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The Status of Huckleberries in Washington State

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The Specialized Forest Products Work Group

prepared by
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Executive Summary

This report includes a summary of the biology and ecology of native huckleberries (the genus *Vaccinium*, exclusive of cranberries) in Washington State. Washington's Specialized Forest Products Act (RCW 76.48) identifies twelve wild species of huckleberry in the state: *Vaccinium membranaceum* (big huckleberry), *V. deliciosum* (Cascade blueberry), *V. ovatum* (evergreen huckleberry), *V. parvifolium* (red huckleberry), *V. globulare* (globe huckleberry), *V. ovalifolium* (oval-leaf huckleberry), *V. alaskaense* (Alaska huckleberry), *V. caespitosum* (dwarf huckleberry), *V. occidentale* (western huckleberry), *V. uliginosum* (bog blueberry), *V. myrtillus* (dwarf bilberry), and *V. scoparium* (grouse whortleberry). These species delineate the scope of this report.

The vegetation types that include huckleberries are also complex: 36 ecological systems – a relatively coarse level of vegetation classification developed by NatureServe - have been described in the state as including huckleberries. Huckleberries are considered to be a major component of 22 of these ecological systems. At a finer scale of vegetation classification, 217 forested or woodland plant associations and 43 shrub and dwarf shrub plant associations have been described in Washington as including huckleberry species. The complexity and wide distribution of huckleberries adds to the difficulty in determining their abundance.

Huckleberries have been utilized for ceremonial purposes, subsistence, and commerce since people first lived in what is now Washington State. Historically, the berries were most important as an essential food source; today, their value to humans is more diverse. For many, the experience of getting out in nature and gathering wild food is the primary appeal, similar to that of hunting and fishing. For a few, harvest and trade in huckleberries is a growing commercial enterprise. For lower-income people in rural communities, harvesting huckleberries may serve a role intermediate between subsistence and commercial, supplementing diverse sources of livelihood. For tribal people, huckleberries remain one of the most important ceremonial foods, and their harvest in specific areas is a treasured tradition.

While all species of huckleberries are edible and palatable, a few key species comprise most of the human harvest. Big huckleberry is described as the mountain species harvested commercially or for personal use in the largest quantities at the present time. Cascade blueberries are also highly regarded, but they occur at higher elevation and in smaller quantities. Alaska huckleberry and oval-leaf huckleberries are also harvested, but they generally are not considered to be as desirable. At lower elevations, evergreen huckleberries are abundant, and this species has occasionally been commercially harvested in large amounts. Red huckleberry is widespread at low elevations but occurs in smaller amounts than big huckleberry or evergreen huckleberry; recently a commercial market for this species has developed.

It is not possible at the present time to precisely measure or even accurately estimate the quantity of wild huckleberries growing in Washington. The complexity of multiple species in a wide range of vegetation types is compounded by pronounced annual

variation in the size of berry production. However, it is clear that the quantity of huckleberries that grow in Washington is large, and they are correspondingly important to wildlife as well as to humans.

While no comprehensive data are available on the size of the wild huckleberry harvest in Washington, either in the past or at the present, two reference points may illustrate its potential size. For eight years in the 1930s, records were kept of the quantity of berries that were transported out of part of what is now the Gifford Pinchot National Forest. In 1933, the biggest year recorded, 59,036 gallons of berries were tallied. Most of these were presumably big huckleberry. At a 2007 price of $18 per gallon paid to pickers, that volume would have a monetary value in the field of over $1,000,000. At a retail price for specialty frozen berries advertised on the internet in 2007, approximately $12 per pound, that would translate into a current market value of $5,300,000.

While we are not able to determine its market value, a second reference point indicates an even larger harvest. In 1959, 500 tons of evergreen huckleberries were harvested on the Kitsap Peninsula, and harvest years in the 1950s of up to 1,000 tons have been reported. This volume is so large that it raises doubts about its accuracy, but a huckleberry cleaning facility, still standing in Key Center on the Kitsap Peninsula, attests to the large size of the huckleberry harvest there in the past.

The potential for huckleberry production in Washington has likely declined in recent years due to fire suppression. Most huckleberries decline as the tree canopy becomes denser, and increase after canopy reduction, though the time required for recovery depends on the nature and severity of the disturbance. Native Americans traditionally kept berry patches in the mountains open by intentional burning. Fire suppression in the past few decades has allowed forest canopies to become denser in many areas, and habitat for huckleberries has correspondingly been reduced. Tree invasion of subalpine meadows, in response to the warm and dry Dust Bowl years, may have also reduced huckleberry habitat. Red huckleberry and evergreen huckleberries are abundant in low elevation forests in western Washington, where the effect of fire is not as well understood as in the mountains.

An understanding of huckleberry production and harvest levels is needed to evaluate sustainability. At times in the past, notably in the years of the Great Depression, the huckleberry resource has been strained by harvest pressure. Conflicts have arisen between commercial harvesters, tribal people, and other traditional pickers. In recent years, with a growing commercial market for huckleberries, reduction of habitat because of forest encroachment, and marked population growth, competition for the resource has again increased. The Gifford Pinchot National Forest is currently preparing a report on the sustainability of this huckleberry harvest. A systematic survey of huckleberry users: tribal pickers, commercial harvesters, and the many others who pick for personal use, may be the best source of quantitative information on the abundance and distribution of huckleberries in Washington. Likewise, these people, closest to the resource, could be the best source of information of potential conflicts between users, and also on potential solutions to these conflicts.

I. Introduction

Legislative context and the intention of this report

The Washington State Legislature in Substitute House Bill 1909 (SHB 1909) established a Specialized Forest Products Work Group to evaluate the effectiveness of the Specialized Forest Products Act (Chapter 76.48 Revised Code of Washington (RCW)) and to make recommendations on potential changes to the law.

While business and tax laws, other ordinances, and Department of Revenue requirements may apply to huckleberries, no Specialized Forest Products Harvesting Permits or other state permits are required for harvesting, possessing, or transporting huckleberries, and no specific permits are required under the Specialized Forest Products Act for purchase of wild huckleberries (Chapter 76.48 RCW). Harvesting huckleberries in any amount using a rake, mechanical device, or any other method that damages the huckleberry bush is unlawful (RCW 76.48.030).

Recognizing a potential need to regulate the harvest, transport, possession and sale of wild huckleberries, Section 5 of SHB 1909 directs the Department of Natural Resources (DNR) to review the uses of and demands upon this resource, to estimate the level of current consumptive uses, and to evaluate whether the current consumptive uses are sustainable and compatible. The DNR is directed to evaluate:

- Whether or not a state permitting requirement to harvest, possess, or transport huckleberries would remedy any problems identified during DNR's review;
- Whether the specialized forest product permit would be the most effective permitting program to utilize; and
- What permit conditions or requirements should be placed on the harvest, possession, or transportation of wild huckleberries.

The Working Group will make recommendations to the Legislature on whether or not a state permitting requirement is necessary and what, if any, requirements should be placed on the harvest, possession, or transportation of wild huckleberries.

As part of the DNR evaluation of huckleberry harvesting in Washington, the Natural Heritage Program has prepared this report to present the best available information on the status of huckleberries in Washington, including a status review of wild huckleberry species in Washington: their taxonomy, ecology, and current trends in abundance.

Structure of this report

This document is intended to be a concise and readable summary supported by more comprehensive appendices. Evaluating human use of huckleberries is outside the scope of this report, but information on this topic that was encountered in its preparation is included in Appendix 1. A list of potential contacts for additional information, particularly on huckleberry harvest, is included in Appendix 2.

Huckleberry Harvest in Washington

No comprehensive data are available on the size of the wild huckleberry harvest by humans in Washington, either in the past or at the present time. Occasional quantities have been recorded, at diverse locations, and these are described in greater detail in Appendix 1. It is clear that huckleberries have been highly valued and utilized for ceremonial uses, subsistence, and commerce since people first lived in what is now Washington State. It is also clear that the volume of harvest, particularly for big huckleberry and evergreen huckleberry, has at times been substantial. A growing market for huckleberries and huckleberry-containing products presents the potential for competition and conflict between commercial harvest and non-commercial pickers, and potentially between human and wildlife use.

Native American harvesters come from a centuries-long tradition of close familiarity with huckleberries, and these people may indeed provide the best source of information about huckleberry abundance, distribution, and harvest. Several tribal members expressed interest in communicating with Department of Natural Resources staff. However, early in the development of this report, we determined that gathering this sensitive and important information in a fair and professional manner was beyond our scope and expertise. We strongly recommend that an appropriate survey of tribal people be made on this topic.

Likewise missing here is information from commercial harvesters, many of whom are recent immigrants to Washington, or migrant, perhaps awkward with the English language, distrustful of government representatives, and guarded about disclosing locations. The voices of these people should also be heard in order to best understand huckleberry harvest in Washington.

Acknowledgements

While it was beyond our scope to conduct a systematic survey, this report has benefited from information generously provided by people whose professional position, personal involvement, or interest has given them knowledge about huckleberries in Washington. The Washington Natural Heritage Program staff extends our appreciation to the following individuals who contributed to our understanding of this complex issue:

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II. Huckleberry Species in Washington

Species taxonomy, description, and distribution
Washington's Specialized Forest Products Act (RCW 76.48) pertains to the twelve wild species of *Vaccinium* included in Table 1. *Vaccinium oxycoccos*, wild cranberry, also native to Washington and also historically important as a food plant, is not included in the discussion here.

The scope of this report is to provide technical information on the status of the genus *Vaccinium*, exclusive of cranberries, in Washington. The species included, as defined in RCW 76.48.020, are *Vaccinium membranaceum, V. deliciosum, V. ovatum, V. parvifolium, V. globulare, V. ovalifolium, V. alaskaense, V. caespitosum, V. occidentale, V. uliginosum, V. myrtillus,* and *V. scoparium.*

Table 1 presents current taxonomy, synonyms, and common names, including identification of the preferred or most commonly used common name. For readability, the common name in bold type in Table 1 will be used in this report. The term "huckleberries" will apply generally to all of the species discussed in this report.

Huckleberry Species Descriptions and Discussions
All species of huckleberries are edible and palatable, and no doubt all species have been, and are, eaten by people in at least small quantities. The quantities of different species of huckleberries that are harvested and eaten by humans have not been systematically documented, but most sources (Richards and Alexander 2006, Freed 2007, Mack 2007) agree that in the mountains, big huckleberry was, and is, the species harvested in the greatest quantities by far. Cascade blueberries are also highly regarded, as the scientific name suggests, but require traveling to higher elevation, and it is likely that the quantities of this species harvested are far below those of big huckleberry. Alaska huckleberry and oval-leaf huckleberries are also harvested, but they generally are not as sweet or as highly sought after as tall huckleberry or Cascade blueberry (Mack and McClure 2002). At lower elevations, evergreen huckleberry is available in large quantities, and has occasionally been commercially harvested in large amounts (Kerns *et al.* 2004). Red huckleberry is widespread at low elevations; recently the commercial market for this species has increased (LaMonte 2007).

Synonyms in Table 1 are from Hitchcock and Cronquist (1973), Kozloff (2005), and Douglas *et al.* (1999).

Table 1. **Huckleberry Species in Washington State**

Current species name (species in RCW 76.48.020)	**Synonyms**	**Common names (name used in this report is in bold)**
V. alaskaense	*V. oblatum, V. ovalifolium*	**Alaska huckleberry**, Alaska blueberry
V. caespitosum	*V. arbusculum, V. globulare, V. nivictum, V. pauludicolum, V. caespitosum* vars*. angustifolium, arbuscula, cuneifolium,* and *pauludicolum*	**dwarf huckleberry**, dwarf bilberry, dwarf blueberry, swamp blueberry, Sierra bilberry, whortleberry, dwarf grouseberry
V. deliciosum		**Cascade blueberry** or huckleberry, blue-leaf huckleberry, blue huckleberry
V. globulare	*V. membranaceum* var. *rigidum*	**globe huckleberry,** blue huckleberry
V. membranaceum	*V. macrophyllum*	**big huckleberry**, thin-leaved huckleberry, thin-leaved blueberry, tall bilberry, black mountain huckleberry
V. myrtillus	*V. oreophilum*	**dwarf bilberry**, low bilberry
V. occidentale	*V. uliginosum* subsp. *occidentale*	**western huckleberry**, western bog blueberry
V. ovalifolium	*V. chamissonis*	**oval-leaf huckleberry,** early blueberry
V. ovatum	*V. lanceolatum*	**evergreen huckleberry,** evergreen blueberry, shot huckleberry, box huckleberry, California huckleberry, box blueberry, black huckleberry
V. parvifolium		**red huckleberry**, red bilberry, red blueberry
V. scoparium	*V. myrtillus* var. *microphyllum, V. erythrococcum*	**grouse whortleberry,** whortleberry, grouseberry
V. uliginosum	*V. uliginosum* var. *occidentale, V. uliginosum* subsp. *occidentale, V. occidentale*	**bog blueberry**, bog huckleberry, bog bilberry

Table 2. Comparative Nomenclature of Washington Huckleberries

Current species name (species in RCW 76.48.020	Hitchcock and Cronquist 1974	Washington Flora Checklist	Illustrated Flora of British Columbia	USDA Plants Database	Kozloff 2005
V. alaskaense	*V. alaskaense* Howell	*V. alaskense* Howell	*V. alaskense* Howell	*V. alaskaensis* T.J. Howell	*V. alaskaense*
V. caespitosum	*V. caespitosum* Michx	*V. caespitosum* Michx	*V. caespitosum* Michx	*V. caespitosum* Michx, V. *c.* var. *caespitosum* and *V. c*. var. *paludicola* (Camp) Hulten	*V. caespitosum*
V. deliciosum	*V. deliciosum* Piper	*V. deliciosum* Piper	*V. deliciosum* Piper	*V. deliciosum* Piper	*V. deliciosum*
V. globulare	*V. globulare* Rydb.	not included	*V. globulare* Rydb.	*V. membranaceum* Dougl.	
V. membranaceum	*V. membranaceum* Dougl.	*V. membranaceum* Dougl. Ex Torr.	*V. membranaceum* Dougl. *Ex.* Hook	*V. membranaceum* Dougl.	*V. membranaceum*
V. myrtillus	*V. myrtillus* L.	*V. myrtillus* L.	*V. myrtillus* L.	*V. myrtillus* L.	
V. occidentale	*V. occidentale* Gray	*V. uliginosum* L.	*V. uliginosum* L.	*V. uliginosum* L.	*V. uliginosum* subsp. *occidentale*
V. ovalifolium	*V. ovalifolium* Smith	*V. ovalifolium* Smith	*V. ovalifolium* Smith	*V. ovalifolium* Smith	*V. ovalifolium*
V. ovatum	*V. ovatum* Pursh	*V. ovatum* Pursh	*V. ovatum* Pursh	*V. ovatum* Pursh	*V. ovatum*
V. parvifolium	*V. parvifolium* Smith	*V. parvifolium* Smith	*V. parvifolium* Smith	*V. parvifolium* Smith	*V. parvifolium*
V. scoparium	*V. scoparium* Leiberg	*V. scoparium* Leiberg	*V. scoparium* Leiberg	*V. scoparium* Leiberg	*V. scoparium*
V. uliginosum	*V. uliginosum* L.	*V. uliginosum* L.	*V. uliginosum* L.	*V. uliginosum* L.	*V. uliginosum* subsp. *occidentale*
Vander Kloet 1988 combined *V. alaskanese* and *V. ovalifolium, V. membranaceum* and *V. globulare, V. occidentale* and *V. uliginosum.*					

Table 3 presents a summary of habitat and distribution of Washington huckleberries.

Table 3. Habitat and Distribution of Washington Huckleberries

Common name	Current species name (species in RCW 76.48.020	Habitat and Distribution
Alaska huckleberry	*V. alaskaense*	Mesic to moist forests and openings from lowlands to the subalpine, generally in the western Cascades and in the Willapa Hills
dwarf huckleberry	*V. caespitosum*	Montane meadows and slopes up to the subalpine zone in the Cascades, and the Olympic and Selkirk Mountains
Cascade blueberry	*V. deliciosum*	Montane forests, subalpine, and alpine slopes in the Cascades and Olympic Mountains
globe huckleberry	*V. globulare*	Low and mid-elevations in the mountains in eastern Washington
big huckleberry	*V. membranaceum*	Widespread in montane forests and openings up to the subalpine in the mountains of Washington
dwarf bilberry	*V. myrtillus*	Montane forests in the eastern Cascades and the Selkirk Mountains, and reported from the Olympic Mountains
western huckleberry	*V. occidentale*	Bogs, lowland to alpine, mostly east of the Cascades
oval-leaved huckleberry	*V. ovalifolium*	Mesic to moist forests, openings, and bogs in the Cascades, and the Olympic and Selkirk Mountains
evergreen huckleberry	*V. ovatum*	Lowlands from the west side of the Cascades to the coast
red huckleberry	*V. parvifolium*	Forests in lowlands west of the Cascades
whortleberry	*V. scoparium*	Montane and subalpine forests and open slopes, up into the alpine, in the eastern Cascades, the Selkirk and Blue Mountains
bog blueberry	*V. uliginosum*	Bogs in coastal areas and lower elevations in the western Cascades

The *Vaccinium* genus is taxonomically complex (Camp 1942a), and hybridization and polyploidy make delineation of species difficult. The genus is characterized by rapid speciation among polyploids and widespread hybridization with backcrosses (Camp 1942b). Cranberries, generally also treated as *Vaccinium* (Hitchcock *et al.* 1959, Hitchcock and Cronquist 1973), have been separated by some taxonomists into the genus *Oxycoccus* (Douglas *et al.* 1999). Cranberries will not be included in this report.

The following discussions are arranged alphabetically by scientific name. As Table 1 indicates, several taxonomic revisions of this genus have occurred, though with the exception of the treatment of Vander Kloet (1988) described below, the species have

been fairly consistently treated since the publication of Hitchcock and Cronquist (1973). The exception is the generally accepted incorporation of *V. occidentale* into *V. membranaceum.*

Common names of plant species will generally be used in this report. The scientific names of species discussed in this report are included in Appendix 3.

Huckleberry Species Treatments

The following section includes discussions of each of the huckleberry species present in Washington. The descriptions, except where otherwise noted, are adapted from Douglas *et al.* (1999) and Hitchcock *et al.* (1959). Information on species ranges is from the same two sources, as well as from the Biota of North America Project (BONAP) (2007) and the USDA Forest Service (2007).

Some genus-wide generalities can be made about the biology of huckleberries. All the species bear fruit that is edible and highly sought-after by humans and wildlife alike, and people have always enjoyed the berries for their flavor. More recently, information is growing about the potential health benefits of antioxidants, documented to occur in high quantities in huckleberries (Yao and Vieira 2006, Maatta-Riihinen *et al.* 2005, many others).

Essentially all western huckleberries consumed by people are gathered in the wild, although the interest in cultivating these species is high. With the exception of evergreen huckleberry, wild huckleberries have not been widely cultivated. Big huckleberry, in particular, could be a valuable commercial crop if it could be domesticated (Barney 1999).

Initial research has also been conducted on the suitability of big huckleberry as a source of genetic material for hybridization with high-bush blueberries. To this end, selections of desirable big huckleberry stock – plants that are precocious, consistently fruitful, and produce good crops of medium to large berries on open, vigorous and disease-free plants – have been propagated for further evaluation. Attempted crosses between these big huckleberry selections and high-bush blueberry have so far been unsuccessful (Finn and Young 1984).

While the autecology of each huckleberry species differs, some generalities can also be made about the ecology of huckleberries. Most require acidic soils and can grow on infertile sites which have relatively small amounts of many essential elements. Most western huckleberries appear vulnerable to soil disturbance, and they are often restricted to areas of relatively undisturbed soil. The plants appear to be damaged by treatments such scarification.

All huckleberries can sprout from their roots and underground stems after disturbance, particularly burning, and in general they are considered to be fire-adapted species. They generally increase after fire, depending on its severity.

The role of fire in establishing new populations of western huckleberries, or in maintaining existing ones, is not completely understood (Martin 1979). However, there is wide evidence of the benefits of moderate or low intensity burning and the harm from either high intensity fires or total fire suppression (Matthews 1992a, Simonin 2000, Tirmenstein 1990a). Seral blueberry fields in Oregon and Washington are most likely the result of wildfires. Shade generally decreases fruit set in most western huckleberries, and native peoples of the Northwest apparently burned red huckleberry and other huckleberries to maintain or enhance fruit production. These fields are dwindling in size as a result of decades of fire suppression.

Fire, by these accounts, increases the abundance of huckleberries, but the amount of time that recovery takes depends on the intensity of the burning; returning to pre-fire vigor may take several years. High intensity fire may kill the plants outright, and re-establishment from seeds happens very slowly.

It appears that, with the exception of red huckleberry, establishment of new plants from seed in nature is not common, though berries are well adapted to animal dispersal and can be transported considerable distances by birds and mammals. Seeds are generally unharmed by digestive processes and can germinate on favorable sites during moist years. However, very limited seedling establishment from off-site sources seems to occur even in favorable years (Matthews 1992a, Tirmenstein 1990b). The seeds of most huckleberries have a short time of viability and, with the exception of bog blueberry, do not enter dormancy. Generally, they do not require pretreatment for germination (Matthews 1992b). However, the seeds of most huckleberries are susceptible to heat and are presumably killed by fire.

Alaska huckleberry - *Vaccinium alaskaense*

Alaska huckleberry is a medium to large shrub, occasionally up to six feet tall. Its leaves are oval-shaped, 3/4 to 2 inches long, dark green on the upper surface and pale beneath, either smooth edged or with indistinct teeth in the lower half of the leaf, and with small, sparse glands on the lower surface of the midrib. The flowers are bronzy-pink and bell shaped, as broad or broader than long and broadest just above the base. The berries may be purplish-black or appear blue because of a waxy bloom, with stalks approximately 3/8 inch long, straight or nearly straight, and slightly enlarged just below the fruit.

This species is easily confused with oval-leaf huckleberry. These two species are often treated as ecological equivalents and merged in vegetation classifications. The most useful characteristics for distinguishing these two species are the tiny glands along the midrib on the under surface of the leaf of Alaska huckleberry and the straight stalk of the fruit, slightly enlarged just below the ovary. Oval-leaf huckleberries lack the glands on the lower midrib and have fruit with curved stalks that are not enlarged below the ovaries.

Vander Kloet (1988) combined these two species into oval-leaf huckleberry, but this combination has not been widely accepted; most authors continue to regard these as distinct species (Douglas *et al.* 1999, Kozloff 2006, Biek 2000). Alaska blueberry has been considered to be a polyploid hybrid derivative from oval-leaf huckleberry and red huckleberry (Camp 1942).

In Washington, Alaska huckleberry generally occurs in the western Cascades and in the Willapa Hills. This species ranges from northern Oregon to Prince William Sound in Alaska (Matthews 1992a).

The following ecological information, except where otherwise noted, is adapted from Matthews (1992a):

Alaska huckleberry occurs in mesic to moist forests and openings from lowlands to the subalpine, up to approximately 6,000 feet elevation, as an understory dominant or co-dominant in many habitats within its range. It is most often associated with Pacific silver fir (*Abies amabilis*), western hemlock (*Tsuga heterophylla*), mountain hemlock (*T. mertensiana*), and Sitka spruce (*Picea sitchensis*). Alaska blueberry primarily occurs in cool-moist forests that have very long fire intervals (perhaps 400-500 years).

Other commonly associated species include noble fir (*Abies procera*), Alaska-cedar (*Chamaecyparis nootkatensis*), salal (*Gaultheria shallon*), fool's huckleberry (*Menziesia ferruginea*), beargrass (*Xerophyllum tenax*), bunchberry dogwood (*Cornus canadensis*), Oregon-grape (*Berberis nervosa*), Pacific rhododendron (*Rhododendron macrophyllum*), devil's club (*Oplopanax horridum*), California false-hellebore (*Veratrum californicum*), gooseberries (*Ribes* spp.), and blackberries (*Rubus* spp.).

Alaska blueberry can be prominent in two successional stages. It can survive fire or other types of disturbance, sprout from underground parts, and become important in early seral stages. It can also be an early colonizer in regeneration harvests, burned areas, and in areas of windthrow. As stands become dense and even-aged (stand age 25-150 years), Alaska blueberry decreases drastically in frequency and abundance. Later, as the stand matures (stand age 150-250 years) and begins to self-thin, Alaska blueberry again increases and forms a low, highly branched layer. Alaska blueberry is often associated with late seral or climax community types and occurs frequently in mature-climax western hemlock, Sitka spruce-western hemlock, coastal true fir-hemlock, and Douglas-fir types.

Like other huckleberries, Alaska blueberry can sprout from roots and underground stems after burning, though high intensity fire may kill the entire plant. Regeneration harvesting and subsequent burning increased the vigor of Alaska blueberry in southeast Alaska. Within four years, the number of aerial stems sprouting from rhizomes in regeneration harvest and burned areas was twice the number found in old stands.

Timber harvest may result in reduction of frequency of Alaska blueberry, at least in the first few years. Harvest of a 65 year-old forest in western Washington (Cedar River

watershed) resulted in reduction of frequency of Alaska huckleberry from 41.7 percent in the undisturbed forest stand to 15 in a regeneration harvest. In a stand where 27 live trees per hectare were left standing, the frequency of Alaska blueberry did not change (North *et al.* 1996).

Dwarf huckleberry - *Vaccinium caespitosum*

As the name suggests, dwarf blueberry is a small mat-forming shrub between 6 inches and 1 foot in height. The leaves are up to approximately 1 inch long, toothed in the half toward the tip, bright green on both surfaces, and prominently veined beneath. The flowers are approximately 1/4 inch long, twice as long as wide. The berries are blue, and up to 3/8 inch in diameter.

This species could be mistaken for Cascade blueberry where the two species overlap, but the latter has a diagnostic waxy surface in the under surface of the leaf.

In Washington, dwarf blueberry grows in the Cascades, and the Olympic and Selkirk Mountains. The species ranges from Labrador, westward through subarctic North America to south-central Alaska. It extends southward through the Cascades into California and through the Rocky Mountains to Colorado and New Mexico. In eastern North America, dwarf huckleberry grows southward through New England to New York and reaches portions of northern Michigan and Minnesota to the west. Disjunct populations have been reported in certain mountainous areas of northern Mexico (Tirmenstein 1990a).

Intermediates between dwarf blueberry and oval-leaf huckleberry have been described by Camp (1942), but these are not referred to in more recent literature (Hitchcock *et al.* 1959, Douglas *et al.* 1999), which note but do not recognize varieties of this species.

Except where otherwise noted, the following ecological information is adapted from Tirmenstein (1990a):

Dwarf huckleberry grows in montane meadows and on slopes up into the subalpine zone. It occurs as an understory dominant or co-dominant in high elevation spruce - fir forests throughout much of western North America. It also grows, often in great abundance, in some relatively moist Douglas-fir, quaking aspen (*Populus tremuloides*), and lodgepole pine (*Pinus contorta*) communities. It is often considered a “frost pocket” species, tolerant of cold sites created by topography (Cooper *et al.* 1987).

Common understory associates in western forests include bog Labrador tea (*Ledum groenlandicum*), grouse whortleberry, queencup beadlily (*Clintonia uniflora*), and bluejoint reedgrass (*Calamagrostis canadensis*), twinflower (*Linnaea borealis*), swordfern (*Polystichum* spp.), huckleberries, elk sedge (*Carex geyeri*), and kinnikinnick (*Arctostaphylos uva-ursi*).

Patches of dwarf huckleberry commonly develop after fire in lodgepole pine and spruce-fir communities of the Pacific Northwest and Rocky Mountains. The widespread representation of dwarf huckleberry in many post-fire communities suggests that it is capable of surviving many, if not most, fires. This species has shallow rhizomes and can presumably re-sprout after fires of light or moderate severity. However, these regenerative structures are fairly shallow and can be damaged or eliminated by deep, duff-consuming fires or mechanical treatments which include severe soil scarification. Twigs are capable of regenerating at the nodes and vegetative expansion can occur even in the absence of disturbance.

Following small, patchy fires, such as those occurring after lightning strikes on high elevation sites with discontinuous fuels, reestablishment would presumably occur through rhizomatous spreading from the perimeter of the burn. Light fires may favor dwarf huckleberry by reducing competitors, increasing nutrient availability, and opening the canopy so that greater amounts of light reach low shrubs. Re-establishment is rapid where rhizomes are capable of re-sprouting. Post-fire cover can greatly exceed pre-burn levels. In parts of the central Rockies, light fires in high elevation spruce-fir forests create a ground cover made up primarily of dwarf huckleberry and a "few hardy herbaceous ... relics."

While dwarf huckleberry reproduces both sexually and vegetatively, vegetative regeneration appears to be of primary importance in post-fire re-establishment. Dwarf huckleberry seedlings are rarely observed under natural conditions in the West. Germination may be limited to exceptional sites in favorable, moist years. Seed stored on-site appears to contribute little to regeneration of this species.

Many sites occupied by dwarf huckleberry burn infrequently. Areas such as wet meadows, bog and pond margins, and areas below timberline which are too rocky to support trees are unlikely to experience fires at frequent intervals. However, fire is an important influence in many forested communities. In Montana, fire-free intervals ranging from 17-28 years have been estimated.

Cascade blueberry - *Vaccinium deliciosum*

Cascade blueberry is a low-growing shrub up to approximately a foot tall. The leaves are indistinctly toothed along the upper 1/2 to 2/3 of their length, 3/4 to 2 inches long, and have a characteristic waxy bloom on the lower surface. The flowers are solitary, nodding, with pink globular corollas less than 3/8 of an inch long. The berries are generally blue, less than 3/8 of an inch long, favored by some people as the best-tasting of all the huckleberries.

In Washington this species occurs in the Cascades and the Olympic Mountains; the species ranges from southwest British Columbia to northern Oregon.

Cascade blueberry grows in a variety of higher elevation montane forests and on subalpine and alpine slopes. Where Cascade blueberry is abundant (>20% cover) in the

Olympic, Mt. Rainier and North Cascades National Parks, it is most frequently found with the trees subalpine fir, mountain hemlock, Alaska yellow-cedar, and Pacific silver fir. Common associated shrubs and dwarf-shrubs in the Olympic, Mt. Rainier and North Cascades National Parks are pink mountain heather (*Phyllodoce empetriformis*), partridgefoot (*Luetkea pectinata*), white mountain heather (*Cassiope mertensiana*), big huckleberry, and Sitka mountain-ash (*Sorbus sitchensis*). Commonly associated herbaceous species in the Olympic, Mt. Rainier and North Cascades National Parks are mountain bistort (*Polygonum bistortoides*), showy sedge (*Carex spectablis*), subalpine lupine (*L. arcticus* var. *subalpinus*), slender hawkweed (*Hieracium gracile*), white avalanche-lily (*Erythronium montanum*), and Sitka valerian (*Valeriana sitchensis*), mountain hairgrass *(Vahlodea atropurpurea),* and Cusick's speedwell (*Veronica cusickii*) (WNHP 2007).

In a study of fire effects in the alpine zone in the North Cascades, Cascade blueberry was the only species that frequently remained in burned krummholz and heath communities. Cover of Cascade blueberry increased from 21 percent to 40 percent in krummholz communities and decreased slightly, from 12 percent to 9 percent, in heath communities (Douglas and Ballard 1971).

Globe huckleberry - *Vaccinium globulare*

Globe huckleberry is a middle-sized shrub, growing up to 4 feet high. The leaves are oblong, rounded to bluntly pointed at the tip, and wedge-shaped at the base, up to an inch and a half long, finely toothed their entire length, paler and with a waxy bloom on the lower surface. The flowers are solitary, pale pink or yellowish, globular, approximately 1/4 inch long, and grow on stalks that curve downward. The berries are bluish-purple, less than 3/8 of an inch long.

In Washington, globe huckleberry occurs only in the mountains near the eastern border; overall, the species ranges from southeast British Columbia, east to Alberta, and south into Oregon and Wyoming (Douglas *et al.* 1999).

Vander Kloet (1988) included *V. globulare* in *V. membranaceum*, but this combination has not been widely accepted. More recent floras regard these as distinct species (Douglas *et al.* 1999, Kozloff 2006, Biek 2000). Vegetation ecologists often consider these two species as ecological equivalents (see the descriptions in the Huckleberry Ecology section of this report) and merge them in vegetation classifications.

Globe huckleberry occurs in dry to mesic forests at low and mid-elevations. This species is ecologically similar to big huckleberry, and information for that species can be considered to be applicable to this one.

Big huckleberry - *Vaccinium membranaceum*

Big huckleberry is a tall to medium-sized rhizomatous shrub up to 6 feet tall. The ovate leaves are up to 2 inches long, acuminate, and serrate nearly full-length. Flowers are

solitary, pale yellowish-pink, urn-shaped, lightly longer than wide, 1/4 to 3/8 inches long. Fruits are round, up to 3/8 inches long, purple or dark purplish-red (occasionally red), lacking a waxy bloom.

The large size of this plant, its fruit color, leaf shape and serrations, and calyx with shallow, deciduous lobes combine to make this species relatively easy to identify.

In Washington tall huckleberry is widespread in the mountains throughout the state. Big huckleberry ranges from Alaska and British Columbia south through the Cascades and the Olympic Mountains to California and east to Ontario, Wyoming, South Dakota, and Minnesota. It also occurs in localized areas of the Upper Peninsula of Michigan (Simonin 2000).

Vander Kloet (1988) included *V. globulare* in *V. membranaceum*, but this combination has not been widely accepted, and more recent floras regard these as distinct species (Douglas *et al.* 1999, Kozloff 2006, Biek 2000). Some taxonomists believe that big huckleberry may be a derivative of globe huckleberry and dwarf bilberry (Dahlgreen 1984). Vegetation ecologists often consider these two species as ecological equivalents and can merge them in vegetation classifications.

Except where otherwise noted, the following ecological information for big huckleberry is adapted from Simonin (2000):

Big huckleberry is widespread in montane forests and openings up to the subalpine zone. It may occur as a dominant understory species with Engelmann spruce (*Picea engelmannii*), western larch (*Larix occidentalis*), ponderosa pine (*P. ponderosa*), lodgepole pine, western white pine (*P. monticola*), western hemlock, and mountain hemlock. Pacific silver fir, subalpine fir (*A. lasiocarpa*), noble fir, grand fir (*A. grandis*), Douglas-fir, and western redcedar (*Thuja plicata*) and are also dominant overstory species. Where big huckleberry is abundant (>20% cover) in the Olympic, Mt. Rainier and North Cascades National Parks, it is most frequently found with Pacific silver fir, subalpine fir, mountain hemlock, Alaska yellow-cedar, Douglas-fir, and western hemlock.

Common shrub associates include sticky flowering currant (*Ribes viscosissimum*), mountain snowberry (*Symphoricarpos oreophilus*), common snowberry (*S. albus*), grouse whortleberry, Cascade blueberry, red huckleberry, and fool's huckleberry. Other common shrub associates include white spirea (*Spiraea betulifolia*), white-veined wintergreen (*Pyrola picta*), pink mountain heather, Cascade azalea (*Rhododendron albiflorum*), Sitka mountain-ash, white mountain heather, strawberry bramble (*Rubus pedatus*), rough-fruit berry (*R. lasiococcus*), little prince's pine (*Chimaphila menziesii*), Rocky Mountain maple (*Acer glabrum*), Pacific dogwood (*Cornus nuttallii*), and Oregon-grape (*Berberis repens*). Where big huckleberry is abundant (>20% cover) in the Olympic, Mt. Rainier and North Cascades National Parks, it is most frequently found with dwarf bramble, pachistima (*Paxistima myrsinites*), Sitka mountain-ash, and pink mountain heather.

Forb associates include beargrass, fireweed (*Epilobium angustifolium*), Sitka valerian, queencup beadlily, twinflower, lupine (*Lupinus* spp.), Pacific trillium (*Trillium ovatum*), and three-leaf foamflower (*Tiarella trifoliata*). Where big huckleberry is abundant (>20% cover) in the Olympic, Mt. Rainier and North Cascades National Parks, it is most frequently found with subalpine lupine (*L. arcticus var. subalpinus*), Sitka valerian, and broadleaf arnica (*Arnica latifolia*).

Foliage of big huckleberry is of low flammability, allowing for survival after low severity fires, with top-kill resulting from higher severity fires. Top-killed plants re-sprout from rhizomes.

The clonal habit of big huckleberry likely favors ecotypic variation among populations. Regular fire intervals would select individuals better suited to surviving fire over individuals growing under fire suppression. Plants are consumed by fire only when adequate fuels are present to dry and preheat stems and foliage. Seed is not an important post-fire re-colonization method and is rarely found in post-fire areas.

Historically, burning of big huckleberry patches by Native Americans was a regular activity in the mid-elevation to subalpine zone of the Cascade and Pacific ranges. To enhance production, fires were set in autumn after berry harvest. Fires reduced invasion of shrubs and trees. Fields of big huckleberry in the Pacific Northwest are considered a product of uncontrolled wildfires occurring before effective fire suppression.

In preferred habitats, big huckleberry will generally survive low to moderately severe fires, attaining pre-burn coverage within 3 to 7 years, with stem number and density increasing. High severity burns may result in moderate to high mortality or greatly reduced sprouting. Moderate to severe fires on coarse textured soil or areas with a thin organic layer kill underground rhizomes, resulting in heavy mortality. Strong decreases occur after severe broadcast burning and wildfire with recovery generally occurring within 15 to 20 years. Overall, low severity burns result in heavy sprouting from rhizomes.

Dwarf bilberry - *Vaccinium myrtillus*

Dwarf bilberry is a low, branching shrub, up to approximately one foot tall, with green or greenish braches. The leaves are elliptic to acuminate, up to an inch long, light green, with sharply toothed margins. The flowers are solitary, urn shaped, just over 1/4 inch long. The berries are round, 1/4 to 3/8 inch long, dark red to blue-black.

Dwarf bilberry is often confused with grouse whortleberry. Dwarf bilberry has minutely hairy branches that are thicker and less numerous, and thus less broom-like, than grouse whortleberry. The berries of grouse whortleberry are also brighter red, and this species has smaller leaves and flowers.

In Washington, dwarf bilberry grows in the eastern Cascades and in the Selkirk Mountains. It ranges throughout the Rocky Mountains from British Columbia and

Alberta to northern New Mexico and southern Arizona. Dwarf bilberry reaches its greatest abundance in the southern Rockies, whereas the closely related and morphologically similar grouse whortleberry is most abundant in the Northwest. This circumboreal species also extends across Europe and Asia.

Dwarf bilberry may have received genetic material from globe huckleberry, dwarf blueberry, and/or big huckleberry (Camp 1942a). Some taxonomists believe that big huckleberry may be a derivative of globe huckleberry and dwarf bilberry (Dahlgreen 1984).

Vander Kloet combined western huckleberry and bog blueberry, a combination recognized by Douglas *et al.* (1999), the Washington Flora Checklist (2007), and the USDA Plants Database (2007). Vegetation ecologists often consider these two species as ecological equivalents and can merge them in vegetation classifications. The description and habitat for this species will be discussed along with bog blueberry, *Vaccinium uliginosum*.

Except where otherwise noted, the following ecological information is adapted from Tirmenstein (1990b):

Dwarf bilberry is a common understory dominant or co-dominant in a variety of coniferous forests. It occurs in abundance in stands made up of subalpine fir, Douglas-fir, and Engelmann spruce. Dwarf bilberry is also an understory dominant in lodgepole pine, ponderosa pine, and western hemlock-western redcedar and quaking aspen communities. Common understory co-dominants include grouse whortleberry, Jacob's-ladder (*Polemonium pulcherrimum*), twinflower, and thimbleberry (*Rubus parviflorus*).

Like other huckleberries, dwarf bilberry can reproduce from seed or by vegetative means, but vegetative regeneration appears to be of primary importance after fire or other disturbance. However, colonies increase laterally through rhizome expansion even in the absence of disturbance. Annual radial increases can average 2.8 inches (2 to 4 inches) per year.

Dwarf bilberry appears well adapted to a regime of fairly frequent fires, which often enhance clonal vigor. Old, large, decadent clones are often broken up by fire. Surviving portions serve as isolated centers of regeneration which give rise to the development of vigorous daughter clones. In parts of Britain and presumably elsewhere, it commonly persists on sites burned at periodic intervals. However, this shrub also thrives under longer fire intervals. In parts of the central and southern Rocky Mountains, it assumes dominance later than the first century after fire. Relatively long fire intervals have also been reported in dwarf bilberry forests of Sweden, where mean fire frequencies are estimated at approximately 91 years.

Dwarf bilberry is generally capable of sprouting from an extended network of underground rhizomes after aboveground vegetation is destroyed by fire. Rhizomes, which occur at depths of 0.24 to 1.2 inches, can survive fires in which soil surface temperatures reach 820 degrees F. However, rhizomes are sometimes destroyed on

severely burned sites. A Colorado study suggests that although post-fire canopy cover is typically high on lightly burned sites, this shrub may be virtually eliminated on severely burned areas. Recovery may take a very long time. On burned and regeneration harvest old growth forests of west-central Montana, dwarf bilberry had not attained pre-burned biomass within 10 to 14 years after disturbance.

Regeneration through seed is reportedly poor on burned, previously forested sites. Although some researchers consider dwarf bilberry to be a seed-banker, seedlings are apparently rare.

Oval-leaf huckleberry - *Vaccinium ovalifolium*

Oval-leaf huckleberry is a large shrub, growing to over six feet tall. Its leaves are oval-shaped, 3/4 to 1 3/4 inches long, darker green on the upper surface and paler beneath, sometimes with a waxy bloom, either smooth edged or with indistinct teeth in the lower half of the leaf. The flowers are bronzy-pink and bell shaped, as broad or broader than long and broadest just above the base. The berries generally appear blue because of a waxy bloom, and the stalks of the fruit are curved.

As noted above, this species is easily confused with Alaska huckleberry. The most useful characteristics for distinguishing these two species are the absence of tiny glands along the midrib on the under surface of the leaf of oval-leaf huckleberry and the curved stalk of the fruit, which is not slightly enlarged just below the ovary.

In Washington, oval-leaf huckleberry occurs in the Cascades, Olympic, and Selkirk Mountains. The species ranges from Alaska to the Cascades of Washington and Oregon, eastward into Idaho and Montana. This shrub also occurs across much of the Pacific Rim, from the Aleutians to Japan, and reaches parts of mainland eastern Asia. Disjunct populations are common throughout eastern Canada and the Great Lakes Region. In eastern North America, oval-leaf huckleberry occurs sporadically from northern Quebec, Nova Scotia, and Newfoundland, southwestward to northern Michigan (Tirmenstein 1990c).

Vander Kloet (1988) combined this species with Alaska huckleberry, but this combination has not been widely accepted; most authors continue to regard these as distinct species (Douglas *et al.* 1999, Kozloff 2006, Biek 2000). Vegetation ecologists often consider these two species as ecological equivalents and can merge them in vegetation classifications.

Oval-leaf huckleberry readily hybridizes with a number of species, including Alaska huckleberry, and intermediate forms have been widely reported. Oval-leaf huckleberry-dwarf blueberry and oval-leaf huckleberry-grouse whortleberry hybrids also occur; oval-leaf huckleberry may also have contributed genetic material to big huckleberry. Intermediates between oval-leaf huckleberry and dwarf huckleberry have also been reported in parts of eastern North America (Martin 1978, Tirmenstein 1990c).

Except where otherwise noted, the following ecological information is adapted from Tirmenstein 1990c):

Oval-leaf huckleberry occurs in mesic to moist forests, openings, and bogs. In western North America, it occurs in coastal montane or interior forests dominated by western redcedar, western hemlock, mountain hemlock, Sitka spruce, Pacific silver fir, and Alaska yellow-cedar. It is frequently found in association with big huckleberry and Alaska huckleberry. Common understory associates include salal, red huckleberry, western swordfern (*Polystichum munitum*), Oregon oxalis (*Oxalis oregana*), Pacific rhododendron, hazel (*Corylus cornuta*), thimbleberry, bog Labrador tea (*Ledum glandulosa*), deer fern (*Blechnum spicant*), and annual grasses. Thimbleberry, salal, salmonberry (*Rubus spectabilis*), vine maple (*Acer circinatum*), and hazel are particularly common brushfield associates.

Oval-leaf huckleberry is shade tolerant and can persist in undisturbed forests dominated by species such as western hemlock. It is a common constituent of climax old growth Douglas-fir - western hemlock, Pacific silver fir, and moist western hemlock forests of the Pacific Northwest. Fire may occur infrequently on some moist sites occupied by oval-leaf huckleberry.

Oval-leaf huckleberry commonly appears soon after disturbance in parts of western Washington and elsewhere. Sprouts were observed on mudflow surfaces in scorch and blowdown areas soon after the eruption of Mount Saint Helens. Oval-leaf huckleberry is also one of the first forest species to colonize bog margins in parts of southeastern Alaska. This shrub often persists on cutover sites throughout its range and frequently forms a nearly continuous layer on newly harvested sites.

Oval-leaf huckleberry is prevalent in young stands that develop in avalanche zones in parts of the northwestern Cascade Range of Washington. Plants pioneer these sites through layering and sprouting after aboveground portions of the parent plants are damaged. The ability to sprout gives species such as oval-leaf huckleberry a competitive advantage during early succession in these shrub communities. Stem numbers of oval-leaf huckleberry reportedly reach a minimum 60 to 150 years after the initial disturbance. Advance regeneration subsequently develops and replaces initial pioneers, producing a subsequent increase in stem density.

Establishment of oval-leaf huckleberry may be slow where parent plants were absent prior to disturbance. Clement observed oval-leaf huckleberry in mature climax forests and in young seral stands on floodplain gravel bars along the west coast of Vancouver Island. However, it was absent in early seral stands. No parent plants were present prior to disturbance and establishment on the newly exposed gravel bars proceeded slowly from off-site seed. Seedlings grow in open, old growth stands or in regeneration harvests, but often do poorly in dense, immature forests.

Evergreen huckleberry - *Vaccinium ovatum*
Evergreen huckleberry is a large to medium sized shrub that may grow to well over ten feet tall in favorable sites. The leaves are evergreen, leathery, deep green and shiny, and strongly serrate. The glossy, serrate, evergreen leaves are diagnostic. The flowers are pink, 5/16 inch long, narrowly bell-shaped, and occur in large clusters. The abundant berries are round, approximately 1/4 to 3/8 inch wide, nearly or quite black, and may have a waxy bloom.

In Washington, evergreen huckleberry occurs from the west side of the Cascades to the coast. The species ranges along the Pacific Coast from British Columbia to central California. It is generally rare in the mountains, but it grows throughout the Coast Ranges and in the central Sierra Nevada; it occurs sporadically in the higher mountains of southern California (Tirmenstein 1990d).

Except where otherwise noted, the following ecological information is adapted from Tirmenstein (1990d):

Evergreen huckleberry grows as an understory dominant or co-dominant in some mature Sitka spruce, Douglas-fir, western hemlock, and western redcedar forests of the Northwest. It also occurs in coastal headland shrub communities co-dominated by species such as Pacific rhododendron, poison-oak (*Toxicodendron diversilobum*), and salal. This species is often found in the salt spray zone, and is usually close to salt water (Pojar and MacKinnon 1994).

Evergreen huckleberry occurs in dry to moist, open forests in lowland habitat, on dry slopes, in canyons, and on barren ridges near the Pacific Coast. It occurs on well-drained microsites on both stabilized and active dunes of the northern Oregon Coast and on steep slopes which face the ocean. It commonly forms dense thickets on open ridges in the fog belt of California. Evergreen huckleberry is tolerant of both sun and shade.

Timber harvest may result in reduction of frequency of evergreen huckleberry, at least in the first few years. Harvest of a 65 year-old forest in western Washington (Cedar River watershed) resulted in reduction of frequency of evergreen huckleberry from 15 percent to zero in a regeneration harvest, and to 10 percent in a stand where 27 live trees per hectare were left standing (North *et al.* 1996).

Huckleberries require acidic conditions and can thrive where pH ranges from 4.3 to 5.2. These shrubs require relatively small amounts of many essential elements and are capable of growing on many relatively infertile soils. Evergreen huckleberry commonly occurs on nitrogen-poor soils. It grows on well-drained sandy and gravelly soils, and on silty loam, but generally reaches greatest abundance on sandy soils.

Evergreen huckleberry grows across a wide range of moisture regimes. Many sites are droughty, or are characterized by summer soil moisture stress. In coastal British Columbia, evergreen huckleberry occurs in mesothermal climatic zones characterized by wet, cool summers.

The role of fire is poorly known and relatively rare in moist coastal forests of which evergreen huckleberry is an integral understory component. Many sites currently occupied by this shrub are believed to have burned at relatively infrequent intervals during pre-settlement times. Consequently, specific adaptations to fire may be poorly developed in this species. Evergreen huckleberry in more inland forests, as those in the Puget lowland, has developed under the influence of fire. In those forests, evergreen huckleberry sprouts after fire, as demonstrated in a study in California where it was observed to increase during the two years after fire (Holzman and Folger 2007). Evergreen huckleberry often sprouts after disturbances such as fire and may primarily represent an adaptation to herbivory or structural damage.

Red huckleberry - *Vaccinium parvifolium*

Red huckleberry is a medium to tall shrub that may grow 6 to 12 feet high, or occasionally even as much as 25 feet high under favorable conditions. Branches are slender, green, and sharply angled. The leaves are small (up to around 1 inch long), thin, and deciduous, oval or elliptic in shape. Juvenile leaves are evergreen and finely serrate, whereas mature leaves are deciduous and entire.

Flowers are solitary, urn-shaped, waxy, and yellowish-pink, whitish, or greenish-yellow. The berries are bright red to pinkish, translucent, and round, approximately 1/4 inch in diameter.

Except where otherwise noted, the following ecological information is adapted from (Tirmenstein 1990e):

In Washington, red huckleberry is found in lowlands west of the Cascades. The species ranges from southeastern Alaska southward to central California. It is a common understory species, ranging in diverse habitats from sea level to 5,000 feet elevation. It occurs in a variety of coniferous forests, including those dominated by Sitka spruce, western hemlock, western redcedar, Douglas-fir, and red alder (*Alnus rubra*). In many forests it is relatively sparsely distributed, but in coastal western hemlock or western hemlock-Sitka spruce forests, red huckleberry often forms dense thickets. It also occurs on warmer sites in the Pacific silver fir zone. Red huckleberry is tolerant of sun or shade, and it commonly grows elevated above the forest floor on rotting logs, snags, or stumps.

Red huckleberry commonly grows in association with salmonberry, Alaska huckleberry, thimbleberry, trailing blackberry, fool's huckleberry, strawberry bramble, salal, oval-leaf huckleberry, dwarf Oregon-grape, bunchberry, lady fern (*Athyrium filix-femina*), and oak fern (*Gymnocarpium dryopteris*).

Red huckleberry grows in moist-to-dry conifer or mixed conifer-hardwood forests, along roadsides, and in forest openings. It is common in lowlands, mountain valleys, on river terraces, alder flats, and on lower mountain slopes. Red huckleberry occurs in dense or open, submontane to subalpine forests. In many areas, it reaches its greatest abundance on mesic, south slopes of less than 45 percent.

Red huckleberry commonly grows on nitrogen-poor soils. Soils may be very nutrient poor to nutrient rich but are often characterized by accumulations of duff and humus.

Red huckleberry sprouts from the stems, roots, underground stems, or rhizomes after aboveground vegetation is destroyed by fire. Some seedling establishment may occur as birds and mammals disperse seed from off-site. Seeds are frequently deposited on these sites by perching birds. Plants have been observed growing on broken or sawed stumps up to 50 feet (15 m) off the ground.

Red huckleberry occurs as a late seral shrub that is capable of surviving many types of disturbances and can be important in early seral communities. In western hemlock forests it is particularly common on unburned regeneration harvests. In the Cascade Range, red huckleberry assumes prominence during the initial herbaceous stage of succession which occurs within 5 years after disturbance. In Sitka spruce-western hemlock forests red huckleberry, along with salal, is also an important early seral species. It commonly sprouts or develops from seed during the first 3 years after logging. Dense shrub stands may develop within 20 to 30 years after timber harvest, and by 50 to 60 years, a nearly continuous layer of huckleberry often develops. During post-logging succession, many shrubs, including red huckleberry, are eliminated or reduced as tree canopies close and before they begin to open again at stand ages of 150 to 200 years. Red huckleberry is common in old-growth Sitka-spruce-western hemlock forests (250+ years), particularly in more open areas. In western hemlock - western redcedar - Douglas-fir communities this shrub may be absent initially after timber harvest; it may then appear in a successional phase characterized by dense shrub growth and then decline again as conifers and deciduous trees develop into a closed canopy. Red huckleberry occurs in both newly disturbed and old-growth stands in Douglas-fir forests of the Northwest.

Timber harvest may result in marked reduction of constancy, at least in the first few years after a regeneration harvest. This loss was significantly reduced in a study where 27 live trees per hectare were left standing (North *et al.* 1996).

Similar to most western huckleberries, red huckleberry appears to be damaged by post-logging treatments which include harsh scarification. Plants are often restricted to areas of relatively undisturbed soil.

While many western huckleberries appear to rely primarily on vegetative propagation, seedling establishment may play a fairly important role in the regeneration of red huckleberry. Kruckeberg (1982) notes that seedlings are generally abundant wherever parent plants occur. Red huckleberry seed is typically produced in abundance and germinates consistently.

Fire may have played an integral role in the maintenance of productive red huckleberry fields, but the importance of fire in many long-lived Northwestern coastal forests, of which red huckleberry is a component, is poorly understood. In many parts of the Northwest, red huckleberry is an important species on both burned and unburned sites.

Shade generally decreases fruit set in most western huckleberries and native peoples of the Northwest apparently burned red huckleberry and other huckleberries to maintain or enhance fruit production. Increased light reaches the forest floor where crowns of trees such as Douglas-fir have been killed by fire and promotes the growth of red huckleberry. Increased nutrient availability may also enhance growth in post-fire communities.

Red huckleberry is described as moderately resistant to fire but aboveground parts are commonly killed. Underground regenerative structures such as roots or rhizomes often persist, enabling portions of the plant to survive many, if not most, fires. Survival is presumably most likely after light to moderate fires which do not remove soil or duff.

Red huckleberry is an important big game browse in some parts of the Northwest, particularly during the fall and winter months. It provides valuable forage for deer, mountain goats, and elk. In western Washington, red huckleberry is an important elk browse. Large amounts of new leaves are eaten in the spring, but this shrub is of primary importance during the fall. Elk use may be heavy in some areas. Elk utilization of 60 to 90 percent has been reported on the Olympic Peninsula.

In many areas, red huckleberry is one of the most important winter foods of the black-tailed deer and is used heavily until covered by snow. Deer consume the fruit, leaves, twigs, leafy shoots, and newly-developing sprouts. Brown observed heaviest use during April, May, and October, but others have reported peak use during early winter when lower-growing vegetation is covered with snow. Red huckleberry can grow beyond the reach of deer on some sites.

Small mammals also browse red huckleberry. In the Coast Range of Oregon, it is a preferred food of the mountain beaver.

Grouse Whortleberry - *Vaccinium scoparium*

Grouse whortleberry is a low, rhizomatous, usually matted, slow-growing shrub that reaches 4 to 20 inches in height. Plants are multi-branched from the base and broom-like in appearance. The small, thin leaves are deciduous; flowers are urn-shaped and inconspicuous, slightly over 1/8 inch long. Berries are 1/8 to 1/4 inch broad (Douglas *et al.* 1999, Johnson 2001).

Grouse whortleberry is sometimes confused with dwarf bilberry, but the latter is a larger plant, with larger leaves, flowers, and fruit. The branches of grouse whortleberry are denser and more broom-like. Vegetation ecologists often consider these two species as ecological equivalents and can merge them in vegetation classifications.

Except where otherwise noted, the following ecological information is adapted from Johnson (2001):

In Washington, grouse whortleberry grows in the eastern Cascades, the Selkirk and Blue Mountains. The species ranges from British Columbia to California and east to Alberta

and Montana. It occurs throughout the Rocky Mountains, extending south to Colorado, Utah, and northern New Mexico. A disjunct population of grouse whortleberry grows in the Black Hills of South Dakota.

Grouse whortleberry grows in dry to moist forests, openings, and open slopes in montane and subalpine forests, and extends up into the alpine zone. Major associated tree species include lodgepole pine, subalpine fir, Engelmann spruce, mountain hemlock, whitebark pine, and subalpine larch. Other common associated species include queencup beadlily, twinflower, woodrush, pinegrass, beargrass, sedges, kinnikinnick, big huckleberry, fool's huckleberry, dwarf huckleberry, bunchberry, white rhododendron, white spirea (*Spiraea betulifolia*), and red mountain heather.

Grouse whortleberry occurs as a seral or climax dominant in many high-elevation conifer forests; it may decline as the overstory canopy closes, or it may persist as a climax associate.

Following regeneration harvestting without heavy mechanical scarification of Rocky Mountain lodgepole pine stands, grouse whortleberry often sprouts and occupies a prominent role in seral communities. With moderately heavy site or slash treatments, grouse whortleberry decreases dramatically. This vulnerability to ground disturbance would presumably also occur in Washington stands.

Grouse whortleberry is described as moderately resistant to fire, and the species relies on prolific rhizomes to survive burning. Most grouse whortleberry rhizomes extend no deeper than between duff and mineral soil, and consequently this shrub is susceptible to severe, duff-reducing fires that eliminate rhizomes and seriously damage or kill the plant. Severe fires can eliminate this shrub from a site. Following low- or moderate-severity fires, grouse whortleberry sprouts quickly and vigorously. Wildfire regimes in forests where grouse whortleberry is common are variable in frequency and severity, including nonlethal understory, severe stand-replacement, and mixed-severity fires.

Drier montane sites, dominated by lodgepole pine and whitebark pine, often have stand-replacing fire return intervals greater than 200 years. Where whitebark pine is climax, fires are infrequent and generally of low intensity.

Although the seed is generally viable, postfire regeneration of grouse whortleberry from seed is rare because of the fragility of the germinants.

Grouse whortleberry provides food and cover for many wildlife species. Lodgepole pine, spruce, fir, and mountain hemlock forests with a grouse whortleberry understory provide good summer range for many large mammal species throughout much of the West. Higher-elevation sites in grouse whortleberry communities may be poor wintering areas for large mammals because of heavy snow accumulations and the absence of tall to medium shrubs.

The abundance and availability of grouse whortleberry contribute to its overall value,

although it is less palatable than many other shrubs. Grouse whortleberry is considered an intermediate elk browse in northwestern Wyoming and is eaten by elk on summer ranges of northern Utah. Grouse whortleberry is an important component of mule deer diets in parts of Utah and Colorado and is an important fall moose food throughout the Intermountain West. In parts of Montana, grouse whortleberry is the most important shrub in the summer diet of Rocky Mountain goats. Bears may rely heavily on huckleberry berries and foliage.

Berries of grouse whortleberry are a valuable food source for many birds and small mammals. Chipmunks, red squirrel, gray fox, red fox, and skunks readily feed on grouse whortleberries. Spruce grouse, ptarmigans, ruffed grouse, blue grouse, bluebirds, thrushes, and other birds commonly consume whortleberries.

Bog blueberry - *Vaccinium uliginosum*

Bog blueberry is a low, spreading, highly branched, deciduous shrub. It is prostrate to erect in form and generally reaches 6 to 12 inches in height. The leaves are oval and leathery, up to an inch in length. The leaves are pale or waxy beneath, with prominent veins. The flowers are white to pink and are borne singly or in clusters in leaf axils, slightly over 1/8 inch long. The berries are blue to black, less than 3/8 inches long. Bog blueberry can form dense mats or open extensive colonies (Matthews 1992b, Douglas *et al.* 1999).

In Washington, bog blueberry occurs in the western Cascades. The species ranges throughout Alaska, Canada, and Greenland, south through New England and the northern portions of the Great Lakes states, and to western Washington and Oregon. Bog blueberry is also found in Japan, other parts of Asia, and in Europe (Matthews 1992b).

Vander Kloet combined *V. occidentale* and *V. uliginosum*, a combination recognized by Douglas *et al.* (1999), the Washington Flora Checklist (2007), and the USDA Plants Database (2007).

Except where otherwise noted, the following ecological information is adapted from Matthews 1992b):

Bog blueberry grows in bogs and fens in coastal areas and lower elevations and can occur as a dominant or co-dominant in a variety of habitats within its range. It may occur as an understory component in open or closed forest habitats, and dominate or co-dominate in dwarf shrub types or bogs. Associated tree species include Alaska-cedar, quaking aspen, black cottonwood, and paper birch.

Associated understory species include: willows, alders, bog birch (*Betula glandulosa*), Labrador tea, bunchberry dogwood, fool's huckleberry, salal, fireweed, bluejoint reedgrass, cottonsedge (*Eriophorum angustifolium*), and various sedges (*Carex* spp.), clubmosses (*Lycopodium* spp.), sphagnum mosses (*Sphagnum* spp.), and lichens (*Cladonia* and *Cladina* spp.).

Bog blueberry is consumed by many species of wildlife. Many songbirds and gamebirds including ptarmigan and spruce grouse eat the berries, often before they are ripe. Bog blueberry leaves are important in the diet of spruce grouse throughout the spring, summer, and fall. Many small mammals, including chipmunks, squirrels, mice, and rabbits, also consume bog blueberry leaves or fruits. Consumption of leaves by snowshoe hares is highest in the spring.

When available, bog blueberries are one of the most important fruits consumed by black bears, at least in interior Alaska, where this huckleberry species is abundant. The bears feed heavily on the berries from July to September and browse on the leaves in the spring.

Seeds are readily dispersed by the birds and animals that eat bog blueberry fruits. The seedlings can colonize exposed mineral soil but are rare in established adult populations. While seeds of most huckleberries are not dormant and generally require no pretreatment for germination, in one study bog blueberry seeds exhibited shallow dormancy, and a 30-day cold stratification at 35 degrees F increased germination success. Very few stratified or unstratified seeds germinated at temperatures below 59 degrees F.

Bog blueberry occurs in organic or inorganic soils that are generally acidic (pH 3.5 to 6.2). Bog blueberry can tolerate a wide range of soil moisture conditions and is found on well-drained to poorly drained sites.

Bog blueberry occurs in a wide variety of habitats, including coastal and interior bogs, fens, sedge meadows, forested areas, rock outcrops, and rocky or sandy shores of lakes and streams. It remains an important component of forest and woodland understory through the early, mid-seral, and late stages of succession. Bog blueberry can also be found in dense, mature-climax forest stands.

Bog blueberry is capable of vegetative and sexual reproduction. It regenerates vegetatively by layering or sprouting from rhizomes. It can sprout from underground plant parts following fire, and it remains important throughout successional stages. It roots in the organic layer and therefore only survives in patches where the organic layer is not consumed. Fire destroys the seeds, so bog blueberry must invade burned areas from off-site sources. Wildfires that occur in the wet sites that bog blueberry often occupies are generally low in severity.

Bog blueberry grows rapidly for the first 50 to 60 years after fire, and reaches its highest postfire cover and frequency 50 to 120 years after burning. Bog blueberry leaves are larger in burned areas, even after 5 years.

III. Huckleberry Ecology

Huckleberries and plant communities

Over 2,000 plant associations have been described by different authors in Washington. One or more *Vaccinium* species appear in 217 forest or woodland associations in Washington. The number of associations a species is documented from indicates where it is most common. Big huckleberry and red huckleberry are the most frequently occurring huckleberry species in forest associations in Washington (Table 4). In forest associations in western Washington, red, Alaska, oval-leaved and big huckleberry are the most frequently encountered huckleberry species (in order of frequency of occurrence). Evergreen huckleberry and red huckleberry are found nearly exclusively in western Washington forest associations. In eastern Washington forest associations, big huckleberry, dwarf bilberry, grouse whortleberry and dwarf huckleberry are the most common species (in order of frequency of occurrence). The latter three species are nearly exclusive to eastern Washington forest associations.

Table 4. Distribution of huckleberry species in forest associations in Washington. Only associations in which a *Vaccinium* species occurred in more than 25% of plots or greater than 1% average cover are included. Associations are distinguished geographically by eastern and western Washington. DF=Douglas-fir, GF=grand fir, WH=western hemlock/western redcedar, SF=Pacific silver fir, MH=mountain hemlock, SAF=subalpine fir, SS=Sitka spruce, WBP=whitebark pine and parkld=subalpine parkland associations. Total=number of associations with that species.

	Western Washington							Eastern Washington							
	DF	SS	WH	SF	MH	parkld	SAF	WBP	SAF	MH	SF	WH	GF	DF	total
Vaccinium scoparium								5%	90%	5%					20
Vaccinium myrtillus									91%	5%					21
Vaccinium caespitosum									50%					25%	3
Vaccinium membranaceum	1%		1%	17%	16%	7%	3%		21%	3%	6%	15%	6%	4%	104
Vaccinium deliciosum					40%	40%	10%								10
Vaccinium ovalifolium				54%	46%										28
Vaccinium alaskaense			7%	69%	18%					2%	5%				61
Vaccinium alaskaense or ovalifolium		38%	54%									8%			24
Vaccinium parvifolium	7%	16%	37%	39%								1%			92
Vaccinium ovatum	13%	38%	25%												6

A preliminary classification of Olympic, Mt. Rainier and North Cascades National Parks recognizes 43 shrub and dwarf-shrub plant associations with huckleberry species. Big huckleberry and Cascade blueberry are the most common *Vaccinium* species in the shrub/dwarf-shrubland associations. Big huckleberry is a dominant shrub in eight preliminary associations in subalpine and lower alpine zones. Cascade blueberry is dominant in ten associations, primarily in alpine and subalpine heather environments. Grouse whortleberry and dwarf huckleberry are dominant in two plant associations each in subalpine zones in the east Cascades. The current National Vegetation Classification (NatureServe 2007) lists eight shrubland associations with a *Vaccinium* species as a dominant or co-dominant: 2 big huckleberry, 2 dwarf huckleberry, 2 Cascade blueberry, 1 evergreen huckleberry, and 1 bog blueberry.

Archaeological investigations of historical huckleberry gathering and drying sites in the Gifford Pinchot National Forest yield insight into the most important plant communities for huckleberry production. Archaeologists found that 76 percent of the drying sites were found in the mountain hemlock vegetation zone, 8 percent were found in the subalpine fir zone. Sixteen percent, from lower elevations, were in the Pacific silver fir zone. Berry processing features were most often closely associated with a mountain hemlock/red mountain heather-Cascade blueberry plant association. Both big huckleberry and Cascade blueberry are abundant in this plant association (Mack and McClure 2002).

Ecological Systems

The Ecological Systems classification developed by NatureServe and The Nature Conservancy for ecoregional level planning is a coarser level of classification than the plant association classification (Comer *et al.* 2003). It seeks to cluster plant associations into groups that appear on the landscape together responding to similar environments and ecological processes. Individual plant associations can appear in more than one ecological system and include dynamic stages of vegetation development. Mapping is an objective of this classification and it serves as the legend for LANDFIRE, GAP analysis, and other federal and national mapping efforts. These maps may provide a means for estimating range-wide abundance of *Vaccinium* species and plant associations dominated by *Vaccinium* species.

Table 5 displays the distribution of *Vaccinium* species in Ecological Systems in Washington (NatureServe 2007). The relative importance of *Vaccinium* species in each Ecological System is designated by "M" where the species is major component and "m" where it plays a minor role. Species are abbreviated by the first two letters of the genus and the species. For example, VAUL is the abbreviation for ***Va****ccinium* ***ul****iginosum.* Two species that have the same 4-letter abbreviation are distinguished as follows: *V. ovalifolium* is VAOVL; *V. ovatum* is VAOVT.

Table 5. Distribution of *Vaccinium* species in Ecological Systems in Washington (NatureServe 2007).

ECOLOGICAL SYSTEM	VAOVT	VAPA	VAAL	VAOVL	VADE	VAME	VASC	VAMY	VACA	VAUL
Forest and Woodland										
North Pacific Dry Douglas-fir-(Madrone) Forest and Woodland	**m**									
North Pacific Broadleaf Landslide Forest and Shrubland		**m**								
North Pacific Hypermaritime Sitka Spruce Forest	**M**	**m**	**m**							
North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest	**m**	**m**	**m**							
North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest	**M**	**m**								
North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest		**m**	**M**			**M**				
North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest		**m**	**M**							
North Pacific Mesic Western Hemlock-Silver Fir Forest			**M**							
North Pacific Mountain Hemlock Forest			**m**		**m**	**M**				
North Pacific Wooded Volcanic Flowage			**M**			**M**	**m**			
North Pacific Maritime Mesic Subalpine Parkland					**M**	**m**				
East Cascades Mesic Montane Mixed-Conifer Forest and Woodland		**m**	**m**			**M**				
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest						**m**			**m**	
Northern Rocky Mountain Mesic Montane Mixed Conifer Forest						**M**				
Northern Rocky Mountain Subalpine Woodland and Parkland						**m**	**M**	**M**		
Northern Rocky Mountain Western Larch Savanna						**M**				
Rocky Mountain Aspen Forest and Woodland						**m**				
Rocky Mountain Lodgepole Pine Forest						**M**	**M**	**M**		
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland						**m**	**M**	**M**		
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland						**M**				
Upland Shrubland and Dwarf-Shrublands										
North Pacific Avalanche Chute Shrubland			**M**	**M**		**M**	**m**			
North Pacific Hypermaritime Shrub and Herbaceous Headland	**M**									

ECOLOGICAL SYSTEM	VAOVT	VAPA	VAAL	VAOVL	VADE	VAME	VASC	VAMY	VACA	VAUL
Upland Shrubland And Dwarf-Shrublands (continued)										
North Pacific Montane Shrubland						**M**				
North Pacific Dry and Mesic Alpine Dwarf-Shrubland, Fell-field and Meadow					**m**					
Northern Rocky Mountain Subalpine Deciduous Shrubland						**M**	**M**	**M**		
Rocky Mountain Alpine Dwarf-Shrubland							**m**	**m**		
Wetlands and Riparian										
North Pacific Bog and Fen										**M**
North Pacific Hardwood-Conifer Swamp			**m**							**M**
Temperate Pacific Subalpine-Montane Wet Meadow										**M**
North Pacific Lowland Riparian Forest and Shrubland			**m**							
North Pacific Montane Riparian Woodland and Shrubland			**m**							
North Pacific Shrub Swamp			**m**							
Northern Rocky Mountain Conifer Swamp				**m**		**m**				
Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland						**m**				
Rocky Mountain Subalpine-Montane Riparian Shrubland						**m**				
Rocky Mountain Subalpine-Montane Riparian Woodland						**m**				

Quantifying the size of the resource

Minore and Dubrasich (1978) examined the relationship between environmental factors and huckleberry yields. They reported that, in general, annual berry production appeared to be influenced by weather more than site factors in a study southwest of Mt. Adams. The Douglas-fir (*Pseudotsuga menziesii)* site index was not correlated with either big huckleberry abundance or berry production. Killing frosts, depth and duration of snowpack, and unpredictable events like hail storms appeared to have a greater effect on big huckleberry fruit production than soil, topography and elevation.

In their plots near Mt. Adams, big huckleberry comprised 5-63% cover. The highest yielding plot they measured produced 935 liters of huckleberries per hectare. The price in 1967 was $2 to $3 per liter wholesale price in the field, giving a potential value of $1,860 to $2,805 per hectare. Of course, the retail value would be several times higher.

Frost tolerance and climatic effects

Because the subalpine/alpine species Cascade blueberry generally occurs at higher elevations than big and globe huckleberry, it is not surprising that seedlings of Cascade blueberry were more frost tolerant than big huckleberry and globe huckleberry *(*Minore and Smart 1978).

Subalpine meadows are kept tree free by prolonged snowpack, and climatic warming would likely result in forest zones moving upwards in elevation, closing in on subalpine areas where huckleberries grow more abundantly than in surrounding forests. Tree invasion of subalpine meadows, in response to the warm and dry Dust Bowl years, is widely documented in the mountains of Washington (Franklin *et al.* 1971), and this climatic effect likely also reduced huckleberry habitat.

General fire ecology and huckleberry production

The potential for huckleberry production in Washington has likely declined in recent years due to fire suppression. Most huckleberry species grow less vigorously as the tree canopy becomes denser and increase after canopy reduction, though the time required for recovery depends on the nature and severity of the disturbance and the plant community in which it occurs.

Huckleberry abundance has likely been affected in complex ways by the activities of people. Native Americans traditionally kept berry patches in the mountains open by intentional burning, so their actions, as they were intended, likely increased the harvest potential for huckleberries.

Red huckleberry and evergreen huckleberries are abundant in low elevation forests in western Washington, where the effect of fire is not as well understood as in the mountains. We can only speculate that fire suppression in these areas also resulted in reduced potential for huckleberry harvest, but over a longer time frame.

Human management of huckleberry patches to increase their productivity, particularly using intentional burning, precedes European settlement in the Pacific Northwest. Early accounts describe Indians starting fires to enhance huckleberries in 1900, and in 1904 and 1905 half of the fires that started on the forest were attributed to Indian burning. Berry patches lasted longer at higher elevations because tree growth is so slow (Mack and McClure 2002).

Fisher (1996) reports that the Yakamas periodically burned the subalpine meadows at the end of berry harvest, using intentional burning to retard the growth of trees.

" 'This is what makes berries,' explained an old Indian woman in 1929. 'God told people to burn the forest and the huckleberries would grow,' she declared during a meeting with

local rangers, ‘so people has been doing this ever since. This is what my old people told me.’” (Fisher 1996)

In northeastern states, as a well-known comparison, prescribed fire has long been used to rejuvenate commercial low sweet blueberry (*V. angustifolium*) fields and to increase fruit yield. Spring burns, conducted when the soil is moist, are generally most effective in promoting huckleberry fruit production (Tirmenstein 1991).

In western forests, however, wildfires are more common in the drier part of the year, and the time required for recovery may be greater. Production in most western huckleberries is generally delayed for at least 5 years after fire, and on some sites, production may be reduced for 20 to 30 years or longer. Big fires burned in Montana in 1910; several years were required for recovery, but ultimately they resulted in increased yields (Hamilton and Alexander 2006).

LANDFIRE

The National LANDFIRE project (2007) is intended to produce consistent and comprehensive maps and data describing vegetation, wildland fuels, and fire regimes across the United States. Map layers include national vegetation composition and structure, surface and canopy fuel characteristics, and historical fire regimes. Rapid Assessment Vegetation (RAV) dynamic models were developed using the best available knowledge of vegetation dynamics to quantify the natural range of variation of potential natural vegetation groups (PNVG). RAV models were based on a simple, standardized five-box model that combined three generic succession stages with two canopy cover classes. Models were used to calculate Fire Regime Condition Class interagency index to indicate the departure of current condition from reference condition representing natural vegetation groups. These models give an estimate of the ratio of vegetation development stages under natural disturbance regime. These maps and ecological models may have application in predicting distribution and relative abundance of huckleberries. For example, each PNVG that supports huckleberry species common during a specific succession stage may estimate the proportion of the landscape expected to support huckleberry fields. Comparison of the predicted proportion to an estimate of the existing area of a successional stage may give an idea of trend in huckleberry coverage. For example, the Spruce-Fir (R#SPFI) model estimates that under a natural fire regime, 5-10% of the landscape would support openings following stand replacement fire and that grouse whortleberry, big huckleberry, bromes, and sedges are likely dominant species in openings. Comparison of this percentage to the proportion of existing shrubfield openings in the current spruce-fir landscape will provide an estimate of departure from natural condition.

Huckleberry Harvest and Sustainability

An understanding of the levels of wild huckleberry production, related to human harvest levels and the needs of wildlife, is needed before an accurate evaluation of sustainability can be made. Those who enjoy this resource are familiar with the pronounced annual variation in abundance of berries, and human pressure on the resource has also varied widely. At times in the past, notably in the years of the Great Depression, the huckleberry resource has been strained by harvest pressure (Fisher 1996, Richards and Alexander). Conflicts have arisen between commercial harvesters, tribal people, and other traditional pickers.

In recent years, with a growing commercial market for huckleberries, reduction of habitat because of forest encroachment, and marked population growth, competition for the resource has again increased. The Gifford Pinchot National Forest is currently preparing a report on the sustainability of this huckleberry harvest (Ruchty 2007). A systematic survey of huckleberry users: tribal pickers, commercial harvesters, and the many others who pick for personal use, may be the best source of quantitative information on the abundance and distribution of huckleberries in Washington. Likewise, these people, closest to the resource, could be the best source of information of potential conflicts between users, and also on potential solutions to these conflicts.

IV. References

The following list includes references that were reviewed in the preparation of this report; not all were cited in the text. Many references contributed to the preparation of the appendices attached to this report.

Agee, J. 1993. Fire Ecology of Pacific Northwest Forests. Island Press, Washington D.C.

Alexander, Susan. 2007. Personal communication. Economist, U.S. Forest Service, Alaska Region. 907/586-8809, P.O. Box 21628, Juneau, AK 99802; salexander@fs.fed.us

Anderson, John Sr. 2007. Foods in Season. Personal communication, October 5, 2007.

Anderson, R.C. 1999. Savannas, Barrens, and Rock Outcrop Plant Communities of North America.

Ashe, Julie. 2007. Gifford Pinchot National Forest special forest products coordinator. Personal communication, September 12, 2007 360/497-1153; jashe@fs.fed.us

Barney, Daniel. 2007. Personal communication, Sandpoint Research and Extension Center, 1904 N. Boyer Ave
Sandpoint, ID 83864, 208/263-2323, dbarney@uidaho.edu.

Barney, D.L., W.M. Colt, and J.K. Fellman. 1992. Berry Varieties for Idaho. University of Idaho Cooperative Extension System

Barney, D.L. 1999. Growing Western Huckleberries. University of Idaho, Cooperative Extension System

Barney, D.L. 2003. Prospects for Domesticating Western Huckleberries - SMALL FRUITS REVIEW

Beik, D. 2000. Flora of Mount Rainier National Park. Oregon State University Press, Corvallis.

Big Huckleberry Summit. 2007. June 21, 2007, Scott Hall in Pack Forest, near Eatonville, WA

Biota of North America Program (BONAP). 2007. Floristic Synthesis of North America, Draft, October 25, 2007.

Camp, W. H. 1942a. A survey of the American species of *Vaccinium*, subgenus *Euvaccinium*. Brittonia. 4: 205-247. [6950]

Camp, W. H. 1942b. On the structure of populations in the genus *Vaccinium*. Brittonia. 4(2): 189-204.

Camp, W. H. 1945. The North American blueberries with notes on other groups of Vacciniaceae. Brittonia. 5(3): 203-275.

Carroll, M.S., K.A. Blatner, and P.J. Cohn. 2003. Somewhere between: social embeddedness and the spectrum of wild edible huckleberry harvest and use. Rural Sociology 68(3): 319-342.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. *Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems*. NatureServe, Arlington, Virginia.

Cooper, D.B., K.E. Neiman, R. Steele, and D.W. Roberts. 1987. Forest Habitat Types of Northern Idaho: a second approximation. USDA FS Intermtn. Res. Sta. GTR INT-236. 135p.

Dahlgreen, Matthew Craig. 1984. Observations on the ecology of *Vaccinium membranaceum* Dougl. on the southeast slope of the Washington Cascades. Seattle, WA: University of Washington. 120 p.

Dell, Malcolm. 2007. Owner, Gourmet Innovations LLC, PO Box 709, Orofino, ID 83544, gourmet@cpcinternet.com; 208/476-3858. Personal communication, October 5, 2007.

Douglas, G.W., D. Meidinger, and J. Pojar. 1999. Illustrated Flora of British Columbia, Volume 3: Dicotyledons (Diapensiaceae through Onagraceae). British Columbia Ministry of Environment, Lands, and Parks, and Ministry of Forests.

Douglas, G.W. and T.M. Ballard. 1971. Effects of fire on alpine plant communities in the North Cascades, Washington. Ecology 52(6):1058-1064.

Duran, Frank. 2007. U.S. Forest Service Region 6, special forest products. 503/808-2970. Personal communication.

Eriksson, O, and H. Froeborg. 1996. "Windows of opportunity" for recruitment in long-lived clonal plants: Experimental studies of seedling establishment in *Vaccinium* shrubs Canadian Journal of Botany/Revue Canadien de Botanique. Vol. 74, no. 9, pp. 1369-1374. 1996.

Finn, C., and A. Young. 1984. Variability for reproductive and vegetative traits in *Vaccinium membranaceum*. Note PNW-256 USDA-Forest Service, Pacific Northwest Forest 1984, D. Minore? Check citation

Fisher, Andrew H. 1996. The 1932 Handshake Agreement: Cultural persistence and accommodation in the Pacific Northwest. Arizona State University, January 1996.

Fisher, Andrew H. 1997. The 1932 Handshake Agreement: Yakama Indian Treaty Rights and Forest Service Policy in the Pacific Northwest *The Western Historical Quarterly*, Vol. 28, No. 2 (Summer, 1997), pp. 186-217

Franklin, J.F., W.H. Moir, G.W. Douglas, and C. Wiberg. 1971. Invasion of subalpine meadows by trees in the Cascade Range, Washington and Oregon. Arctic and Alp. Res. 3:215-24.

Freed, James. 2007. Personal communications. Washington State University

Hinrichs, C.C. 1998. "Sideline and Lifeline: The Cultural Economy of Maple Syrup Production." Rural Sociology 63: 507-32.

History Link. 2007. Yacolt Burn history at http://www.historylink.org/essays/output.cfm?file_id=5196. Access on Aug. 27, 2007

Hitchcock, C.L. and A. Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press, Seattle.

Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. 1959. Vascular Plants of the Pacific Northwest, Part 4: Ericaceae through Campanulaceae. University of Washington Press, Seattle.

Holzman, B.A. and K. Folger. 2007. Post-fire vegetation response in the Bishop pine forest at Point Reyes National Seashore. Available on-line at http://plantbio.berkeley.edu/~bruns/espm134/papers/HolzmanFoger.pdf

Johnson, Kathleen A. 2001. *Vaccinium scoparium*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, October 25].

Kopischke, Wayne. Idaho Panhandle National Forests. Personal communication, October 5, 2007.

Kendall, K. 2007. Grizzly ear and black bear ecology. USGS synopsis, available on-line at http://www.nrmsc.usgs.gov/research/grizzlyb.htm.

Kerns, B.K., S.J. Alexander, and J.D. Bailey. 2004. Huckleberry abundance, stand conditions, and use in Western Oregon: evaluating the role of forest management. Economic Botany 58(4): 668-678.

Kruckeberg, A. R. 1982. Gardening with native plants of the Pacific Northwest. Seattle: University of Washington Press. 252 p.

LaMonte, Rick. 2007. Northwest Wild Foods. Burlington WA 866/945-3232; rlamonte@nwwildfoods.com. Personal communication, October 4, 2007

LANDFIRE. 2007. LANDFIRE Rapid Assessment Reference Condition Models. (2007, January - last update). [Homepage of the LANDFIRE Project, U.S. Department of Agriculture, Forest Service; U.S. Department of Interior], [Online]., Available: ttp://www.landfire.gov/index.php [2007, February 8].

Lonsdale, W.M. 1999. Global patterns of plant invasions and the concept of invisibility. Ecology 80(5): 1522-1536.

Maatta-Riihiner, K.R., M.P. Kahhonen, A. R. Torronen and I.M. Heinan. 2005. Catechins and procyanidins in berries of *Vaccinium* species and their antioxidant activity. J. Agric. Food Chem. 53(22): 8485-8491.

Mack, Cheryl. 2007. Gifford Pinchot National Forest archaeologist. Personal communication

Mack, Cheryl. 2001. A Burning Issue - Native Use of Fire in the Mount Rainier Forest Reserve Gifford Pinchot National Forest. Heritage Program Home Page, GPNF Website, Gifford Pinchot National Forest. Last updated on 01/05/01

Mack, C.A. and R.H. McClure. 2002. *Vaccinium* processing in the Washington Cascades. Journal of Ethnobiology 22(1): 35-60

Maffei, Ed. 2007. Colville National Forest, special forest products. Personal communication.

Martin, Laura. 2007. Mount Baker-Snoqualmie National Forest botanist. Personal communication

Martin, Patricia A. E. 1979. Productivity and taxonomy of the *Vaccinium globulare, V. membranaceum* complex in western Montana. University of Montana. 136 p. Thesis.

Mastenbrook, J. (or LeCompte-Mastenbrook). Graduate student at University of Washington in environmental anthropology, attendee at the Handshake Agreement commemoration on August 25, 2007. Personal communication, September 24, 2007

Matthews, R. F. 1992a. *Vaccinium alaskensis*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [October 25, 2007].

Matthews, R. F. 1992b. *Vaccinium uliginosum.* In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [October 25, 2007].

Minore, D. 1972. *The wild huckleberries of Oregon and Washington - A dwindling resource*. USDA, Forest Service Research Paper No. 143, Portland, Oregon.

Minore, D., A.W. Smart, and M.E. Dubrasich. 1979. Huckleberry ecology and management research in the Pacific Northwest. U.S.D.A. Forest Service General Technical Report PNW-87

Minore, D. 1984. *Vaccinium membranaceum* berry production seven years after treatment to reduce overstory tree canopies. Northwest Science, Vol. 58, No. 3

Minore, D. and M.E. Dubrasich. 1978. Big huckleberry abundance as related to environment and associated vegetation near Mount Adams, Washington. U.S.D.A. Forest Service Research Note PNW-322. October, 1978.

Minore, Don, Alan W. Smart. 1978. Frost Tolerance in Seedlings of *Vaccinium membranaceum, Vaccinium globulare,* and *Vaccinium deliciosum.* Northwest Science, Vol. 52, No. 3, 1978.

Moore, James .N. 1993. The blueberry industry of North America. Acta Hort. (ISHS) 346:15-26 http://www.actahort.org/books/346/346_1.htm

Washington Natural Heritage Program (WNHP). 2007. Vegetation plot data files.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA, U.S.A. Data current as of 27 August 2007

North , M., J. Chen, G. Smith, L. Krakowiak, and J. Franklin. 1996. Initial response of understory plant diversity and overstory tree diameter growth to a green tree retention harvest. Northwest Science 70 (1): 24-35.

Qian, H. 1999. Floristic analysis of vascular plant genera of North America north of Mexico: characteristics of … - - Journal of Biogeography, 1999 - Blackwell Synergy

Parks, C.G., S.R. Radosevich, B. A. Endress, B. J. Naylor, D. Anzinger, L.J. Rew, B.D. Maxwell, and K.A. Dwire. 2005. Natural and land-use history of the Northwest mountain ecoregions (USA) in relation to patterns of plant invasions. Perspectives in Plant Ecology, Evolution and Systematics 7 (2005) 137-158.

Pojar, J. and A. MacKinnon. 1994. Plants of the Pacific Northwest Coast, Washington, Oregon, British Columbia, and Alaska. Ministry of Forests and Lone Pine Publishing, Redmond WA and Vancouver, B.C.

Reynolds, Nathan. 2007. Huckleberry heritage of the Cowlitz Indian Tribe. Unpublished draft report.

Richards, Rebecca T.; Alexander, Susan J. 2006. A social history of wild huckleberry harvesting in the Pacific Northwest. Gen. Tech. Rep. PNWGTR-657. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 113 p.

Ruchty, Andrea. 2007. Gifford Pinchot National Forest botanist. Personal communication.

Savage, M. 1995. Pacific Northwest Special Forest Products, an industry in transition. Journal of Forestry 93(3): 6-11.

Schlosser, W.E. and K.A. Blatner. 1989. The special forest products industry. Washington State Univ., Pullman. Int. Market. Progr. For Agric. Commod. & Trade Inf. Ser. 39.

Simonin, Kevin A. 2000. *Vaccinium membranaceum*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, October 25].

Tirmenstein, D. 1990a. *Vaccinium caespitosum*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, October 25].

Tirmenstein, D. 1990b. *Vaccinium myrtillus*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, October 25].

Tirmenstein, D. 1990c. *Vaccinium ovalifolium*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, October 25].

Tirmenstein, D. 1990d. *Vaccinium ovatum*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, October 25].

Tirmenstein, D. 1990e. *Vaccinium parvifolium*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, October 25].

Tirmenstein, D. A. 1991. Vaccinium angustifolium. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, November 1].

Turner, N. J., L.C. Thompson,. M.T. Thompson, and A.Z. York. 1990. Thompson Ethnobotany, knowledge and usage of plants by the Thompson Indians of British Columbia. Memoir No. 3, Royal British Columbia Museum.

USDA Plants Database. 2007. On-line at http://plants.usda.gov/java/nameSearch. Access in October 2007.

U.S.D.A. Forest Service. 2007. Fire Effects Information System, available on-line at http://www.fs.fed.us/database/feis.

Vander Kloet, SP. 1988. The genus *Vaccinium* in North America . Minister of Supply and Services Canada

Washington Flora Checklist. 2007. Available on-line at http://biology.burke.washington.edu/herbarium/waflora/checklist.php. Accessed on October, 2007.

Willson, MF . 1993. Mammals as Seed-Dispersal Mutualists in North America - - Oikos

Yao, Y. and A. Vieira. 2006. Protective activities of *Vaccinium* antioxidants with potential relevance to mitochondrial dysfunction and neurotoxicity. NeuroToxicology 28(1): 93-100.

Web references on the wild huckleberry market

http://www.nwwildfoods.com/products.cfm?catid=6&gclid=CKDG9vbk0I4CFRQtYAodyUlpoQ

http://seattletimes.nwsource.com/html/localnews/2002440188_huckberry14m.html

http://www.huckleberries.org/page5.html

http://www.for.gov.bc.ca/hfp/publications/00002/chapt4.htm

http://seattle.bizjournals.com/seattle/stories/2007/08/13/smallb1.html?page=2

http://www.mtinbusiness.com/inbiz-0510/bus05.php

http://www.fpl.fs.fed.us/documnts/usda/agib666/aib66602.pdf

http://www.fs.fed.us/pnw/bmnri/pubs/nrn8-4.pdf

http://www.fpb.gov.bc.ca/SPECIAL/reports/SR19/SR19.pdf

Potential primary sources:

The following references were not reviewed, but they are recorded here as potential sources of early written accounts of encounters with huckleberries in the Pacific Northwest.

Henry Brewer, description of an 1845 trip to Mt. Adams huckleberry fields (Mudge 1854, noted in Mack and McClure 2002)

George McClellan 1853 journal (noted in Mack and McClure 2002)

Francis Marion Streamer 1878 journal (Briley 1986, noted in Mack and McClure 2002)

George Gibbs, ethnographic reports (Gibbs 1855, 1877, (noted in Mack and McClure 2002)

C.E. Rusk, 1890 trip around Mt. Adams, (Rusk 1924, reported in Mack and McClure 2002)

Appendix 1: Huckleberries and Humans

The scope of this Washington Natural Heritage Program report was to describe the biology and ecology of huckleberries in Washington, in the context of providing information to the Washington Legislature pertaining to human harvest and potential regulations. Part of our investigation involved determining which species were of the greatest human importance. In the process, we encountered a great deal of information that was outside of the scope of our report, but which we deemed would be of potential use to further study of human harvest and the huckleberry industry in Washington. For the benefit others involved in this investigation, notes on these related topics are compiled here. While this is in no way a systematic or comprehensive study, the information we encountered is organized under the following headings:

Cultural Significance
Commercial Harvest and Conflicts with Other Uses
Historical Notes on Huckleberry Harvest
Special Forest Products
The Wild Huckleberry Market
Huckleberry Products
Comments on Regulations
Ecological Notes

Cultural significance
Since before historical records, huckleberries have been highly valued by Native American people in the Pacific Northwest for cultural purposes, subsistence use, and trade (Mack and McClure 2002).

In the mountains, big huckleberry was, and is, the species harvested in the greatest quantities; Cascade blueberries are highly regarded but are not as abundant and require traveling to higher elevation. Alaska huckleberry and oval-leaf huckleberries are also harvested, but they generally are not as sweet or as highly sought after as tall huckleberry or Cascade blueberry (Mack and McClure 2002). At lower elevations, evergreen huckleberry is available in large quantities, as are smaller amounts of red huckleberry. It is highly likely that all species of huckleberries were, and are, also eaten in smaller amounts.

Areas of the Colville National Forest are currently used for huckleberry harvest by the Colville Confederated Tribes, the Kalispel, and the Spokane tribes. These tribal groups also have consultation rights pertaining to the Colville National Forest. The Colville Confederated Tribes in 1872 included Colville, Lakes, Methow, Nespelem, Okanogan, and San Poil tribes. Later the Nez Perce, Palus, Columbian, Entiat/Chelan and Wenatchi people were added (Dahl 1990 in Carroll *et al.* 2003).

In the Gifford Pinchot National Forest, huckleberries are one of the ritually important foods to the Yakama and Warm Springs Indians, honored at first foods ceremonies, as were roots, salmon, and venison. The area now considered to be the Gifford Pinchot National Forest (GPNF) was visited by Klickitat, Yakama, Skinpah, Kamiltpah, Wyam, Tenino (Sahaptin speakers) and Wishxam, Wasco, and Watlala (Chinookan-speaking) people. Archaeological investigations in the GPNF have documented 274 huckleberry drying features at 38 sites along the Cascade crest, mostly from the historical period, but evidence is also present of prehistoric use. A strong correlation was observed between specific plant communities in the mountain hemlock zone and high density of these features. In the past appeared to have been collected at higher elevations (Mack and McClure 2002).

Tall huckleberries are regarded as especially valuable, in Sahaptin called *wiwnu*, the "chief" of all the berries, containing great power. " 'They are the same as good words from the other world' states Yakama oral tradition. ' They know everything; they do nothing wrong.' As long as the people showed respect for *wiwnu*, taking only what they needed and giving thanks for this sacred food, the berries would return each summer to help fill the tribe's winter stores". This quote in Fisher 1996 was from Virginia Beavert, *the Way it Was: "Aaku Iwacha"; Yakima Indian Legends* (Richards and Alexander 2006).

Berries were gathered for subsistence, and consumed fresh or dried. Large quantities were dried and stored for long term use; use of standard sizes of cedar packages has been interpreted as an indication that the berries were used for trade (Mack and McClure 2002).

A berry drying feature was excavated at Big Meadow Camp on the GPNF in 1995. Analysis of tree ring data from peeled cedars (bark used for temporary baskets for transporting berries) indicated that patches were used from 40 to 70 years and then left, possibly because of declining productivity of a patch after that long. Higher elevation sites lasted longer because of the slower invasion and growth of trees (Mack and McClure 2002). Evidence from multiple sources suggests that resource intensification, likely including processing huckleberries, started some time in the mid-Holocene, approximately 5,000 to 3,000 years B.P. (Mack and McClure 2002).

Berry gathering was specifically included in the language of the 1855 treaties between the United States and tribal people, assuring "the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land" within what was then the Columbia National Forest, now the GPNF (quote from June 9, 1855 treaty)

When settlers of European ancestry arrived in the Pacific Northwest, huckleberries were available for sale or trade with local tribal people. An 1878 journal (Francis Streamer) referred to having abundant fresh berries to take and sell at the Dalles (Mack and McClure 2002). Settlers soon adopted subsistence use of huckleberries, and commercial trade increased, especially during certain historical phases.

Commercial Harvest and Conflicts with Other Uses

High levels of harvest occurred during the Great Depression, when unemployment was widespread and large numbers of people made use of huckleberries for subsistence and monetary income. In 1931 nearly 7,000 jobless non-Indians went into the Twin Buttes area to pick. They sold the berries as well as traded them for milk, food, and other wares. The berries were sold in Portland or shipped east. Conflicts over the resource escalated (Fisher 1996).

In 1932 large numbers of non-Indians again camped in the Twin Buttes area. In alarm over the encroachment, William Yallup of the Kah-milt-pah (Rock Creek) band called for a council with Forest Supervisor J. R. Bruckart. They met on September 2, 1932 at the Surprise Lake Indian camp. Leverett Richards of the Oregonian provided the only written record of the meeting. Bruckart stated:

"I myself was placed here by the Great White Father to see that all people enjoyed the forest equally… I cannot exclude the White Man from the berry fields or I would also have to exclude the Indians…But I can and I will set aside an area including Surprise Lakes and Cold Springs for the exclusive us of Indians during the huckleberry season."

After this, legislative resistance remained against granting rights beyond use in common on lands outside of the reservations. But local rangers and the public generally respected the exclusive use. In 1938 the Mt. Adams district ranger verbally reaffirmed the agreement; a 1936 Forest Service brochure gave the following verbal assurance: "Hundreds of Indians make annual pilgrimages to these huckleberry fields. Their use of the area is assured by an old treaty which gives them the right to gather roots and berries in this region for all time. A portion of the berry fields have [sic] been reserved for their use. The public is requested to respect their rights". 1980 brochure outlines Yakama treaty rights and says that by staying out of the area reserved "you are not only obeying the law, you are also respecting the culture of another people." The legal sanction implied does not apparently exist, and the Forest Service has relied on the good will of non-Indian visitors. Flare-ups have occasionally occurred over the years, including in 1979, and after the Mt. St. Helen's eruption. The Handshake Agreement of 1932 was put on paper in 1990 (Fisher 1996).

The commercial industry in the Pacific Northwest subsided after World War II, when better-paying jobs were available. In the mid-1980s commercial harvest levels again rose, again conflicting at time with cultural and broader subsistence use (Richards and Alexander 2006).

In 1983 the Yakamas built a temporary long house at Cold Springs and commemorated the Handshake Agreement. The 1990 Gifford Pinchot Land and Resource Management Plan included recognition of the agreement. In 1991 a monument including cedar carvings was unveiled at Surprise Lakes. The inscription reads:

> " May the Creator honor the memory and spirits of Chief William Yallup and the Columbia National Forest Rangers, and all the other people who took part who had the wisdom and foresight to make the 1932 Handshake Treaty for all the future generations. The Creator made the Mother Earth, the mountains, streams, trees, animals, roots and berries and made it sacred. May the future generations honor and respect the work of the past elders in working in harmony to create the treaty." (Fisher 1996).

On August 25, 2007, Yakama tribal members, Forest Service representatives, and others commemorated the Handshake Agreement at Surprise Lake. At that time many of the Yakama people described conflicts between non-Indian commercial harvesters and Yakamas in the designated Indian picking areas (Joyce Mastenbrook 2007).
"Racial tension is increasing as Asian and Hispanic harvesters move into areas with long local harvesting histories." (Savage 1995).

The patterns of huckleberry harvest, and the social context in which it occurs, are complex. In a study in northeast Washington, researchers found that the distinction between harvest for personal use and as a commercial enterprise was not very clear. A quote from that paper illustrates the observation:

> **"You're saying 'commercial' and 'non-commercial' and I know what you mean, but people who pick and sell to make a living aren't commercial." Statement by a huckleberry picker and processor, Priest Lake, Idaho (Carroll *et al.* 2003).**

Carroll *et al.* 2003 point out that regarding huckleberry harvesting as either "recreational" or "commercial" is simplistic, and does not succeed at describing the complex relationships that people have with huckleberries. Individuals may engage in recreational, subsistence, and commercial picking, and the boundaries between these activities may not be distinct. They compare the cultural embeddedness concept, as applied by Hinrichs' 1998 research on maple syrup production in New England and eastern Canada. These resources are important culturally, provide food for personal use, and supplement incomes for some local families.

Carroll *et al.* categorized the pickers that they interviewed into four categories. These overlapped, and individuals might occasionally move from one category to another:

1. native harvesters
2. non-native household harvesters
3. income supplementers
4. full timers

Hinrich's (1998) "embeddedness" concept emphasized how other work, activities, household relations, the surrounding community, and the resource environment shape the possibility for and understandings of minor resource production activities (Carroll *et al.* 2003, p 507)

Joyce Mastenbrook described that the loss that people, especially Indian people, are feeling, is

- As much to do with a change in experience as in depletion of the resource
- About loss of specific locations that have importance
- About need for places with berries that are accessible to elders

Historical Notes on Harvest Levels and Value
No comprehensive data are available on the size of the wild huckleberry harvest by humans in Washington, either for past or present harvest. Occasional quantities have been recorded, at diverse locations, and these are listed below to give a sense of the scale or potential scale of harvest.

The wild huckleberry industry appears to be larger in Montana, or is at least better documented. Much of the harvest is for personal use, by an uncounted number of people, on National Forests, private timber land, State lands, tribal lands. The commercial harvest is also largely unregulated, and estimates based on commercial permits give only a rough estimate. The following notes, from scattered sources, are compiled to give a general impression of the size of the resource and the monetary value resulting from it.

While big huckleberry is generally considered the species that is harvested in the greatest amounts, evergreen huckleberry is also widely harvested, and at least in the 1950s was gathered in huge quantities on the Kitsap Peninsula (Freed 2007).

An experienced individual may harvest up to 5 gal/day by hand, 12-15 gal/day with a scoop or rake, 50 gal/day with beaters (Richards and Alexander 2006).

Huckleberries weigh approximately 7.5 lb/gal.

Phases of the Huckleberry Industry
1878: An 1878 journal (Francis Streamer) referred to having abundant fresh berries to take and sell at the Dalles. Also reference in 1930s to Indians taking berries to town to sell house to house or to stores (Mack and McClure 2002).

Huckleberry harvest welled as an industry in the Depression years.

1933: rapid growth in harvesting in the Cabinet NF. ”Value of huckleberries…far exceeds total for grazing, special use, and timber receipts”. (Hamilton and Alexander 2006)

Declined during WW II and years after due to better jobs.

1970-1996 - In western Montana the economy boomed, and with population growth was a slow revitalization of the huckleberry industry (Richards and Alexander 2006).

1980s – nostalgia and tourism market, broader use in a variety of products, including chocolate (Richards and Alexander 2006).

1995 or 1996 – MT industry over $1 million (Richards and Alexander 2006).

1997 - MT manufacturers used 59,000 lbs of huckleberries in a wide range of products

2003 – MT sales 18% less than 1996 (Richards and Alexander 2006).

2006 – One Washington company reports gross product of $750,000.

Dollar value of huckleberries: the prices paid for huckleberries to pickers varies widely from the prices on the retail market, and from the monetary value of huckleberries as an ingredient in many different commercial products.

1911 newspaper article refers to Indians selling fresh berries in town for $0.50 to $1.00 per gallon (Mack and McClure 2002).

1925 advertised berries at $1.10/gal

1926: earliest account of commercial sale in MT, $0.23/lb [could this be gal?), under FS free use (Richards and Alexander 2006)

1930s: In Hamilton MT paid up to 400 Indian pickers $0.39/gal

1932: Flathead NF $0.25 to $0.60 to the picker, market price as high as $1/gal

1933: Missoula $0.22 to $1.00 per gallon

1930s: In Hamilton MT two pickers were paid $0.35/gal (Hamilton and Alexander 2006)

1936: Kootenai NF, West Fisher drainage, $0.50/gal

1965: A picker reported huckleberry price at $4-$5/gal sold to a store, or $10/gal sold direct to customers

1978: reported as $2 to $3 per liter in the Mt. Adams area (Minore and Dubrasich 1978)

1995 – in Mt, a candy producer paid $12 - $16/gal.

2007 Frozen berries on-line from Burlington WA, NW Wild Foods, Rick LaMonte, $750,000 gross in 2006

2007 price to pickers, wholesale price acc to Seattle times $18/gal or $3/lb

NW Wild Foods, Burlington WA advertise these prices on-line:

12 lb. Wildblue $149.95
4 lbs. Idaho and Mt. St. Helens $49.95
6 lbs. Mt. St. Helens $74.50
6 lbs Hoh River Red $77.85
4 lbs Hoh River Red $52.95
8 lbs Hoh River Red $102.95

Size of harvest: While it is impossible to determine precisely, these quantities from small samples in localized harvest areas give an idea of harvest potential:

1930s huckleberries were a major National Forest free use resource

1932 Cabinet NF 60,000 gal (just in one high use area)

1932: Pend Oreille NF 90,000 gal

1932: Kaniksu NF 33,000 gal

1932 Kootenai 48,000 gal

1932 Flathead NF 20,000 gal.

1933: An estimate from the Cabinet National Forest, of 60,000 gal, sold at $0.40 per gal.

1933: Coer d'Alene NF 15,000 gal at $0.30 - $0.75 per gal

Here is a table of records from the 1930s:

Huckleberries removed from the Gifford Pinchot National Forest (then named the Columbia National Forest)

Year	**1931**	**1932**	**1933**	**1934**	**1935**	**1936**	**1937**	**1938**
White berrypickers	5101	5549	4548	600	5500	5777	7862	9901
Indian berrypickers	1204	830	865	200	500	1034	910	1195
Total pickers	6305	6379	5413	800	6000	6811	8772	11096
Gallons of berries taken out	59000	52467	59036	3370	20336	31067	24977	45467

These numbers, obtained 9-12-07 from Cheryl Mack, GPNF archaeologist, are from a 1938 Recreation Atlas

1934 was considered crop failure due to late frost; 1935 was an off-year because the berries ripened later than usual

1936: Kootenai NF reported 3,903 man-days in the West Fisher drainage, estimated pick of 19,515 gal in this area, pickers averaged 8-12 gal/day. Adults picked 10-12 gal, children tried for 5
1942 Kootenai NF est. 20,000 gal in the south end of the county in a good year

Decline in commercial harvest during and after WWII because of war-time demands and better jobs afterwards (Hamilton and Alexander 2006)

1948 ME Mercer Co sold >350 tons of evergreen huckleberries from Puget Sound area

1959 ME Mercer Co sold 500 tons of evergreen huckleberries from Puget Sound area, some years up to 1,000 tons (Kerns *et al.* 2004).

Areas with largest levels of huckleberry harvest
Large quantities of evergreen huckleberry were harvested on the Kitsap Peninsula, with especially high levels in the 1950s. Now only 2,000 to 3,000 lbs are picked per year. There is a cleaning facility in Key Center (Jim Freed, pers. com).

Northeast Washington: some complaints about over-harvest, limited to areas with easiest access (Jim Freed, pers. com)

Gifford Pinchot National Forest: this is apparently the area with the greatest pressure (Jim Freed, pers. com).

Olympic Peninsula: of course no commercial harvest in the Olympic National Park, and there is almost no harvest pressure in the Olympic National Forest (Jim Freed, pers. com).

Blue Mountains: probably huckleberries are not of great importance here (Jim Freed, pers. com).

Special Forest Products

While huckleberry harvest differs from the forest greens industry, because of the long history of cultural use, experience from the apparently much larger greens industry may give insight into the challenges of increasing commercial harvest of huckleberries.

Greens for the Christmas market and for the floral display market is a large industry in Washington. See Schlosser and Blatner 1989 for the best estimates of its size. This size of this market is difficult to measure, but included more than 10,000 people and $128.5 million in the northwest in 1995. A quote from Savage 1995, addressing the floral greens gathering industry, could apply as well to huckleberries:

The Wild Huckleberry Market

Western huckleberries are native to the western United States and western Canada. The fruits were important for food and trade among some Native Americans and were popular with European settlers. Commercial sales of huckleberry food and health products have increased dramatically, with demand often exceeding supplies. Evergreen huckleberries are a source of a macular dilator (Jim Freed, pers. com). All fruits are presently harvested from naturally-occurring stands, predominantly from 1,200 to 1,800 m (4,000 to 6,000 ft) elevation mountain sites. Harvest labor costs and weather-related fluctuations in yields have limited commercial expansion. Forest and fire management practices on public lands have adversely impacted the size and productivity of huckleberry colonies, further limiting commercialization and increasing the potential for overharvest. This paper describes western huckleberries, summarizes pertinent research, and outlines prospects for domestication (Barney 2003).

Huckleberry Products from a variety of sources

wild huckleberry jellybeans
wild huckleberry candles
wild huckleberry hot cocoa
wild huckleberry hand cream
wild huckleberry lip balm
wild huckleberry bon bons
wild huckleberry honey
huckleberry flavored honey in a squeezable bear
huckleberry creamed honey
wild huckleberry hand and body lotion
wild huckleberry fudge
wild huckleberry fruit spread
wild huckleberry gummi bears
wild huckleberry jam
wild huckleberry razzle jam
wild huckleberry syrup
wild huckleberry cordials
wild huckleberry chocolate bars
wild huckleberry bark
wild huckleberry cheesecake jelly beans
wild huckleberry wine

whole beans huckleberry coffee
huckleberry muffin mix
huckleberry pancake mix
wild huckleberry pretzels
wild huckleberry vinaigrette
huckleberry dipping sauce
wild huckleberry BBQ sauce
Olympic Mountains ice cream

Comments on regulations

State regulations would not likely help resolve the conflicts; the existing regulations have gone un-enforced for 25 years (Jim Freed, pers. com)

"Policy implications include the need to move beyond the commercial/recreational dichotomy in regulating the harvest of berries as well as the need to like the notions of community, forestry, and subsistence to the harvest of non-timber forest products more generally." (Carroll *et al.* 2003)

Dan Barney (personal communication) thinks that the demand for huckleberries always far exceeds the supply. He would like to see harvest regulated, because of the large quantities and reports significant damage.

Ecological notes

Sheep grazing history on the Gifford Pinchot National Forest

According to Fisher (1996) berry gathering areas were often cleared and farmed by Euro-Americans, or grazed, especially by sheep. In 1908, over 100,000 sheep grazed the Columbia National Forest (part of today's Gifford Pinchot National Forest). Possibly 6,000 sheep used Indian Heaven by 1930s. 1911 recorded the first clash over sheep, a protest brought by an Indian - Raymond Duncan. Then District Forester Charles Flory did not think the complaint was valid, and was turned off by Duncan's long hair and costume. Assistant forester L.F. Kneipp, Flory's superior, was more sympathetic, and expressed that "It has always been the understanding of this office that such an area was actually reserved and closed to sheep grazing, and if such an area has not already been reserved, it should be." But Secretary (of Dept. of Ag?) wrote that sheep grazing should be allowed as long as there was a surplus of berries. Sheep had been excluded by the Forest Service by late 1920s. A council was held at Meadow Creek campground on August 25, 1929, with Forest Supervisor F.V. Horton and District Ranger Harvey Welty, Klickitat chief Joseph Stehi, Yakama chief Job Charley, Nez Perce Sam Morris. Roads and automobiles added to the conflicts (Fisher 1996).

Non-Indian and Indian pickers cooperated to get a grazier to remove his sheep in 1936 from allotment. (Fisher 1996)

Ecological changes due to human activity

The level of ecological effects caused by humans has gone through cycles in response to changes in population size and types of human activities, including fire control and intentional burning. Original humans in the Pacific Northwest were likely one of many

browsers of the berries with minimal impacts. Once burning was adopted as a means to open and maintain forest openings by native peoples, overall huckleberry production likely increased along with increased human use. Following the first small pox epidemic in 1775, Yakama peoples population dropped from around 7,000 to 2,000 by mid 1800s (Fisher 1996). This likely led to a slow decline in non-forest area as native prescribed fires decreased. Large fires such as the Yacolt Burn of 1902 that burned 238,920 acres, south and west of Indian Heaven (History Link 2007) reduced forest cover but contributed to a political climate that lead to active suppression of all fires. Active fire suppression since around 1920 has probably led to increase in tree invasion and reduction in forest openings with huckleberries. Referring toYakama berry fields in Klickitat County, Fisher (1996) states that since 1920 "Indian patches have shrunk by about 100 acres per year." Fisher (1996) further states that the Twin Buttes picking area that extended over 12,000 acres in 1920s, is now a third that size and is predicted to be gone within 40 years.

Invasive plant species

Invasive species at higher elevations and closed forests are generally not as severe as lower elevation disturbed forests and riparian areas. However, there is some worry about invasive species threatening subalpine and alpine environments, see additional references mentioned on pg. 145 (Parks *et al.* 2005). There is little information addressing huckleberry fields specifically.

Response to forest management

"Despite the known extensive human use of huckleberries, little is known about how species abundance patterns are related to common forest management practices and stand conditions (Kerns *et al.* 2004). In western Oregon, researchers found than overstory stand conditions and forest management can affect huckleberry species abundance. Studies need to target areas where people harvest these products, and to measure commercial productivity (Kerns *et al.* 2004).

Appendix 2. Potential contacts on Huckleberry Harvest

This list of contacts has come from various sources, including from Rodney Cawston of the DNR, on-line searches, and referrals from initial contacts. These individuals may or may not have ever been contacted, and have not necessarily expressed willingness to give information or be quoted.

Alexander, Susan. From Juneau, or Corvallis. presenter at Huckleberry summit. Co-author of Kerns *et al.* 2004 on huckleberry abundance and forest management

Cawston, Rodney
DNR Tribal Relations Manager, enrolled Colville
Rodney.cawston@dnr.wa.gov
360/902-1012, 360/701-3482 cell

James Freed
Special forest products, WSU extension
360/902-1314
freedj@wsu.edu

Duran, Frank
FS Regional Special Forest Products program manager
503/808-2970

Dell, Alexander. Commercial huckleberry buyer.
Idaho

Mack, Cheryl. GPNF anthropologist, present at the Huckleberry summit

Maffei, Ed contracting officer for the Colville NF 509/684-7229; emaffei@fs.fed.us

Joyce Mastenbrook or LeCompte-Mastenbrook
jklm@u.washington.edu cell phone # is 206-849-5119.
Doing dissertation research on huckleberries, tribal use, commercial harvest. 9-24-07:

Don Minore, Corvallis, probably retired, but very knowledgeable about impacts of treatments on huckleberries, available

Becky Richards, U. of Montana professor, GTR on huckleberries,
Rebecca.richards@umontana.edu

Washines, Helen. Yakama Tribal Chairperson. Family picked and traded huckleberries.

The following tribal contacts were provided by Rodney Cawston of the DNR:

Francis Cullooyah, Cultural Program Director
Kalispel Tribe of Indians
509-445-1147 ext. 281 office 509-671-2319 cell
fcullooyah@kalispeltribe.com

Clifford Casseseka
Cultural Resource Specialist
Yakama Nation
509-865-5121 office
casseseka@yakama.com

Becky Kerns
co-author on Economic Botany paper on commercial harvest, in Prineville,
bkerns@fs.fed.us, previous phone 541/416-6602
David W. Powell
TFW Archaeologist
Yakama Nation
509-865-5121 ext. 6312 office
509-945-4925 cell
dwpowell@yakama.com

Janice Mabbe, Chair
Sauk-Suiattle Indian Tribe
360-436-2827 office
annarae@sauk-suiattle.com

Deb Louie, Councilman
Colville Confederated Tribes
509-634-2207 office
509-631-0487 cell
mailto:deb.louie@colvilletribes.com

John Sirois, Cultural Resources Director
Colville Confederated Tribes
509-634-2712 office
509- 322-3155 cell
john.sirois@colvilletribes.com

Warren King George, Oral Historian
Muckleshoot Tribe
253-939-3311 office
warren.kinggeorge@muckleshoot.nsn.us

Wilson Wewa, Councilmember
Warm Springs Tribe
541-553-3313 office
paiutewewa@yahoo.com

Vivian Lee, Hoh Chair, she would like to be interviewed. Contacted by Rodney

Angela Buck, a traditional food gatherer from Wanapum Village at Priest Rapids and she has also agreed to be interviewed. Contacted by Rodney.

Rick LaMonte, NW Wild Foods, Burlington WA 866/945-3232;
rlamonte@nwwildfoods.com

Appendix 3: Scientific names of species included in the text

The first list below is sorted by common name used in the text; the second list is sorted by scientific name.

Species sorted by common name

common name	scientific name
Alaska huckleberry	*Vaccinium alaskaense*
Alaska yellow-cedar	*Chamaecyparis nootkatensis*
avalanche-lily	*Erythronium montanum*
beargrass	*Xerophyllum tenax*
big huckleberry	*Vaccinium membranaceum*
black cottonwood	*Populus balsamifera* subsp. *trichocarpa*
bluejoint reedgrass	*Calamagrostis canadensis*
bog birch	*Betula glandulifera*
bog blueberry	*Vaccinium uliginosum*
California false-hellebore	*Veratrum californicum*
Canadian bunchberry	*Cornus canadensis*
Cascade blueberry	*Vaccinium deliciosum*
Cascade Oregongrape	*Berberis nervosa*
creeping Oregon-grape	*Berberis repens*
Cusick's speedwell	*Veronica cusickii*
deer fern	*Blechnum spicant*
devil's club	*Oplopanax horridum*
Douglas-fir	*Pseudotsuga menziesii*
dwarf bilberry	*Vaccinium myrtillus*
dwarf bramble	*Rubus lasiococcus*
dwarf huckleberry	*Vaccinium caespitosum*
elk sedge	*Carex geyeri*
Engelmann spruce	*Picea engelmannii*
evergreen huckleberry	*Vaccinium ovatum*
fireweed	*Epilobium angustifolium*
fool's huckleberry	*Menziesia ferruginea*
globe huckleberry	*Vaccinium globulare*
grand fir	*Abies grandis*
grouse whortleberry	*Vaccinium scoparium*
hazelnut	*Corylus cornuta*
kinnikinnick	*Arctostaphylos uva-ursi*
Labrador tea	*Ledum groenlandicum*
little pipsissewa	*Chimaphila menziesii*

lodgepole pine	*Pinus contorta*
low sweet blueberry	*Vaccinium angustifolium*
lupine species	*Lupinus* sp.
mountain bistort	*Polygonum bistortoides*
mountain hairgrass	*Vahlodea atropurpurea*
mountain hemlock	*Tsuga mertensiana*
noble fir	*Abies procera*
Oregon wood-sorrel	*Oxalis oregana*
oval-leaf huckleberry	*Vaccinium ovalifolium*
pachistima	*Paxistima myrsinites*
Pacific dogwood	*Cornus nuttallii*
Pacific rhododendron	*Rhododendron macrophyllum*
Pacific silver fir	*Abies amabilis*
paper birch	*Betula papyrifera*
partridgefoot	*Luetkea pectinata*
pearly everlasting	*Anaphalis margaritacea*
pink mountain heather	*Phyllodoce empetriformis*
poison-oak	*Toxicodendron diversilobum*
ponderosa pine	*Pinus ponderosa*
quaking aspen	*Populus tremuloides*
queencup beadlily	*Clintonia uniflora*
red alder	*Alnus rubra*
red huckleberry	*Vaccinium parvifolium*
Rocky Mountain maple	*Acer glabrum*
salal	*Gaultheria shallon*
salmonberry	*Rubus spectabilis*
showy sedge	*Carex spectablis*
Sitka mountain-ash	*Sorbus sitchensis*
Sitka spruce	*Picea sitchensis*
Sitka valerian	*Valeriana sitchensis*
skunk-leaved polemonium	*Polemonium pulcherrimum*
slender hawkweed	*Hieracium gracile*
strawberry bramble	*Rubus pedatus*
subalpine fir	*Abies lasiocarpa*
subalpine lupine	*Lupinus arcticus* var. *subalpinus*
swordfern	*Polystichum munitum*
thimbleberry	*Rubus parviflorus*
three-leaf foamflower	*Tiarella trifoliata*
trapper's tea	*Ledum glandulosum*
trillium	*Trillium ovatum*
twinflower	*Linnaea borealis*

vine maple	*Acer circinatum*
western hemlock	*Tsuga heterophylla*
western huckleberry	*V. occidentale*
western larch	*Larix occidentalis*
western redcedar	*Thuja plicata*
western white pine	*Pinus monticola*
white mountain heather	*Cassiope mertensiana*
white rhododendron	*Rhododendron albiflorum*
white spirea	*Spiraea betulifolia*
white-veined wintergreen	*Pyrola picta*

Species sorted by scientific name

scientific name	**common name**
Abies amabilis	Pacific silver fir
Abies grandis	grand fir
Abies lasiocarpa	subalpine fir
Abies procera	noble fir
Acer circinatum	vine maple
Acer glabrum	Rocky Mountain maple
Alnus rubra	red alder
Anaphalis margaritacea	pearly everlasting
Arctostaphylos uva-ursi	kinnikinnick
Berberis nervosa	Cascade Oregongrape
Berberis repens	creeping Oregon-grape
Betula glandulifera	bog birch
Betula papyrifera	paper birch
Blechnum spicant	deer fern
Calamagrostis canadensis	bluejoint reedgrass
Carex geyeri	elk sedge
Carex spectablis	showy sedge
Cassiope mertensiana	white mountain heather
Chamaecyparis nootkatensis	yellow-cedar
Chimaphila menziesii	little pipsissewa
Clintonia uniflora	queencup beadlily
Cornus canadensis	Canadian bunchberry
Cornus nuttallii	Pacific dogwood
Corylus cornuta	hazelnut
Epilobium angustifolium	fireweed
Erythronium montanum	avalanche lily
Gaultheria shallon	salal
Hieracium gracile	slender hawkweed

Larix occidentalis	western larch
Ledum glandulosum	trapper's tea
Ledum groenlandicum	Labrador tea
Linnaea borealis	twinflower
Luetkea pectinata	partridgefoot
Lupinus sp.	lupine species
L. arcticus var. *subalpinus*	subalpine lupine
Menziesia ferruginea	fool's huckleberry
Oplopanax horridum	devil's club
Oxalis oregana	Oregon wood-sorrel
Paxistima myrsinites	pachistima
Phyllodoce empetriformis	pink mountain heather
Picea engelmannii	Engelmann spruce
Picea sitchensis	Sitka spruce
Pinus contorta	lodgepole pine
Pinus monticola	western white pine
Pinus ponderosa	ponderosa pine
Polemonium pulcherrimum	skunk-leaved polemonium
Polygonum bistortoides	mountain bistort
Polystichum munitum	swordfern
Populus balsamifera subsp. *trichocarpa*	black cottonwood
Populus tremuloides	quaking aspen
Pseudotsuga menziesii	Douglas-fir
Pyrola picta	white-veined wintergreen
Rhododendron albiflorum	white rhododendron
Rhododendron macrophyllum	Pacific rhododendron
Rubus lasiococcus	dwarf bramble
Rubus parviflorus	thimbleberry
Rubus pedatus	strawberry bramble
Rubus spectabilis	salmonberry
Sorbus sitchensis	Sitka mountain-ash
Spiraea betulifolia	white spirea
Thuja plicata	western redcedar
Tiarella trifoliata	three-leaf foamflower
Toxicodendron diversilobum	poison-oak
Trillium ovatum	trillium
Tsuga heterophylla	western hemlock
Tsuga mertensiana	mountain hemlock
Vaccinium alaskaense	Alaska huckleberry
Vaccinium angustifolium	low sweet blueberry

Vaccinium membranaceum	big huckleberry
Vaccinium deliciosum	Cascade blueberry
Vaccinium ovatum	evergreen huckleberry
Vaccinium parvifolium	red huckleberry
Vaccinium globulare	globe huckleberry
Vaccinium ovalifolium	oval-leaf huckleberry
Vaccinium caespitosum	dwarf huckleberry
Vaccinium occidentale	western huckleberry
Vaccinium uliginosum	bog blueberry
Vaccinium myrtillus	dwarf bilberry
Vaccinium scoparium	grouse whortleberry
Vahlodea atropurpurea	mountain hairgrass
Valeriana sitchensis	Sitka valerian
Veratrum californicum	California false-hellebore
Veronica cusickii	Cusick's speedwell
Xerophyllum tenax	beargrass

Appendix 4

Notes from personal communications

Susan Alexander, U.S. Forest Service, **Economist for the Alaska Region**.
Phone conversation with Joe Arnett on October 11, 2007. 907/586-8809, P.O. Box 21628, Juneau, AK 99802; salexander@fs.fed.us

Here are some good references:

Becky Kerns, co-author on Economic Botany paper, at bkerns@fs.fed.us, now in Prineville, previous phone 541/416-6602

Becky Richards, U. of Montana professor, GTR on huckleberries, Rebecca.richards@umontana.edu

Don Minore, Corvallis, probably retired, but very knowledgeable about impacts of treatments on huckleberries, available.

The US export market US international trade database is worth investigating, huckleberries are the only exported food were wild and cultivated fruit is documented separately.

Institute for Culture and Ecology, EFCAE.org, does contracts on various topics, including pinon harvest.

Talked to buyers, along the coast, some still selling evergreen huckleberry in Oregon, but in small amounts

Red huckleberry and evergreen huckleberry are used in floral products.

Oregon has possession limits, states and forests have commercial permits for some special forest products, maybe only for mushrooms and floral greens.

The Forest Service has a regional website with a special forest products appraisal system. BLM also has one, though it may not be on-line.

High levels of evergreen huckleberry reported in the Kitsap? Ask Becky Kerns and check the Economic botany article that Becky and Susan were co-authors on , along with Baily in 2004.

Forest Service question: Does “free use” exclude commercial harvest? Does not appear to in Cultural History p. 81. Susan thought that it did, or that if you paid for a permit, you could sell the product, but that material obtained with a free permit could not be sold.

Malcolm Dell, Gourmet Innovations LLC.
Phone interview by Joe Arnett on Oct. 5, 2007. Malcolm's background is in forestry. He feels that rakes appropriately used are not very damaging to the plants, and he reports that many people cut off the plants – still legal- and then pick the berries [note that Washington Law SHB 1909 Section 4 RCW 76.48.030 reads that "It is unlawful for any person to: Harvest huckleberries in any amount using a rake, mechanical device, or any other method that damages the huckleberry bush." So, according to this, cutting the plants off is not legal].

The biggest problem in the industry is the damage to the plants, favors some sort of certification, or training in use of rakes so they are used properly. Rakes allow the picker to harvest 5-10X what could be picked by hand, if berries are abundant. He understands that rakes are legal to use on your own land.

Generally huckleberry availability is OK; 2007 was a very poor berry year. He is aware of conflicts between commercial and recreational pickers, reports complaints about where commercial pickers had completely cleaned out berry patches. On permitting, he says we have to stop the degradation of the plants and plant communities, have to make it illegal to damage the plants. May need to require certification or training in use of rakes. Lack of fire and timber harvest has reduced huckleberries, but now higher intensity fires may kill the plants, wonders if this has been studied.

On regulations: does not like the poundage limit, 500 pounds is too small, August 15 as a start date is reasonable, or some other date.

Frank Duran, Forest Service Regional Special Forest Products Program
The Forest Service has some information by forest, year. Fruits and berries are recorded by pounds, give values to be removed. Gifford Pinchot National Forest: removed and sold this much. Permits are for specified amounts or time. Permits are issued to insure sustainability of the resource, and include general requirements (such as not allowing rakes, or digging up the plants, etc) to protect the resource. Amounts are not tracked, but are calculated based on assumed amount within the time of the permit. It is a challenge to balance between tribal needs, wildlife use, and the general public.

National Forests now keep the receipts from these permits, using those funds to support NEPA analysis.

What Forests in Washington issue commercial harvest permits? The Gifford Pinchot does, there may be others in Washington, such as the Wenatchee or MBS. These forests may have free use programs, which are for personal use only.

Is there a limit to personal use harvest? Individual National Forests set these limits, but cannot give more than a value of $200 per year. Free use limit could be less.

Beyond expected annual variation, are you aware of increase or decline in huckleberry abundance? Conflicts over the resource is reported in some areas; this will go through a larger analysis. Environmental Assessment in being prepared, probably programmatic Environmental Assessment, for the Gifford Pinchot National Forest.

Do you have any estimate of the volume of commercial/personal use harvest? Many people harvest at small levels, providing benefits for the public, but not measured in dollars.

Can you recommend other individuals to ask about this topic? Julie Ashe from the Gifford Pinchot, Laura Potash Martin from Mount Baker-Snoqualmie National Forest; tribal members, especially from the Yakama; Nancy Ryke, Trout Lake District Ranger 509/395-3401, Howard Tronson and Mark Savage of DNR

A draft state rule that was scratched was that confiscated berries would be given to the tribe. Frank thought that was a good idea.

Rick LaMonte, NW Wild Foods, Burlington WA
Phone interview by Joe Arnett on October 4, 2007.
Rick respects anyone wanting to work hard. Complained about dealers in berries raising the prices ("price elasticity"), said that $6/lb is way too high in his judgment, a price asked by some picking operations. Because this is a cash business, there is a danger of a criminal element, especially connected to drugs. Rick says that he has lost a lot of money in this business.

Species most used: big huckleberry most, evergreen and red huckleberry some, and smaller amounts of Cascade blueberry, Alaska huckleberry, and oval-leaf huckleberry.

Sources: Rick buys berries from all over, including Canada and Alaska.

Ownerships: Rick buys berried picked on private, National Forest, and state land

Pickers: Rick has buyers out there who buy for him, and he (and his employees?) also picks. Says that some of the people picking make a very good living gathering different products seasonally (boughs, mushrooms, etc). He also mentioned encountering drug problems and undependable buyers.

Availability of the berries: Does not have a problem getting what he needs, uses many sources.

Thoughts on regulations: Does not like them

Cheryl Mack, Gifford Pinchot National Forest
Phone conversation with Joe Arnett, Sept 12, 2007

Julie Ashe, GP special forest products coordinator, may have numbers on permits and harvest, though lower numbers in the past two years reflect fewer commercial pickers asking for permits, while the harvest level may even be higher. Much commercial harvest before the Aug. 15 date. The number of permits a poor measure, because often only one person in a group will have the permit, and other pickers pass off their gallons before they exceed the personal use level.

2007 appears to be a good year for berries on the Gifford Pinchot.

A sustainable harvest study in the FS is underway, contact Andrea Ruchty.

David Powell, Yakama staff, would be a good contact.

A pinch point often expressed at the handshake agreement reaffirmation is difficulty obtaining early berries for the religious practices of the feast in Late July, early August.

Julie Ashe, **Gifford Pinchot National Forest, special products permits**
Phone conversation with J. Arnett on Sept. 12, 2007. Will send records on permits issued, more in the north than the south this year, used to issue personal use permits, but there were too many. She has been there since 1992. Sept. 26: Julie sent tables giving numbers of commercial (FY93-FY07) and non-commercial (FY93-FY96) permits issued.

EDIBLE BERRY (PERSONAL USE)								
Gifford Pinchot National Forest								
	Cowlitz Valley		Mt St Helens NVM		Mt Adams		Total	
	# Permits	$$$	# Permits	$$$	# Permits	$$$	# Permits	$$$
FY96	4210							
FY95	5680		1548		10300		17528	
FY94	4797				9627		14424	
FY93	2719		631		5579		8929	
Starting in 1995 - Personal use berries and mushrooms combined into 1 permit.								

EDIBLE BERRY (COMMERCIAL)								
Gifford Pinchot National Forest								
	Cowlitz Valley		Mt St Helens NVM		Mt Adams		Total	
	# Permits	$$$	# Permits	$$$	# Permits	$$$	# Permits	$$$
FY07	362	$14,480.00	39	$1,560.00	101	$4,040.00	502	$20,080.00
FY06	178	$7,110.00	46	$1,820.00	135	$5,400.00	359	$14,330.00
FY05	97	$6,645.00	23	$920.00	60	$2,400.00	180	$9,965.00
FY04	111	$2,775.00	40	$1,000.00	396	$9,900.00	547	$13,675.00
FY03	95	$2,375.00	30	$745.00	180	$4,500.00	305	$7,620.00
FY02	23	$575.00	6	$150.00	134	$3,350.00	163	$4,075.00
FY01	27	$675.00	7	$175.00	165	$4,125.00	199	$4,975.00
FY00	15	$375.00	5	$125.00	84	$2,100.00	104	$2,600.00
FY99							0	$0.00
FY98	10	$250.00					10	$250.00
FY97	5	$125.00					5	$125.00
FY96							0	$0.00
FY95	9	$225.00	2	$50.00	0	$0.00	11	$275.00
FY94	21	$525.00	0	$0.00	83	$2,075.00	104	$2,600.00
FY93	6	$150.00	0	$0.00	19	$475.00	25	$625.00

Ed Maffei, Colville National Forest
Joe Arnett met Ed Maffei, contracting officer for the Colville National Forest, on Sept. 4, 2007 in CNF office; 509/684-7229; emaffei@fs.fed.us. We also communicated later by phone.

The Colville National Forest does not issue commercial permits, and allows free use of up to 3 gal./day for private use.

No quantitative data is available, but a lot of picking occurs of National Forest and Department of Natural Resources land, including by Colville tribal members.

Areas of focus: Huckleberry Mountain (private), west of Colville, in Sherman Mt. west of Columbia, to the east, in common with Idaho Panhandle National Forest.

Does the huckleberry resource appear to exceed use? On roads maybe the picking gets thin, but elsewhere the resource does not appear depleted.

Are huckleberries sold? Yes, at farmers markets, roadsides maybe. Not monitored.

Andrea Ruchty, GPNF botanist
Andrea is working on a report on the sustainability of huckleberry harvesting. The report is in progress. Phone message Oct. 29, 2007

Possible questions to ask agency land managers:
Does personal use harvest occur in your area of management?
Is there a limit to personal use harvest?
Beyond expected annual variation, are you aware of increase or decline in huckleberry abundance?
Does commercial harvest occur in your area of management?
Which species primarily are involved in commercial/personal use harvest?
Are you aware of a decrease or increase in availability of huckleberries?
Can you identify areas that appear to be particularly important in huckleberry harvest?
Do you have any estimate of the volume of commercial/personal use harvest?
Do you have a commercial harvest permit process?
Are you aware of conflict between commercial and personal use harvest?
Do you think a state permitting requirement to harvest, possess, or transport huckleberries, either for commercial or personal use, would remedy conflicts over huckleberry supply or the sustainability of this resource?
Can you recommend other individuals to ask about this topic?

Possible questions to ask tribal representatives or staff (it seems appropriate for the purposes of this report to limit questions of tribal harvest outside of tribal land):
Do tribal members harvest huckleberries outside of tribal land?
Do tribal members also harvest huckleberries outside of tribal land for sale? Is this minor or substantial?
Which species primarily are involved in commercial/personal use harvest?
Can you identify areas that are particularly important in huckleberry harvest? The response to this question can be as general or specific as the responder wishes to be.
Beyond expected annual variation, are you aware of increase or decline in huckleberry abundance?
Do you have any estimate of the volume of commercial/personal use harvest by tribal members outside of tribal land?
Are you aware of conflict between commercial and personal use harvest?
Are you aware of conflict between tribal members and others during harvest?
Do you think a state permitting requirement to harvest, possess, or transport huckleberries, either for commercial or personal use, would remedy conflicts over huckleberry supply or the sustainability of this resource?