /čuʔŋłp/ 'black cottonwood' |
| *Cicuta*[161] *douglasii* (DC.) | sak$^{u}$qwuk'ka´in 'water hemlock' |
| *Daucus pusillus* Michx. | /sak$^{w}$q/ 'wild carrot' |
| *Heracleum lanatum* Michx. | /sx$^{w}$mək$^{w}$usŋən/ 'cow parsnip' |

# APPENDIX B

## General Plant Terms in the Clallam Language

| | |
|---|---|
| Bark (generic) | /sk̓ʷəc̓əŋ/ |
| Bark (thick) | /c̓ayiʔ/ |
| Bark (thin) | /k̓ʷiyaʔkʷikʷs/ |
| Berry (generic) | /sčaʔyəqʷɬ/ |
| Berry (dried) | /šam/ |
| Branch | /sxʷiʔiʔyis/ |
| Bread, Flour | /saplin/ |
| Bush | /šuʔuʔem/ |
| Charcoal | /c̓aʔis/ |
| Cone | /c̓aʔeʔmac̓/ |
| Fruit, Juice | /sxʷqʷaʔtnʔ/ |
| Grass | /sxcaʔyaʔneqʷ/ |
| Hay | /sxcaʔiʔ/ |
| Indian Rope | /č̓əč̓ɬ/ |
| Leaf | /sc̓uc̓ɬa/ |
| Log (drift) | /qʷɬayʔ/ |
| Log (rotten, erect) | /c̓q̓ʷəŋiɬč/ |
| Log (rotten, fallen) | /pkʷayʔ/ |
| Pitch, Pitchwood, Gum | /č̓eʔəx/ |
| Plant (generic) | /čeniŋɬ/ |
| Plant Medicine | /stayŋxʷ/ |
| Root (generic) | /q̓ʷc̓əŋ/ |
| Sprout (generic) | /scacqi/ |
| Stick of Wood | /sč̓uyʔu/ |
| Tree (generic) | /sqiʔyayŋxʷ/ |
| Tree (fruit) | /sčəʔəyəqʷɬiɬč/ |
| Tree (stump) | /sčaʔeč/ |
| Underbrush (thick) | /q̓ʷay/ |
| Vine (generic) | /ʔəsayʔaʔyət/ |

# THE ASSOCIATION BETWEEN ANTHROPOGENIC PRAIRIES AND IMPORTANT FOOD PLANTS IN WESTERN WASHINGTON

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ABSTRACT

In part of western Washington unique physiographic prairies exist that support a complex of plants more readily associated with California or Great Plains regions than western Washington. These assemblages of plants contain the major sources of carbohydrate, most of the berries, the only significant source of vegetal protein in this region, and numerous sources of vitamins utilized in the aboriginal dietary. Historical and scientific evidence is offered which strongly suggests that these prairies were maintained through time by the native people who regularly burned them in order to preserve and fertilize these important sources of food. Without regular burnings (annual or bi-annual) these prairies would have long since vanished due to encroachment by Douglas fir (*Pseudotsuga menzesii* [Mirbel] Franco) and these valuable and necessary additions to the dietary would have vanished with them.

## Description of the Region

The prairies of western Washington are unique floral areas, containing particular complexes of plants which were highly prized by the original inhabitants of the area. The first writer to note the uniqueness of the prairies was Dr. J. G. Cooper who visited the area in the early 1850s and collected botanical specimens. He writes:

> Of the 360 species there given, more than 150 are peculiar to these prairies, being a very large proportion considering their small extent in comparison with the forests. It is also observable that these are of a group characteristic of the Great Plains and California, of which botanical regions these prairies form the northwestern outskirts [1860:23].

The origin and maintenance of these prairies has been a subject of inquiry to many early travelers, historians, and contemporary scientists because they differ from the overall physiography of western Washington which is hilly to mountainous and was once covered with dense stands of mostly coniferous trees. The prairies, on the other hand, are flat or gently undulating, contain few trees, mostly oak (*Quercus garryana* Dougl.) and pine (*Pinus contorta* Dougl. and *P. ponderosa* Dougl.), with a few members of the willow family. Although information concerning these prairies is scattered and incomplete I have assembled evidence and arguments which suggest that these prairies were an important source of food plants for the Indians of western Washington and that their persistence through time was achieved by active manipulation on the part of those people. This land management was achieved by burning and the side effects of regular gathering activities using digging sticks which would have altered the landscape by tilling and aerating the soil, and thinning of plants.

The singularity of the prairies of western Washington was remarked upon by many early explorers, many of whom made reference to the fact that they appeared unnatural in origin. Those descriptions offer us the best available picture of the region during pre-contact times. George Vancouver, visiting the Straits of Juan de Fuca in 1792 wrote:

> The summit of the island presented nearly a horizontal surface, interspersed with some inequalities of ground, which produced a beautiful variety, on an extensive lawn covered with luxuriant grass, and diversified with an abundance of flowers. To the northwest was a coppice of pine trees and shrubs of various sorts, that seemed as if it had been planted for the sole purpose of protecting from the Northwest winds this delightful meadow...[1801:63];

and

> As we advanced [in Admiralty Inlet] the country seemed gradually to improve in beauty. The cleared spots were more numerous, and of a larger size [1801:74].

Vancouver posited this theory for the origin of the prairies:

> It is also possible, that most of the clear places may have been indebted, for the removal of their timber and underwood to manual labor. Their general appearance furnished the opinion, and their situation on the most pleasant and commanding emminences, protected by the forest on every side, except that which would have precluded a view of the sea, seemed to encourage the idea [1801:111].

Charles Wilkes, exploring the region in 1841, noted the prairies and some of the plants associated with them. While traveling on the Nisqually Plain he wrote that there were "...prairies here and there breaking through the pines with lupine, camass, sunflower, and the scarlet [blank] and buttercup" (1926:22). Further south he comments on the "...Lupines and Kamass flowers all seeming in the utmost order as if man had been ever watchful of its beauty and cultivation" (1926:51).

The specific area is bounded on the west by the Pacific Ocean and on the east by the Cascade Mountains. The northern boundary is the one which distinguishes Canada from the United States and excludes the Cowlitz, Chehalis, and Willapa drainages. This southern boundary is not arbitrary but is made because it is the limit of the area of western Washington which harbors the unique prairies found on glacial outwash deposited during the recessional stage of the Vashon glaciation. This area of western Washington comprises approximately $18{,}000^2$ mi. ($47{,}000^2$ km) and some 2185 mi. (3516 km) of marine shoreline, 1784 (2870) of them in Puget Sound and the Strait of

Georgia (National Oceanic and Atmospheric Administration 1978:10). Puget Sound, generally meant to include the entire region "...from the inlets south of Olympia, Washington, to the bays south of Vancouver, Canada" (Smith 1941:197) is an inland sea which receives water from the numerous streams and rivers draining the Cascade and Olympic ranges. It flows to the Pacific through the Strait of Juan de Fuca and the Strait of Georgia. The Sound was important to the native peoples both for the marine life it supported and also as a maritime highway.

The temperature of western Washington is generally mild with warm wet summers and cool wet winters. This agreeable feature has been commented upon by innumerable writers. Typical of these comments is one by Mr. Lorin Blodget who wrote in 1857:

> The winter at Puget's Sound is warmer than at Paris, the mean being 69° at the first, and 38° at Paris; and ...a distance like that from Paris to Aberdeen must be passed over, *beyond the extreme at the north of Puget's Sound* to find a winter as cold as that of this city, Washington D.C. [Swan 1857:45].

Summer temperatures rarely exceed 27°C (80°F) and minimum winter temperatures frequently do not drop below 0°C (32°F) in the lowland regions. While temperature does vary from area to area the range is not as extreme as the range for precipitation. The rainfall in this area varies considerably from site to site. For example, one area under consideration lies in the "rain shadow" of the Olympic Mountains and includes the northeast portion of the Olympic Penisula, the San Juan Islands, and Whidbey Island. This region has average annual rainfalls of from 50.8 cm (20 in.) to 114.3 cm (45 in.). Whereas rainfall in the Pierce and Thurston County areas totals 101.6 cm (40 in.) to 127 cm (50 in.) a year, while Kitsap, Mason, and the western part of Clallam County[1] have annual rainfalls of 152.4-177. cm (60-70 in.) and 203.1-228.6 cm (80-90 in.) per year respectively. Since the prairies of western Washington exist in areas which have as little rain as 50.8 cm (20 in.) a year and as much as 228.6 cm (90 in.) some factor other than rainfall or lack of it must account for the common plant associations found on these prairies.

## Land Management for the Production of Food Plants and Forage

Burning as a method of land management is widely known to have been used by hunters and gatherers, horticulturalists, and herders (Gould 1977; Wolf 1966; Evans-Pritchard 1940). Proudfoot argues for the development of grasslands throughout the world from deliberate burning of forests by hunting groups which preyed on herbivores. He ranks fire as the preeminent method used by humans to modify the landscape, and consequently the soil (1971:12). In the literature of the Northwest burning is cited as a common method of land-plant management for the Indians of western Washington but all too often no references are given (Franklin and Dyrness 1969; Kellog 1922). For example, Morris (1934:338) discusses the evolution of fire control in Oregon and Washington from 1806 to 1933 and writes "First, the Indian burned off the valleys each year, then the whites drove them from the valleys and prevented annual burning." There is no way of checking his sources or knowing which region he is discussing.

While the references to the aboriginal practice of burning by ethnographers or others in the field are few for this area they do exist and are associated with either berries (*Rubus* sp.), camas (*Camassia quamash* [Pursh] Greene), bracken (*Pteridium aquilinum* Kuhn.), or hunting. Collins (1974:57) reports a cautious remark which appears to reflect an awareness of white disapproval of native burning "One spirit supplied the song to make the berries grow, together with the knowledge of how to burn an area of the forest in a careful, controlled way." She adds that the Skagits were well aware that berries grew more profusely in a burn than in other areas. Twana women were also aware of this for Elmendorf (1960:126) writes that they "...journeyed sizeable distances to the burnt-over areas where berries were abundant." These two reports tally well with a communication from L. D. Parsons, Supervisor of Big Game Management for the Washington State Department of Game, who writes that "The best way to provide forage for deer is to set a forest fire, which we cannot do for obvious reasons" (Personal Communication 1978). The plants listed by Parsons which form the major portion of deer forage are:

> Trailing blackberry - 25%; Grasses - 10%; Plantain - 9%; Vine Maple - 9%; Annual Agoseris - 8%; Salal - 6%; Red Alder - 5%; Red Huckleberry - 4%; Salmonberry - 3%; Clover - 3% [Personal Communication].

These plants rapidly move into burned areas. It should be noted that the burn Collins reports is a forest burn, which presumably would not be done on a regular basis. The blackberry and most of the other plants would be destroyed by annual or bi-annual burning.

Reagan, Indian Agent at the Quileute Reservation, discussed bracken root as an important source of food for the Quileute and Hoh, and also as forage for deer. He wrote:

> The burning of the fern year by year was what kept up the "prairies" of the peninsula and extended these areas. The Indians burned the ferns for the purpose of clearing out the prairies so they could shoot the deer and elk when they came to feed on the young "fern sprouts" [1934:56-57].

He is probably correct that the Forks and Quileute prairies were burned each year in the process of plant management but he is incorrect in stating they were burned so that the deer could feed on the "fern sprouts." As noted above bracken does not comprise much if any forage for deer and may have the same fatal effects on deer as it does on cattle (Pohl 1955). And, also, regular burning would destroy the very plants on which deer feed. The burning of these prairies may have provided some grasses for deer but the principle reason for burning was undoubtedly to fertilize the bracken crop and destroy adventitious species.

A nineteenth century observer writing extensively about the unique prairies of western Washington notes that they are of several types but the most interesting are those which are dry - the ones of concern in this paper - scattered about the area and from one to four miles in length. Cooper's (1860:23) description of these prairies gives a good picture of the territory as it must have looked for thousands of years.

> A few remarks are necessary upon the origin of the *dry* prairies so singularly scattered throughout the forest region. Their most striking feature is the abruptness of the forests which surround them giving them the appearance of lands which have been cleared and cultivated for hundreds of years. From various facts observed I conclude that they are the remains of much more extensive prairies, which, within a comparatively recent period, occupied all the lower and dryer parts of the valleys, and which the forests have been gradually spreading over in their downward progress from the mountains. The Indians, in order to preserve their open grounds for game, and for the production of their important root, the camas, soon found the advantage of burning... On some prairies near Vancouver[2] and Nisqually, where this burning has been prevented for twenty years past, young spruces are found to be growing up rapidly, and Indians have told me that they can remember when some other prairies were much larger than at present.

Cooper (1860:33) also reports that "...the introduction of the horse, about the beginning of this century was a further inducement for burning...." The Nisqually region orginally included both a large grassy plain and numerous smaller prairies. The Nisqually Plain produced a good grazing grass and the Puget Sound Agriculture Company imported thousands of sheep, Spanish "horned cattle," and horses to feed on this grass. These animals (over 16,000 all together) competed with native animals for forage and the sheep soon ruined all the prairies as sources of food plants according to a letter written by Dr. William Tolmie (1841) concerning his qualifications for the position of Indian Agent in British Columbia.

> The difficulty of Indian management at Nisqually had been greatly enhanced by the introduction of sheep and cattle in large numbers on the plains. The Indians themselves, owners of horses, and considerably dependent on roots of native growth for subsistence found the innovation so much for the worse that discontent was often exhibited.

Hunt and Kaylor (1917:181) cite Edward Huggins, agent for the Puget Sound Agriculture Company, concerning the changes wrought on the Nisqually Plain and prairies, and the disappearance of the original grass due to these animals and increasing white settlers.

> ...The nutritious blue bunch grass was plowed up or killed out by too close pasturing and followed the cattle into the things of the past. The most diligent cultivation failed to make the gravelly soil of the plains produce profitable crops; fields again were turned into pastures which produced a scant growth much inferior to the original blue bunch grass which, Huggins says, he has seen waving in the breeze like the great fields of ripening grain.

The Nisqually Plain then, originally produced grass in quantities sufficient for numbers of horses, was burned to increase this forage which would also provide forage for deer while the prairies held an important supply of roots.

## Historical Evidence of Fires in Western Washington

Historical sources confirm that there were fires in western Washington, in prairie areas, at the time of year fires would most likely have been set, just prior to the onset of fall rains. Tolmie, scribe at Nisqually house writes on

> 7 July 1833 Fire has today consumed all the herbage on the plain for an extent of several miles [1915:190];

and the following year he writes:

> 6 September 1834 The weather warm and we are surrounded by a thick smoke owing to fire being put to the field behind us [1916:73];
>
> 11 September 1834 The weather has become clear and the smoke has partly disappeared [1916:74].

Tolmie's entries for 1835, again indicate fires:

> 14 August 1835 The country around us is all on fire and the smoke is so great that we are in a measure protected from excessive (illegible)
>
> 17 August 1835 No change in the weather everything burning up.
>
> 18 August 1835 The country side on fire, weather warm.
>
> 19 August 1835 Weather still smoky and warm.
>
> 23 August 1835 Some rain fell during the night.
>
> 25 August 1835 Weather fair. The sun nearly hid from us owing to the smoke.
>
> 29 August 1835 During the night we had a thunder storm and some rain fell.
>
> 8 September 1835 The weather fair but we scarcely can see the sun from the smoke around.
>
> 12 September 1835 Smoke disappearing [1833-39].

In the following year he writes, after a spell of fair weather, that on the 16 of September it was cold and foggy and on

> 17 September 1836 Cloudy weather, very smokey.
>
> 18 September 1836 The country around us on fire
>
> 19 September 1836 We have not seen the sun from the smoke. The wind from the northeast.
>
> 20 September 1836 Thick smoke around us [1833:39].

These entries do not indicate who or what set the fires.[3] They do occur at the time of year when Indians would have burned and also when lightning caused fires would be most likely. However these are the same Nisqually plains where Dr. Cooper reports that burning by the Indians was prevented some 20 years past which would place the prevention of fires in the early 1830s. Since the Puget Sound Agriculture Company had brought 300 horses, 8000 sheep, and 6000 "horned cattle" to feed on the Nisqually Plains and established a large agricultural center it seems likely that aboriginal burning practices would have been discouraged during this time (Tolmie 1878: 20).

The next report of fire is from an early American settler on prairie land which is today Olympia. Levi Smith (1952:300) writes in his Journal that on the 8th, 14th, 15th, and 17th of August 1846 that "...it is very smokey." He gives no cause for the smoke.

Col. and Mrs. I. N. Ebey (1917:309), early settlers on Whidbey Island, report that on 9 June 1852 "A great deal of smoke is to be seen on the other side which I suppose is caused by the Indians burning the woods" (note that the date is June and that woods are being burned). They also report that Indians had set fires on the 9th and 17th of August of that year during a period of cool weather. On 22 August 1855 Winfield Ebey (1855:93) ferried from Port Townsend to the mouth of the Skagit and wrote of his trip "Fair wind and tide, the only drawback the smokey state of the atmosphere which prevents seeing objects at any great distance" and on the 27th of August, while at Port Townsend reports "Morning very foggy. In the afternoon it became more clear of fog (or I believe the most of it was smoke)" (Ebey 1855:103). He gives no reason for the smoke and the site, or sites of the fires are indefinite.

Col. and Mrs. Ebey's diary is the only historical source which gives direct evidence for aboriginal burning. Their diary and the reports of Cooper, Reagan, and Collins are the only accounts which specifically cite Indians as burning or having burned in western Washington. That these fires occurred when the area would be most subject to thunderstorms might argue for lightning caused fires. However the instances of forest fires in western Washington are not altogether frequent and the extent of the fire is determined by the condition of the forest, the amount of rainfall which falls during the storm, and whether or not the fire is controlled. Forest fires, in the past, would have burned until extinguished by rains.[4] A look at lightning caused fires for the State of Washington for a 10 year period gives some indication of the variability of forest fires on a portion of Washington forests (State Protected Lands only).

| Year | Fires | Acres Involved |
|---|---|---|
| 1977 | 178 | 170 |
| 1976 | 56 | 72.6 |
| 1975 | 176 | 176 |
| 1974 | 120 | 59.1 |
| 1973 | 140 | 37.8 |
| 1972 | 192 | 114.3 |
| 1971 | 60 | 12.3 |
| 1970 | 203 | 4698.6 |
| 1969 | 63 | 9.5 |
| 1968 | 68 | 12.1 |

(Department of Natural Resources, Personal Communication)

These figures are for both eastern and western Washington with the majority of fires, over 85%, occurring in eastern Washington. As noted above, uncontrolled fires would involve more acreage and indefinite time periods. Lightning caused fires are a consideration when reviewing the historical record and although they occur infrequently in western Washington, and even less frequently in the lowland region where the prairies are established, if they went uncontrolled, they might have burned for long period, making the atmosphere "very smokey." Some of the fires noted by the early settlers then may have been the results of lightning.

Another natural phenomenon which must be taken into account in evaluating the reports from Tolmie and Smith are indicated in these remarks made about a journey over the Cascades in early August 1854.

> During our ascent of the western slopes of the Cascades range we passed for days through dead forests, perhaps burnt by ignition from the hot ashes which were thrown out by Mt. St. Helens several years before; but large tracts were on fire at the same time, filling the air with smoke, so that we could not see the surrounding country for several days...It is only where it, *Pseudotsuga menzesii* [Mirbell] Franco, abounds that extensive tracts are found killed by conflagration [Cooper 1859:20-21].

Mt. St. Helens erupted in 1831, 1835, 1842, and 1857. The eruptions consisted of strong pyroclastic explosions and steam. Whether or not these eruptions would have affected the Nisqually region is uncertain. Mt. Rainier eruptions are cited as 1820, 1841, 1843 (?), and 1854 (?) (Harris 1976). They consisted of light pumice ash. The smokey atmosphere noted by Tolmie and Smith may have been caused by these eruptions. Evidently fire was not involved in the Rainier eruptions.

To summarize to this point I believe we can take as evidence for burning by the Indians the reports of Cooper, the Ebeys, Reagan, and Collins. Their reports indicate that Indians burned both prairies and woods. They also indicate that the burning of the prairies was on a regular basis. Burning of the prairies on a regular basis would preserve the prairies from invasive species and fertilize the food plants growing on them, and while it might not provide much forage for deer or elk, sporadic burning of forest lands would offer just such forage. Although the evidence is sparse I believe these reports together with evidence for burning offered below will show that the Indians of western Washington regularly burned the prairies to maintain valuable food sources.

## Other Evidence for Anthropogenic Prairies in Western Washington

Examination of literature other than historical or anthropological reveals that burning did exist on the prairies of western Washington to a time extending well into the past. The paper by Lotspeich and others, "Vegetation as a Soil-forming Factor on the Quillayute Physiographic Unit in Western Clallam County, Washington," contains information which confirms work to be cited below but does not arrive at the same conclusions as other works. This paper is unique in that it assumes no disturbance of the prairies by aboriginal people, in fact, it presents a totally static view of the environment except for periodic flooding prior to white settlements. Lotspeich and others (1961:53) find that the herbaceous plants have been established on the Quillayute Prairie for a long time and that "There is no evidence that trees have ever grown on the main portion of the Quillayute Prairie." Sitka spruce (*Picea sitchensis* [Bong.] Carr) has encroached on the prairie only where the soil has been disturbed by settlers with the most mature trees being 70 to 80 years old. They further note that the "...boundary is marked by an abrupt change from low growing herbaceous plants to dense forest," a feature for all prairies of western Washington. To account for the lack of trees they analyze the composition of the soil to determine if this is the tree inhibiting factor. The Quillayute soil is organic (which deters invasion by Douglas Fir, although they do not say this), blackish in color (Ugolini & Schlichte) which contrasts with the yellow red or brownish soil of the forest, fine textured, contains charcoal in the surface layers and lies on estuarine beds of pebbles and gravel which allows good drainage. They conclude that this textured soil along with other factors such as stream cutting, fire, human disturbance, and lack of seed source (they do not indicate how there could have been a lack of seed source) have been the determining factors in stopping the encroachment of the surrounding forest. I find their conclusions inadequate for the following reasons. The fire and human disturbance they write about occurred in the late 1870s which does not explain the absence of trees on the prairie since the withdrawal of glacial ice some 12,000 years ago. They further find that Sitka Spruce is invasive in disturbed areas, concluding that it is resistant to smothering by bracken (*Pteridum aquilinium* Kuhn) noting that "The physiognomy of the prairies is determined in a large degree by the fern *Pteridum aquilinium* var. *pubescens* (L) Kuhn" (Lotspeich and others 1961:53). However, they contradictorily state that in those disturbed areas Sitka Spruce "...does not appear to be reproducing itself" (Lotspeich and others 1961:57) which leads one to conclude either that it is not resistant to smothering by bracken or some other factor, such as too rapid drainage and dry summer conditions, or organic soil have kept it from invading the prairie. They do not explain the charcoal in the surface soil nor do they give any time depth data concerning it. The reader is left assuming that the charcoal source was fire caused by the whites since the underlying assumption of this paper is that no human intervention occurred on the prairie prior to 1879. It should be remembered that this is one of the prairies mentioned by Reagan as having been regularly burned. Although the paper by Lotspeich and others is unsatisfactory in many ways it does point out some of the distinctive features of the prairies of western Washington; their flatness, lack of trees, organic and quickly drained soil, and abundance of bracken and other herbaceous plants. A list of the plants they found while sampling the soil is found in Appendix I. This list reveals that they found relatively few camas (*Camassia quamash* [Pursh] Greene) plants which is interesting because Reagan reports that this prairie was a good source of those plants. The probable reason for this discrepancy is discussed below.

Ugolini and Schlichte (1973:218) offer a scholarly, well reasoned argument for the origin and maintenance of prairies in Pierce and Thurston counties based on the unique geology of the prairies.

> The prairies are found on level glacial outwash areas of several hundred hectares deposited approximately 14,000 years B.P. during the retreat of the Puget lobe of the Vashon Stade of the Fraser Glaciation. The outwash deposits on which the prairies have developed are dominated by sand and gravel and display an excessive drainage. Smaller isolated outwash areas, deposits of glacial drift other than outwash, and areas of uneven sloping topography have apparently never supported prairie vegetation.

They present evidence that a period of maximum warmth occurred in western Washington between 7500 and 4500 BP which allowed the prairie plants to become well established before a cooler climate set in and this has been confirmed by Hansen (1947:271). "This climate period, which has been called the Hypersithermal Interval by Deevey and Flint had a considerable effect on vegetation as shown in pollen sequences..." (Ugolini and Schlichte 1973: 219). Following deglaciation pollen diagrams reveal that for several thousand years the area was dominated by conifer species. Oak (*Quercus garryana* Dougl.) first appears in the area about 10,000 BP along with increasing non-arboreal pollens which indicates that these outwash areas began to support complexes of prairie plants at about the same time humans entered the area. Gradually the climate shifted and became cooler and more moist, conditions which favor conifer forests. Pollen diagrams "...for the last 4000 years show little evidence for climatic or vegetational changes and reflects the present floral assemblage" (Ugolini and Schlichte (1973:220). The authors find that these prairies have persisted over time resisting conifer encroachment for two reasons:

> (1) the resistance of the prairie community to invasion by other species and (2) the occurrence of frequent prairie fires started by Indians.

They argue that the ability of the prairie plants to repulse invasive species is due to the fact that in undisturbed areas the thick cover of moss which exists between the grasses and other forbs acts as a shield, preventing invasive seeds (particularly Douglas Fir) from reaching the mineral bed which is necessary for their germination. Periodic burning would destroy any seedlings which may have become established. They also note that the oak, which is found only on the prairies of western Washington, is a tap-*rooted species well adapted to the summer drought* conditions created by the rapidly drained soil. Douglas Fir is not tap-rooted and does not tolerate drought.

In an analysis of the Spanaway soils of these prairie regions Ugolini and Schlichte (1973:226) report that they have been "...affected by infusion of finely divided charcoal originated from the burning of the prairies by the Indians" and that they are a dark brown to black color. The only source they quote for evidence of aboriginal burning is Lang (1961). Although as Ugolini admits (Personal Communication) the evidence for aboriginal burning is scarce, the material accumulated in this paper supports their theory and makes their argument even more persuasive.

Hansen's work also supports the theory postulated by Ugolini and Schlichte as do that of Stuiver, Lang and Hedlund. Hansen finds that pollen profiles taken from 13 sphagnum bogs in the Puget Sound region show that climate has not been the major controller of forest succession but rather fire and soil conditions have been. He finds soil conditions on the prairies favored xerophytic species such as oak and pine (*Pinus contorta* Dougl. and *P. ponderosa* Dougl.) which are relics of a warm dry period between 8000 and 4000 BP, and that they have persisted to the present because of the dry, well drained soils in the prairie areas and periodic fire. Pine is a pioneering species, intolerant of shade, which invades near the ice front of glaciers and in burns. This species, along with oak is found on all the prairies of the area from the San Juan Islands to the Nisqually region. Hansen (1947:271) also writes that "Periodic fire may have also favored the persistence of the open prairies." Although they give no direct evidence for burning, Stuiver and others offer information which makes explicit what is implicit in Hansen's work. They find that periodic fire is indicated in their pollen profiles by the "...significant percentages of *Pinus*" (Stuiver and others 1978:19) which is a fire dependent species. They also note "...the absence of Douglas Fir in the Puget Lowland during much of the Holocene."

Lang (1961) finds that the Euroamerican invasion has wrought more change on the prairie landscapes than has occurred since the Vashon Glacier. By comparing U.S. Survey maps made in the 1850s with those of today he shows the prairies have been considerably reduced in size. This reduction in size is due to the steady encroachment of the Douglas Fir onto the prairies. He notes that by 1900 Douglas Fir had made considerable advancement and since there had been no change in climate or soil which accounts for this encroachment Lang (1961:75) concludes that mechanical disturbance of the soil along with absence of controlling fire has allowed this degradation of the prairies in Pierce and Thurston counties.

> The only prairie which is burned with any regularity is at Lake Nisqually. This prairie is the U.S. Army artillery impact range. It is either purposely burned by the military authorities as a safety measure, or it is accidently set on fire by shelling every year...One can see (by comparing the maps) that this area is the only one upon which no apparent encroachment of the Douglas Fir on the prairies has taken place in the last 100 years.

Lang (1961:85) also concludes that periodic burning by the Indians would have kept out invasive species and would not have harmed the prairie plants.

Hedlund (1973:94) has also done work on these prairies and like other scholars finds no reason why they should not have been invaded by Douglas Fir unless they were deliberately maintained. He offers the following evidence for these anthropogenic prairies:

> Perhaps the best evidence that the prairies were man-made or kept is their location. All of the prairies in the area of study (five) have the following characteristics:
>
> 1. All have archeological sites (with considerable evidence of cultural activity).
>
> 2. All are located near permanent water courses where salmon would be expected to run.

3. All are located on relatively level or low-lying areas.

4. All consisted of at least a section or more of open land.

5. Although streams are found in the area of such prairies the archeological sites are not especially oriented to them, i.e., on Connel's prairie the Imhof and Schodde sites are over one mile from the White River.

> The fifth point above is perhaps the best evidence for the creation or keeping such open sites. If the prairies had not been maintained, the occupants of the sites would have lived in an evergreen forest of perpetual darkness or twilight even during sunny days at noon... Such open sites in the forests would have been desirable on more than a sunshine basis, since open areas, if managed by regular-burning, would help sustain a larger human population by sustaining larger plant and animal populations. Animals would have more and better grazing on the grasses and brush in such areas, while plants would be stimulated by increased sunlight and fertilized by the ash from burning.

To summarize to this point, the prairies of western Washington have unique glacially deposited gravel beds which allow rapid drainage, creating drought conditions in the summer months of least rainfall. The soils associated with the prairies differ in kind from soils of the forested regions. Oak and other nonarboreal plants became established on these prairies about 10,000 BP, a period when humans also entered the area. The Spanaway soils support thick expanses of moss on the prairies which does not afford Douglas fir access to needed mineral soils, however without periodic burning some considerable encroachment or annihilation of these prairies would have occurred in 10,000 years. The presence of *Pinus*, particularly *Pinus contorta* Dougl. offers further evidence that burning occurred in these areas as it is a fire dependent species. Historical and ethnographic evidence lend support to the thesis that the prairies were regularly fired.

## The Association Between These Prairies and Important Food Plants

If we can accept the argument that the prairies of western Washington have been periodically burned over a long time period, and I believe that the evidence offered above strongly suggests that this is the case, then the next move is to ask, why were they burned? The answer may lie in the suggestion given by Hedlund (1973:94) that the natives would otherwise have lived in eternal gloom but I find his second suggestion more accurate "...plants would be stimulated by increased sunlight and fertilized by the ash from burning."

White (1976:332) finds that the Salish of Whidbey and Camano islands burned the prairies to increase production of camas and bracken.[5] He writes that

> The abundance of these plants on the prairies was not fortuitous. Rather than being major Indian food sources because they dominated the prairies, bracken and camas more likely dominated the prairies because they were major Indian food sources.

Bracken, probably a major source of starch in this area, is reported as being profuse and very large on these prairies (Cooper 1860; Reagan 1934; Lotspeich and others 1961). Both bracken and camas can survive fall burnings because the root systems are protected and as Lang (1961:85) notes "Most native species are perennials and have their perennating buds at or below the surface of the soil" and are therefore biologically capable of surviving periodic fire. An examination of Appendix I and II shows that many of the plants associated with the prairies would be unharmed by burning. Burning would also fertilize the soil and Suttles (1951b) reports that the Saanichton, Samish, and Songish burned their camas beds for precisely that reason. And, burning would destroy adventitious species.

The importance of bracken as a source of starch has been documented elsewhere and will not be repeated here (Norton 1978). The abundance of camas on the prairies and its importance as a food has likewise been well documented (Gunther 1945; Cooper 1860; Swan 1857; Suttles 1951b). What is not as well known is that the first white settlers homesteaded on these prairies, partly because of the ease of building without taking down a forest, and partly because of the camas itself. Suttles (1951b:59) has noted that sheep caused degradation of camas beds on the San Juan Islands but on Whidbey Island it was undoubtedly pigs which are responsible. Mrs. Ebey (1917:134) writes

> We have but a few hogs yet; but in another year we expect to have more. They can do well on Kammus. There are quantities of it here on this island, and it is excellent for both Indians and hogs.

Hogs are quite fond of camas and root up the bulb, eventually destroying the camas beds (Haskins 1977:33). Since early settlers depended on the camas as a source of fodder for their pigs this may account for the lack of camas in the sample of Lotspeich and others of the Quillayute Prairie. The destruction or degradation of many of the prairies in western Washington by sheep, hogs, and horned cattle at an early date ruined them as the sources of food for the natives and has hindered our understanding of how the prairies and the plants associated with them contributed to the subsistence of pre-contact people. An entry from Winfield Ebey's diary for 21 May 1855, echoes what other writers have so frequently noted, that the prairies were sources of food for people from all parts of the Puget Sound lowland.

> There is quite a number of Indians from about Seattle and Port Madison encamped along the beach near my brother [Col. I. N. Ebey, Whidbey Island]. They are on the regular visit to the island to dig the "Kamas" which they collect in large quantities from the prairies which after a certain process make excellent food.

Besides bracken and camas the oak is also a prominent member of the prairie plant complex. Although the oak is little noted as a source of food in this region it may have played a more important part than has been previously thought. Gunther (1945:28) writes "...in the true evergreen forest area that [acorn] is an unknown dish." However, Tolmie (1833:39) writes on 9 August 1833 that a large party of "...natives have pitched near us for the purpose of gathering acorns and berries." He mentions that they include the

Ah qua mish (Duwamish or Suquamish) and the Sin no oh mishes (Snohomish). On October first of the same year he writes that Indians are still gathering acorns. This is also a time when fires are being set in the fields at Nisqually. Boyd reports that the Karok burned under the oak to kill diseases or pests on the tree and clear the ground making it easier to pick up the acorns (1976:33). The Indians in this area may have burned for the same reason. Curtis (1913:58) reports that hundreds of bushels were harvested annually in peculiar little prairies.

> The Nisqually plains, at the head of Puget Sound, furnished the chief supply of nuts for the Sound tribes, and thither in the fall came canoes from all points on the neighboring waters and even from the Straits of Juan de Fuca.

Curtis' account fits well with Tolmie's report. The oaks of western Washington were early used by shipbuilders as they found the wood "...excellent for frames and knees" (Swan 1859). Oak was widely used by other manufacturers as well which may account for its relative scarcity today.

Bracken, camas, and the acorn all grew on the prairies. The first two have been proven to be important sources of carbohydrate, acorns probably were the only significant sources of vegetable protein. Appendix II is a listing of the plants collected by Dr. Cooper in 1853 on the prairies of western Washington. It is, of course, not an exhaustive listing of plants which must have been here aboriginally, and unfortunately, he has not specifically stated where each plant was found so I could not find the 150 plants which he says are peculiar to the dry prairies. However, I found 114 plants which were associated with these prairies, of those four are exotics leaving 110 native plants. A total of 46 of those plants are reported in the literature as having been used by the native people either for food or medicine. Ten of the plants I have not been able to identify. Of the 114 native plants 46 are known to have been used and another 17 may have been used making a total of 63 useful plants. Since these plants were necessary to the diet and herbal kits of the natives and are associated only with the prairies this strongly suggests that these prairies were very important to the economic life of the native peoples. The evidence for regular burning presented above and the fact that camas and other root plots were owned, inherited, weeded, and re-planted also gives evidence of the importance of the prairies as sources of food and medicinal plants (Stern 1934; Suttles 1951b; Collins 1974).

The 46 plants known to have been used, along with the 17 possibles, include the major sources of carbohydrate mentioned in the literature for people of western Washington except *Sagittaria latifolia* Willd. which is cited only for the Skagits (Collins 1974:56), and those root plants common only to coastal areas such as *Abronia* sp. and some lupines and clovers. They also include several "shoots," prized sources of necessary vitamins and a number of the important complex of berries, along with the acorn, the only significant source of vegetal protein in this region. The forest and other non-prairies areas would yield considerably fewer food plants. The prairie and forest ecotones, marshy areas, and beaches contain the remaining members of the berries, fruits, roots, shoots, and medicinal plants.

## Conclusion

The evidence has shown that the prairies of western Washington are unique phytogeographic units established during an altithermal about 10,000 BP containing unique assemblages of flora important to the economic life of the aboriginal peoples. Further, these prairies and their associated plants would not have been able to persist through time without the active manipulation of humans who periodically burned these prairies thereby inhibiting the advance of adventitious species and fertilizing the root crops. Burning was also done on non-prairie land for the purpose of increasing berry crops. The lack of information concerning these prairies, the plants associated with them and methods of land management practiced by the natives is due to rapid settlement and degradation of these prairies by white settlers and introduction of non-native species.

## Acknowledgement

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## Notes

[1]Lotspeich and others (1961) give an average of 116 in. (194.64 cm) of precipitation for the Quillayute Prairie with a minimum of 78 in. (198.12 cm) and a maximum of 153 in. (383.62 cm). The least precipitation occurs in August and September (1961:57).

[2]The prairies near Vancouver and in the Willapa and Chehalis drainages are of different geological origin than those under discussion.

[3]Since women are primarily associated with the gathering and maintenance of food and food plants it is interesting to read that the employees of the Puget Sound Argiculture Company hired Indian men to do carpentry and cut cedar while Indian women were employed at times digging potatoes and "...in burning out the swamp" (Journal...Nisqually House 19 October 1849).

[4]Swan (1857) writes about a forest fire he and some of "the boys" started on the Fourth of July which burned until extinguished by winter rains.

[5]White (1976:331) also reports that the Skagit burned their nettle patches in the fall after harvesting the plants for use in medicines and the manufacture of twine. The nettle grew profusely on refuse heaps which had rich soil. These beds were carefully tended by the Skagit and later became the sites for potato patches. As Suttles has noted the practice of heaping refuse from clearing around the potato patches so that it eventually became a low wall indicates a practice of long standing. This practice has been noted for all Puget Sound tribes (Suttles 1951a:280).

# Appendix I

Plants found on the Quilayute Prairie by Lotspeich and others (1961:55) in 1961.

| Species Exhibiting Greatest Frequency and (or) Coverage values in | Prairie-Ecotone | | Prairie | | My |
|---|---|---|---|---|---|
| | Cov. | Freq. | Cov. | Freq. | Comment |
| Ecotone | | | | | |
| *Agrostis abla* | 1.8 | 8 | | | Introduced |
| *Athyrium filix-femina* | 32.8 | 72 | | | Used as food |
| *Blechnum spicant* | 3.3 | 8 | | | |
| *Bromus vulgaris* | 0.4 | 4 | | | |
| *Cystopteris fragilis* | 0.1 | 2 | | | |
| *Daucus carota* | 2.4 | 16 | | | Introduced |
| *Disporum smithii* | 4.1 | 38 | | | Used as a charm |
| *Galium aparine* | 1.4 | 6 | | | Used in the bath |
| *Galium triflorum* | 6.9 | 52 | | | Used as perfume |
| *Gaultheria shallon* | 11.8 | 30 | | | Food plant/forage |
| *Maianthemum dilatatum* | 9.3 | 70 | | | Medicinal plant |
| *Poa pratensis* | 0.4 | 4 | | | Introduced |
| *Polemonium carneum* | 0.7 | 6 | | | |
| *Prunella vulgaris* | 0.4 | 6 | | | Introduced |
| *Rhamnus purshiana* | 3.3 | 6 | | | Medicinal plant |
| *Rubus parviflorus* | 35.7 | 78 | | | Food plant/forage |
| *Smilacina liliacea* | 0.9 | 6 | | | |
| *Symphoricarpos albus* | 9.7 | 34 | | | Food and medicine |
| *Tellima grandifora* | 10.6 | 62 | | | Medicinal plant |
| *Tiarella trifoliata* | 0.4 | 4 | | | Medicinal plant |
| *Viola adunca* | 0.3 | 2 | | | Medicinal plant |

| Species Exhibiting Greatest Frequency and (or) Coverage Values in Prairie | Prairie-Ecotone Cov. | Prairie-Ecotone Freq. | Prairie Cov. | Prairie Freq. | My Comment |
|---|---|---|---|---|---|
| *Achillea millefolium* | 7.2 | 38 | 23.1 | 80 | Medicinal plant |
| *Agrostis oregonensis* | 0.4 | 4 | 2.1 | 14 | Forage |
| *Anaphalis margaritacea* | 3.8 | 16 | 9.6 | 38 | Medicinal plant |
| *Anthoxanthum odoratum* | 3.3 | 16 | 14.1 | 58 | Introduced |
| *Aquilegia formosa* | | | 0.7 | 6 | Edible root |
| *Casmassia quamash* | | | 0.5 | 8 | Edible root |
| *Cerastium viscosum* | | | 0.1 | 2 | Introduced |
| *Chrysanthemum leucanthemum* | 0.4 | 4 | 1.7 | 16 | Introduced |
| *Cirsium arvense* | | | 1.3 | 12 | Introduced |
| *Eriophyllum lanatum* | | | 12.5 | 58 | Medicinal/charm |
| *Fragaria bracteata* | 2.1 | 24 | 5.7 | 58 | Food plant |
| *Galium boreale* | 3.4 | 26 | 7.9 | 54 | Charm |
| *Holcus lanatus* | 8.2 | 48 | 30.1 | 82 | Introduced |
| *Hypericum perforatum* | | | 20.2 | 88 | Introduced |
| *Hypochoeris radicata* | | | 4.1 | 26 | Introduced |
| *Luzula parviflora* | 0.3 | 2 | 0.4 | 4 | |
| *Malus fusca* | 0.3 | 2 | 8.6 | 16 | Food plant |
| *Phleum pratense* | | | 0.8 | 10 | |
| *Prunella lanceolata* | | | 10.6 | 36 | Medicine |
| *Pteridium aquilinum* | 64.5 | 98 | 81.6 | 100 | Food plant |
| *Ranunculus occidentalis* | | | 0.3 | 10 | Food/medicine |
| *Rosa* sp. | 0.7 | 6 | 0.7 | 18 | Food/medicine |
| *Sisyrinchium idahoense* | | | 0.8 | 10 | |
| *Solidago canadensis* | | | 4.5 | 26 | |
| *Spiraea menziesii* | 16.9 | 52 | 15.9 | 62 | Wood used |
| *Stachys ciliata* | 2.8 | 22 | 3.4 | 36 | Medicine |
| *Trientalis latifolia* | 0.5 | 10 | 0.4 | 14 | Medicine |

Their results were based upon analysis of fifty 2 x 5 dm plots for each area.

Of the 48 plants examined by Lotspeich and others 11 are exotics, 9 have no known use except perhaps as forage, and the rest were important food or medicinal plants for pre-contact peoples.

# Appendix II

Dr. Cooper (1860:55-71) writes that of the 360 species collected west of the Cascade range, more than 150 are specific to the prairies. Unfortunately he does not always note which plants are found in the prairies. A search of his text revealed 114 plants noted as being found on the prairies. They are listed below with common usage indicated. Those plants which were possibly used are marked † .

Plants Found on Western Washington Prairies

*Ranunculaceae*

1. *Ranunculus aquatilis* Linn. *Ranunculus* sp. roots were used as food, the leaves were used as a poultice.
2. *R. occidentalis* Nutt. Dry prairies, Puget Sound and Coast. †
3. *R. recurvatus* Poir. Whidbey Island. †
4. *Aquilegia canadensis* (Linn.) var *formosa* Fischer. Gibbs says this "root edible."
5. *Delphinium azureum* DC. now probably *D. nuttallii* Gray or *D. menziesii* DC. used as a poultice.

*Fumariaceae*

6. *Dicentra formosa* DC. now *Dicentra formosa* (Andr.) Walp. This plant was used as an insecticide, to kill lice, etc.

*Cruciferae*

7. *Nasturtium curvisiliqua* Nutt., now *Rorippa curvisiliqua* (Hook.) Bessey. †
8. *Barbarea vulgaris* R. Br., winter cress. †
9. *Cardamine oligosperma* Nutt., Bittercress. †
10. *Arabis hirsuta* Selys, now *A. hirsuta* (L.) Scop., rockcress. †
11. *Sisymbrium canescens* Nutt. now *S. officinale* (L.) Scop., introduced, Tansy.
12. *S. deflexum* Harvey, introduced.
13. *Erysimum asperum* DC. now *E. inconspicuum* (Wats.) MacM., Wallflower, used as a medicine to cause blistering.
14. *Draba nemoralis* Ehrh., probably now *D. nemorosa* L. Whitlow grass, introduced.
15. *Capsella bursa-pastoris* Moench. (now L.) Shepherd's Purse, introduced.

*Violaceae*

16. *Viola adunca* Smith, prairie and on coast, used for labor, blistering.
17. *V. nuttallii* Pursh.

*Hypericaceae*

18. *Hypericum scouleri* Hooker now (Hook.) Hitchc., St. John's wort.

19. *Maehringia lateriflora* Linn. unknown.

*Caryophyllaceae*

20. *Stellaria nitens* Nutt., Starwort, dry prairies.

21. *Cerastium arvense* Linn. chickweed.

*Portulacaceae*

22. *Calandrinia menziesii* Hkr. now *C. ciliata* (R. & P.) DC., Red Maids.

23. *Claytonia dichotoma* Nutt. now *Montia dichotoma* (Nutt.) Howell.

24. *C. parviflora* Dougl. now *M. perfoliata* (Donn) Howell, Miners Lettuce, edible. †

*Geraniaceae*

25. *Geranium carolinianum* Linn., Crane's Bill, *G. oreganum* has very astringent roots. †

*Rhamnaceae*

26. *Ceanothus thyrsiflorus* Esch. now probably *C. sanguineus* Pursh.

*Leguminosae*

27. *Vicia gigantea* Hooker, Giant Vetch, the seeds eaten.

28. *Psoralea physodes* Dougl., Bread-root, leaves used as a poultice and for tea.

29. *Trifolium microcephalum* Pursh, Clover, the roots may have been eaten. †

30. *T. fimbriatum* Lindl. now *T. wormskjoldii* Lehm., roots eaten.

31. *Hosackia bicolor* Dougl. now *Lotus pinnatus* Hook.

32. *H. decumbens* Benth., now *L.* ?

33. *H. paviflora* Benth., now *L.* ?

34. *Lupinus micranthus* Dougl. Lupine, roots may have been eaten. †

35. *L. lepidus* Dougl. †

36. *L. laxifloris* Dougl. †

*Rosaceae*

37. *Spiraea douglasii* Hook., on the ecotone, seeds used for medicinal tea.

38. *Potentilla gracilis* Dougl., used as a charm and medicine.

39. *Fragaria virginiana* Ehrh., (now Duchesne), Strawberry, a food.

40. *F. vesca* Linn., Strawberry.

41. *Rubus leucodermis* Dougl. Black cap, a food. On dry open prairies and in burned over areas.

42. *R. macropetalus* Dougl., now *R. ursinus* Cham & Schlecht. Blackberry, a food.

43. *Amelanchier canadensis* Linn. now *A. alnifolia* Nutt. Service-berry, on prairie ecotone, a food.

*Onagraceae*

44. *Oenothera biennis* Linn., Evening Primrose, shoots peeled and eaten.

45. *O. vinosa* Lindl. now ?

46. *O. lepida* Lindl. now *Clarkia purpurea* (Curtis) Nels. & Macbr.

47 *O. quadravulnera* Lindl., now *C. quadravulnera* (Curtis) Nels. & Macbr.

*Cucurbitaceae*

48. *Megarrhiza Oregona* Torr. & Gray now *Marah oregona* (T. & G.), Manroot, used as a poison and perhaps a medicine.

*Saxifragacea*

49. *Saxifraga integrifolia* Hook., on prairies, may have been used as medicine. †

50. *Lithophragma parviflora* (Hook.) Nutt., Fringecup, used medicinally.

*Hydrangeaceae*

51. *Philadelphus gordonianus* now *P. lewisii* (Pursh), leaves used as soap, wood useful.

*Umbelliferae*

52. *Edosmia gairdnera* Hook. & Arne, now *Perideridia gairdneri* (H. & A.) Math., Yampah, the root eaten.

53. *Sanicula menziesii* Hook. & Ark. now *S. crassicaulis* Poepp., perhaps a medicine. †

54. *S. bipinnata* Dougl. now *S. bipinnatifida* Dougl. Snake root.

55. *Conioselinum fischeri* Weim & Grab. now *C. pacificum* (Wats.) Coult. & Rose, Seashore Parsley, Gibbs says on interior prairies and coast common. Plant has the odor of anise. †

56. *Peucedanum leiocarpum* Nutt., now *Lomatium triternatum* (Pursh) Coult. & Rose, the stems were peeled and eaten.

57. *P. foeniculacum* Nutt. now *L. urtriculatum* (Nutt.) Coult. & Rose, root was eaten, found on prairie and seashore.

58. *Glycosma occidentalis* Nutt. now *Osmorhiza occidentalis* (Nutt.) Torr., Sweet-Cicely has a thick root, plant was used as a charm and flavoring for camas.

*Caprifoliaceae*

59. *Lonicera occidentalis* Hook., a honeysuckle. Honeysuckles were used medicinally.

60. *Sambucus glauca* Nutt. now *S. cerulea* Raf., Elderberry, a food plant.

*Compositae*

61. *Erigeron speciosum* DC. now *E. speciosus* (Lindl.) DC. Fleabane.

62. *E. canadense* Linn. now *Conyza canadensis* (L.) Cronq., Canadian Fleabane.

63. *Balsamorhiza deltoidea* Nutt., Balsam Root, root edible, seeds and stems eaten.

64. *Bahia lanata* Nutt. now *B. oppositifolia* (Nutt.) DC.

65. *Achillea millefolium* Linn., Yarrow a medicinal plant.

66. *Antennaria plantagifolia* Hooker, Pussy-Toes.

67. *Cirsium undulatum* Spreng. (now [Nutt.] Spreng.) Thistle, root eaten and plant used medicinally.

68. *Hieracium scouleri* Hook., Hawkweed.

69. *Tanacetum huronese* Nutt. Tansy now ?

70. *Macrorhynchus laciniatus* Torr & G. now *Agoseris glauca* (DC. Eaton) Smiley, Gibbs reports the root as edible.

71. *M. heterophyllus* Nutt. now *A. heterophyllus* Greene.

72. *Gnaphalium purpureum* L., Cudweed.

*Campanulaceae*

73. *Campanula linifolia* Hkr. Harebell, Bluebell now ?

74. *Specularia perfoliata* A. DC. now *Triodanis perfoliata* (L.) Nieuwl., Venus Looking Glass.

75. *Heterocodon rariflorum* Nutt.

76. *Githopsis specularioides* Nutt., Common Bluecup.

*Ericaceae*

77. *Vaccinium caespitosum* Michx., Blueberry, a food.

78. *Arctostaphylos uva-ursi* Linn., berries used as food and leaves for tobacco.

*Plantaginaceae*

79. *Plantago patagonica* Jacq., Indian Wheat. †

*Primulaceae*

80. *Dodecatheon meadia* Linn. now *D. pulchellum* (Raf.) Merrill, Shooting Star.

81. *Aphyllon uniflorum* T. & G. now *Orobanche uniflora* L., Broom rape, Cancer root.

*Scrophulariaceae*

82. *Linaria canadensis* Linn., (now [L.] Dumont) Toadflax.

83. *Collinsia grandiflora* Dougl. (now Lindl.) Blue-eyed Mary.

84. *Synthyris reniformis* Benth., (now Dougl.] Benth.) Kittentails.

85. *Castilleja* spp., Indian Paint Brush, used as a sympathetic medicine.

*Labiatae*

86. *Mentha canadensis* Linn. now *M. arvensis* L., Mint used for teas, etc.

87. *Brunella vulgaris* Linn. now *Prunella vulgaris* L. Self-heal, used as poultice. While this is the introduced species the native species *P. lanceolata* (Barton) Fern. is widely distributed and was used medicinally.

*Boraginaceae*

88. *Myosotis verna* Nutt., Forget-me-not.

89. *Eritrichium chorisianum* (A) DC.

90. *E. scouleri* (A) DC. now ?

*Polemoniaceae*

91. *Polemonium micranthum* Benth., Jacob's Ladder (Hitchcock says east of Cascades).

92. *Collomia grandiflora* Dougl., may have used the seeds for a glue. †

93. *C. gracilis* Dougl. now *Microsteris gracilis* (Hook.) Greene.

94. *Gilia archillaefolia* Benth., Blue Ball now ?

95. *Navarretia heterophylla* Benth. now probably *N. squarrosa* (Esch.) H. & A.

*Polygonaceae*

96. *Rumex domesticus* Hartm. ex-Hook. now ? Reported as leaves boiled and eaten.

*Iridaceae*

97. *Sisyrinchium anceps* Linn. now probably *S. douglasii* A. Dietr.

*Liliaceae*

98. *Lillium canadense* Linn. now *L. columbianum* Hanson, Tiger lily, bulb eaten

99. *Erythronium grandiflorum* Pursh Fawn lily, eaten.

100. *Fritillaria lanceolata* Pursh Chocolate lily, eaten.

101. *Anticlea douglasii* Torr. now *Zigadenus* spp., poison camas, not common on the prairies according to Gibbs.

102. *A. nutallii* Torr. now *Zigadenus* spp., Poison camas, rare on prairies.

103. *Hesperoscordon hyacinthiinum* Lindl. now *Brodiaea hyacinthinum* (Lindl.) Baker, the root is edible.

104. *Dichelostemma congestum* Kunth. now probably *B. congesta* Smith. Gibbs errs and says this is the poison camas but reports the flower as being purple. Eaten.

105. *Brodiaea grandiflora* Smith now *Brodiaea coronaria* (Salisb.) Engl., food.

106. *Camassia esculenta* Lindl. now *C. quamash* (Pursh) Greene, a food.

*Gramineae*

107. *Koeleria cristata* Pers., June Grass, evidently a good range grass per Hitchcock.

108. *Poa annua* L. a grass.

109. *Ceratochloa breviaristata* Hook. now *Bromus carinatus* H. & A., readily grazed.

*Polypodiaceae*

110. *Pteris aquilinea* Linn. now *Pteridium aquilinum* (L.) Kuhn, reported as abundant on the prairies, an important food plant.

*Juncaceae*

111. *Luzula parviflora* Desvaux now *L. piperi* (Cov) Jones, Woodrush.

*Fagaceae*

112. *Quercus garryana* Dougl. White oak, acorn used for food.

*Pinaceae*

113. *Pinus ponderosa* Dougl. reported in the prairies as stunted. This must include *P. contorta* Dougl. Cambium was eaten.

*Orchidaceae*

114. *Spiranthes cerna* Rich now *S. romanzoffiana* Cham.

The plants listed above were collected by Dr. Cooper, Dr. Suckley, and George Gibbs in 1853-1855 on the prairies of western Washington. The binomials used by them are given first and the current binomials given second are from Hitchcock and Cronquist (1973).

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# AN ANALYSIS OF KWAKIUTL PLANT TERMS[1]

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ABSTRACT

Kwakiutl plant terms have been analyzed and hypothetically classified according to the linguistic markers of stem and suffix. The results indicate that the Kwakiutl categorize their plant world in terms of functional considerations, i.e., the use of plants or plant product. This contrasts sharply with the scientific method of plant classification, which deals mainly with morphological homologies in an evolutionary context. The Kwakiutl system allows the anthropologist to determine what part of a plant is used and often how it is used.

## Introduction

This study will analyze the botanical terms utilized by the Kwakuitl Indians. The terms are Kwakiutl labels given to different plant or plant part referents (denotata). The initial assumption of such a study is that the Kwakiutl segregate this field as a separate domain somewhat as we do, separating out a distinct unit, the plant kingdom. Our Linnaean model of classification will be used as a reference point.

First a general description of the Kwakiutl, their locality, and their general relationship to their botanical environment will be considered. The Kwakiutl belong to the Wakashan language family of southern and central British Columbia, Canada. The only other member of that language family is Nootka. Both groups are adjacent to one another and occupy southwestern and northern parts of Vancouver Island and the central coast area of British Columbia. Besides being related linguistically, the Kwakiutl and Nootka share other cultural characteristics. They are unique among coastal groups in their predominant marine orientation. Besides emphasizing the salmon resources, as all coastal groups do, the Wakashans stress hunting of sea mammals and fishing of deep sea products, especially the halibut. This emphasis on marine resources is important here since it implies a general lack of attention given to inland food resources, including plant products. Part of this minimal interest in inland food products reflects the general lack of easily obtained abundant plant and/or animal food resources within the rugged forested coast. The relatively easily obtained and very abundant food products from rivers, coast, and sea obviated efforts to use the food resources inland. This does not mean that plant life was not important to the Kwakiutl Wakashan, as the following list illustrates, but most food-subsistence interests were at sea. The categorization of the plant world centers around the following use categories:

1. Artifacts: their house, canoes, weapons, implements, clothing, containers (baskets, boxes, bowls), hunting and fishing gear, were almost totally of vegetal materials. (Ozette archaeological site, where all vegetal artifacts have been preserved, has demonstrated this well.)

2. Medicinal: several health and other problems were treated with plant products. A variety of medicinal teas, poisons, laxatives, soaps, and strengtheners were utilized.

3. Foods: a) several berries, fruits (seasonal) b) young sprouts, stems (seasonal) c) barks (seasonal) d) roots, bulbs, rhizomes (generally seasonal).

The collection of these plant foods was usually restricted to short seasonal periods generally lasting for a few weeks or months per year. The berries were enjoyed as one of the few sources of sugar and were often dried into cakes for winter use (if the particular berry type was not too watery for drying). The edible bulbs (lilies, etc.), roots (cinquefoil), and rhizomes (ferns) have high starch content and were the main source of carbohydrate in the Kwakiutl diet (most of their years food was oily marine fauna). Bark from several trees was eaten by the Kwakiutl, but mainly when other food resources were lacking or unobtainable. The bark is somewhat nutritious, but largely unpalatable because of the high cork content. Sprouts and stems are usually only available for a few weeks in the spring before maturity renders them too woody.

4. Charms: plants used as charms are poorly described in the literature and are somewhat related to medicinal plants. Though not applied in the same sense as medicine, they were used to effect religious and supernatural cures or hexes.

## The Structure of Plant Terms in Kwakiutl

The morphology of plant terms and almost all words in Kwakiutl may be reduced to a stem and suffix or suffixes (Boas 1947:224). Generally, the plant nouns are composed of a stem and a nominalizing suffix. Stems are ambivalent and are fitted with an affix for syntactic function as noun or verb.

The plant term stems and suffixes then, will be the main components of analysis. The meanings given the stems and suffix components of plant terms will be the basic data for the proposed Kwakiutl plant classification. Boas has provided most of the interpretations for the stems and, in particular, the suffixes (1947), and these will be evaluated and modified to better serve this analysis.

## Strategy of This Analysis

To analyze the stem and suffix components of Kwakiutl plant terms-i.e., to understand better what they may mean or mark in terms of the plants (the denotata), several sources were used which deal with the specific plants and plant parts. The primary Kwakiutl linguistic data were derived from Boas' works (1893, 1921, 1931, 1947). For current taxonomy and distribution of the plants, *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973), was used. For *use* of the different plants by the Kwakuitls and adjacent coastal peoples, *Ethnology of the Kwakiutl* (Boas 1913), "The Ethnobotany of the Coast Salish Indians of Vancouver Island" (Turner and Bell 1971), and *Ethnobotany of Western Washington* (Gunther 1945) were used. Unfortunately, no specific ethnobotany has been done for the Kwakiutl. As a general plant classification reference, an indroductory botany text, *Botany* (Wilson and Loomis 1965), was used. From these resources, the following aspects dealing with the plant denotata were selected:

1. the data set: Kwakiutl plant terms

2. scientific names for the plants

3. the hypothetical meaning of the linguistic markers (stem and suffix) in plant terms (Boas 1947)

4. morphology and geographic distribution of the plants

5. ethnographic uses of the plants

6. the Western scientific plant classification method

The data gathering approach followed these steps:

1. A glossary of Kwakiutl plant terms was compiled and grouped according to suffixes. The suffixes appear to provide the major classification of Ǩwakiutl plant terms (see glossary).

2. The common names and scientific family, genus, and species names were recorded in order that there will be no confusion as to which plant is being considered. The list will also be used to determine whether Kwakiutls ever classified plants into groups based on morphological features, somewhat similar to our system.

3. General morphological and habitat preference data were noted in order to see if certain features (e.g., flower color, leaf shape, bog or dry land preference, population size, etc.) correspond with Kwakiutl suffix or other categories.

4. The ethnographic use of the plants (generally as food, medicines, charms, or artifacts) was recorded to see if any of these data corresponded with Kwakiutl suffix or other categories.

These recorded features comprise the data used to analyze Kwakiutl plant terms. It was hoped that in them would be found any patterns which might exist between specific morphological, distributional, and/or functional characteristics of plants and the Kwakiutl stem and/or suffix labels for the plants. Patterns did indeed emerge and they are given here as a hypothetical basis for Kwakiutl plant classification.

## Kwakiutl Plant Term Stems

As mentioned before, the stem is an ambivalent form in the Kwakiutl language; it is neither a noun nor a verb until a modifier is attached. Many of Boas' defined plant term stems are verb forms minus the verbal suffix (a) and take the following forms: to gather---, to dig---, to pick---, to eat---, a particular plant denotatum; or are given a verb quality like "to stick like burr (bedstraw)," "to fold (skunk cabbage leaves)," "to blow (willow trees)," and "to wipe rear (white moss)." This "verb" stem type (designated Stem A) occurs with many suffix classes and is the indicator of the plant term theme. It seems to indicate the functional importance of the different labeled plants, since each stem of this type has a gathering connotation. In regards to this first stem type, Boas wrote: "names of plants are derived from stems expressing the gathering of the particular plant" (Boas 1931:164). (See glossary for examples).

A second stem type tends to indicate a quality of the plant, functioning more as an adjective or noun than verb. Examples of this stem type (designated Stem B) would be the berries of a plant; the color (red, plants used for dyes); associated qualities such as beavers mat--water-lily; fire flames--fireweed; eyes are sore--snowberry (medicinal qualities); the bark of trees--red or yellow cedar; trout--salmonberry, etc. (See glossary for these and other examples.)

The third stem type (designated Stem C) comprises those stems Boas never defined or recorded. Stems then can be classed and defined as follows:

*Stem Types*

Stem A: "verb;" focuses on the gathering of a plant product

Stem B: associated quality of a plant; the berry, color, medicinal use, etc.

Stem C: undefined

Since the stems were probably not consistently defined by Boas or his assistants in their vocabulary, there are probably errors in the stem definitions; but since we are restricted to Boas' data and cannot at this point retest them, we must assume the classification to be a reasonable useful one. Note that, in general, the stems tend to indicate the important functional qualities of their plant denotata rather than the morphological and distributional qualities of the plants. This contrasts with the Linnaean form of classification, reflected in the Latin nomenclature, which strictly emphasizes morphological similarities of plants as critical criteria. This is a major difference in emphasis and will be enlarged by the suffixes, as will be shown.

Another characteristic of Kwakiutl stems is their different forms of stem reduplication and expansion. These processes seem to correspond to specific suffix types rather than any specific meaning.

# Kwakiutl Plant Term Suffixes

Suffixes in Kwakiutl plant terms tend to orient the meaning of the term and therefore are of major importance in determining the manner in which plants are classified in the Kwakiutl language. The Kwakiutl plant term suffixes and Boas' general definitions of them are listed below.

| | | |
|---|---|---|
| 1. | =En, -En | nominal ending |
| 2. | -oχ | nominal |
| 3. | -K$^{υ}$ | nominal (rare) |
| 4. | -Em, =Em, -!Em | nominal formative suffix (frequently used language) |
| 5. | -mEs, $^{\varepsilon}$ms, -Ems | nominal suffix--in names of plants, derived from the term for the fruit, bark, or other part used |
| 6. | -χ, -!χ | nominal |
| 7. | -as | (nominal) tree (=as place of--) |
| 8. | -awe | no definition |
| 9. | -wēs | no definition |
| 10. | -ole | suffix for fruits of plants |
| 11. | -!a | to be ready to---, to try to---, to try to get---, to be ready to get--- |
| 12. | =xLo | ends of branches of trees, leaves, hair on body of animal |
| 13. | -(a)a$^{\varepsilon}$no | a long, stretched-out object and attached to something |
| 14. | -a$^{\varepsilon}$m | suffix for names of plants, reduplication 5 |
| 15. | -!emas, -!ema, -omas | classes or characteristic condition of things, stem expansion 7 |
| 16. | -ts!ē, -ts!, -sdē | no definition |
| 17. | -os | a doubtful suffix |
| 18. | -ala (e or ē) | no corresponding definition (Boas' definitions of suffix 1947) |

Analysis of the glossary, the suffixes, and Boas' definitions of the suffixes, indicates that certain semantic relationships correspond to different suffixes. Some of these meanings correspond to Boas' definitions of the suffixes, others do not, and some new suffixes with corresponding meanings have been discovered. Boas' definitions and how each orients the theme of the term, are hypothetical. After this analysis, new meanings of somewhat greater detail may be added to the data and provide new hypotheses. It is proposed that they improve upon the old definitions in as much as they are more specific and inclusive. The validity of the suffix classes remains hypothetical without further testing with Kwakiutl speakers.

The plant term suffixes will be defined in a paradigmatic classification using selected dimensions (the terms paradigmatic classification and dimensions are used here as defined by Lounsbury [1969]). The dimensions of this classification are as follows:

1. locational properties

2. edible-inedible

3. specific plant part indicators

4. nominalizer qualities

The existing attribute categories found in these dimensions that are significant in defining plant suffixes are listed below. These are the significatum of the suffix definitions:

Dimension 1: Locational Properties

a. location of groups of (a tree type)
b. located in wet boggy environments
c. neuter (not a pertinent dimension)

Dimension 2: Edible-Inedible

1. generally edible plant parts
2. specific edible bulbs of Liliaceous plants
3. berries (dryable)
4. berries (nondryable)
5. inedible; other generally useful qualities (artifacts, etc.)
6. inedible; medicinal properties stressed
7. inedible; specific indicator of plant wood, leaves, or branch parts
8. neuter (not a pertinent dimension)

Dimension 3: Specific Plant Part Indicator

I. bulbs
II. roots
III. fruits, berries
IV. long, stretched-out parts
V. juices (utilized)
VI. branch, leaves, wood
VII. neuter (not a pertinent dimension)

Dimension 4: Nominalizer Qualities

A. general class indicator
B. specific plant terms
C. general nominalizer (besides plant terms also)
D. non-nominal, more verbal

If these dimensions and their semantic attributes are used in the paradigmatic classification of plant term suffixes, the following listed definitions with their suffix denotatum appear. The definitions are coded according to the letter or number used for each attribute given in dimensions above; asterisk indicates my definition is identical to Boas' 1947.

| SUFFIX DENOTATUM | DEFINITION | CATEGORY NAME |
|---|---|---|
| =En, -En<br>-oχ<br>-k$^{\upsilon}$<br>-Em, =Em, -!Em | c 8 VII C | * "general nominalizers" |
| -mEs, $^{\varepsilon}$ms, -Ems | c 8 VII B | * "nominalizer for plant terms only, stem indicated the plant product used" |
| -χ, -"χ | c 3 III B | "dryable berry suffix" |
| -as | a 8 VII B | "groups of a kind of tree (often indicative of specific location of)" |
| -awe<br>-wēs | b 8 VII B(?) | "boggy plants (in wet places)" (Boas does not define suffix) |
| -ole | c 4 III B | "nondried berries suffix (usually too watery for drying)" |
| -!a | c 8 VII D | * "more verbal; to try and get--- (plant product)" |
| =xLo | c 7 VI C | * "plant branch, leaves, wood parts suffix" |

| SUFFIX DENOTATUM | DEFINITION | CATEGORY NAME |
|---|---|---|
| -(a)a$^{\varepsilon}$no | c 8 IV C | "plants with long stretched-out parts suffix" |
| -a$^{\varepsilon}$m | c 5 VII B | "exclusive suffix for names of useful but inedible plants (never trees)" |
| -!emas, -!ema, -omas | c 8 VII A | * "general class plant term (bush, berries)" |
| -ts!ē, -ts!, -sdē | c 2 I B(?) | "bulb plants of Liliaceae" (not recognized as suffix by Boas) |
| -os | c 1 II B | "edible root suffix" |
| -ala (e or ē) | c 6 V C | "medicinal juices suffix" |

These fourteen derived suffix classes will be the mutually exclusive suffix types for defining Kwakiutl plant terms. From the existing 22 attribute categories in the four dimensions of the paradigmatic classification, there exists a possibility of 672 suffix classes; only 14 classes are filled by Kwakiutl plant term suffixes. This indicates that the significant combinations of actual criteria are very limited and not random.

To abbreviate and indicate hypothetical major suffix types according to similar suffix-function, these classes are synthesized and denoted as follows:

| | | | | | | |
|---|---|---|---|---|---|---|
| SUFFIX 1 | [a, b] | 8 | VII | B | "locative" | [groups of trees / boggy plants] |
| SUFFIX 2 | c | 8 | VII | [A, B, C] | "nominalizer" | [general classes specifically plant terms general (also others] |
| SUFFIX 3 | c | 8 | IV | C | "morphologic" | (long parts) |
| SUFFIX 4 | c | 8 | VII | D | "verbal" | action: to try and get---plant product |
| SUFFIX 5 | c | [3, 4] | III | B | "berry" | [dryable / nondryable] |
| SUFFIX 6 "general plant product indicative suffixes" | c | [5, 2, 1, 6, 7] | [VII, I, II, V, VI] | [B] (VII, I); [C] (II, V, VI) | [only plant term suffixes] (B); [nonrestricted suffixes for plants only] (C) | [inedible products / Lil. bulbs / edible roots / medicinal juices / leaves, branch parts] |

## A Proposed Classification of Kwakiutl Plant Terms

The above abbreviated suffix classes will be used in classifying the different forms of complete Kwakiutl plant terms, i.e., the combined form of Stem (type) + Suffix (type). The classification will generally reflect the major suffix classification since the suffix orients the theme of the Kwakiutl term. The stem in each case will be types A, B, or C as previously defined.

## Classification of Kwakiutl Plant Terms

Plant Term 1: stem + suffix 1 (Locative suffix)

(a) stem $\begin{Bmatrix}A\\B\\C\end{Bmatrix}$ + (-as): "useful trees in group plants"

This term class is exclusive to plant terms and indicates the location of a particular group of one kind of tree.

(b) stem $\begin{Bmatrix}A\\B\\C\end{Bmatrix}$ + $\begin{Bmatrix}\text{-wēs}\\\text{-awe}\end{Bmatrix}$: "useful boggy plants"

This term class indicates a plant that grows in wet boggy places. Boas did not recognize these as suffixes.

Plant Term 2: stem + suffix 2 (General nominalizer suffix)

(a) stem (C) + (-emas, -omas): "general class of plants"

This class is not exclusive to plant terms and indicates terms of general classes (bushes, berries) and corresponds to Boas' definition (1947).

(b) stem $\begin{Bmatrix}A\\B\\C\end{Bmatrix}$ + (-mEs, -$^{\varepsilon}$ms, -Ems): "plant names"

This term class has an exclusive plant-name suffix and the stem indicates plant product utilized.

(c) stem $\begin{Bmatrix}A\\B\\C\end{Bmatrix}$ + $\begin{Bmatrix}\text{=En, -En}\\\text{-o}\chi_{ʊ}\\\text{-k}\\\text{-Em, -!Em, =Em}\end{Bmatrix}$: "plant names" (nominalizer suffixes not exclusive to plant terms)

This term class has frequently-used general nominal suffixes, the stem indicates the plant quality of significance.

Plant Term 3: stem + suffix 3 (Morphologic suffix)

(a) stem $\begin{Bmatrix}A\\B\\C\end{Bmatrix}$ + (-(a)a$^{\varepsilon}$no): "long, stretched-out parts plants"

This term class has a suffix not exclusive to plant terms; it is the stem which indicates the plant quality. The suffix indicates long, stretched-out parts, such as tendrils, spikes, or long stipes. This is the only plant term class that seems to rely on plant morphology, and is rather general at that.

Plant Term 4: stem + suffix 4 ("Verb" suffix)

(a) stem $\begin{Bmatrix}A\\B\\C\end{Bmatrix}$ + (-!a): "to try and get plants"

Plant terms of this class seem to be indicative of the action--to try and get--yew wood, cedar wood, service berries, etc. I believe this "verb" plant term exists in Boas' vocabulary since most of the terms are gotten from the texts and this verb form might be accidentally taken as a noun form.

Plant Term 5: stem + suffix 5 (Berry suffix)

(a) stem $\begin{Bmatrix}A\\B\\C\end{Bmatrix}$ + (-Ł, -!Ł) (berry dryable): "dryable berries"

(b) stem $\begin{Bmatrix}A\\B\\C\end{Bmatrix}$ + (-ole) (berry nondryable): "nondryable berries"

Both of these plant term classes deal specifically with the plant berries (not the plant name). One suffix indicates berries that were commonly dried into cakes for later use and the other indicates those that are too watery for drying or are only occasionally mixed with "dryable" berries into cakes; both berries are eaten raw also. The large number of berry terms and the marker for dryable and nondryable forms may indicate the importance of berries as a plant food to the Kwakiutl. The berry was one of the few sources of sugar in the Kwakiutl diet (except for historic European sources), and dried berry cakes would be especially valuable since they could be saved and eaten when fresh berries were out of season.

Plant Term 6: stem + suffix 6 (General plant product indicative suffix)

Plant terms in this category have suffixes that seem to indicate plants that are utilized for special products, such as edible roots, bulbs, medicinal uses, artifact manufacture, etc.

(a) stem $\begin{Bmatrix}A\\B\\C\end{Bmatrix}$ + (-a$^{\varepsilon}$m): "artifact plants, nontree"

The suffix on this term class is exclusive to plant names. These are inedible plants whose products are used for artifact manufacture or medicinal purposes. Only herbs, never trees, have this suffix.

(b) stem (C) + (-ts!ē, -ts!, -sdē): "bulb plants"

This plant term class has a suffix exclusive to plant names, and it indicates the edible bulb plant in the Liliaceae. The lily bulb, especially of the camas plant, was one of the main sources of starch in the Kwakiutl diet. This suffix class is the only one that corresponds to a family in scientific classification, the Liliaceae, but Liliaceous plants occur with other suffix classes. Boas does not recognize this suffix class.

(c) stem $\begin{Bmatrix} B \\ C \end{Bmatrix}$ + (-os): "root plants"

The suffix on this term class is not exclusive to plant terms; when referring to plants it seems to correspond with terms meaning edible roots of plants. The cinquefoil root, a staple food of the Kwakiutl, is found with this suffix.

(d) stem $\begin{Bmatrix} A \\ B \\ C \end{Bmatrix}$ + (-asla (e or ē)): "medicinal juice plants"

The suffix on this term class is exclusive to plant names. It refers to medicinally used plants and the juices of the parts of these plants which are used for this purpose, e.g., sea-milkwort root juice, juice of goatsbeard, etc.

(e) stem $\begin{Bmatrix} A \\ B \\ C \end{Bmatrix}$ + (=xLo): "branches, leaves, wood of plants"

The suffix on this term class is not exclusive to plant terms; with the above stems it denotes the branches, leaves, or wood of plants, or parts of a plant used (Boas 1947). The term is not a plant name, but refers to plant parts.

In summary, the general labels of the plant term classes within the six plant term types may be listed as follows:

Plant Term 1 Locative suffix

(a) "useful trees in group plants"
(b) "useful bog plants"

Plant Term 2 General nominalizer suffix

(a) "general class of plants"
(b) "plant names" (stem indicates plant product utilized)
(c) "plant names" (stem indicates plant quality of significance)

Plant Term 3 Morphological suffix

(a) "long, stretched-out parts plants"

Plant Term 4 "Verb" suffix

(a) "to try to get plants"

Plant Term 5 Berry suffix

(a) "dryable berries"
(b) "nondryable berries"

Plant Term 6 General plant product indicative suffix

(a) "artifact plant, nontree"
(b) "bulb plant"
(c) "root plant"
(d) "medicinal juice plant"
(e) "branches, leaves, wood parts of plants"

The structure and elements of this classification scheme are based dominantly on functional criteria. The six plant term categories include one category with locative emphasis (groups of useful trees, useful bog plants), one category with action implications ("to try to get" a plant product), and the remaining categories emphasize specific useful plant and/or plant products (berry categories, bulb, root, medicinal qualities).

## Summary and Conclusion

This analysis of Kwakiutl plant terms is, as Boas' definitional scheme, a hypothetical classification. The general morphological structure of Kwakiutl terms is based upon stems and suffixes, the former providing the theme and the latter the orientation. The Kwakiutl appear to base the categorization of plant terms heavily upon their functional uses; other criteria such as morphology and habitat are only lightly used, while classification by morphological similarity, as in the modern Linnaean method, is absent.

The following summary clearly indicates the functional emphasis:

1. STEMS often denote the process of gathering particular plant products or a quality of a plant.

2. SUFFIXES usually denote one of the following categories:

    a. location of useful plants
    b. nominal character
    c. morphologic feature
    d. action or "verb" feature: to try to get plant product
    e. berry and fruit product
    f. general plant product of plants:

        1. artifact material
        2. bulbs
        3. roots
        4. medicinal juices
        5. leaves, branches, and woods

Analysis of the six types of plant terms reveal that a degree of predictability comes into play. If a plant term is given, often the useful part of that plant can be predicted by the suffix even if the plant itself is not identified. Furthermore, if the stem is known, the meaning of the stem + suffix can also be predicted.

Considering the limited part that plant food products seem to have played in the lives of the marine oriented Kwakiutls, the elaboration of plant term classes can indicate what plant food resources were important. Certainly berries were well known and seem to have been classed into preservable and nonpreservable types. Bulbs and roots also have individual suffix forms, indicating the relative importance of these starchy plant foods to the Kwakiutls. Trees are seen to be important in groups and singly, and inedible nontree plants used for artifacts, both are given their own separate suffix markers.

The next step should be to test and evaluate these ideas, noted patterns, and this classification. These results should be taken to the appropriate ethnobotanists, the Kwakiutls, to see if they describe their floral world in the same and predictable ways.

## Note

[1]An earlier version of this paper was presented in Dr. James A. Goss's seminar in Linguistic Anthropology at Washington State University.

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# APPENDIX 1

## Glossary of Kwakiutl Plant Terms

LEGEND:

*Functions of Plants*

(A) : Artifact
(F) : Food
(M) : Medicinal
(Ch): Charms

In the scientific names of the plants, the abbreviated and capitalized three letters are the first three letters of major families.

Suffix -os

| | | | | |
|---|---|---|---|---|
| Laxabâlis. | cinquefoil roots, ROS. | LEk$^{u}$- | cinquefoil | (F) root eaten |
| t!Ex$^{u}$so's. | cinquefoil roots, ROS. Potentilla sp. (?) | t!Eq$^{u}$- | | (F) the fleshy taproots of this species were a staple food of Kwakiutl (Boas 1921) |
| tsa'k'os. | fern root, POL. | tsak'- | | (F) rhizomes eaten |
| hä'ɫos & qe'$^{\varepsilon}$ los | a berry | | | (F) berry eaten |

Suffix -as

| | | | | |
|---|---|---|---|---|
| k'oā'as | tree | | | |
| $^{\varepsilon}$mo't!as | balsam fir, PIN. Abies grandis | (mōt!exsdē | camas) | (M) hair tonic (pitch), pitch fired on paddles, canoes |
| dE'n$^{\varepsilon}$yas | red cedar. CUP. Thuja plicata | dEns- | cedar bark | most used of plants (A) roots, limbs, wood, bark |
| de'$^{\varepsilon}$was | yellow cedar, CUP. Chamaecyparis nootkatensis | dex̣$^{u}$- | splitting wood? | (A) soft bark for clothes, wood, etc. |
| ăne-was | spruce, PIN. Picea sitchensis | ălēx̣$^{u}$- | to go sea hunting | (A) roots (strong, pliable) basketry/ ropes; gum for chewing, wood |
| q!wax$^{\varepsilon}$as | hemlock tree, PIN. Tsuga heterophylla | q!wax- | hemlock branches | (F) bark (A) red dye, wood, (M) wash body with branches |
| pō'x̣was | willow, SAL. Salix sp. (?) | pox$^{u}$- | to blow | (A) bark used for fish lines, bows, fire drill |
| k'!o'ɫas | oak, FAG. Quercus garryana | ? | | (F) acorns (steamed, roasted, or boiled to remove tannin) |
| k'!îlk'as | a plant | k ! i lEm | =tongue of ground | |

Suffix -oɫ

| | | | | |
|---|---|---|---|---|
| wEna'gwEɫ | fir, PIN. | wEng$^{u}$- | red | (A) wood carved (doesn't split well) |
| wa'doɫ. | kelp, ALGAE | wat- | | |
| wŭnāgŭɫ. | pine, PIN. | | red | (A) wood carved |

Suffix -Em, !Em, E'm

| | | | | |
|---|---|---|---|---|
| k'!Et!Em. | ryegrass, GRA. Elymus mollis | | | (M) bundles of rubbed on body after bathing |
| k'!ētEm. | grass, GRA. | | | (A) basket weaving |
| xEtEm. | umbelliferous plants, UMB. | | | |
| gēsdEm. | cow-parsnip, UMB. Heracleum lanatum | | | (F) young stems eaten (M) root drug, hair tonic |
| ts!āts!ayîm. | eel grass, ZOS. | | | |
| ɫEnwŭm. | ocean-spray, ROS. Holodiscus discolor | | | (A) wood carved for bows, arrows, etc. |
| k'!a'k'!eLEm$^{\varepsilon}$. | a sedge | | | (A) basketry |
| na'nesEm$^{\varepsilon}$. | A grass, GRA. | | | (A) basketry |
| x'ōkum. | strawberry, LIL. Fritillaria camschatcensis | x'ōkw(a) | to dig lily bulbs | (F) bulbs may be eaten |
| sElEm. | huckleberry bush, ERI. Vaccinium ovalifolium | sElE'm. | berries of huckleberry bush | (F) berries eaten |
| gwādEm | huckleberry, ERI. | gwa'dEm | huckleberries | (F) berries eaten |
| lEgEm. | plant used poultice | | | (M) |
| ḶEx'sEm. | cinquefoil, ROS. Potentilla occidentale | ḶEk'(a) | to gather cinquefoil | (F) staple root of Kwakiutl (Boas, 1921) |
| dzEndzenx'LEm | nettles, URT. | ? | | (A) made into strings (M) ritual bathing |
| L!ăk!ŭm. | chokecherry bush, ROS. Prunus virginiana | L!ēkw(a) | to pick chokecherries | (M) ? drupe sweet but astringent (F) ? |

| | | | | |
|---|---|---|---|---|
| **Suffix -ole** | | | | |
| t!Emẍwalē | gooseberry, SAX. Ribes sp. (?) | t!Rmxw(a) | to pick gooseberries | (F) berries eaten fresh (if dried mixed with salalberries) |
| L!Eq!Exōlē. | bearberry, CAP. Lonicera involucrata | L!Eqw(a) | to break off branches | (F) branches occasionally eaten (probably fresh) |
| L!aL!Eq!ŭxLa | dogweed, COR. Cornus stolonifera | L!Eqw(a) | red | (F) berries eaten raw (M) bark quice for vomiting |
| qEk'!aalē. | bunchberry (dogwood), COR. Cornus canadensis | q!Ek'!aale<br>q!Ek'a | fruit of bunchberries<br>to gather bunchberries | (F) berries commonly eaten (Boas, 1921) |
| k'Esp!olē. | gooseberry, SAX. Ribes laxiflorus | ? | | (F) berries eaten fresh (A) roots for nets (M) thorns for boils (leaves hairy, hairy, thorny stems) |
| hābaxsolē. | gooseberry, SAX. Ribes lacustre | hap- | hair on body | (F) berries eaten occasionally (M) |
| go'lale | salmonberry, ROS. Rubus spectabilis | gol(a) | trout | (F) spouts, berries always eaten fresh--too watery for cakes |
| got!alē. | chokecherry, ROS. Prunus virginiana | got!(a) | to punch with fist | (M) ? drupe sweet but astringent (strengthens) |
| kuxālas. | blueberry (a berry), ERI. Vaccinium globulosum | ? | | ? |
| **Suffix a$^{\varepsilon}$no =(a)a$^{\varepsilon}$no** | | | | |
| tsE'ltsE'lwaa$^{\varepsilon}$no. | stems of crab-apple, ROS. Pyrus fusca | tsElxw(a) | crab apple | (F) eat crabapples (with flowers on spur shoots) |
| ĻEg'a'$^{\varepsilon}$no. | cinquefoil, ROS. Potentilla occidentale | ĻEk'(a) | to gather cinquefoil | (F) staple root of Kwakiutl (shoots along ground, long stipes) |
| x'o'gwa$^{\varepsilon}$no. | lily plant, LIL. | x'okw(a) | to dig lily bulbs | (F) bulbs eaten (long stipes) |
| t!E'na$^{\varepsilon}$no. | stem of elderberry, CAP. Sambucus sp. (?) | ts!ēx (a) | to pick stem of elder-berries | (F) (flowers on spikes) |
| q!wEndza$^{\varepsilon}$no. | lupine plant, LEG. Lupinus L. sp. (?) | q!wEns- | ? | (M) roots have drug, causes sleep (often tendrils) |
| q!ōxsawanē. | sorrel, POL. Rumex occidentalis | ? | | (F) stalk eaten (stringers) |
| **Suffix -emas, -!omas, ema** | | | | |
| no'nE$^{\varepsilon}$we'mas<br>q!wa'q!wEx$^{\varepsilon}$omas | berries (as food)<br>bushes | $^{\varepsilon}$nox$^{u}$-<br>(q!waq!wEx'emas) | blue berries | (F) |
| **Suffix =ł** | | | | |
| tsEgEł. | raspberry, ROS. Rubus tomentosum | | berries of raspberry | (F) berries eaten fresh or made into cakes |
| tsEgE'ł. | raspberry, ROS. Rubus villosus | tsEqa | | (F) berries eaten fresh or made into cakes |
| nEk!wE'ł. | salal berry, ERI. Gaultheria shallon | nEkw(a) | to pick salal berries | (F) eat fresh and in cakes |
| **Suffix -!a** | | | | |
| k!wāk!waq!a. | to try and get cedar wood, CUP. Thuja plicata | kwaq- | ? | (A) wood for canoes, houses, boxes, etc. (important) |
| ëx'p!a. | serviceberry, ROS. Amelanchier semiintegrifolia | | = to taste sweet (verb) | (F) eat berries in late summer, (A) wood for arrows, halibut hooks; tough |
| xEtxEt!a | water hemlock, UMB. Cicuta sp. (?) | | = an Umbelliferae plant | (M) the Kwakiutl used with caution as purgative and induce vomit (poison) |
| hōsdEk!wa. | blackberry, ROS. Rubus ursinus | hōs(a) | to count | (F) eat berries raw or in cakes, (M) tea for stomach, green berries on sores |
| L!Emq!a | yew tree (wood), TAX. Taxus brevifolia | L!Emxw(a) | stiff, hard, brittle | (A) weapons and implements requiring strength and toughness (M) for strength (-q!a to feel verb) |

Suffix =xLo

| | | | | |
|---|---|---|---|---|
| gagELExLo$^{\varepsilon}$yo | branch pulling hook | gEL=xLo=ayu gEl rib | | |
| $^{\varepsilon}$wi$^{\varepsilon}$lg·ElxLo. | (pick) all off bush | $^{\varepsilon}$wi$^{\varepsilon}$l(a) all gEl rib | | |
| -awo'dzoxLo | broad-leaved | awo | great (pl) | |
| k!waxLâ$^{\varepsilon}$. | cedar wood, CUP. *Thuja plicata* | k!waq- | | (A) wood used for houses, canoes, boxes, etc. |
| -awo'xLo | big leaved (as broad-leaved) | awo | great (pl) | |
| ăn$^{\varepsilon}$andExLâla. | herring spawn branch | ant- | to gather herring spawn branches | |
| le'łE$^{\varepsilon}$lxLo | dead leaves | ? | | |
| hadzapamxlē$^{\varepsilon}$. | pineapple weed, COM. *Matricaria matricarioides* | ? | | |

Suffix -k$^{u}$.

| | | | | |
|---|---|---|---|---|
| gwēx'sk'!îk'!aōk$^{u}$. | plantain, PLA. *Plantage* sp. (?) (like skunk cabbage) | ? | | |
| k'!îk'!aōk$^{u}$. | skunk cabbage, ARA. Lysichitum americanum | ? | | (A) leaves used for wrapping |
| L!EsL!Ek$^{u}$. | kelp, ALGAE | łEq! | seaweed, Esl ? | |
| L!EsL!Ek$^{u}$. | seaweed , ALGAE | łEq! | seaweed | |

Suffix -En

| | | | | |
|---|---|---|---|---|
| dzEx'i$^{\varepsilon}$na. | maidenhair fern, POL. *Adianthum pedatum* | dzEx(a) | to split, crack | (A) roots, stems used to imbricate baskets (split off) |
| yîsx'En. | plant | yi- that | | |
| q!Exmēn. | biscuit root, UM *Lomatium leptocarpum* | ? | | (F) sprouts eat like celery |

Suffix -ts!e, -ts!, -sde

| | | | | |
|---|---|---|---|---|
| mEq!wats!ē. | wild onion, LIL *Allium cernuum* | ? | | (F) eat onions (M) chew, put on chest for pleurisy pains |
| x'aā'x'înt!ē. | fawn lily, LIL. *Erythronium oregonum* | ? | | (F) bulbs were an important food for Kwakiutls |
| t!Emts!. | false-lily-of-valley, LIL. *Maianthemum dilatatum* | ? | | (F) berries eaten raw (not liked especially) |
| mōt!Exsdē. | camas, LIL. *Camassia leicht linii* | mot!as | balsam fir | (F) very important plant food; only extensive starch in diet |

Suffix -ala -e or -ē

| | | | | |
|---|---|---|---|---|
| ho'q!wa$^{\varepsilon}$le. | sea-milkwort, PRI. *Glaux maritima* | hoqw(a) | to vomit | (M) root cause sleepiness--vomiting if too much |
| nūsnElaa. | goatsbeard, ROS. *Aruncus sylvestris* | ? | | (M) rubbed on sores |
| aāgala. | woodnymph, ERI. *Pyrola uniflora* (small flower) | ? | | |
| Ex'p!ālaēs. | heuchera, SAX. *Heucheria micrantha* | ? | | (M) hair tonic (small hairy plant, stream banks, rocky crevices) |
| k'!îlxEla. | thorny, with juices | k !ilEm | tongue | |

Suffix -wes

| | | | | |
|---|---|---|---|---|
| gwax$^{u}$gugwīs. | seaweed, ALGAE | ? | | |
| wExaLalayugwa. | licorice-root, UMB. *Ligusticum* sp. (?) | ? | | (bogs) |
| łEk!wï. | licorice fern, POL. *Polypodium glycyrrhiza* | lEkw(a) | to gather licorice fern | (moist banks, tree trunks) use ? |
| wElxkwēs. | sundew, DRO. *Drosera rotundifolia* | ? | | (M) leaves used for removing corns, warts, bunyons (bogs) |
| dōxdEgwēs. | bogbean, MEN. *Menyanthes trifoliata* | ? | | (bogs) |

Suffix -Ems, ms, -mEs

(-Ems)

| | | | | |
|---|---|---|---|---|
| L!Eq!Exo'le$^{\varepsilon}$Ems | bearberry bush, CAP. Lonicera involucrata | L!Eqw(a) | to break off branches | (F) berries eaten |
| sa'q!wa$^{\varepsilon}$Ems. | maple tree, ACE. Acer sp. (?) | sa'q!w(a) | to peel off bark | (F) bark eaten (A) bark woven, wood carved |
| LEq!Ems. | old fruit and leaves dropping off | ? | | |
| ax$^{u}$so'le$^{\varepsilon}$Ems. | skunk cabbage, LIL. Veratrum L. sp. (?) | ? | | (M) poison, magical potency, root used in medicinal sweat bath |
| ga'gEl$^{\varepsilon}$wa$^{\varepsilon}$Ems. | fir tree, PIN. | ? | | (A) wood carved, does not split well |
| gEms. | lady fern, POL. Athyrium filix-femina | gEms | dead fronds | (F) new shoots and rhizomes eaten (all kinds of old fern fronds) |
| sa'laedana$^{\varepsilon}$Ems. | fern plant, POL. | sālaēdana. | sword fern | (F) eat rhizomes |
| lEgo'$^{\varepsilon}$Ems. | strawberry plant, ROS. Fragaria sp. (?) | lEgō. | strawberry | (F) berries |
| q!a'q!ane'$^{\varepsilon}$Ems. | thornapple, ROS. Crataegus douglasii | q!aq!El!Ega | to be tangled in bush | (F) dry sweetish fruits |
| p!ElE'ms | moss, MOSS | p!El(a) | to pluck (feathers, hair) | |

(-ms.)

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|---|---|---|---|---|
| x'o'kwEm$^{\varepsilon}$ms. | lily, LIL. | x'ōkw(a) | to dig lily bulbs | (F) bulbs eaten |
| sa'gwE$^{\varepsilon}$ms. | fern root, fern, POL. | sak$^{u}$- | to dig fern | |
| ha$^{\varepsilon}$mo'$^{\varepsilon}$ms. | barberry bush, BER. Berberis sp. (?) | ha$^{\varepsilon}$m- | to eat barberries | (F) berries eaten |

(-mEs)

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|---|---|---|---|---|
| $^{\varepsilon}$no'xu$^{\varepsilon}$mEs. | huckleberry bush, ERI, Vaccinium sp. (?) | nōxwa | small blueberries | (F) berries eaten |
| la'x$^{\varepsilon}$mEs. | hemlock tree, PIN. Tsuga sp. (?) | lâq | hemlock sap | (F) eat bark (A) dye red |
| xE'x$^{u\varepsilon}$mEs. | pine tree, PIN. | xEK!ŭm | pine bark | (F) bark eaten |
| dEna's$^{\varepsilon}$mEs. | red cedar, CUP. Thuja plicata | dEns- | cedar bark | (A) use bark, limbs, roots, wood, extensively |
| de'x$^{u\varepsilon}$mEs. | yellow cedar, CUP. Chamaecyparis nootkatensis | dex$^{u}$- | yellow cedar bark | (A) soft bark for clothing, wood carved |
| q!ă'mdzEx$^{u\varepsilon}$mEs. | salmonberry bush, ROS. Rubus spectabilis | q!ams(a) | to pick salmonberries | (F) sprouts, berries |
| gE'lx$^{\varepsilon}$mEs. | rosebush, ROS. Rosa sp. (?) | gEgElx | rose fruit | |
| paā'k'mis. | maple, ACE. Acer sp. (?) | | = leaf tree | (A) wood (F) bark eaten |
| L!a'x$^{u\varepsilon}$mEs. | alder tree, BET. Alnus rubra | L!a- | red | (F) bark eaten (A) wood carved, dye (red), (M) |
| t!E'mx$^{u\varepsilon}$mEs. | gooseberry bush, SAX. Ribes sp. (?) | t!Emxw(a) | to pick gooseberries | (F) berries eaten |

Suffix -a$^{\varepsilon}$m

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|---|---|---|---|---|
| gwāgŭltama | fireweed, ONA. Epilobium angustifolium | gŭlt(a) | fire flames | (A) used to pad wool |
| k!wa'k!wata$^{\varepsilon}$m | cottonwood, SAL. Populus trichocarpa | | | (A) carved wood, pitch, fire starters, (M) hair tonic |
| gā'gex'a$^{\varepsilon}$m | bedstraw, RUB. Galium aparine | gex'- | to stick lick burr | (A) to take off pitch, dried plant to start fires |
| k'!a'k'lagwa$^{\varepsilon}$m. | willow-weed, ONA. Epilobium spicatum | k'!Eq$^{u}$- | small sticks stand up | (A) used for small throwing sticks in game |
| dadeqa$^{\varepsilon}$m. | white moss, MOSS | deqa | to wipe anus | (A) wipe rear |
| pa'pesa$^{\varepsilon}$ma. | a medicinal plant | pe'ts!ala | to whistle | |
| L!a'L!opa$^{\varepsilon}$m. | a plant | L!op- | | |
| ma'mā$^{\varepsilon}$m. | leaves | | | |
| gāgexa$^{\varepsilon}$mē. | a vine ? | | | |
| qāqomxwama | cotton grass, CYP. Eriophorum gracile | | | |
| hādzapama. | yarrow, COM. Achillea californica | | | (M) boiled leaves for stomachaches (tea) |
| ya'yElqa$^{\varepsilon}$m | snowberry, CAP. Symphoricarpos sp. (?) | yElq- | eyes are sore | (M) bark boiled and used for eye-wash; poultice; hair soap |
| k'la'k'!osa$^{\varepsilon}$m. | skunk cabbage ??, ARA. Struthiopteris spicans | k'!os- | to fold | (A) often used as wrapper, liner |
| k'la'k'!eLa$^{\varepsilon}$m. | bulrush (tule), CYP. Scirpus microcarpus | k'!eL- | to gather bulrush | (A) stems made into mats |
| pa'pesa$^{\varepsilon}$ma. | a plant | | | |
| dza'dzequa$^{\varepsilon}$m. | nine bark, ROS. Physocarpus capitatus | dza'qwEm | forked end of spear | (M) root tea as quick laxative |

Suffix -awe

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|---|---|---|---|
| ƚē^εwa^εyasats!āwē | waterlily, NYM. | stem=beaver mat | (M) medicinal use of root (?)<br>(F) root |
| wāxŭlāwē. | water-parsley, UMB. <u>Oenanthe</u> <u>sarmentosa</u> | | (F) eat young stem (M) root for laxative |
| wāxolawē^ε. | water hemlock, UMB. <u>Cicuta</u> sp. (?) | | (M) poison (vomiting) |
| ƚE'nƚEnxExLa'we^ε. | fir pollen, PIN. | | (Ch) cones used to stop rain |