# Native Plant Materials for Economic Development in Southeast Alaska

## *A Senior Thesis*

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*Oplopanax horridum*, **Devil's Club**: this valuable medicinal plant grows throughout southeast Alaska. Collection requires protective gear from head to toe to guard the gatherer from its many long and sharp spines. See plant entry, page 15.

## Acknowledgments

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## Abstract

Current economic situations such as mill closures from timber industry reconstruction in southeast Alaska have stimulated interest in commercial development of secondary forest products; resources and opportunities other than wood pulp and saw log production. Twenty native species of southeast Alaska were chosen based on a score of their combined economic value and abundance throughout southeast Alaska. Details about the potential uses, ecological requirements, propagation, and management related to the marketable attributes provided the foundation for scoring. Eleven of the twenty species were utilized for their fruits and berries. Six species could be sold as floral products. One species was used for seedling production concurrently with floral product production. Finally, the last two species produced botanical products. There is substantial potential for development in southeast Alaska with these secondary forest products, as well as others that were not mentioned in detail.

## Introduction

Communities in southeast Alaska are searching for new forms of economic development that can diversify the economy and improve employment opportunities. One community in particular, the Annette Island Indian Reservation in Metlakatla, Alaska, is interested in developing new natural-resource-based businesses. Previously, logging and fishing sustained the local economy, but these industries have declined in recent years.

The Annette Island Indian Reserve received a planning grant from the USDA Forest Service to identify native plant materials that offer opportunities for economic development. Potential micro-enterprises or "cottage industries" could involve berry production for jams and jellies, wild herb cultivation, production of plants for revegetation, charcoal, wood for smoking or cutting, botanicals and medicinals, aromatics, wood chips, floral products, or syrups. Products may be produced under cultivation or in managed wild stands. The purpose of this research was to assemble a list of native species occurring in southeast Alaska that have demonstrated some marketable economic value; to rank those species according to local abundance and economic value; and to identify twenty species with the greatest potential for economic development. Subsequently, a review of the top twenty species was conducted to outline potential uses, methods of propagation, commercial specifications, and potential markets.

## Previous Research

While there has been research published for the utilization of native plant materials in interior Alaska for industry development (Walsh, 1986), nothing has been done that focuses on southeast Alaska. The USDA Forest Service has published an information bulletin that provides suggestions for business opportunities with special forest products for a variety of plant species found in the United States (Thomas, 1993). Much of this work is similar in its application and is quite beneficial to reference but the difference in ecology and economic infrastructure between the two locations change several key factors.

## Methods

A list of all recognized species native to southeast Alaska was compiled from *Native Plants of Southeast Alaska* (Hall, 1995). Those species with economic value were identified by comparing the species list with these references: *Income opportunities in Special Forest Products* (Thomas, 1993), *Foraging in Alaska* (Walsh, 1986), and *Wild Berries of the Pacific Northwest* (Underhill, 1974).

Similar plants, such as the huckleberries and blueberries, were examined as individual species although it is often difficult if not impossible to differentiate some of these species or their products.

Each of these species was assessed for value in any singular use as well as multiple uses. References often gave information about the potential and current demand of individual plant species (Thomas, 1993). Other sources (Walsh, 1986) supplied lists of materials currently being utilized in small businesses in interior Alaska that were also native to Southeast and potentially harvestable. These publications also made reference to buyers and industry contacts. Some of these businesses were

**Table 1: Native plants of southeast Alaska with established markets in the United States.**

| Species | | Economic Value | Abundance | Combined Score |
|---|---|---|---|---|
| Horsetail | *Equisetum arvense* | 3 | 4 | 7 |
| Bracken Fern | *Pteridium aquilinum* | 2 | 3 | 5 |
| Mountain Juniper | *Juniperus communis* | 5 | 1 | 6 |
| Western Redcedar | *Thuja plicata* | 5 | 4 | 9 |
| Sitka Spruce | *Picea sitchensis* | 6 | 10 | 16 |
| Shore Pine | *Pinus contorta* | 5 | 8 | 13 |
| Mountain Hemlock | *Tsuga mertensiana* | 5 | 8 | 13 |
| Western Hemlock | *Tsuga heterophylla* | 4 | 10 | 14 |
| Western Yew | *Taxus brevifolia* | 5 | 1 | 6 |
| Devil's Club | *Oplopanax horridum* | 8 | 6-7 | 14-15 |
| Yarrow | *Achillea millefolium* | 6 | 6-7 | 12-13 |
| Sitka Alder | *Alnus sitchensis* | 5 | 9 | 14 |
| Thinleaf Alder | *Alnus incana* | 7 | 3 | 10 |
| Paper Birch | *Betula papyrifera* | 5 | 2 | 7 |
| Prarie Peppergrass | *Lepidium densifolium* | 5 | 3-4 | 8-9 |
| Pacific Red Elderberry | *Sambucus racemosa* | 3 | 5 | 8 |
| Highbush Cranberry | *Viburnum edule* | 7 | 6 | 13 |
| Field Chickweed | *Cerastium arvense* | 3 | 3-4 | 6-7 |
| Bering Chickweed | *Cerastium earlei* | 3 | 2 | 5 |
| Black Crowberry | *Empetrum nigrum* | 6 | 7 | 13 |
| Kinnikinick | *Arctosaphylos uva-ursi* | 4 | 5 | 9 |
| Salal | *Gaultheria shallon* | 8 | 5 | 13 |
| Red Huckleberry | *Vaccinium parvifolium* | 8 | 6 | 15 |
| Dwarf Alpine Blueberry | *Vaccinium ulignosum* | 8 | 9 | 17 |
| Alaska Blueberry | *Vaccinium alaskaense* | 8 | 9 | 17 |
| Early Blueberry | *Vaccinium ovalifolium* | 8 | 9 | 17 |
| Bog Blueberry | *Vaccinium caespitosum* | 7 | 9 | 16 |
| Lingonberry | *Vaccinium vitis-idaea* | 8 | 9 | 17 |
| Stink Currant | *Ribes bracteosum* | 5 | 4 | 9 |
| Dwarf Mistletoe | *Arceuthobium campylopodium* | 3 | 6-7 | 9-10 |
| Fireweed | *Epilobium angustifolium* | 6 | 8 | 14 |
| Seashore Plantain | *Plantago macrocarpa* | 4 | 8 | 12 |
| Matweed-Doorweed | *Polygonum aviculare* | 3 | 2 | 5 |
| Pisissewa | *Chimophila umbellata* | 5 | 2 | 7 |
| Northern Serviceberry | *Amelanchier alnifolia* | 6 | 1 | 7 |
| Goatsbeard | *Aruncus dioica* | 4 | 3 | 7 |
| Nootka Rose | *Rosa nutkana* | 9 | 2 | 11 |
| Nagoonberry | *Rubus arcticus* | 6 | 6 | 12 |
| Cloudberry | *Rubus chamaemorus* | 5 | 9 | 14 |

continued

**Table 1: Native plants of southeast Alaska with established markets in the United States.**

| | | | | |
|---|---|---|---|---|
| Thimbleberry | *Rubus parviflorus* | 7 | 6 | 13 |
| Salmonberry | *Rubus spectabilis* | 7 | 8-9 | 15-16 |
| Black Raspberry | *Rubus leucodermis* | 7 | 2-3 | 9-10 |
| Quaking Aspen | *Populus tremuloides* | 3 | 1 | 4 |
| Scouler Willow | *Salix scouleriana* | 6 | 3 | 9 |
| Stinging Nettle | *Urtica dioica* | 3 | 7 | 10 |
| Skunk Cabbage | *Lysichiton americanum* | 2 | 10 | 12 |
| False Hellebore | *Veratum viride* | 3 | 8-9 | 11-12 |

also contacted to provide the most current evaluation of the market. Those species that had multiple uses, as well as those plants whose single use was noted as being of high profitability, demand, or importance were moved to yet another list. Species that were only mentioned by one source were considered less valuable and removed from the list.

The resulting list was ranked according to species abundance. Dr. Glenn Juday, ecologist at the University of Alaska Fairbanks, examined the species list and scored each species on a scale of one to ten, one being extremely rare and ten being abundant based on his personal experience and research throughout southeast Alaska. This score would play an important role in the outcome of the final list because this criterion was independent of all other research.

The species with commercial demand were then given a separate score for economic value on a scale of one to ten; one being of low value and ten being of high value. This evaluation was accomplished by categorizing each species (aromatics, berries and fruits, cones and seeds, cooking/smoke/fuel wood, decorative wood, botanicals, greenery/floral, and weaving and dying materials). The possible species in each category were ranked in order of demand for that particular use. Publications by the Forest Service (Thomas, 1993), private individuals who participated in those markets, and personal communications with individuals who operate or have operated a business that utilized those types of forest products provided information on which of the species were the preferred species to use and which ones had strongly defined or growing markets (see References, Personal Communications). At times, new species that were not on the original list were identified and were subsequently added to the list and scored (Brook, pers. comm., 1996).

Walsh (1986) used three levels to rank native plants for marketability: good marketability, underdeveloped market (cottage industry uses recommended), and potential market undeveloped. He also identified species that had been cultivated, and this attribute increased the species' score. In some markets, such as the botanicals, many more species were mentioned as having botanical uses than were identified as having "commercial potential" in botanical markets (Thomas, 1993). Those with commercial potential scored higher than unmentioned or slightly mentioned species, which received a lower score.

If the species had multiple markets, its highest score in any one market was used to calculate a base score for marketability. If, however, the secondary markets for that species were compatible with the primary use of the species, its total score for marketability was increased and thus was greater than its score in any single category. An example is salal, which has berries for use in a jam or jelly and foliage for the floral market.

The Internet provided access to the most recent research by the Forest Service (www.fs.fed.com), information on global actions relating to secondary forest products from the United Nations Food and Agriculture Organization (www.fao.org), and links to wholesale buyers and distributors. Types of products like the ones thought to be promising for Alaska are currently in trade throughout the world. In some cases this increased the potential for development here, while in others it decreased the chance of success. For example, the aromatics market is currently very competitive and a substantial starting cost would be associated with their development here, while demand for wild berries from the Pacific Northwest is growing, and new production from places such as Alaska could be quite promising.

For each species, the two scores for abundance and marketability were combined to achieve a final score. The twenty species with the highest scores were included in the final stage of research where information about their identification and production management was researched. This document does not include all of the relevant information needed by an entrepreneur to start a new business. It is better used as a starting point from which to look at several possible endeavors for secondary forest products.

Each species was ranked according to the final scores with one being the highest possible; progressively larger numbers mean the species have less potential for economic development. Where two or more species received the same score, no distinction was made to separate them in rank.

**Table 2. Twenty most marketable and abundant plants in southeast Alaska**

| Rank | Common Name | Species | Primary Product |
|---|---|---|---|
| 1 | Lingonberry | *Vaccinium vitis-idaea* | Fruit |
| 1 | Dwarf Alpine Blueberry | *Vaccinium uliginosum* | Fruit |
| 1 | Alaska Blueberry | *Vaccinium alaskaense* | Fruit |
| 1 | Early Blueberry | *Vaccinium ovalifolium* | Fruit |
| 2 | Sitka Spruce | *Picea sitchensis* | Cones & Seed / Floral Products |
| 2 | Bog Blueberry | *Vaccinium caespitosum* | Fruit |
| 3 | Salmonberry | *Rubus spectabilis* | Fruit |
| 4 | Red Huckleberry | *Vaccinium parvifolium* | Fruit |
| 5 | Devil's Club | *Oplopanax horridum* | Botanicals |
| 6 | Western Hemlock | *Tsuga heterophylla* | Cones & Seed |
| 6 | Sitka Alder | *Alnus sitchensis* | Cones & Seed |
| 6 | Fireweed | *Epilobium angustifolium* | Cones & Seed |
| 6 | Cloudberry | *Rubus chamaemorus* | Fruit |
| 7 | Highbush Cranberry | *Viburnum edule* | Fruit |
| 7 | Crowberry | *Empetrum nigrum* | Fruit |
| 7 | Salal | *Gautheria shallon* | Floral Products |
| 7 | Thimbleberry | *Rubus parviflorus* | Fruit |
| 7 | Mountain Hemlock | *Tsuga mertensiana* | Cones & Seed |
| 7 | Shore Pine | *Pinus contorta* | Cones & Seed |
| 8 | Yarrow | *Achillea millefolium* | Botanicals |

## *Results*

There were 170 recognized plants native to southeast Alaska with an existing marketable value. The complete lists are provided in the appendices. Appendix A is an outline of all the species by the markets that are available. Appendix B lists the species by their family, genus, and species, and also gives the Roman numeral for the economic markets to which they are applicable. Forty-seven native species were identified as having well established markets in other areas of the United States and therefore the most potential for development in Alaska (Table 1). The twenty species with the highest scores following ranking by abundance and market value are shown in Table 2.The final twenty species were possible candidates in all of the eight market fields (Thomas, 1993); aromatics, berries and wild fruit, cones and seeds, cooking/smoking/fuel wood, decorative wood, forest botanicals, greenery/transplants/floral products, and weaving and dyeing materials. Species such as Sitka spruce were possible candidates in several categories but not of equal value in each of the categories. The following discussion provides silvicultural information for the top twenty species; their preferred use(s); the market fields; how species in each field compared with others; and the most beneficial and productive market for each species. Information on secondary benefits is also provided, such as the enhancement of wildlife forage and protection, control erosion, and protection of critical watershed qualities.

There is continual change in the specific demands and product quality sought by wholesalers. It is beyond the scope of this paper to provide all the critical and up-to-date information on the market opportunities and risks that are inherent to all forms of entrepreneurship.

# Individual Species Information

*(Editor's note: species are arranged alphabetically by major common name.)*

## SITKA ALDER, *Alnus sitchensis* (Reg.) Sarg.

Abundance=9 Value=5 Rank=6

### General:

The Sitka alder is a deciduous shrub or small tree that grows to 9 m (30 ft) tall. The finely haired twigs are sticky and turn from orange brown to light gray as they mature. The bark is gray to light gray (Hall, 1994) and becomes scaly. The lateral buds are oppressed and pointed. The leaves are alternate, thin, and smooth. Leaf shape is oval with a somewhat rounded base and pointed tip. Leaves are 4-10 cm (1.54 in) long and the underside is shiny and somewhat sticky (Pojar and Mackinnon, 1994). The lobes are somewhat wavy and double toothed. The top surface is sometimes speckled yellow. The male flowers are narrow catkins (Hall, 1995) that open at the same time as the leaves. The fruit is a small nutlet that is elliptic with two broad wings. The female cone is 1.5-2 cm (0.6 in) long and shaped like an egg. They form in clusters of 3 to 6 and on stalks that are longer than the cone (Pojar and Mackinnon, 1994).

### Uses:

The three primary commercial uses for alder include seed and cone production, wood for smoking, and greenery and floral business. The least destructive of these is cone collection. In 1991, alder cones sold for $3.90 per kg ($1.80 per lb) and are used in decorations and jewelry (Thomas, 1993). The cones are electroplated with gold and fashioned into earrings and necklaces that can sell for $5.00 to $7.00 each (Holloway, pers. comm., 1996).

The use of alder as a cooking wood or smoke wood is also renowned. It adds excellent flavor to salmon or trout and can produce a fire hot enough to melt iron, making it a fine fire wood (Schofield, 1989). The floral use is relatively new. Trees up to 7.5 cm (3 in) in diameter are harvested for the shape of their branches. They are dried and treated before new artificial leaves are attached, and it is sold to use indoors as artificial foliage. This is a new use for the plant that is growing; production is between 80,000 and 100,000 trees annually (Thomas, 1993).

Alder provides vital cover for a number of wildlife species (such as the grizzly, bear, beavers and hares) that commonly eat the twigs and leaves. Alder seeds, buds, and catkins are eaten by birds and small mammals throughout the winter. Big game uses the cover of this tree, and bird nesting and foraging are also aided by their abundance (Uchytik, 1989).

Sitka alder is valuable for its use on disturbed sites to control erosion on steep slopes. Its seeds are well adapted to mineral soil on even the most cool and moist sites. Transplanting for this purpose is best done with two- to three-year-old stock.

***Alnus sitchensis***, also known as ***A. sinuata*** (Regel) Rydb., or Sitka alder.
—J. E.(Jed) and Bonnie McClellan, © 2005 California Academy of Sciences

This species also will establish on coal mine spoils and could therefore be used in that type of reclamation (Uchytik, 1989).

Alder extract has also been used traditionally to treat such things as stomach aches, inflammation, and diarrhea. The bark was also used for making baskets (Schofield, 1989) and for dyeing leather or textiles (Uchytik, 1989).

### Ecology:

This plant is abundant in most of Alaska as a pioneer species. It forms thickets around mountain slopes, avalanche tracts, on stream banks, shorelines, terraces, and recently deglaciated areas (Hall, 1995). It thrives on moist sites with high water tables (Pojar and Mackinnon, 1994).

Alder is more common on middle to high elevations in the mountains, mostly above 915 m (3,000 ft), and is regarded as moderately shade tolerant. Its tolerance for shade allows it to grow beneath pine and hemlock but it can not tolerate a dense overstory. Normally this tree is found on north-facing slopes or other shaded areas that are cool and moist. It grows vigorously on talus slopes, avalanche chutes, high elevation mountains, and seepages where there is commonly abundant surface moisture (Uchytik, 1989).

Sitka alder grows on soils of a wide variety of parent materials and soil textures. The soils are commonly higher in available nitrogen because of this species' ability to fix 8-25 kg (18-55 lbs) per acre annually. This is also the feature of its lifestyle that allows it to invade sterile soil. Preferred soil texture varies from silts to coarse sands that are consistently more acidic than adjacent conifer stands (Uchytik, 1989).

Exposed soils from either natural or human-based actions offer an ideal seedbed for Sitka alder communities. Once established, this alder can be either a mid-seral or at least a long-term persistent species. When conifer overstories are removed by wildfire, avalanche, or massive soil slumping, alder rapidly invades the sites with high water tables and high moisture. These dense stands can at times retard the regrowth of young conifers yet it (Uchytik, 1989).

## Propagation and Management:

The Sitka alder can be propagated from seed or through several vegetative means. Plants are able to sprout naturally from the root collar or stump when they are damaged or injured by fire. Seeds are dispersed in the fall and provide the primary means of reproduction. The seedbed does need to be a moist mineral soil for germination to occur. Plants will begin to produce seed after four to seven years (Uchytik, 1989).

Controlled propagation is also done by seed or with cuttings, suckers, and grafting. Seed can be gathered in the fall, than dried, and sown in the spring (L.H. Bailey Hortorium, 1976). The seed should be stored in a cold and dry storage area over the winter. The seeds, when sown, should be thinly covered with moss or compost and kept moist. One source called for a stratification of 60 days at 5°C for a spring sow, but no stratification if sown in the fall (Uchytik, 1989). However, this may only be true of seeds that during the storage period have had their moisture content maintained below 10 percent. Nurseries in Washington prefer to sow in the spring (Schopmeyer, 1974).

The alder cones (strobiles) can be collected from standing trees when the bracts begin to separate. They easily open when spread on drying racks in a well-ventilated room for several weeks at ambient temperature. They can be opened more quickly with a kiln drying at 26-38°C. Much of the seed will fall out during the drying process and that which does not can be removed by shaking or tumbling. Purity can be quite high for some species of alder, but there is some difficulty in separating the empty seed from the viable seed. These seeds can be stored in air-tight containers at 1-3°C and maintain viability for a couple of years. Sitka alder produces good crops of cones about every four years (Schopmeyer, 1974).

*Vaccinium alaskaense* How., Alaska blueberry.

—PHOTO COURTESTY US FOREST SERVICE

## ALASKA BLUEBERRY, *Vaccinium alaskaense* How.

**Other common names:** Alaskan blueberry, Alaska huckleberry

Abundance=9 Value=8 Rank=1

## General:

Alaska blueberry is a spreading or erect shrub that grows to 2 m (7 ft) high. The twigs are thin, weakly angled, and end in a narrow stub. Twigs are a yellow-green when young and become gray with age. The thin leaves are entire or sometimes shallowly toothed on the edges. The upper surface is green; the lower surface has a few short glandular hairs on the mid-vein and appears whitish (Hall, 1995). The deciduous leaves are oval to egg-shaped and 2-6 cm (0.8-2.4 in) long. The urn-shaped flowers are 7 mm (0.03 in) long and are bronze to pinkish-green in color. They occur with or before the leaves (Pojar and Mackinnon, 1994). They form singly at the base of the leaves with a straight stalk from April to May. The flowers are widest just above the base and are usually broader than long. The fruit is a berry, appearing bluish black to purple on a stalk in late July and August (Hall, 1995).

## Uses:

The commercial uses for all of the native blueberries are identical and the berries are seldom distinguished from one another when they are processed, even though there are some differences in flavor and appearance (Reed, pers. comm., 1996). Alaska blueberry may produce up to 100 berries per bush, which makes it one of the more profitable and time-efficient berries to harvest for commercial uses (Matthews, 1992b). This species most commonly grows in mixtures with oval-leafed blueberry and is not easy to tell apart (Pojar and Mackinnon, 1994). Other noncommercial uses that were mentioned for the dwarf alpine blueberry are also known uses for this blueberry (Schofield, 1989).

Wildlife benefit from Alaska blueberry as they do from the other blueberries, which provide food (both the fruit and foliage) and cover. The fruit is rich in vitamin C and energy and has very little fat. In areas of disturbance caused by windthrow, openings in the canopy are formed that allow for the colonization of this blueberry (Matthews, 1992b).

## Ecology:

Alaska blueberry is found throughout southeast Alaska and spreads to the Kenai Peninsula and Prince William Sound. It can form dense thickets in coastal forests, open areas, and

in clearcuts, often with early blueberry (Hall, 1995). It often prefers soils rich in decaying wood (Pojar and Mackinnon, 1994). It is found on a number of different sites from valley bottoms to mountain slopes, but is most often found on cool moist sites in mountain forests that are classified as moderately productive. Alaska blueberry is abundant on sites with minimal soil disturbance and at elevations below 1800 m (6,000 ft) on variable aspects throughout its range, but more likely below 900 m (3,000 ft) in Alaska. It is capable of handling a variety of soil moisture conditions and is often found on well-drained as well as poorly drained soils. This shrub has been classified as an indicator of hyper-maritime climates, and moist to very moist nitrogen-poor soils. It generally occurs in sandy, silt, or clay loams that have developed in colluvial, morainal, or glacial till (Matthews, 1992b).

Alaska blueberry is capable of surviving disturbances such as clearcutting, fire, and windthrow. It is also an important seral species that colonizes early; as timber stands become dense and even aged, the blueberry is less frequent and less abundant. Alaska blueberry is, however, most often associated with late seral or climax types of communities such as the mature Sitka spruce-western hemlock cover type (Matthews, 1992b).

## Propagation and Management:

The Alaska blueberry can be propagated by seed or through vegetative means. The vegetative means, however, are of primary importance to most of the *Vaccinium* species (Matthews, 1992b). The seeds of Alaska blueberry are not dormant and require no pretreatment to germinate (Crossley, 1974). Information on seed production, collection, and treatment is identical to all other blueberries and can be found in the section on dwarf alpine blueberry propagation.

These seeds germinate well but their germination is strongly correlated to available light. Emergence of the seedlings in one study showed 45 percent emergence in light-limiting stands and 73 percent in open stands. Natural germination on nurse logs is also quite common and the seeds are readily dispersed by birds and mammals (Matthews, 1992b).

Natural spreading comes from basal sprouts or rhizomes. The sprouting from the branches and stems may be common after fire or herbivore predation, or rhizomal spreading can occur in the absence of such disturbance. After clearcutting, the blueberry can sprout from these underground stems or can reproduce by seed within three years (Matthews, 1992b).

Alaska blueberry production differs greatly depending on the habitat in question. In hemlock-spruce habitats, this plant was able to produce 110 kg per ha (98.6 lb per ac) of biomass when associated with skunk cabbage *(Lysichiton americanum*), but only 9 kg per ha (8.66 lb per ac) when associated with bunchberry dogwood *(Cornus canadensis)*. Where blueberry production is the most important use, succession must be delayed. This is best accomplished by burning the site every two to three years. Chemical or mechanical thinning may also help to increase the production of blueberries (Matthews, 1992b).

## DWARF ALPINE BLUEBERRY, *Vaccinium uliginosum* L.

**Other common names:** alpine blueberry, bog bilberry, bog blueberry, alpine bilberry, bog huckleberry, bog whortleberry

Abundance=9 Value=8 Rank=1

## General:

This blueberry is a widely branched low shrub that can be erect to prostate, while commonly rooting along the branches. The twigs are slender, round and brown with minute hairs. The older twigs have many branches and are colored yellow-brown to gray with a shredding bark (Hall, 1995). The alternate leaves are firm and oval to elliptic, but definitely broadest above the middle. Leaf tips are rounded, pointed, and not serrated. These leaves, 1-3 cm (0.4-1.2 in) long, are green above and pale beneath. A network of veins are strongly pronounced on the lower surface (Pojar and Mackinnon, 1994). The leaves sometimes have a whitish bloom. Flowers occur from May to July singly or in groups up to four from the ends or sides of the branches. The nodes form on the stalk and are urn shaped with four short lobes. The petals are pink (Hall, 1995) and 5-6 mm (0.02 in) long. The fruits are a blue to black berry, 5-10 mm (0.02-0.04 in) across, sometimes covered with a fine waxy powder (Pojar and Mackinnon, 1994).

## Uses:

The dwarf alpine berry is well know for its sweet flavor and use in jams, jellies, baked goods and wines (Underhill, 1974). Its greatest commercial potential lies in the use of these berries. This is one candidate for "berry ranching" in Alaska. Washington and Oregon produce tons of blueberries each year (Walsh, 1986). Dwarf alpine blueberry is bought by most, if not all, of the fruit processors already operating in Alaska. They bring around $6.60 per kg ($3.00 per lb) when cleaned and separated from the stems, or sell for about $3.30 per kg ($1.50 per lb) when not cleaned (Reed, pers. comm., 1996). They are also used in homemade ice cream or syrup for use on hotcakes (Schofield, 1989). When collecting the early blueberry for commercial harvest, berries are likely to mold and should be processed or frozen quickly. Leaves are also dried to make a sweet tea. For this purpose, it is important to collect the leaves before fruiting to obtain the most fragrant leaves and to avoid a messy harvest with squashed berries. (Walsh, 1986).

Noncommercial uses: the leaves of the plant are said to help control diabetes and urinary disorders when brewed in tea. The juice is also said to help sore throats and inflamed gums. It has also been used to make dyes for clothing (Schofield, 1989).

Many species of wildlife utilize the fruit of the blueberry, including songbirds and game birds, while some birds and small mammals rely on the foliage for nutrition. The fruit is rich in vitamin C and energy and has very little fat. Some cover is also provided to smaller wildlife species that hide and rest in dense understory mats of this species (Matthews, 1992c).

Vaccinium uliginosum L., dwarf alpine blueberry.

—PHOTO BY PATRICIA HOLLOWAY

The dwarf alpine blueberry is tolerant of high concentrations of heavy metals in soils. These metals include uranium, copper, lead, zinc, nickel, and arid iron, which can also collect in large concentrations in the foliage without doing any apparent harm to the plant. This gives it some potential for use in reclamation, as well as some potential in mineral exploration for these metals (Matthews, 1992c).

## Ecology:

Dwarf alpine blueberry is common in low elevation bogs, but also forms on rocky areas at alpine elevations (Pojar and Mackinnon, 1994). Habitats such as coastal bogs, sedge meadows (Matthews, 1992c), forested areas (Robuck, 1989), rocky or sandy shores of lakes and streams, rock outcrops, and barrens can be home to this blueberry. It occurs in both organic and inorganic soils that are generally acidic, the pH ranging from 3.5 to 6.2. It can tolerate a wide range of moisture conditions, growing on well-drained and poorly drained sites. Characteristic climate for this blueberry is cool-temperate to cool-mesothermal areas (Matthews, 1992c).

## Propagation and Management:

Propagation of the dwarf alpine blueberry can be accomplished by seed or through vegetative means. Sprouting from rhizomes and layering are the most common forms of spreading (Crossley, 1974). When cultivated, the flowering and fruiting over the first five years is usually insufficient to support commercial harvest (Holloway, pers. comm., 1996).

To collect seed from any blueberry, the fruits can be collected by hand when the berries are ripe. Faster harvesting may be done by holding the bush over a large container and beating the bush with a short stick or hose. These berries should be chilled at 10°C for several days before the seed is extracted. At that time the fruit can be shredded in a blender for 30 seconds; the sound seeds will settle to the bottom and the pulp and unviable seeds can be floated off. They should then be dried for 48 hours at 16°-21°C. After the drying, seeds may be stored for up to twelve years under normal refrigeration (Crossley, 1974).

While most blueberries require no stratification, the dwarf alpine blueberry has been shown to have a conditional dormancy. Germination success was improved when seeds were treated with a thirty-day cold stratification at 2°C. Seeds that were stratified indoors for thirty days at 25°C had a 91 percent germination. Light was shown to be beneficial in increasing germination. After 83 days of outdoor cold stratification, 55 percent of the seeds germinated. Without the treatment, only 4 percent will germinate. Germination occurred within 30 days on filter paper at 22°C (Matthews, 1992c).

All blueberry seeds should be sown in a mixture of sand and horticultural peat. The seedlings can be transplanted after 6-7 weeks from the time they emerge, but should not be transplanted to the field until they have spent one growing season in the nursery. At that time they can be planted from 1.5 m by 1.5 m (5 ft by 5 ft) to 2.5 m by 2.5 m (8 ft by 8 ft) spacing. Their site requirements are critical, and a poor site can have disappointing effects. Culturing of a natural blueberry stand is quite possible (Crossley, 1974).

Cuttings from any blueberry can be made from the half-mature side shoots. A section 5-8 cm (2-3 in) long, firm towards the base, can be taken. Care should be used to collect these with careful trimming. These can be inserted close together in a mixture of three parts sand to one part loam and 1 part peat moss. They should than be watered well and covered with a shaded jar. In the spring, the cutting should be examined for root development. Those that exhibit growth can be lifted and potted (Sheat, 1948). The deciduous *Vaccinium* can be rooted as semi-mature cuttings in early summer or as hardwood cuttings in late winter. Hormodin #3 or an equal is used and the cuttings are placed in a peat-perlite medium (Anonymous, n.d.).

This species in particular has shown poor success from hardwood and softwood cuttings, but 52 percent of rhizomes will produce shoots when planted immediately after storage at 4°C for several months. Shoots begin to emerge at a mean of 56 days. One study has shown that fertilization and irrigation causes no significant response in the dwarf alpine blueberry (Matthews, 1992c).

### EARLY BLUEBERRY, *Vaccinnium ovalifolium* Sm.

**Other common names:** ovalleaf huckleberry, oval-leaved huckleberry ovalleaved whortleberry, ovalleaf whortleberry, oval-leaved bilberry, oval-leaf bilberry, early huckleberry, blue whortleberry, blue huckleberry, bog bilberry, tall bilberry, huckleberry, kurousugo

Abundance=9 Value=8 Rank=1

## General:

The early blueberry is a spreading shrub that can often grow to 2 m (7 ft) tall. The twigs are slender and shiny, often ending

*Vaccinium ovalifolium* Sm., early bluberry.

—photo © Jamie Fenneman (Photo ID #4268), E-Flora BC Photo Gallery, www.eflora.bc.ca

in a narrow stub. They are yellowish green to red when young, turning more gray in the second and third years. The branches commonly are weakly angled. The thin leaves are oval, rounded at the tip and base, and are usually entirely (but sometimes shallowly) toothed (Hall, 1995). The leaves form alternately and are deciduous. Typically they are green above and paler beneath. They are seldom longer than 4 cm (1.5 in). The flowers are pinkish and globular. They can be urn-shaped to egg-shaped bells that are longer than broad; about 7 mm (0.03 in) long. Single flowers form at the leaf axils (Pojar and Mackinnon, 1994) and are nodding on stalks. The fruit is a blue to bluish-black berry that often has a whitish bloom. In southeast Alaska it flowers from April to May and fruits from July to September (Hall, 1995).

## Uses:

The early blueberry shares the same uses as the other three known blueberries that are common in southeast Alaska. The main commercial use is for processing preserves. The blueberries hold a large potential for berry ranching in Alaska, and this species in particular is a good candidate because its form more closely resembles the "high-bush" blueberries that are cultivated in the Pacific Northwest for commercial purposes. As with the other blueberry species, the berries should be processed immediately or frozen to avoid molding (Walsh, 1986). The leaves are also collected for use in potpourri and teas (Thomas, 1993), but these should be collected before fruiting occurs to avoid a messy harvesting situation (Walsh, 1986). Cleaned, washed, and stemmed, berries can sell for $6.60 per kg ($3.00 per lb); uncleaned berries sell for $3.30 per kg ($1.50 per lb) (Reed, pers. comm., 1996).

The fruits of this plant are also important to birds and mammals as a food source. In British Columbia, this plant is a favorite of the grizzly bear. The fruit is rich in vitamin C and energy and has very little fat (Trimenstein, 1990c).

This species of *Vaccinium* was first cultivated in 1880 (Crossley, 1974) and while many of the blueberry species are used as ornamentals and fruit producers in backyard gardens, one report suggests that the early blueberry does not appear well suited for horticultural breeding purposes (Trimenstein, 1990c). There is also the possibility that this plant could be used to stabilize disturbed sites, but no details were found that related to the success of the experiment (Crossley, 1974).

## Ecology:

This shrub occurs throughout Alaska from southeast to the Aleutians and the Interior. It grows in coastal forests, subalpine areas, edges of bogs, openings, clearcuts, and dense thickets (Hall, 1995) where it is cool and moist. Often it is found on elevated micro sites in poorly drained areas. This blueberry is commonly absent from major valley bottoms, but does occur on subhydric and morainal sites in smaller valley bottoms (Trimenstein, 1990c).

Early blueberry is shade tolerant and is a common understory species that is dominant on mesic, north facing slopes in the humid coastal Sitka spruce-hemlock forests of southeast Alaska. It is also a prominent component of the shrub layer in other coastal western hemlock, maritime mountain hemlock, and yellow cedar forests of the northwest. It also grows well on cutover sites within forest communities where it forms a shrub layer (Trimenstein, 1990c).

The soils for early blueberry must be acidic. The species can grow on soils that are infertile with few of the essential elements. This blueberry thrives on soils that are low in nitrogen. In general, early blueberry will grow well on well-drained, nutrient-poor to nutrient-rich soils with a pH of 4.0 to 5.0. The elevational range of this shrub is from sea level to timberline. While it can occur on sites that are dry, it generally prefers sites that are moderately moist most of the time (Trimenstein, 1990c).

## Propagation and Management

Early blueberry is able to reproduce both vegetatively and by seed. As with most of the other western blueberries, the vegetative means appears to be the most important to the species (Trimenstein, 1990c). The seed is collected identically to the previously discussed blueberries.

Properly stored seed exhibits good germination when exposed to 14 hours of light at 33°C followed by 10 hours of darkness at 13°C. Fresh seeds germinate successfully at the same conditions or with slightly cooler temperatures down to 22°C during the day and 5°C for the night. The seedlings first emerge in approximately one month. They will continue to emerge

for longer times if the seed is not stratified (Crossley, 1974). In favorable conditions, 50-60 percent of the seeds germinate and 93 percent germination is possible in laboratory conditions (Trimenstein, 1990c). With fifteen days of warm temperatures (room temp) followed by 15 days in a cooler room (0-5° C), 93 percent of the seed germinated within 69 days of the test (Crossley, 1974).

Early blueberry commonly sprouts from dormant basal buds after repeated browsing or other disturbances that damage the crown. Layering will occur in the absence of disturbance, but rhizomal sprouting is the primary means in which colonies expand (Trimenstein, 1990c). Cuttings can be made propagated by following the recommendations for the previously discussed blueberries (Crossley, 1974).

Beneath a forest canopy, a minimum of two percent full light is needed for germination and seedling development. Germination can occur on a variety of substances such as decaying wood, humus, moss, and mineral soil. The plants typically produce seed annually, although large amounts of seed are rarely seen except on forest edges and in clearings. Thinned stands of hemlock and spruce in southeast Alaska with a tree spacing of 2.5 m by 2.5 m (7.9 ft by 7.9 ft), had scattered seedlings. Other stands in the same area that had tree spacing of 5m by 5 m (16.5 ft by 16.5 ft), possessed more abundant densities and there was even production of flowers. Their survival is fairly poor in immature stands (Trimenstein, 1990c).

## BOG BLUEBERRY, *Vaccinnium caespitosum* Michx.

**Other common names:** dwarf huckleberry, dwarf blueberry, swamp blueberry, dwarf bilberry, Sierra bilberry, blueberry, huckleberry, whortleberry, dwarf grouseberry

Abundance=9 Value=7 Rank=2

### General:

Bog blueberry is a low spreading shrub that reaches heights up to 30 cm (11 in). There are numerous branches within the foliage mat that commonly root at the nodes. The younger twigs are slender, round or sometimes angled, and often with short green hairs. The older twigs turn a brown or gray and the bark appears shredded (Hall, 1995). The alternate leaves are deciduous and less than 3 cm (1.1 in) long. These elliptic, or sometimes oblanceolate, leaves are distinctly toothed. Both sides of the leaf are a bright green, although at times the lower surface may appear lighter than the top. There is a pronounced network of veins on the underside (Pojar and Mackinnon, 1994) that is conspicuous on some plants. Single flowers form at the base of the leaves on nodding stalks (Hall, 1995). The flowers are 5-6 mm (0.02-0.03 in) long and whitish to pink colored. There are five lobes that are narrowly urn-shaped. The fruit is a blue berry that commonly has a pale gray bloom (Pojar and Mackinnon, 1994). In southeast Alaska the flowers bloom from May to the middle of July and plants fruit in August (Hall, 1995).

*Vaccinnium caespitosum* Michx., detail of flower of bog blueberry.

—PHOTO BY MARY ELLEN (MEL) HARTE, WWW.FORESTRYIMAGES.ORG

### Uses:

The main commercial use for bog blueberry is the same as the other species of *Vaccinium*. The production of jams and jellies from a mixture of these and the other blueberries found in this region can be sold for comparative prices to what the blueberries of the interior and the Kenai Peninsula are sold for. Cleaned berries sell for $6.60 per kg ($3.00 per lb) and uncleaned berries can sell for $3.30 per kg ($1.50 per lb) (Reed, pers. comm., 1996). There are numerous cultivars of blueberry that can be sold as ornamentals or garden plants. The bog blueberry in particular, forms an attractive ground cover (Trimenstein, 1990b) and was first cultivated in 1823 (Crossley, 1974).

Wildlife utilize bog blueberry with other species of blueberry. Many bird and small mammal diets include the fruit of this plant. Grizzlies and black bears are known to thoroughly utilize bog blueberry. In fact, tests have shown a moderate correlation between the reproductive success of black bears and the size of the blueberry crops. The low-growing form of this plant provides minimal cover for large mammals, but smaller mammals and bird can hide and nest within the thickets (Trimenstein, 1990b).

The spreading root system of the bog blueberry can presumably aid in preventing erosion on some sites. Its value is greater for long-term stabilization than for short-term remedies (Trimenstein, 1990b).

### Ecology:

Bog blueberry gains it name from its affinity for wet meadows, bogs, and poorly drained forest sites where it commonly grows, but it also appears in alpine areas above treeline (Hall, 1995). It is known to appear along riverbanks and near snowbanks as well. It commonly grows on moist subalpine or alpine slopes and on mossy forest floors where it usually becomes a low, nearly continuous, layer. It is particularly abundant on flat terraces, benches, or basins subject to frost (Trimenstein, 1990b).

This blueberry grows well in medium to coarse, well-drained, granitic soils. Like other *Vaccinium*, it prefers acidic soils and can grow on infertile sites with few of the essential elements. Bog blueberry prefers soils with a pH from 5.5 to 7.0. Bog blueberry extends throughout the subalpine and well above timberline (Trimenstein, 1990b).

## Propagation and Management:

The bog blueberry can be propagated from seed or through vegetative means. To collect seed and propagate, follow the instructions for the previously discussed blueberries unless specific information for the bog blueberry is given. When cold stratified outdoors for 83 days, 33 percent of the seeds germinated within 169 days, the first emerging in 28 days. Only 9 percent germinated in 252 days without cold stratification (Trimenstein, 1990b). Seeds showed a 96 percent germination capacity. The seedlings first began to emerge after one month and continued to emerge for several weeks after that (Crossley, 1974).

One study stated that the bog blueberry in particular could be propagated from soft or ripe wood cuttings collected in July or August that were inserted into a framed peat-sand bed. These should be shaded and then were ready to plant in the spring or in September if placed into a shady spot (Trimenstein, 1990b).

The bog blueberry can often survive clearcutting followed by a broadcast bum, but more severe scarification of the site may severely damage the rhizomes. Trampling by berry pickers and recreationalists is not too damaging to this moderately resistant shrub. Site preparation should avoid soil compaction and any type of burning technique that causes extremely hot fires; eliminating site preparation all together may be the best plan to promote the most rapid regrowth (Trimenstein, 1990b).

### CLOUDBERRY, *Rubus chamaemorus* L.

**Other common names:** salmonberry, knotberry, bake apple, baked apple-berry, ground mulberry, akpik

Abundance=9 Value=5 Rank=6

## General:

This perennial herb originates from extensively creeping woody rootstock and forms erect flowering stems up to 20 cm (8 in) tall. The leaves are not divided into leaflets and one to three will form for each stem. They can be round to kidney shaped and are more or less five-lobed (Pojar and Mackinnon, 1994). The leathery leaves are palmately lobed and veined with sharply saw-toothed margins. The showy flowers are solitary with five broad petals and five hairy sepals. Male and female flowers occur on separate plants; flowering occurs from May to June (Hall, 1995). The white flowers are 1-2.5 cm (0.4-1 in) across. The fruits are raspberry-like drupelets that first have a reddish tint, later turn amber, then are yellow when mature. It is reported to have a baked-apple taste (Pojar and Mackinnon, 1994) or by some, more of a rotten-apple taste (Robuck, 1985).

***Rubus chamaemorus*** L., known as cloudberry or salmonberry.

—Jim Gaither, Yukon Delta National Wildlife Refuge, US Fish & Wildlife Service

In southeast Alaska the fruits develop in July and August (Coladanta, 1993).

## Uses:

Many of the *Rubus* species are cultivated for either their fruit, flowers, or foliage. They are also beneficial to wildlife and the watershed environment (Brinkman, 1974). This fruit, while said to be an acquired taste, can be used commercially in jams and jellies. It has two and one-half to three times more vitamin C by weight than oranges (Robuck, 1985). Fruit is the most profitable product, but several noncommercial uses include the edible flowers and leaves; the juice is said to remedy hives; and cloudberry is a prime groundcover for shady areas of the home garden (Schofield, 1992). In Scandinavia cloudberries are commercially bottled whole in syrup or water, or as a liqueur. They could also be cultivated for commercial production. The berries do spoil quickly, so the must be processed without delay (Walsh, 1986).

## Ecology:

Cloudberry is common throughout Alaska in bogs, meadows, and alpine areas (Hall, 1995); some sources only recognize it at lower elevations (Pojar and Mackinnon, 1994). The plant can tolerate the moist conditions of peat or tundra, as well as open forests (Schofield, 1992). Cloudberry is shade tolerant, and in bog flats it is one of the first species to establish after thick sphagnum cover. It is more common on wetter sites (Coladanta, 1993).

## Propagation and Management:

While there are nearly 400 species of *Rubus*, only a few are difficult to propagate. The growth habit for each species will dictate the particular treatments (Sheat, 1948). Cloudberry reproduces primarily through vegetative means with rhizomes, but also has been propagated by seed (Coladanta, 1993).

Naturally, the plants spread from layering, although seed propagation also is common. The ripe fruits should be picked from the vine by hand and than allowed to fully ripen. The seeds can than be separated by macerating the fruit in water and skimming off the pulp while the seeds settle out. The water should be changed several times to clean the seed thoroughly. The seed should then be dried before storage. They are known to keep for several months at 5°C. Most *Rubus* species require a minimum of warm stratification (30°–20°C) for 90 days followed by cold stratification (36°–41°F.) for 90 days. Improved germination on raspberries and blackberries was noticed when the seeds were scarified for 20-60 minutes with sulfuric acid or for seven days with 1-percent sodium hypochlorite before they were subjected to stratification. Fall sown seed does not require the cold pretreatment. Once the seed has been treated, it can be tested in sand or in a germinator, alternating from 20°C to 30°C for 30–60 days. The best germination occurs when stratified seed is sown in late summer or early fall. The sown seed should be covered with 0.3–0.5 cm (0.1–0.2 in) of soil. Winter mulching reduces soil drying and freezing (Brinkman, 1974).

## HIGHBUSH CRANBERRY, *Viburnum edule* (Michx.) Raf.

**Other common names:** squashberry, mooseberry, few-flowered highbush cranberry

Abundance=6 Value=7 Rank=7

### General:

The highbush cranberry is a deciduous shrub that grows from 0.6 to 3.5 m (2-11 ft) tall. The bark is a smooth gray; the thick twigs have rings at the nodes and a white pith (Hall, 1995). The bark is at times reported as reddish, and rhizomes are present. The leaves are opposite and shallowly three-lobed with teeth, and the underside is often hairy (Pojar and Mackinnon, 1994). There are three main veins on the leaves, and the tips of the lobes are pointed. It flowers in Alaska from May to July with terminal clusters on short lateral twigs. The clusters have several to many short-stalked flowers with white petals (Hall, 1995). The clusters are 1–3 cm (0.4–1.2 in) wide. The fruit appears in clusters of three to five berry-like drupes. These fruits are 1–1.5 cm (0.4–0.6 in) long and contain one seed (Pojar and Mackinnon, 1994) which is rounded and flat. In Alaska the fruit ripens from July to September (Hall, 1995).

### Uses:

The highbush cranberry has what is considered by many an unfavorable taste when raw, but cooking greatly improves its flavor so the fruit can be processed into a delightful preserve. For high-quality jams and jellies, the fruit is best harvested just before it fully ripens and is still somewhat green (Schofield, 1989). On the Kenai Peninsula, the fruit is purchased for $3.30 per kg ($1.50 per lb) to be used in commercial production of jams (Eden, pers. comm., 1996). The fruit can also be processed into a sauce that is well suited for use on wild and domestic meats. Quality wines and liqueurs have also been made that could have commercial value (Schofield, 1989).

***Vibernum edule*** (Michx.) Raf., highbush cranberry, showing detail of berries and leaves.

—PHOTO BY DAVE POWELL, USDA FOREST SERVICE, WWW.FORESTRYIMAGES.ORG

The fruits are also important to wildlife. They are consumed by many small mammals, game birds, and songbirds, as well as black and grizzly bears. The foliage is also browsed by rabbits, beaver, and the hare. Both black and grizzly bears eat the fruits as well. The plants, an important component of forest edge and hedge row habitats, provide hiding and thermal cover to small mammals and birds. Highbush cranberry is also cultivated as an ornamental shrub for its brilliant red autumn foliage (Matthews, 1992d).

The plant has little known value for the rehabilitation of disturbed and contaminated sites. It was included in a study on oil sands reclamation, but no results for the species were reported; for this purpose, demand for the species is low (Matthews, 1992d). This species is sometimes confused with the more popular species *Viburnum trilobum*, which is also called the highbush cranberry.

### Ecology:

The highbush cranberry is found throughout Alaska, except on the Aleutian chain and the extreme coastal plains (Hall, 1995). It grows in moist forests and forest edges, thickets, rocky slopes, river terraces, stream banks, and on the rocky coast in Alaska (Pojar and Mackinnon, 1994). It can also occur in swamps and bog margins. In British Columbia it is found from sea level to 1500 m (4,900 ft). It shows a high tolerance for frost and an ability to grow in cool soil and air temperatures. In most climates, highbush cranberry grows on submesic and subhydric soil. While it can be found under a deciduous or coniferous canopy, it prefer full sunlight. Highbush cranberry is moderately shade tolerant and is important throughout all stages of forest succession (Matthews, 1992d).

The best growth is seen on well-drained alluvial soils with textures of clay, silty clay, sandy clay loam, and fine loam. It is found on luvisols, brunisols, humo-ferric podozols, regosols, and gleysol soil types (Matthews, 1992d).

Highbush cranberry shows varying responses to overstory removal, but in general it is thought to have a slightly lower or constant frequency and cover percentage for the first few years after overstory removal. On favorable sites, vigor may increase. Because this shrub is a seedbanking plant (one that deposits large amounts of seed into the overlying organic material for future regeneration), mechanical site preparation favors the germination of buried seed, provides site for fresh seed to germinate, and can cause sprouting from the damaged root stocks and stem bases (Matthews, 1992d).

## Propagation and Management:

In the wild, highbush cranberry reproduces both sexually and through vegetative means. It can fruit at approximately five years of age, then produces large quantities for nearly every year after that. The seeds are spread by birds and mammals that consume them, and germination is usually delayed until the second year. Germination takes place in two stages: the first shows hypocotyl germination and root development; the second shows epicotyl germination and shoot production. This is best accomplished when a warm period is followed by cold stratification (Matthews, 1992d). Natural layering and sprouting from damaged root stocks, stem bases, and stumps can also enable the plant to colonize new areas. While the plant has rhizomes, there is no real evidence that the parent spreads through root suckers (Matthews, 1992d).

The seed should be separated from the pulp, dried, and stored at temperatures just above freezing (Densmore, 1974). Clean seed that has been air dried can last up to 10 years without loosing viability (Matthews, 1992d). Seeding can be done through broadcast methods or sown onto beds and mulched with sawdust or sown with drills and mulched with straw. Those grown in nurseries may need shading in certain locations. The best germination will occur on fertile moist soils that are slightly acidic. Dormancy can be broken when the seed is exposed to temperatures from 5–20°C after an initial warm period. The radicle begins its growth in the first warm period and then the cold treatment breaks the dormancy for the plumule, which begins its growth in the second warm period. After that, germination should take place after 50 days of exposure to warm temperatures (Densmore, 1974).

Vegetative propagation can be done from hardwood or softwood cuttings, although the softwood less successfully produces roots. The softwood will root more readily in sand than perlite, and the rooting success of both types of cuttings can be increased with the use of Inodule-3-butyric acid. Rhizome cuttings can also successfully produce roots when planted immediately after fall collection, or cuttings can be collected and stored over winter. Survival was increased when they were treated for several months at 4°C (Matthews, 1992d). Cuttings are best taken late in the growing season from semi-hardwood stems of one year old or new growth (Holloway, pers. comm., 1996).

*Empetrum nigrum* L., crowberry.

—PHOTO BY GERALD AND BUFF CORSI, © CALIFORNIA ACADEMY OF SCIENCES

## CROWBERRY, *Empetrum nigrum* L.

**Other common names:** blackberry, mossberry, black crowberry, curlewberry

Abundance=7 Value=6 Rank=7

## General:

Crowberry is a low and creeping evergreen shrub that forms a dense mat to 15 cm (6 in) tall. There are horizontal stems with numerous branches. The leaves are crowded in a whorl of four or occur alternately. These linear leaves have margins that roll under and spread (Hall, 1995). They are commonly 3–7 mm (0.01–0.07 in) long and are minutely glandular and hairy. The underside has a distinct groove. The flowers appear crimson and inconspicuous (Pojar and Mackinnon, 1994). The flowers bloom in June and form alone in the upper axils with bracts, sepals, petals, and stamens all appearing in groups of three. The stamen is much longer than the petal (Hall, 1995). At times, male and female flowers appear on different plants. The fruit is a juicy and black berry-like drupe (Pojar and Mackinnon, 1994). The fruit has large reddish brown seeds; it ripens in Alaska in August (Hall, 1995).

## Uses:

The crowberry is used in jams and jellies; beer or sparkling wines can be made from the juice (Hall, 1995). Berries are reportedly best harvested after the first frost has sweetened the fruit. If they are picked before the frost, they can be placed in the freezer to achieve the same effect. They are often used with other berries to fill in when somewhat more preferable berries are not produced in large enough quantities (Schofield, 1989). Commercial producers in Alaska buy these berries from harvesters for $2.20 per kg ($1.00 per lb) (Eden, pers. comm., 1996).

There are also many noncommercial uses for this beneficial plant. Forty species of songbirds, waterfowl, and upland game birds use the fruit as winter forage because it persists on the plant throughout the winter. It is also a large part of the red-backed

vole diet. The berries are eaten by bears year round; they make up 5.9 percent of scat volume in the spring and 12.9 percent in the fall. There is little use of this plant for rehabilitation, but it is known to catch wind blown soil and incorporate it where it grows in areas of high wind exposure (Matthews, 1992a).

Crowberry is also used in a number of traditional medicinal preparations. They are used to treat colds, kidney troubles, and tuberculosis. At times they are even used for sore eyes and to reduce cataracts (Schofield, 1989).

## Ecology:

Crowberry is widespread in Alaska from sea level to alpine elevations on bogs and moist rocky slopes (Hall, 1995). It occurs on such habitats as sphagnum moss, rock fields, conifer forests, coastal bluffs, and on sea cliffs exposed to salt spray. Crowberry can tolerate a range of soil moisture but is intolerant of prolonged waterlogging. It often is found in areas exposed to winds, fog, and salt spray. These different site characteristics will influence the growth form of the plant. In areas of high wind exposure the plant grows many branches and is prostrate. On wetter sites, plants are sparsely branched and have long annual growth increments. In dry areas, branching shoots are rather bushy (Matthews, 1992a).

Crowberry exists in sandy to rocky soils, glacial till, and alluvial deposits. Soil pH where this shrub is common ranges from 2.5 to 7.7 and the sites may be established on mineral soil that is nutrient rich or stagnant. It is also thought of as an indicator of nitrogen poor soils (Matthews, 1992a).

Crowberry is a pioneer on sandy blowouts; dry, lichen-covered depressions; on eskers; and in avalanche areas. It is more often however associated with seral or climax communities. It is common or abundant in areas that have not been subject to recent fire (Matthews, 1992a).

## Propagation and Management:

This shrub can reproduce both vegetatively and from seed. The crowberry is classified as polygamous, dioecious, and even monoecious in some areas, producing a drupe that contains 6-9 nutlets. The flowers are pollinated by wind. Bisexual flowers are rare, and in the Arctic there are more hermaphroditic than unisexual flowers. The seeds are naturally dispersed by birds and mammals, but seedling mortality is considered quite high. Unstratified seed does not germinate, but seed stratified for 2–3 months at 5°C showed an 85 percent germination with half of the seeds germinating before 25 days. Seed can be sown outdoors in October or in spring in a peaty mixture, but they may take up to two years to germinate (Matthews, 1992a).

Sprouting from the underground or basal portions is this plant's main form of reproduction. There are also roots that form from the branches when they come in contact with the ground. Propagation is also possible through cuttings of nearly ripe wood in the late summer, or from young shoots collected in the spring. Both types of cuttings should be heeled in peat-sand mixtures, and rooting hormone should be applied (Matthews, 1992a).

*Oplopanax horridum* (Sm.) Miq., or devil's club. This photo clearly shows the long sharp spines that inspired the plant's name.

—PHOTO BY STAN SHEBS, GNU FREE DOCUMENTATION LICENSE, WIKIMEDIA COMMONS, HTTP://COMMONS.WIKIMEDIA.ORG

## DEVIL'S CLUB, *Oplopanax horridum* (Sm.) Miq.

**Other common name:** Alaska Ginseng

Abundance=6-7 Value=8 Rank=5

## General:

This common shrub forms erect to sprawling thickets 1–3 m (3–10 ft) tall. There are few branches, but plants are often crooked and armed with many yellow spines up to I cm (0.4 in) long. The wood has a sweetish odor (Pojar and Mackinnon, 1994) and white pith. The leaves are palmately veined and have sharp points. The lobes are sharply toothed and irregularly shaped. There are only a few leaves (Hall, 1995) but they are quite large, up to 35 cm (14 in) across with 7–9 lobes. Pyramidal terminal clusters of white flowers have numerous individual compact heads (Pojar and Mackinnon, 1994). The flowers are erect and cone shaped with nearly no stalk and minute sepals. The fruits are numerous bright red berries that normally contain one to two seeds. They are known to persist on the plant over winter (Hall, 1995).

## Uses:

This plant is best known and has the most commercial potential for its taxonomic relationship to Siberian ginseng,

which is noted for its body-balancing and system-strengthening qualities. Ginseng is ingested for general wellbeing, colds, arthritis, black eyes, gallstones, ulcers, constipation, and diabetes (Walsh, 1986). Walsh states that devil's club has an underdeveloped market suitable for cottage industry development. In Virginia, another relative of the Siberian ginseng is harvested in the wild and sold for $1,000 per kg ($450 per lb) (Food and Agriculture Organization, web page, 1996). While there is currently not much of an established market in botanicals for devil's club under its common name, it has a greater potential if marketed as Alaska ginseng. Industries that manufacture products with ginseng can use this variety as a substitute for the more commonly sought after source. This fact could make it profitable for export. Plant collectors require protective gear from head to toe because devil's club spines are known to enter the skin, where they commonly fester. When the roots are being collected, it is best to grab the stalk at the base and gently pull until the root begins to be exposed and then grab further down to pull more of the root out. Continue doing this until the entire root is exposed. Occasional taproots too difficult to remove can be broken off and left in the ground. It is best to concentrate on the long, straight sections with a diameter of 1.3 cm (0.5 in) or larger, leaving the more gnarled clubs (more difficult to peel and clean) to regenerate the area. For a premium product, the root bark should be peeled off with a knife; for commercial grades it can be left on. This is then placed on screens to dry. The commercial quality roots will be mechanically chipped later (Walsh, 1986).

This plant has long been a highly valuable species in the cultures of many native groups in southeast Alaska for both medicinal and cultural reasons. Some people eat the new greenery before the spines harden and make it unpalatable. Externally it is used to treat boils, toothaches, skin irritations (like those caused by contact with this plant), and to reduce swelling from a fracture. It is also used in several cultural displays and shamanistic rituals (Schofield, 1989); one of which includes surviving on nothing but devil's club for one to several weeks (Walsh, 1986). In areas outside its normal range, there is somewhat of a market for its sale as an ornamental (Schofield, 1989), but its leading use and the only market that is in existence for it is as a botanical (Thomas, 1993).

Devil's club, while not a preferred plant for browsing, is eaten by bears, deer, and populations of the Roosevelt elk herds. It also provides hiding, escape, and thermal cover for various birds and rodents. The bear nibbles the plant while fishing on the stream bank. On these banks, devil's club is also thought to be beneficial to the salmonoid fisheries and their eggs (Howard, 1993).

## Ecology:

Devil's club commonly inhabits moist woods where the climate is wet but soil is well drained, allowing water to flow through the root zone. It is also common along steams and in avalanche tracks (Pojar and Mackinnon, 1994). Bottomland forests, the bases of cliffs, forest edges, and under alder or salmonberry thickets are typical locations, as are subalpine Mountain hemlock zones (Hall, 1995). Its elevational range for southeast Alaska is from sea level to 520 m (1,700 ft). Devil's club is a wet site indicator and is reported to be drought intolerant. It occurs on variable aspects in soils that can be sandy, loamy, or silty in texture. These soils are commonly derived from quartzite or from fluvial, colluvial, glacial, acustrine, or morainal deposits. They are generally acid and were measured at a pH of 3.8 in the Sitka alder-devil's club forest type of southeast Alaska. Devil's club is moderately shade tolerant and is primarily found in the understory of late seral, climax, or old-growth forests. Densities in Sitka spruce-western hemlock stands of southeastern Alaska change depending on amount of cover from 0 kg (0 lb) dry biomass per acre on clearcut sites, 0.04 kg (0.09 lb) dry biomass per acre in young stands (30–100 yr. old), 2.2 kg (4.8 lb) dry biomass per acre in mature stands (100-250 yr. old), and 1.3 kg (2.9 lb) dry biomass per acre in old growth forests (250+ yr. old) (Howard, 1993).

## Propagation and Management:

This plant is propagated from seeds from a drupe, by suckers, and from root cuttings (L.H. Bailey Hortorium, 1976). It is usually treated as a weed and not encouraged where it commonly grows (Schofield, 1989). Seedling growth is reportedly slow and its vegetative means of reproduction are not known, but has been speculated to be from rhizomes and layering. The species is listed as a root crown sprouter (Howard, 1993).

### FIREWEED, *Epilobium angustifolium* L.

**Other common names:** willow herb, great willow-herb, rosebay willow-herb, willow-weed, common fireweed, perennial fireweed, narrow-leaved fireweed, blooming Sally, wild asparagus

Abundance=8 Value=6 Rank=6

## General:

Fireweed is a perennial herb that spreads from rhizome-like roots. The leafy stem is most commonly unbranched and often turns purplish at the tip and grows short hairs (Pojar and Mackinnon, 1994). The plant can grow to 2 m (7 ft) tall in various locations throughout its range (Pavek, 1992). The hairless leaves are alternate, lancelet shaped and acute. The underside appears paler and is distinctively veined (Hall, 1995). These stalkless leaves grow 5–20 cm (2–8 in) long. The stalked flowers are colored rose to purple and are quite large (2–4 cm (1–2 in) across) (Pojar and Mackinnon, 1995). Flowering usually occurs in southeast Alaska from July to August (Hall, 1995). Many flowers, often more than 15, form in long clusters along the terminus of the plant. The fruits are four-chambered pod-like capsules colored green to red and 4–9 cm (2–3.5 in) long. Each of these opens to release hundreds of fluffy white seeds (Pojar and Mackinnon, 1994). The capsules are often covered with short, soft hairs (Hall, 1995).

## Uses:

Fireweed is used commercially as a botanical, for ornamentals and potpourri in the greenery and floral business, and for weaving and dying materials (Thomas, 1993). It is used noncommercially for teas that are made from its leaves and flowers in folk remedies for conditions ranging from constipation to whooping cough and asthma. It is a floral emblem in Canada and many use it as a garden ornamental to attract bees. Fireweed also has a number of edible portions that have been gathered by recreationalists and survivalists alike. The wealth of this prolific herb in nutrition, beauty, and health are great (Schofield, 1989). The color of the flowers make it valuable for the manufacture of potpourri and it is in high demand in Europe for its botanical uses. When the flowers are gathered it is important not to gather the long and slender seed pods, because they will release all of the sticky seed when the flowers are being dried. They must also be dried quickly to preserve their color (Walsh, 1986).

Wildlife also benefits from fireweed. Ungulates such as the black-tailed deer commonly browse on this plant. Fireweed is also used for revegetation of mined lands throughout the northwest. It is also used to protect ground cover on disturbed sites such as logged areas and roadways. Fireweed has been known to survive diesel fuel on its foliage, but not on the root system. Fireweed can be used as an ornamental, but can quickly become an aggressive weed (Pavek, 1992).

Fireweed can overtop conifer seedlings and persist for ten years or more. It shows better adaptation to boreal and alpine sites than to coastal regions. Disturbance performed on the forest floor by a V-blade and a brush rake can increase fireweed density (Pavek, 1992).

## Ecology:

Fireweed is common in moist to dry areas with recent disturbances. These include clearings, roadsides, meadows, thickets, lake shores, river bars, and especially on recently burned areas (Pojar and Mackinnon, 1995). This species is known for its renewal qualities and "No soil is too thin, poor or unlikely for fireweed" (Dawson, 1980). It often grows in dense patches and invades from persistent underground roots (Pavek, 1992).

Fireweed grows in soils ranging from clays and clayey loams to sandy loams or on nonweathered parent material. The organic matter content may be low or very high and peaty. Soil pH may affect plant fertility; soils with a pH of 3.5 produced 80 percent less seed than soils with a pH of 5. However, fireweed also grows on soils with a neutral pH. This plant is one of the first to appear in the seedling/ herb stage of succession and may also act as a pioneer species on glacial moraines, establishing with willows; or on exposed gravel, sand, or silt bars (Pavek, 1992).

## Propagation and Management:

Fireweed can be propagated from seed or division and spreads rapidly from the creeping root stock. Propagation has also been done with rhizome cuttings. While one source said that germination is not enhanced by outdoor cold treatment,

*Epilobium angustifolium* L., or fireweed, growing near the offices of the School of Natural Resources and Agricultural Sciennces.

—PHOTO BY DOREEN FITZGERALD, AFES FILE PHOTO

a one-month cold stratification was shown to improve germination in another study. A 90-day stratification of the seeds is needed, or they can also be sown outdoors in the fall. Most seeds that are collected lose viability after 18 to 24 months. Their optimum germination occurs in warm, well-lighted, and humid conditions. One hundred percent of newly collected seed germinated within ten days of collection. The seeds gathered in August and September will produce blooming plants the second year. These prolific seeders may produce 80,000 seeds per plant in one year (Pavek, 1992).

Vegetative reproduction occurs by rhizome spreading within dense colonies. The new shoots grow rapidly and bloom within one month. Root cuttings can also be used for propagation. They should be placed in sandy loam at a 45° angle. These colonies rapidly disperse their own seed to facilitate their expansion (Pavek, 1992).

# MOUNTAIN HEMLOCK, *Tsuga mertensiana* (Bong.) Sarg.

**Other common name:** black hemlock

Abundance=8 Value=5 Rank=7

## General:

The mountain hemlock is a small to large evergreen tree that grows 15–30 m (49–98 ft) tall and 25–80 cm (10–32 in)

*Tsuga mertensiana* (Bong.) Sarg., mountain hemlock.

—PHOTO BY TIMOTHY D. IVES

in diameter, except in peat bogs or at high elevations, where it is a shrub. Mountain hemlock boles taper markedly when grown in the open, displaying a narrow crown of drooping to horizontal branches (Hall, 1995). The branches tend to have an upward sweep at the ends. Needles are equal in length (1–3 cm (0.5–1.2 in) and bluish green. Both the upper and lower surfaces are covered with stomata. Needles grow in all directions and the sprays are not flattened (Pojar and MacKinnon, 1994). The upper surface of the needles is flattened; the lower is rounded or angled. The lower branches that are concealed by the canopy may appear as though the needles are two ranked. The cones are stalkless and usually hanging down. They are purplish-brown with many thin papery scales (Hall, 1995), which become more brown at maturity. The cones are 3–8 cm (1.2–3.2 in) long (Pojar and Mackinnon, 1994). This tree is slower growing and appears more bluish than its counterpart, the western hemlock (Hall, 1995).

## Uses:

Mountain hemlock is utilized for wood products, often harvested and marketed with western hemlock (Pojar and Mackinnon, 1994). Mountain hemlock, however, has two nonwood uses that are commercially marketable: its cones and the foliage. The cones are of greater importance than the foliage for economic development (Thomas, 1993).

The cones of hemlock are the preferred cone for use in the manufacture of potpourri. They have an attractive shape and are lightweight. In 1991, cones were selling for $3.33 per kg ($1.50 per lb). The foliage is used in floral wreaths and flower arrangements and sells for $0.28 per kg ($0.13 per lb) (Thomas, 1993).

Mountain hemlock also provides good hiding and thermal cover to a variety of wildlife. Deer in Alaska use stands of this hemlock in the summer because of the large amount of forbs available in the understory. There is even some evidence that crows and grouse eat hemlock (Tesky, 1992b).

Mountain hemlock is also important to watershed protection. Plant associations based on hemlock that are common in Alaska are important because they capture snow and runoff for plant use (Tesky, 1992b).

This hemlock is also used as an ornamental for landscaping in the Pacific Northwest. Its slow growth and attractive form make it an ideal garden conifer. This same species is also used for this purpose in Great Britain (Tesky, 1992b).

## Ecology:

In southeast Alaska this tree grows on boggy areas, coastal forests, and mountains (Hall, 1995) but is most often found associated with wet sites with deep organic soils. Often it is more prominent at lower elevations than the more alpine areas (Pojar and Mackinnon, 1994). Commonly it is found on cold, snowy subalpine or boreal sites, where it grows slowly with a lifespan up to 800 years. Pure stands are uncommon, except in areas of Alaska and British Columbia. Within the coastal region, it is better adapted and more common than western hemlock in colder climates with great snow depths. Moderate to high precipitation is needed as well. In Alaska it grows from sea level to 1,050 m (3,500 ft). Mountain hemlock is a shade tolerant species that is also a known pioneer of glacial moraines in Alaska (Tesky, 1992b).

Soils can be derived from a host of parent materials, but on calcareous parent materials mountain hemlock is rare or shows stunted growth. In Alaska it is found mostly on organic soils and the best development is on loose, coarse textured, well-drained soils with adequate moisture. In British Colombia it grows thick on very acidic organic matter and decayed wood. Minimal nutrients are required and the desired pH is between 3.4 and 5.0. In coastal areas it can even grow on the rockiest soils if enough moisture is present (Tesky, 1992b).

Mountain hemlock is very frost tolerant but is susceptible to windthrow because of its shallow roots. The loss of mountain hemlock is becoming more important in areas of Alaska as timber harvest of this species continues (Tesky, 1992b).

## Propagation and Management:

Mountain hemlock can reproduce by seed or through layering. At twenty years of age it can begin producing cones. It will produce cones every year with a large crop of cones every one to five years. Layering is an important form of

natural reproduction for this species in Alaska on muskegs and khrummolz areas (Tesky, 1992b).

The cones of mountain hemlock become ripe in Alaska in August. Before they ripen, they appear yellow-green, then turn brownish when mature. Hemlock cones are small and somewhat difficult to harvest. While most easily collected from the tops of trees that have been felled during harvest, they can also be harvested by using ladders, pole trimmers, and other types of climbing equipment. As with the collection of all cones, care must be used to ensure collection occurs before the seeds are released, unless they are not being collected for the seed (Ruth, 1974).

Handling for hemlock is similar to other conifers. Cones should be stored in open sided drying sheds until they are ready for processing. Green cones have a tendency to mold unless dried on screen surfaces and not in breathable bags. Good air circulation is necessary to minimize the buildup of heat and to prevent molding. Cones may also be placed in a warm room to pre-dry for up to 36 hours before using a kiln to thoroughly dry them. The pre-dry reduces the risk of exposing seed that is still saturated to high kiln temperatures that could damage seeds. Drying time in the kiln is about 48 hours at temperature of 30–44°C (Ruth, 1974).

Seed extraction is quite simple, although moldy cones may require repeated moistening and reheating to eventually get them to open and release the seed. The cones are tumbled and shaken during drying or right after they have been dried in the kiln. With the variation in time between good cone crops, seed storage is important to ensure regular seedling production. Mountain hemlock averages 253,500 viable seeds per kg of seed (114,060 viable seeds per lb of seed) (Ruth, 1974).

Seeds retain good viability for at least five years, providing some insurance against cone production variability. The long-term storage should include -18°C temperatures with a moisture content of 6–9 percent. Mountain hemlock should be stratified in moist sand for 60–90 days at 5°C or sown in the fall after collection (Ruth, 1974).

Seedling management in nurseries is not well known due to the lack of demand for these seedlings. They are easily damaged by excessive sun and due to their small size are susceptible to frost heaving. A spring sowing of stratified seed is often preferred to fall sowing. Seedlings are often germinated beneath burlap, which is removed after the radicle has penetrated the soil. The seedlings are then covered with a mulch of peat moss. At this young age, overfertilization can kill the seedlings. Seedlings are commonly held at the nursery for two or three years, spending their last year in pots after being transplanted from the germination bed (Ruth, 1974).

## WESTERN HEMLOCK, *Tsuga heterophylla* (Raf.) Sarg.

**Other common names:** Pacific hemlock, west coast hemlock

Abundance=10 Value=4 Rank=6

***Tsuga heterophylla*** (Raf.) Sarg., western hemlock, valued for its timber, cones, and ornamental quality.

—PHOTO BY J.E.(JED) AND BONNIE MCCLELLAN, © CALIFORNIA ACADEMY OF SCIENCES

### General:

Western hemlock is a large evergreen tree 30–50 m (98–164 ft) tall with diameters of 60–200 cm (24–500 in). They commonly have a slender and fluted trunk. The crown, composed of drooping or horizontal branches, appears short and narrow. The leader is curved downward. Twigs are reddish brown (Hall, 1995) and slender, often being roughened by the bases of the needles that have fallen. The bark is rough, scaly, and reddish brown. It becomes quite thick and furrowed on the older trees. The needles are short, flat, and blunt. Needles vary in length from 5–20 mm (0.02–0.08 in) and are irregularly spaced. They produce a flat and leathery spray. They appear yellowish-green on the top surface and whitish on the underside because of the two stomata lines. They are twisted at the base and appear two ranked (Pojar and Mackinnon, 1994). The stalkless cones hang down from the end of the twig. These small elliptic cones have many thin papery scales (Hall, 1995). The small cones, 2 cm (0.8 in) long, appear purplish-green when immature and light brown at maturity. Pollen cones are numerous (Pojar and Mackinnon, 1994).

## Uses:

Timber harvest of this species is extensive. Its wood is considered the "all-purpose raw material" and is used in many wood products from kitchen cabinets to railways (Tesky, 1992a). However, its cones can be collected without complete tree harvest and are commercially valuable. The cones of this hemlock are purchased for the same uses as the mountain hemlock. These cones also sell for $3.30 per kg ($1.50 per lb) (Thomas, 1993).

As with mountain hemlock, western hemlock is valuable hiding and thermal cover for large game. There are many small mammals that benefit from the understory that it promotes. Grizzly bears, squirrels, voles, and porcupines use this tree as food. The northern three-toed woodpecker uses western hemlock for nesting sites (Tesky, 1992a).

Western hemlock is used as an ornamental in Great Britain and can be planted in moist, nutrient-poor sites as pure or mixed stands. It is best mixed with Sitka spruce, alder (spp.), and Pacific silver fir. Natural regeneration is preferred to planted stock for rehabilitation of disturbed sites (Tesky, 1992a).

## Ecology:

Western hemlock is the most abundant tree species in southeast Alaska, occurring mostly in coastal forests (Hall, 1995). It grows from above tidewater to subalpine elevations (610 m, 2,000 ft) on the coast (Tesky, 1992a). It can grow on fairly dry sites but is more common on wet sites. It is also well adapted to growth in humus and decaying wood (Pojar and Mackinnon, 1994).

Mild and humid climates where frequent fog and precipitation occur during the growing season are needed to obtain the best growth. In areas that are less humid, the hemlock is confined to northerly aspecting slopes, moist stream bottoms, or seepage sites. It occurs on sites in Alaska that receive a mean annual precipitation up to 104 cm (262 in) and mean annual temperature of 0°C to 12°C on the coast and 2°C to 8°C inland. The frost-free period on the coast is less than 100 days to 280 days. In Alaska, it shows its best growth on moist flats and low slopes (Tesky, 1992a).

Western hemlock shows good growth on all bedrock materials within its range except serpentines. Sedimentary, metamorphic, and igneous materials do not inhibit growth. It is also found on most soil textures, but the inability of its roots to penetrate compact soils leads to a decrease in height growth on soils with high bulk densities or clay content. It does not grow well where the water table is less than 2.4 cm (6 in) deep. Seedlings grow best where the pH is 4.5 to 5.0 and trees are found on soils ranging from 4.0 to 6.3 pH. This hemlock remains highly productive even on soils with few nutrients but its productivity does increase with an increase in soil nitrogen (Tesky, 1992a).

Western hemlock is very shade tolerant and is considered climax species where it occurs either alone or with a few similarly shade-tolerant species. However, it can be found in all stages of succession; it can invade several stages of succession after a forest canopy has formed and is an aggressive pioneer because it grows quickly when exposed to full light and good seedbeds (Tesky, 1992a). It will not grow on sites with insufficient organic matter, such as recently deglaciated areas (Pojar and MacKinnon, 1994).

## Propagation and Management:

Western hemlock is known to reproduce through seed or by vegetative means. Cones may be produced on 20 year old trees in clearings. Good crops of cones are uncommon until the trees are 25 to 30 years old. Some cones are produced every year; large crops are seen every three to four years. The cones contain 30–40 seeds, of which 10–20 are viable. The seeds are quite small and light; there is an average of 135,000 seeds per kg of seed (260,000 seeds per lb of seed). Even hemlock trees in dense stands are known to produce good cone crops and even the seed from stunted trees will be viable. In a good cone year for southeast Alaska, a pure stand of western hemlock produced 91 pounds of seed per acre (Tesky, 1992a).

Western hemlock cones are harvested and processed for use in the same manner as mountain hemlock. Both seed extraction and seedling management are identical between the species. Western hemlock is different in that it prefers a 24–36 hour soaking prior to stratification to increase germination success. The viability of the seed can vary between 36 and 55 percent, the mean being 46 percent (Tesky, 1992a). Full descriptions of the other processes are found in the section on mountain hemlock.

Most seedling mortality will occur within the first two years; in British Columbia the main source of mortality was drought or frost. The seedlings are known to be very shade tolerant but are susceptible to heat, cold, drought, and wind. Growth the first couple of years is slow (a two year old seedling is commonly less than 20 cm (8 in), but once established, with good light it can grow 60 cm (24 in) each growing season (Tesky, 1992a).

Seedlings that have died back will commonly sprout from the buds near the root collar, but no sprouting occurs from the roots or the base of larger saplings. Western hemlock is also suitable for grafting; grafted material shows better growth than the rooted material (Tesky, 1992a).

## RED HUCKLEBERRY, *Vaccinium parvifolium* Sm.

**Other common names:** red huckleberry, red whortleberry, highbush red bilberry, red-berry huckleberry, red bilberry, red blueberry, red-fruit blueberry, tall red huckleberry, tall red bilberry, tall red whortleberry, huckleberry

Abundance=6 Value=8 Rank=4

## General:

Red huckleberry is an erect shrub, 1–3 m (3–10 ft) tall, with slender twigs that are shiny green and turn at strong angles or appear ridged. They often end in a narrow stub (Hall, 1995).

When young, the branches are smooth but they commonly become hairy with age. The leaves are alternate and mostly deciduous. Occasionally young leaves are toothed (Pojar and Mackinnon, 1994). Individual leaves are oval to elliptic and entire. The upper surface is green while the underside appears grayish. In Alaska this huckleberry flowers from May to June. Flowers are solitary at the base of leaves and are composed of five small waxy lobes (Hall, 1995). These greenish-yellow or pinkish flowers are bell or urn-shaped and are usually up to 5 mm (0.02 in) long. The fruit is a bright red round berry measuring 1 cm (0.4 in) across (Pojar and Mackinnon, 1994).

## Uses:

The berries are purchased commercially for use in jams and jellies or can be used to form a commercial dye (Thomas, 1993). This species falls into the confusing name game where there are several known names for this one species. As Underhill had written, "all (are) delectable additions to the outdoor larder." She points out red huckleberry as one to definitely seek out (1974). Berries are easily harvested by hand and 240 g (8.5 oz) are reportedly harvested in an eight minute time period (Trimenstein, 1990d).

Red huckleberry is also used as an attractive ornamental or garden plant and admired for its fall appearance with its reddish leaves and green stem. There has also been demand for marketing a variety of this berry producer that is well suited for commercial berry production (Trimenstein, 1990d).

Encouraging this shrub can benefit wildlife. It supplies forage to deer year-round and its berries are eaten by a variety of birds and mammals. Both black and grizzly bears typically exploit this berry. To manage this use, road closures and harvest seasons can be used to minimize human interference (Trimenstein, 1990d). Red huckleberry also provides cover for smaller birds and mammals to hide, rest, and nest (Crossley, 1974).

## Ecology:

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, in alder flats, and on lower mountain slopes. It apparently achieves its greatest abundance on mesic sites with a south aspect and slopes of less than 45 percent. It commonly grows on mossy rotting logs, snags, or stumps (Trimenstein, 1990d).

The soils are commonly derived from parent materials of serpentine, quartz diorite, diorite, and gabbro. This huckleberry requires acidic soils with a pH of 4.0 to 5.0 and can persist on infertile soils with low levels of essential elements. It commonly grows on nitrogen-poor soils. Commonly the soil is characterized by accumulations of duff and humus (Trimenstein, 1990d).

## Propagation and Management:

Red huckleberry can reproduce through seed or by vegetative means. The primary method of regeneration for most huckleberries seems to be through vegetative means, but red huckleberry seedlings play a fairly important role in regeneration. Seedlings are generally abundant wherever parent plants are found. Seed is usually produced in abundance with the average shrub in British Columbia containing 1,400 flowers annually. Nearly 90 percent of those flowers eventually set fruit. Tests showed that up to 25 percent of seeds would ultimately germinate in the wild (Trimenstein, 1990d).

*Vaccinium parvifolium* Sm., red huckleberry.

—PHOTO BY GERALD AND BUFF CORSI, © CALIFORNIA ACADEMY OF SCIENCES

No special treatment is needed for germination (Trimenstein, 1990d). In the absence of cold stratification, seedlings first began to emerge in one month and continue to emerge for several months (Crossley, 1974). Seed that was stored properly exhibited good germination with alternating temperatures of 28° and 13° C for 14 and 10 hours, respectively. Fresh seed also germinated well when treated at the same time and light intervals but with 22°C and 5°C for day and night, respectively. Seeds are naturally dispersed by many birds and mammals and their digestive processes may help to promote germination (Trimenstein, 1990d).

Seedlings are best established on thick and acidic forest floors that have a high capacity for holding water. Development on decaying logs is common and may provide the best establishment site. In wild stands, almost seven percent of all huckleberry seed will ultimately develop into healthy seedlings (Trimenstein, 1990d).

Vegetative reproduction by layering normally occurs from the branch or stem after damage by fire, mechanical removal, or browsing. Rhizomes account for clonal expansion even in the absence of disturbance, and sprouting from the roots is also reported but not well documented (Trimenstein, 1990d).

This huckleberry commonly persists after logging in conifer and mixed conifer-hardwood stands. It is also an important component of many different long-lived seral brushfields and after five years can effectively compete with conifer seedlings in the Sitka spruce-western hemlock zone. Post-logging scarification can damage these plants even though the plants are often restricted to areas of relatively disturbed soil (Trimenstein, 1990d).

*Vaccinium vitis-idaea* L., or lingonberry, in bloom.

—Margaret Williams. Courtesy of Nevada Native Plant Society. USDA-NRCS PLANTS Database, http://plants.usda.gov/index.html.

## LINGONBERRY, *Vaccinium vitis-idaea* (Lodd.) Hult.

**Other common names:** mountain cranberry, lowbush cranberry, dry ground cranberry, moss cranberry, alpine cranberry, shore cranberry, rock cranberry, lingen, redberries, red whortleberry, vine of Mount Ida, crowberry, partridgeberry, foxberry

Abundance=9 Value=8 Rank=1

## General:

Lingonberry is an evergreen and creeping shrub that forms dense mats on the forest floor 5–15 cm (2–6 in) tall. The rhizomes are slender, trailing, and light brown to yellow. Rooting occurs at the nodes. The wide and thick leaves are oval with a shiny green top, green beneath and spotted with short stiff green hairs. The edges of these leaves are slightly rolled to the under side. In June and July, one to several flowers form at the end of the twigs with a short stalk. The flower has four lobes and is bell shaped and pink. The fruit is a bright red berry (Hall, 1995).

## Uses:

This plant is widely used commercially across the state of Alaska to produce sauce, jam, and jelly. In 1986 it was reported that five tons are used each year to produce jams and jellies (Walsh, 1986). In the Pacific Northwest lingonberries are occasionally used as a substitute for commercially grown cranberries, although their flavor when raw is said to be much less appealing; this masks the potential of the cooked lingonberry (Underhill, 1974). There are also marketable liqueur products that can be manufactured from lingonberry (Schofield, 1989). In 1942 it was noted that considerable amounts of this fruit were imported into the United States and it has potential for more extensive commercial development (Trimenstein, 1991).

Other uses that are less substantial include its use as an ornamental ground cover (Trimenstein, 1991), and its folklore medicinal uses to treat bladder problems, gout, and rheumatism (Robuck, 1985). Arbutin, which is obtained from the leaves and stems, has been used by Europeans to treat intestinal problems (Trimenstein, 1991) and this may lead to another potential product for commercial sale (Walsh, 1986). Wildlife such as the black bear and the hare are known to browse this plant, while its fruit is consumed by other small mammals and birds. Migrating birds are especially known to eat the overwintered berries (Trimenstein, 1991).

Lingonberry is known to survive on extremely harsh sites, granting it consideration for use on sites with previously disturbed ground. Cuttings transplanted to disturbed sites have shown a survival ranging from 30 to 90 percent (Trimenstein, 1991).

## Ecology:

Lingonberry is commonly abundant in northern and interior Alaska but less so in the coastal forests of southeast. It occurs in bogs, alpine tundra, poorly drained forests, in loose mats in moist mossy sites, and in dense mats on dry rocky alpine slopes (Hall, 1995). It is common on exposed sites such as windswept crags, barren headlands, rocky ledges, and on scree slopes, sea cliffs, and mountain summits. In its northern range it can be common on both wet and dry sites, but can also occur on sand dunes or in peatlands, forest swamps, and bogs. It can probably persist indefinitely and reach climax if not shaded out by conifers (Trimenstein, 1991).

Lingonberry inhabits soils such as shallow, poorly developed mineral soil or a drained peat. It thrives on acidic sandy loams or loamy clays that are often of low fertility; they may have little calcium and may be high in decaying matter. Vegetative growth has been reported on sandy soils and in pHs ranging from 2.7 to 8.2, although the optimum pH range is thought to be 4.0 to 4.9. Soils may be characterized by low lime content and low base saturation. Known soil parent materials that support lingonberry are sandstone, gneiss, granite, and glacial sands and gravels (Trimenstein, 1991).

## Propagation and Management:

Lingonberry can be propagated vegetatively or from seed. Seedlings will first bear fruit at 3–4 years of age, but few flowers are reported until the plants are 5–10 years old. Plants may self pollinate or cross pollinate and they often utilize insects to do this. Fruit should be collected at the end of September for the most rapid germination. Seeds should be stored in the berry at near freezing temperatures. The soil should be unsterilized with high organic matter and low pH. Research by Holloway (pers. comm. 1996) indicates that anywhere from 0–45 seeds can be produced in each berry. The seed can naturally germinate on bare ground but only under the right conditions. Fresh seed shows the best germination. Germination declined from 76.5

percent to less than ten percent from fresh seeds to those that had been stored 12 to 16 months before planting. Laboratory Laboratory tests of air-dried seeds show that cold stratification for up to five months at 0° to 5°C promotes germination. Seeds typically germinated within three weeks. Natural seedlings are rarely seen around parent plants (Trimenstein, 1991).

Vegetative reproduction is of primary importance to wild lingonberry. It expands through rhizomes that may sprout singly or in groups of one or two per square meter. Large older clones may be separated into numerous daughter clones when influenced by fire, frost, or the animal burrowing of mammals. The rhizomes grow well in peat and also penetrate into mineral soil. Trailing or creeping stems can root at their nodes (Trimenstein, 1991). The evergreen plants can be rooted as semi-mature cuttings in early summer, or as hardwood cuttings in late winter (Anonymous, n.d.). Current and one-year-old wood can be collected for cuttings in autumn or in the spring just before bud break (Trimenstein, 1991).

Fruit production of any plant can be affected by its location as well as the genetic makeup of the particular clone. Little fruiting or flowering is ever seen in lingonberry plants growing in the shade, but those with full sun commonly produced an abundance of flowers and fruit. Poor fruit production is often linked to lack of pollinators, cold and damp weather during flowering, late spring frosts, or hail. Plants growing in peat produced more fruit than those growing on mineral soil. Experimental trials showed yields of 82 kg per 100 m2 (1.5 lb per yd2) on peat and 14 kg per 100 m2 (0.25 lb per yd2) on mineral soil. Temperatures of -1°C can kill 50 percent of all flowers and exposure to -3°C can destroy 50 percent of the unripe fruit and buds (Trimenstein, 1991).

Maximum yields in cultivated stands may reach 10,240 kg per ha (9,140 lb per ac) in Swedish peatlands and 630 kg per ha (560 lb per ac) in Finnish forests. Cultivated lingonberry shows more favorable response to fertilizer than do other *Vaccinium*, although application of fertilizer does not always increase fruit yield; little fertilizer is needed for good growth and development. Using too much of the fertilizer may promote vegetative growth at the expense of fruit production. Mulches such as milled peat can increase fruit production (Trimenstein, 1991).

## SHORE PINE, *Pinus contorta* var. *contorta* (Dougl.) Loud.

**Other common name:** lodgepole pine

Abundance=8 Value=5 Rank=7

## General:

Of the four botanical varieties of lodgepole pine *(Pinus contorta)* three are sometimes given the rank of subspecies, inlcuding shore pine, which occurs along the Pacific coast from Alaska to California. Shore pine is typically less than 5 m (16 ft) tall, while lodgepole pine (*Pinus contorta* var. *latifolia*) can be up to 40 m (130 ft). Hall (1995) describes shore pine as less than 6 m (20 ft) tall and lodgepole as being greater than 6 m (20 ft). Pojar and Mackinnon (1994) identified dwarfed coastal stands as shore pine (up to 20 m (66 ft)) and the inland species as lodgepole pine (to 40 m (130 ft).

*Pinus contorta* var. *contorta* (Dougl.) Loud., shore pine.

—photo © Br. Alfred Brousseau, Saint Mary's College

In southeast Alaska, shore pine is a low spreading or scrubby tree that is commonly 2-12 m (7-40 ft) tall, but up to 20 m (66 ft) is possible. Diameters can be from 20–70 cm (8–28 in) within this range (Hall, 1995). The trunk is often crooked or irregular and the crown appears "pillowy." The bark can be thick (2 cm (1 in) and dark brown or somewhat blackish. The needles of this conifer are in fascicles of two and often curved or twisted. The individual needles are 2–7 cm (1–3 in) long and a deep green (Pojar and Mackinnon, 1994) or sometimes tinted yellow. The cones are egg-shaped and almost stalkless. They are pointed backwards on the branch and open at maturity, irregularly, over the several years that they persist (Hall, 1995). The cones can grow 3–5 cm (1–2 in) long, and the scales are slightly curved and have a sharp prickle at the tip (Pojar and Mackinnon, 1994).

## Uses:

In the past there has been some utilization of the brittle and short-grained wood for fuel, which produces 8,730 British Thermal Units (BTUs) per pound (Cope, 1993). However, the greatest commercial potential of this plant appears to be in marketing its cones and foliage. Whole trees are used for Christmas trees in the northwest (Pojar and Mackinnon, 1994). Cones are bought for decorative purposes. They are an important product because they appear in such abundance; they can sell for $0.88 per kg ($0.40 per lb) in the Pacific Northwest (Thomas, 1993).

Seeds of the shore pine are an important food source for rodents, and porcupine eat the cambium. Shore pine cover is beneficial to bigger game, and in Alaska the yellowlegs use this species for nesting sites (Cope, 1993).

Because of the shore pine's ability to tolerate strong winds, salty conditions, and wet depressions, it has been used in California to stabilize sand dunes (Cope, 1993). Because of its

form and winter hardiness, it is also well suited for watershed stabilization and shelterbelt planting. The seedlings exhibit rapid growth (Krugman and Jenkinson, 1974), and they absorb excessive rainfall, regulating water flow (Cope, 1993).

## Ecology:

Shore pine grows on bogs, sandy glacial outwash, forest edges, and on beaches or near lakes from sea level to alpine areas. It is reportedly more common in the southern parts of southeast than the northern areas (Hall, 1995). This is a very adaptable tree that is tolerant of low nutrient conditions (Pojar and Mackinnon, 1995).

It grows best in a maritime climate that receives between 152–508 cm (60–200 in) of precipitation annually, mostly in the form of rain. In Alaska, shore pine grows from sea level to just over 1,525 m (5,000 ft) (Cope, 1993).

The shore pine can inhabit coastal dunes, seaside bluffs, and exposed rocky headlands, where it can tolerate the salt spray and strong winds. It is most commonly found on deep, poorly drained histosols, but also grows on inceptisols, alfisols, and ultisols. Better growth is also seen on loams with a pH of 5 (Cope, 1993).

This pine facilitates succession and commonly grows in areas that are unfavorable for its competitors because of windthrow and landslides. In bog woodlands, shore pine can be climax; although it is regarded as shade intolerant, it can reproduce below its own canopy (Cope, 1993).

Shore pine is also a known host to lodgepole pine dwarf and hemlock dwarf mistletoe, but neither is considered a great threat. The wet soils with thick organic layers favored by shore pine make road construction difficult and this should be avoided when possible (Cope, 1993).

## Propagation and Management:

The shore pine does not reproduce vegetatively; it is propagated from seed (Cope, 1993). Seed is collected from the ripe cones. In California, the cones ripen from September to October and disperse the seeds in the fall; this would occur earlier farther north. Some cones may persist on the branches and not release the seeds for several years. Shore pine matures and can produce cones in four to eight years, with good cone crops occurring every two years. The ripe cones are lustrous light yellow or yellow-brown, while the unripe cones are a purple-green (Krugman and Jenkinson, 1974).

This tree was first cultivated in 1855. It is best to collect cones from trees of superior growth and form. Though the larger cones do have more seeds, only cones with obvious diseases or insects are not collected. Widely spaced trees with large crowns produce the most seed, provided there is enough pollen for fertilization. A ladder can be used to collect cones by hand from the tree; they also can be gathered from animal caches or felled trees (Krugman and Jenkinson, 1974).

Dry cones as soon as possible after picking to avoid mold and internal heating that can reduce seed viability. They can be dried on a dry surface in the sun, on trays in a well-ventilated building, in hanging sacks protected from the rain, or in a kiln. Shore pine cones can be dried for 2–20 days in the open air (15–32°C) or in a kiln at a mean temperature of 50°C for 96 hours (Krugman and Jenkinson, 1974).

After the cones open, they can be shaken on screens to remove the seeds. Large machines are available. The wings of the seed are also removed by machine, but this should be done with care to avoid damaging the seed. Wings can also be removed by placing the seeds in a sack and shaking it, or by rubbing. Empty seeds can be separated out at this time by floating in water; the viable seeds will settle out and the empty seeds are skimmed from the surface. California studies found between 247,000 and 367,000 seeds per kg (111,000–165,000 seeds per lb). These can than be placed in cold storage (0–5°C) for up to 17 years with acceptable viability (50 percent) (Krugman and Jenkinson, 1974).

Fresh seed from the shore pine requires no stratification, but stored seed should be treated for 20–30 days at 0°–5°C (Krugman and Jenkinson, 1974). After 18 days, stratified seed had 86 percent germination; 51 percent of unstratified seed germinated (Cope, 1993).

Germination tests for viability should be done on top of blotter paper or in a petri dish at alternating temperatures of 20/30°C for 16 and 8 hours, respectively. Germination will occur in 28 days, and light for 7 to 8 hours may be beneficial in increasing germination (Association of Official Seed Analysts, 1981).

Shore pine can be successfully grown in a greenhouse on most soils that are fertile and have good drainage and aeration. Thirty seedlings can be grown per square foot. Seeds should be sown at a depth of 30 mm (0.125 in). Seedlings are often planted after their first year in the nursery. In most nurseries, fungicides are used to prevent damping-off and to control insects (Krugman and Jenkinson, 1974).

### SALAL, *Gaultheria shallon* Pursh

**Other common name:** Oregon wintergreen

Abundance=5 Value=8 Rank=7

## General:

Salal is a stiff, creeping to fully erect evergreen shrub, reaching one m (3.2 ft) in height (Hall, 1995). The shrub forms dense clumps due to vegetative propagation by layering and suckering (Pojar and Mackinnon, 1994). The twigs are scattered with hairs that are often gland-tipped but become hairless with age. They have a shredding bark that is reddish-brown. The large, stiff, and thick leaves often feel leathery (Hall, 1995) and are 5–10 cm (2–4 in) long. These alternate and evergreen leaves are sharply and finely toothed on the edges (Pojar and Mackinnon, 1994). The upper surface is shiny green with raised veins; the underside is a lighter green. The leaves have a sharply pointed apex and a short stalked base (Hall, 1995). Leaves commonly

only persist for two to four years; the twigs live sixteen years or longer (Trimenstein, 1990a).

From May to June, flowers form in long hairy glandular racemes, usually near the twig tips, and are pink with stiff reddish brown hairs (Hall, 1995). The flower stalks bend so that the 7–10 mm (0.03–0.04 in) long flowers are oriented in the same direction. Reddish brown to dark purple berry-like fruits (actually fleshy sepals), 6–mm (0.020.04 in) in diameter, surround the round seed capsule (Pojar and Mackinnon, 1994).

## Uses:

Salal is sold primarily in floral products and as a wild transplant. When it becomes dominant, it is beneficial to watershed protection and wildlife habitat, and is recommended for coastal and sand dune stabilization (Dimock et al., 1974). There is a potential commercial use for making oil of wintergreen to flavor other products (Trimenstein, 1990a). Sometimes called the "forgotten fruit," it lends itself well to commercial use because it is easy to collect. The entire cluster is gathered and processed into an exceptional jelly; wine makers use it to add aroma (but little flavor) to their products (Underhill, 1974). In Washington, up to 0.21 (0.44 pints) of the berries can be harvested in approximately eight minutes; heavily canopied areas may produce fewer berries (Trimenstein, 1990a).

While salal is collected year-round for use in floral industries, it must be properly inspected for leaf deformities, spots, and any kind of insect damage before harvest. The market calls for several forms and sizes of branches. The majority of buyers purchase a mixture of sprays and single stems that have at least five leaves on each individual stem. Stem length can range from 40–80 cm (16–32 in) depending on buyer preference. There is also a market for tips with a minimum of five leaves on a 7.2 cm (3 in) stem. The average price for large, loose cuttings is $1.30 per kg ($0.6O per lb); bunched cuttings bring $1.70 per kg ($0.80 per lb). The tips can sell for $0.45/bunch, each bunch containing 32 stems (Thomas, 1993).

Salal foliage is browsed heavily by back-tailed deer , and small mammals such as the beaver. The fruits are eaten by many birds and mammals, including squirrel and black bear. It is also a good source of cover for wildlife (Dimock, et al., 1974).

Salal spreads aggressively, making it well suited as ground cover on erosive banks, roadcuts, and other types of reclaimed ground. It is cultivated as an ornamental and used in landscaping, often to attract wildlife (Trimenstein, 1990a).

Production can be increased through different management actions. Increased growth occurs after timber harvest; heavy thinning can increase biomass by up to 2.8 times. Salal can compete heavily with conifer regeneration, most of this competition occurring within the soil rather than above ground. Nitrogen used by salal is not the deciding factor in competition with conifer seedlings, except on extremely poor sites. It has also been noted that heavy application of fertilizer can decrease aboveground biomass of salal (Trimenstein, 1990a).

*Gaultheria shallon* Pursh, salal in bloom.

— Photo by Brother Alfred Brousseau, courtesy of St. Mary's College of California. © St. Mary's College of California

## Ecology:

This understory shrub is common along the coast and on islands in southeast Alaska from Sitka to the Dixon Entrance. It can grow in poorly drained soils, but prefers well-drained western red cedar-hemlock forests. It also occurs in meadows, and on seashores (Hall, 1995). Pojar and Mackinnon (1995) reported it on rocky bluffs, in dry and moist coniferous forests, and on the seashore from low to medium elevations.

Salal can tolerate salt spray and is commonly found in dense stands on the coast. It is also common on sites that receive full sunlight. Timber removal increases its abundance, but it can also persist in more shaded areas. Salal grows on a variety of mineral and organic substrates, including shallow rocky soils, sand dunes, coarse alluvium, glacial till, and peat, but it does best on moist sandy or peaty soils where it will take the form of upright shrub. It will grow on nutrient poor to moderately rich soils. The parent material of its soils can be diorite, breccia, basalt, serpentine, granite, and metamorphic rock. On coastal British Columbia it is found up to elevations of 800 m (2,624 ft) (Trimenstein, 1990a).

Salal exhibits its best growth on cool, humid sites where winters are mild. Salal is sensitive to frost, and prefers locations that receive little snow accumulation. The plants appear dwarfed in areas that do not have enough moisture (Trimenstein, 1990a).

## Propagation and Management:

Salal is propagated by seeds, layering, cuttings, suckers, and division (L.H. Bailey Hortorium, 1976). Good seed crops are produced yearly, except under dense canopies where little or no seed may be produced (Trimenstein, 1990a). The seed is best collected from mature fruit; repeated washings separate the seed from the pulp. Low yield of seed per unit weight (2.3–4 percent) of fresh fruit may be expected because the seeds are extremely small (Dimock et al., 1974). There are, on average, 11,000,000

seeds per kg (5,000,000 seeds per lb). The collected seed can remain viable for up to two years when stored in a cool dry place. After one year of storage at 4°C, germination decreased from 31 percent to 21 percent occurred with one year of storage at 4°C. Seed can be sown in August or September. First germination is 27 days after sowing, and maximum germination occurs within 73 days (Trimenstein, 1990a). Stratification, while improving germination somewhat (Sheat, 1948), is not necessary. Seed is best sown on Sphagnum moss (Trimenstein, 1990a). Sheat (1948) also lists finely sifted peat moss as an option for a sowing bed. The seedlings should be covered with paper and placed in a shaded area before transplanting. Surface sowing such as this is recommended in flats, or seeds can be sown in open beds covered with paper or muslin that the seedlings penetrate. In laboratory conditions, up to 73 percent of the seeds germinate when at least eight hours of light is supplied daily (Dimock et. al., 1974).

Natural production of seedlings is not great because few seedlings establish from the many that germinate. The first growth of the seedlings is slow (Trimenstein, 1990a); and is favored by moist, acidic, conditions with partial shade (Dimock et al., 1974).

Salal readily propagates vegetatively (Trimenstein, 1990a). The most common method is through root cuttings. These plants do well in moist, acid, conditions under partial shade (Dimock et al., 1974). Cuttings of hall-ripened wood can be rooted in a peat-perlite mix, after new growth becomes firm in July (L.H. Bailey Hortorium, 1976). Plant division can be performed in the spring when the new shoots are three inches long (Anonymous, n.d.). Separate the clumps and line the small pieces four inches apart in a shaded area where the soil is fairly moist and has good quantities of sand and peat (Sheat, 1948). The care of this plant in the greenhouse is not well known; it is thought to be susceptible to late frosts and should remain protected (Dimock et al., 1974).

Under canopies where the cover exceeds 33 percent, vegetative reproduction is the only viable method. Plants under sparse overstory produce an average of 0.21 new shoots per plant per year while those in a closed canopy produce 11 new shoots per plant per year. However, the shoots live longer (just over ten years) in sparse cover than in a closed canopy (approximately 6 1/2 years). As the canopy thickens, more rhizomal development and extension is seen. As these plants mature, they dedicate less energy to aboveground growth and no new shoots are produced by plants nine years or older. Plants may need as long as five years to regenerate stems and produce aboveground growth (Trimenstein, 1990a).

## SALMONBERRY, *Rubus spectabilis* Pursh

**Other common name:** muck-a-muck

Abundance=8-9 Value=7 Rank=3

### General:

Salmonberry is a biennial (Trimenstein, 1989b), erect,

***Rubus spectabilis*** Pursh, salmonberry.

—PHOTO BY CHARLES WEBBER, © CALIFORNIA ACADEMY OF SCIENCES

and large-armed shrub that forms dense thickets (Pojar and MacKinnon, 1994) 1–3 m (3-10 if) tall (Hall, 1995). It forms branching rhizomes. The zig-zagging twigs are hairless with scattered prickles.

The bark becomes golden brown and it appears shredded. The deciduous leaves are alternate and usually have three dark green, sharply toothed leaflets (Pojar and Mackinnon, 1994). The leaf stipules are linear and the leaflets are arranged pinnately. Flowers are very showy and appear on the short leafy shoots. They occur singularly, rarely in groups. The petals are reddish-purple, orange (Hall, 1995) or sometimes pink to red. They measure up to 4 cm (1.6 in) across (Pojar and Mackinnon, 1994). The fruits are very much like raspberries and ripen in July or August depending on stand's elevation. Berries are either orange or red when mature (Hall, 1995).

### Uses:

This plant has several unique uses but there are markets only for their berries and other edible parts of the plant (Thomas, 1993). The berries are juicy and commonly used in jams or jellies, even though there is some disagreement on how flavorful the berry is (Hall, 1995). These berries can be collected at a rate of approximately 1 liter (0.9 qt) per fifteen minutes of harvesting (Trimenstein, 1989b). Some say that there may be a flavor difference between the light and darker red berries, but this is also questionable. Some say both taste sour. The pith of the stems are also eaten raw on the trail and the flowers are used to garnish salad. Tea made from the leaves is used to treat diarrhea and dysentery, and the bark and leaves are used in facial steams to reduce oily skin. Salmonberry is sometimes planted as an ornamental in gardens for its edible qualities (Schofield, 1989) and was first cultivated in 1827. The cover it provides is beneficial in protecting watershed quality (Brinkman, 1974).

Leafy growth is preferred by deer, and other mammals such as black and grizzly bears enjoy the fruit. Smaller rodents commonly consume the seeds. Beaver, rabbits, and porcupine are known to eat the foliage. Bushes provide vital cover for a variety of birds and mammals (Trimenstein, 1989b).

The deep root system of salmonberry can be used to stabilize erosion on steep slopes, but this creates formidable competition with conifer seedlings (Trimenstein, 1989b).

## Ecology:

These plants prefer moist to wet places in forests and disturbed sites. They are abundant along streams, in avalanche tracks, and in freshly logged wet areas at low to subalpine altitudes (Pojar and Mackinnon, 1994). It also forms dense thickets with devil's club in logging clearcuts and on subalpine locations (Hall, 1995). Salmonberry has been reported as both shade tolerant and shade intolerant; as a Sitka spruce-hemlock overstory develops, the plant is gradually eliminated. Salmonberry is also known to persist in the understory of many hardwood communities or as one source stated "natural success of salmonberry communities may result in relatively permanent pure shrub communities" (Trimenstein, 1989b).

Salmonberry can tolerate a wide range of soil types and grows well on rich loam, loamy clays, pure peat, and excessively drained gravel. These soils also tend to be of relatively low fertility and commonly acidic. They are also soils that tend to be saturated for much of the year. salmonberry is a pioneer or early species for which disturbance is essential for seedling establishment. Seedlings appear in abundance after fire, timber harvest, or other types of disturbance. After two to five years, the nitrogen demands of salmonberry often depletes the site and fruit production begins to decline (Trimenstein, 1989b).

## Propagation and Management:

Propagation of salmonberry is by division similar to thimbleberry and other species of Rubus. Fruit collection and the cleaning preparation for the seeds is the same as cloudberry. Salmonberry averages 315,000 cleaned seeds per kg of seed (143,000 seeds per lb of seed) (Brinkman, 1974). Seeds of salmonberry have a hard, impenetrable coat and a dormant embryo that requires some form of mechanical or chemical scarification before it will germinate (Trimenstein, 1989b). While no data is available strictly for Salmonberry, the species in this genus average about 8.8 kg (4 lb) of seed per 220 kg (100 lb) of fruit. In a germinator with an eight-hour period of light and temperatures alternating from 30°C to 20°C, the germination capacity was 32 percent after 45 days (Brinkman, 1974). Stem cuttings may also be used to propagate in the same manner as thimbleberry (Trimenstein, 1989b). It should also be noted that salmonberries are biennial: only second-year growth produces flowers and fruit (Schofield, 1989). Salmonberry produces an average of thirty berries per shrub (Trimenstein, 1989b).

Seedlings and cuttings can be transplanted into disturbed sites with good success. Leaf buds had a survival of 63 percent; stem cuttings and root cuttings had 82 percent survival rate (Trimenstein, 1989b). Seed was also successfully planted with a drill followed by a covering (0.3–0.1 cm, 0.12–0.19 in) of soil soil (Brinkman, 1974).

Natural regeneration is most notably vegetative through sprouts from the root crown, stem base, root stock, or from the stem tip. They also form a dense network of rhizomes that enhance spreading. Once the aboveground foliage has been damaged, buds on the crown are the best source for regrowth. Layering is also seen when litter buries the aerial canes that subsequently form root systems. The aboveground portions of cane can also root and produce clones when mechanically damaged (Trimenstein, 1989b).

Rhizomes usually form in the top four to eight inches of the soil, although they down to depths of 1.8 m (6 ft). In logged areas, total rhizome length can total up to 42 miles per stand. On rocky sites however, rhizomes may be absent (Trimenstein, 1989b).

### SITKA SPRUCE, *Picea sitchensis* (Moench) Voss

**Other common names:** tideland spruce, coast spruce

Abundance=10 Value=6 Rank=2

## General:

The Sitka spruce is an evergreen tree that can grow to 70 m (230 feet) tall and 1–3 m (3–10 ft) in diameter. The main branches are horizontal and long with drooping branchlets (Pojar and Mackinnon, 1994). The straight trunk is enlarged by gray bark that is smooth and becomes purplish-brown with scaly plates. Needles stand erect on all sides of the twig, are flattened with a slight keel, sharply tipped with two visible bands of stomata's on the upper surface (Hall, 1995), and are usually 1–3 cm (0.4–1.2 in) long. The pollen cones, which appear red, are the same size as the cylindrical seed cones; 5–8 cm (9.3–3.1 in) long. Seed cones are reddish or purple brown and become brown at maturity. The scales are irregularly toothed, thin, and wavy (Pojar and Mackinnon, 1994).

## Uses:

While Sitka spruce has long had substantial economic value as lumber for saw logs, high-grade pulpwood, musical instruments, machinery, etc. (Griffith, 1992), there are new opportunities for economic use of these trees that do not entail large-scale logging operations. The existence of large harvested areas has resulted in demand for seedlings for reforestation (Thomas, 1993). This demand for seedlings is growing as more acreage is harvested and environmental legislation for revegetation is enforced. Natural revegetation has been the normal practice in Alaska, but stochastic events such as the bark beetle outbreak on the Kenai Peninsula and the Copper River Valley can lead to a large demand for healthy seed stock (Holsten, pers. comm., 1996).

Sitka spruce also has commercial value in the floral greenery and Christmas tree markets. Christmas trees and wreaths of foliage and roots are bought seasonally, and natural ornaments can be fashioned from spruce cones (Safford, 1974). Potpourri ingredients could include both spruce oil and cones (Thomas, 1993). Spruce tip jelly and syrup are sold throughout Alaska (Brook, pers. comm., 1996). These are compatible with seedling

*Picea sitchensis* (Moench) Voss, Sitka spruce.

—photo courtesy US Forest Service

production. There is also the possibility of distilling spruce to produce aromatic oil for use in soaps, fresheners, and essential oils (Safford, 1974). However, these uses demand wood amounts that may be greater than desired by persons wanting a business alternative to logging (Thomas, 1993).

Wildlife benefits greatly from spruce cover that is allowed to form dense canopies that shed snow. Deer, grizzly, and other smaller mammals take advantage of it. Deadfalls and snags provide nesting sites for birds, including the bald eagle and peregrine falcon.

Sitka spruce has little value as a soil stabilizer on highly disturbed sites even though it is commonly a pioneer species (Griffith, 1992); however it can protect watershed quality once established (Safford, 1974).

Some uses for spruce are not commercially developed, such as basket making with roots and bark, canoe caulking using the pitch (Griffith, 1992), chewing gum, and various medicinal uses for extracts. There has been a minimal use of spruce bark and foliage for human food, but this is quite limited (Robuck, 1985).

## Ecology:

Sitka spruce occurs throughout southeast Alaska and along the coast to the Kenai Peninsula, with some extending down to Kodiak. It can be found along streams, on rocky slopes, below cliffs, on shorelines, and from sea level to alpine elevations (Hall, 1995). This species occurs in pure or mixed stands, often on moist well-drained sites such as alluvial floodplains, marine terraces, headlands, recent glacial outwash, and in avalanche tracts (Pojar and Mackinnon, 1994). This spruce can tolerate salt spray on beaches, headlands, and dunes or the brackish water of bogs. The Sitka spruce is limited to areas of high annual precipitation and cool moist summers (Griffith, 1992).

Sitka spruce prefers soils that are high in nutrients such as calcium, magnesium, and phosphorus. Entisols, spodosols, inceptisols, and histosols are the preferred soil types. The soils are in most cases acidic with a pH ranging from 4.0 to 5.7 (Griffith, 1992).

## Propagation and Management:

Sitka spruce has been in cultivation since 1831. It is propagated primarily by seed and occasionally through cuttings. Trees can begin producing seed at twenty years of age and large cone crops are common every three to four years (Safford, 1974). The seed must be gathered early and quickly stored in a cool dry storage area. One technique is to place the seed in suspended paper bags where they are safe from rodents and will not collect moisture (Sheat, 1948). Cones should be air dried for a few weeks or in a convection kiln for 6–24 hours at 38–49° C. They should then be separated by shaking them on a screen or in a tumbler. If the seeds are not removed from the cone quickly, viability could be lost. The wings can be separated from the seeds by moistening the seeds and stirring in a bowl with a soft scraper. When they dry the separation is quite simple. The other cleaning machines available must be adjusted so they don't damage the thinly coated seeds. Unfilled seeds may be separated from filled seeds using an aspirator or by floating the seeds in alcohol. This treatment will remove most of the empty seed, which is a large proportion of the total seeds removed from the cones. Seed collected this way should have purity over 95 percent, zero percent foreign seed, 5 percent inert matter, and a 75 percent apparent germination. There are on average 3,600 cones per hectoliter (1,300 cones per bushel) which can equate to 0.17–0.57 kg (6–20 oz) of seed. There is an average of 463,000 viable seeds per kg of seed (210,000 viable seeds per lb of seed) (Safford, 1974).

Fall sowing or a 30–60 day stratification at 5°C is the recommended pretreatment for seed germination (Babb, 1959). Germination tests for viability involve placing seed on top of blotter paper at alternating temperatures of 20/30°C for sixteen hours of light and eight hours of dark. Most germination occurs within twent-one days with seven to eight hours of light each day (Association of Official Seed Analysis, 1981).

The addition of a 0.2 percent solution of potassium nitrate to the substrate may improve germination. The seeds may also be pelleted with fungicide, insecticide, and aluminum flakes to repel animals without any damage to the seed. Seeds should than be covered with 60–90 mm (0.25–0.36 in) of soil. During the first season, partial shade will benefit growth but is not necessary when using overhead irrigation. Seeds left outdoors for the winter can benefit from a straw mulch of equal height to the seedlings to protect them from snow mold that is common in areas where light or intermittent snow is common (Safford, 1974).

Stem cuttings of semi-mature terminal shoots of the current year's growth can be cut 5.0–7.5 cm (2–3 in) long. A rooting medium of equal parts loam, peat, and sand with a 1.3 cm (0.5 in) covering of sharp sand will facilitate rooting. Shade should also be provided to prevent scorching (Sheat, 1948). Cuttings from the current year's growth work much better than do those from older shoots. Sitka spruce is also known to reproduce naturally by layering (Griffith, 1992).

*Rubus parviflorus* Nutt., thimbleberry.

—PHOTO BY MARY ELLEN (MEL) HARTE, WWW.FORESTRYIMAGES.ORG

## THIMBLEBERRY, *Rubus parviflorus* Nutt.

**Other common names:** western thimbleberry, salmonberry, mountain sorel, white-flowering raspberry, white thimble raspberry

Abundance=6 Value=7 Rank=7

## General:

Thimbleberry is an unarmed (Underhill, 1974) deciduous shrub that grows from 0.4–1.5 m (1–5 ft) tall (Hall, 1995). New growth is commonly hairy and glandular; older stems form a shredding bark. It most often forms in dense thickets due to the rhizome network. The large alternating leaves are soft, hairy on both sides, and shaped like maple leaf (Pojar and Mackinnon, 1994). Leaf shape is simple with paired lanceolate stipules and thin petioles. The leaves are palmately lobed with sharp doubly toothed margins. The flowers that occur during June and July are in flat-topped terminal clusters. They have five spreading sepals that appear narrow, hairy, and greenish and have five white obovate petals. They occur in groups of three to seven within each cluster (Hall, 1995). Each flower is large, to 4 cm across, and the petals appear as though they have been crinkled like tissue paper. The fruit is shallowly domed, appearing as a thimble, and forms in clusters like raspberries. The red and hairy drupelets are quite juicy. The taste is subjective to growing site and personal taste (Pojar and Mackinnon, 1994).

## Uses:

Thimbleberry has two recognized markets; one for its fruit and the other in the floral and greenery market (Thomas, 1993). Although the berry is edible, it is not as favored for its taste as are raspberries and huckleberries. It is instead mixed with other fruit (Pojar and MacKinnon, 1994). Remarks about thimbleberry have been from "fabulous" tasting to "ho-hum," and this is attributed to soil moisture differences (Schofield, 1989). Berries are excellent for jelly, but too seedy for jam.

Approximately 0.301(0.27 qt) of the fruit can be gathered in roughly ten minutes (Trimenstein, 1989a).

The stalks are commonly attacked by an insect that causes an irritation and misshapen stalks with large galls. These forms can be collected in the winter and used in floral arrangements (Underhill, 1974). The younger sprouts are peeled and eaten raw by survivalists. The flowers are used to garnish salads or on seasonal dishes, and can be included in teas as a remedy for diarrhea or dysentery (Hall, 1995). Facial steams with the leaves can also be used to treat oily skin (Schofield, 1989).

Thimbleberry provides food and cover for a variety of wildlife species and is an important summer browse of the black-tailed deer. The bark is eaten by numerous small rodents and the leaves feed rabbits and beaver. The fruits are low in nutritional value but are eaten by both black and grizzly bears. Cover is important to small nesting birds, and deer often bed down within it (Trimenstein, 1989a).

There is low to moderate value of thimbleberry for use in soil erosion prevention. It has potential for use in the reclamation of disturbed sites because when it is established, these clumps expand rapidly. Its survival was quite good in experiments, but it is thought to be difficult to propagate. Seeds may be difficult to locate commercially. Revegetation is best done by planting stem cuttings or rhizome fragments (Trimenstein, 1989a).

## Ecology:

Thimbleberry is most commonly found in open areas such as clearings, road edges, shorelines and avalanche tracts, and occasionally in open forests such as that formed with red alder. It occurs at lower elevations (Pojar and Mackinnon, 1994) and is absent from Admiralty, Baranof, and Chichagof islands (Hall, 1995). First-year stems develop from buds at or below ground level and generally produce no fruit. The perennial stems, or canes, will typically only live for two to three years (Trimenstein, 1989a).

This moderately shade-tolerant shrub can survive within the understory where it only receives 3.5 percent of full sunlight. Patches are most dense on disturbed sites that are within the forest canopy, such as cutover or windthrow areas (Trimenstein, 1989a). This species can do well on barren or infertile soils (Brinkman, 1974) and can tolerate a range of soil pH and air temperatures; adequate soil moisture is required for optimum growth. Thimbleberry grows "good" on loam or clay-loam soils "fair to good" on sandy loams, and "less than fair" on gravel, sand or clay (Trimenstein, 1989a).

Thimbleberry frequently dominates the understory for several decades after a disturbance and generally has its greatest abundance in seral stands. It is a nitrogen demanding species, and this factor can cause a decline in growth two to five years after nutrient levels decrease. Thimbleberry can establish as early as the first growing season after clearcutting has occurred and in some areas can dominate the understory within five years after logging. Cover can be as much as ten times greater on sites with little overstory than on sites with 55 percent or more tree cover. It is also know to compete heavily with conifer regrowth and even compete with it for water during drought (Trimenstein, 1989a).

## Propagation and Management:

Seed collection and propagation is equivalent to cloudberry, but thimbleberry is also commonly propagated by division (Sheat, 1948) and stem cuttings (Brinkman, 1974). The optimum method of propagation is by layering in early spring or to mound layer. Early the next spring, the plant is lifted, divided and lined out in nursery rows one foot apart (Sheat, 1948). In the early spring, stem cuttings can be gathered for propagation (Trimenstein, 1989a).

The primary method of natural establishment into newly disturbed areas is through seeding. Local expansion is accredited to rhizome sprouting (Trimenstein, 1989a). Good seed crops are produced by the plant nearly every year (Brinkman 1974), but production may be limited at higher elevations. Seeds, which remain viable for a long time, require both warm and cold stratification for germination (Trimenstein, 1989a).

# YARROW, *Achillea millefolium* L.

**Other common names:** millifoil, yarroway, thousandleaf, nosebleed, soldier's woundwork, poor man's pepper, devil's plaything, field hop, staunchwort, blindwort, sneezeweed

Abundance=6-7 Value=6 Rank=8

## General:

Yarrow is a strongly scented herb that can grow to 1 m (3.3 ft) in height. The stem is covered with white hairs. The leaves are a grayish-green and linear, with many finely divided, short leaflets (Hall, 1995). The fern-like leaves are stalked below but there are no stalks on the upper surface. The flowers are divided into rays, usually about five, with 10-30 disc flowers in each ray. The flowers are white or sometimes pink or reddish in a flat or rounded top cluster. The individual bracts are dry and overlap in several series. They produce hairless and flattened achenes that lack a pappus (Pojar and Mackinnon, 1994). The achenes are 1–2 mm (0.004–0.008 in) long (Hall, 1995).

## Uses:

Yarrow is a very useful herb. The flowers contain a chemical that hastens blood clotting (Hickerson, 1986) and is bought for use in medicinal drugs (Thomas, 1993). Walsh states that all herb companies will purchase dried yarrow flowers and some floral arrangers will buy whole dried flowers. There are other medicinal uses that indicate that this plant has good marketability. It is also favored for collection because it grows in large colonies (Walsh, 1986). Yarrow seed can also be sold in wildflower seed mixes and for revegetation of roadsides and mine sites (Holloway, pers. comm., 1996).

Folklore on remedies suggest drinking the tea of this plant to reduce fever, treat colds and flu, and to relieve irregular

*Achillea millefolium* L., yarrow.

—photo by Chris Evans, The University of Georgia, www.forestryimages.org

menstruation and menopause. External use of yarrow is thought to relieve oily or irritated skin as to and ward off biting insects (Schofield, 1989).

Forage value for yarrow can very greatly; deer, sheep, and goats are known to consume it. Grouse also depend on this plant during early development (age 4–8 weeks old), even though it is thought to be relatively low in nutrient value (Hickerson, 1986).

Yarrow is exceptionally hardy and is well suited for the regeneration of disturbed sites because its extensive network of rhizomes binds the soil together. Yarrow has been used in a number of erosion control projects in Utah and Massachusetts, where it was the only tested species to survive on roadside test sites (Hickerson, 1986).

## Ecology:

Yarrow is common throughout Alaska except on the northern coast. It grows best on beaches, meadows, and roadsides (Hall, 1995) and on rocky slopes, gravel bars, and clearings where light is adequate. It can live on a range of dry or moist sites (Pojar and Mackinnon, 1994). Full sun is desired, and once the plant is well established on a site it is extremely drought resistant. Yarrow is intolerant of shade and rarely grows within a forest canopy. It is especially common on thin soils and sandy, gravely, loamy soils of open flats and meadows (Hickerson, 1986).

This plant is an invader species at times and is relatively tolerant of competition. It is most often present in the earliest stages of vegetation development and can remain prominent well into the later stages. The flowering season of yarrow is quite long and varies from state to state (Hickerson, 1986).

## Propagation and Management:

Yarrow can be propagated from seed or by division; cuttings have rarely been tried (L.H. Bailey Hortorium, 1976). Natural regeneration is accomplished from spreading rhizomes or by wind dispersed seeds (Hickerson, 1986).

Collected seed can survive for two years in cold and dry storage. While first year seedlings may produce flowers (Hickerson, 1986) most do not produce until the second year (L.H. Bailey Hortorium, 1976). The seeds of yarrow should be planted sparingly onto the surface of flats. They need light to germinate and the soil should be kept evenly moist. Self-seeding is rare relative to rhizome spreading. If used, seed should be applied at one pound per acre (Hickerson, 1986).

The plant's strong white rhizomes can also be used to propagate yarrow. These can be collected and planted in the spring or early fall. They should be spaced 15–30 cm (6–12 in) apart and planted 0.6 cm (0.5 in) deep. When planted in a rich soil, leaf production was increased but flower production was reduced (Hickerson, 1986).

# Markets

It is important to view each of the potential markets for Alaska native plant materials separately, regardless of which particular species will be used. Market prices and specifics can change rapidly: In all cases a proper business plan and market analysis investigation should be performed before full-scale development is attempted.

## *Aromatics*

The aromatics marketplace has been dominated by foreign producers and is regarded as fairly difficult for the small businessperson to feasibly enter. Circumstances in other countries allow producers there to out-produce and undersell a small-time operator in the United States. Success might be possible for an Alaska producer if an investor was willing to invest in a large-scale distillation plant that could cost from one to two million dollars and demand close to fifty tons of raw material per day. Sitka spruce, while being a possible species for this type of operation would need to be harvested in a near clear-cut style (Thomas, 1993), and be managed on a much shorter rotation period than stands producing wood products.

## *Berries and Wild Fruit*

The market for berries and wild fruit is clearly the most promising one for southeast Alaska. Eight of the thirteen marketable species in this region are among the twenty species included in this report. Markets for berry products and opportunities for recreational harvesting are steadily increasing (Thomas, 1993).

Only a small percentage of harvested goods actually go into fresh produce sales; the vast majority is processed into one or several products. Each berry has several possibilities, each of which can be marketable, although one particular use may be best suited for a given species of berry. Berry production is completely controlled by the weather; so the production of final products must be flexible enough to utilize whatever berries are most plentiful in each growing season. It also should be understood that harvesting berries is labor intensive and takes place in conditions that are often quite harsh and undesirable for some (Reed, pers. comm., 1996).

Several of these berry producing plants have other valuable unedible products that might be produced in conjunction with their primary use. For instance, the leaves of several *Vaccinium* can also be used in potpourris and aromatic oils. Other wild berries have undesirable flavors by themselves and are best used in combination with another more favorable or complimentary fruit (Underhill, 1974).

This paper follows the common names as used in southeast and throughout Alaska. It should be noted that some of these berries are traded on the international market under varying names. If an entrepreneur intends to participate at this level, he or she should stipulate transactions by the scientific name and not the common names used in this paper (Holloway, pers. comm., 1996).

Production and marketing of nontimber forest products is expanding as more research is carried out and current knowledge is applied to the cultivating of these plants in both forest and farm settings. As more knowledge becomes available and interest increases, the future will only look better than it does presently (Thomas, 1993).

## *Cones and Seeds*

Cones are used for decorative products in such items as potpourri and wreaths, while the seeds are used for seedling production. The cones can usually be purchased from seedling producers after they have extracted the seeds; provided the cone is able to withstand the seed extraction and still be intact (Thomas, 1993).

Most cones have a particular use for which they are best suited, but the reality is that markets continually fluctuate. Operations should be based on the specific types of cones that are in supply each harvest season. Hemlock cones are important because their size and shape are preferred by potpourri manufactures and small pine cones work well for seasonal decorations like wreaths (Thomas, 1993).

Federal agencies are most commonly the purchasers of seed for restocking, although it is slowly becoming more common for private timber harvesters to assume more responsibility for replanting harvested lands. It is not an extremely large business and cone crops can fluctuate regardless of timber harvests, so seed storage may be an important factor. Because seed must be from the same elevation and climate as the area in which the seedlings are to be planted, seed from all types of areas must be on hand and separated (Thomas, 1993).

## *Cooking Wood, Smoke Wood, and Flavor Wood*

Wood for cooking, smoking and flavoring purposes can be supplied in a variety of ways; chips and chunks are most commonly sold to the residential user; sawdust is purchased by businesses involved in smoking and producing liquid smoke. Wood briquettes are also becoming a substitute for charcoal and can be marketed to the environmentally conscious consumer (Thomas, 1993).

There is a high cost associated with drying and chipping wood and processing and packaging the product. There are several types of equipment that can be used and the suitability of equipment will depend on the individual situation of each producer. It is thought that for production on a rural scale, the lower the overhead associated with the production, the greater the chances are that it will be successful (Thomas, 1993).

## Decorative Wood

There are a number of trees that, due to some type of injury or natural characteristic of growth, develop deformations in the wood that make them highly valuable. The markets available for this wood is only limited by the creativity of the woodcarver in the studio. Disfigured wood is in demand by woodcrafters and is now even bought and sold through wood-crafting magazines. Trade in final products can also take place in which the raw wood is never sold. If there are enough available craftsmen, then a finished product may be the approach to take. A relatively large investment must be made in equipment and processing of the wood before carvers can even begin to perform the detailed work (Thomas, 1993).

## Forest Botanicals

Many of the plants that commonly grow in the forest have a number of uses as culinary or pharmaceutical products. Culinary products range from herbs for spices and flavorings to edible flowers, roots, greens, or tubers. The compounds these plants naturally produce have potential uses as nutritional or naturopathic supplements. There are also plant products whose physical chemistries can be used for producing medicine. Many of the drugs available today are synthesized forms of these natural compounds, and there is growing interest in new uses for natural compounds (Thomas, 1993).

The market for botanicals is constantly changing. It is important to make contacts with purchasers and stay current with what is in demand and how the prices are changing. The value of whatever is collected often depends on the time and effort put forth in the collection. The most valuable materials are often far off the beaten path and their collection requires intense labor. It is also important to guard the stands which are most valuable and monitor them for insects and disease (Miller, 1985).

Samples of the product should be sent to a purchaser for inspection before any deals are made. When the sample is sent, a substantial volume (900 kg (2,000 lbs) should be on hand and ready to deliver if the purchaser approves the sample and wishes to do business. There is also the thought that a smaller commercial farm may be more profitable then simply foraging for these plants. The key to success is in the development of centralized processing facilities, because most products require some processing after they are picked, and it is most beneficial to the community if the value is added before the goods leave the community (Thomas, 1993).

## Greenery Transplants and Floral Products

The most active area of the United States for the production of greenery, transplant, and floral products has been the Pacific Northwest, and some of the more prominently collected plants also exist in southeast Alaska. Demand for these products from the principal harvesting areas has steadily increased and many new regions are beginning to emerge as greenery and floral producers. There are a couple of notes of caution that need to be given. First, it is important to experiment and determine just how much time and money is needed to collect, process, and distribute the product. Second, prices should be able to consistently secure profit margins, not just at particularly favorable market periods (Thomas, 1993).

## Weaving and Dyeing Materials

Although there are numerous plants that can be utilized in weaving, decorating, and dyeing, the commercial market for these goods is small. Instead, they are best marketed locally to craft producers and traditional basket makers. Although there are many different types of supplies that can be used for making baskets, some have a higher value and produce higher quality products. Research should be done with local crafters to discern which materials are best suited for each product, and this should be compared to what can be feasibly harvested on a large scale (Thomas, 1993).

Marketing for these types of goods will depend on the region in which they are gathered. They are primarily sold through catalogs, but most companies also operate a local supply store Because harvesting can have detrimental effects on the resource, attention must be given to the harvest methods when demand for any plant increases. It can be easy to deplete the supply and put yourself out of business by trying to produce too much (Thomas, 1993).

The forest botanical pipsissewa, or ***Chimaphila umbellata.***

# Discussion and Conclusions

There is clearly a great deal of potential for secondary forest products industries to develop in southeast Alaska. These industries would utilize a number of different plant species and produce a plethora of different products. The key to success will not so much lie in the choice of what to do, but more in the dedication and business strategies required when working in the unique environment of Alaska. There are a number of factors that affect development, no matter where you intend to locate your operation. Southeast Alaska is no exception, and may in fact it be more troublesome than a number of other areas (even in the Pacific Northwest, where one could operate with the same plant species). The location and access will create increased shipping costs and fewer opportunities for on-site distribution, which needs to be adequately addressed when developing every aspect of business design. The importing of any raw materials will be more expensive because low-cost transportation routes are lacking. Finished products will also have to bear the cost of shipping, unless they can be marketed for sale to tourists who are passing through. The clientele will most likely reside somewhere other than Alaska.

One continual theme that was apparent while researching this topic was that the collection of most of these materials requires a dependable and substantial work force to supply a production facility. This has been a limiting factor in previous "cottage industries" in Alaska and will surely continue to be one. The work involved is most often labor intensive and occurs in a less than hospitable working environment. To make matters worse, the wages for doing such work may not be acceptable to many. Recent changes in the structure of the welfare system may stimulate job searching, even in rural areas such as those in southeast Alaska.

However, there are benefits from producing goods out of this part of the "last frontier." Successful producers are proud of the fact that their goods are grown and produced in this state. The location of production will be one of the strongest qualities of several products, and this should be progressively taken advantage of. Advances in the methods and tools utilized in advertising will serve the Alaska entrepreneur well. Proper marketing will make almost any product sell. Images of this "wild" country will have to be incorporated with the products so that consumers are not only buying another kind of jelly, they are tasting one flavor of this rich land.

Tourism is not a market that was explicitly discussed in this paper, but it is an aspect of life in this part of the world that cannot be avoided when giving any thought to future development. The attractiveness of this area for travel is continually increasing and there is little chance that it will seriously decline anytime in the near future. Alaska's qualities should be used symbolically for marketing locally produced goods.

For this paper, the method used to select the top twenty species for examination was not a foolproof one. Certain things were noticed during the process of selection and the gathering of information that raised many questions. Some of the more marketable plants were eliminated because they are simply not common in Southeast, even though they are present to some extent. These are species that could, with more research, prove to be more profitable than any I have outlined if there are efficient ways in which to mass produce them. The wild rose is one of the most valuable plants used in the Interior (Reed, pers. comm., 1996), but it is uncommon in Southeast. Cultivating this plant may be more useful than working with a species with a higher total score.

Other, non-native, or naturalized hybrid species like the Sitka strawberry, were also not considered in the scope of this project because they are not native species. These too could have possibilities as a cultivated species for production (Brook, pers. comm., 1996). Other plants could also be introduced to the area for development, but this creates a number of ecological and ethical concerns about the possible dangers that are inherent to the introduction of new species.

This project, while supplying information about a number of selected species, is not capable of supplying all the necessary information for operating a business that would utilize these species. This information is intended to be preliminary guide and should therefore direct more serious economic research into products that are promising for the area. Once a particular idea appeals to developers, more complete and more current research should be done on that species. It may even be possible for this publication to be used in the selection of a species that was not profiled at all, but was mentioned in earlier phases of the project. In either case, there is information that may be extremely useful on the management of any species that is not provided in this publication due to the scope of this subject.

I do hope that those who find this report will have use for what it provides. I see a new dawn for Alaska; not in just how it operates its businesses, but in how we think about ourselves and our respective place in a global community. Wise development in areas that are more renewable than others, and that are less destructive, is most urgently needed. Creativity is never-ending, and this state can be stable if we truly wish it to be that way. I have faith that this work strengthens that dream.

*Polygonum amphibium*. *P. amphibia* is a rhizomatous perennial with aquatic and terrestrial growth-forms. One use of the plant is making dye.

J. E.(Jed) and Bonnie McClellan © California Academy of Sciences. Photo courtesy of CalPhotos online gallery

## Appendix A: Southeast Alaska Plant Species with Income Opportunities in Special Forest Products Classified by Marketable Use (Native Species). 

| I. Aromatics | |
|---|---|
| 1. Birch oil | *Betula glandulosa* |
| | *Betula papyrifera* |
| 2. Cedar leaf oil | *Thuja plicata* |
| 3. Spruce oil | *Picea sitchensis* |
| 4. Wintergeen | *Pyrola asarifolia* |
| | *Pyrola chlorantha* |
| | *Pyrola minor* |
| | *Pyrola secunda* |

| II. Berries and Wild Fruit | |
|---|---|
| 1. Blueberry | *Vaccinium alaskaense* |
| | *Vaccinium caespitosum* |
| | *Vaccinium ovafolium* |
| | *Vaccinium uliginosum* |
| 2. Crab Apple | *Malus (Pyrus) fusca* |
| 3. Cloudberry | *Rubus chamaemorus* |
| 4. Currant | *Ribes bracteosum* |
| | *Ribes glandulosum* |
| | *Ribes hudsonianum* |
| | *Ribes lacustre* |
| | *Ribes laxiflorum* |
| 5. Elderberry | *Sambucus racemosa* |
| 6. Huckleberry | *Vaccinium parvifolium* |
| 7. Lingonberry (Mt. Cranberry) | *Vaccinium vitis-idaea* |
| 8. Raspberry | *Rubus leucodermis* |
| 9. Salal | *Gautheria shallon* |
| 10. Salmonberry | *Rubus spectabilis* |
| 11. Serviceberry | *Amelanchier alnifolia* |
| 12. Strawberry | *Fragaria chiloensis* |
| 13. Thimbleberry | *Rubus parviflorus* |

| III. Cones and Seeds (Cone Producers) | |
|---|---|
| 1. Alder | *Alnus incana* |
| | *Alnus rubra* |
| | *Alnus viridis* |
| 2. Hemlock | *Tsuga heterophylla* |
| | *Tsuga mertensiana* |
| 3. Western redcedar | *Thuja plicata* |
| 4. Lodgepole Pine | *Pinus contorta* |
| 5. Sitka Spruce | *Picea sitchensis* |

| IV. Cooking Wood, Smoke Wood, & Fuel Wood | |
|---|---|
| 1. Alder | *Alnus incana* |
| | *Alnus rubra* |
| | *Alnus viridis* |

| V. Decorative Wood | |
|---|---|
| 1. Diamond Willow | *Salix arbusculoides* |
| | *Salix monticola* |
| | *Salix scouleriana* |
| 2. Juniper | *Juniperus communis* |
| 3. Sitka Spruce Roots | *Picea sitchensis* |
| 4. Yew | *Taxus brevifolia* |

| VI. Forest Botanicals as Flavorings, Medicinals, and Pharmaceuticals | |
|---|---|
| A. Botanicals | |
| 1. Devil's Club | *Oplopanax horridum* |
| 2. False hellebore | *Veratum viride* |
| 3. Fireweed | *Epilobium angustifolium* |
| 4. Horsetail | *Equisetum arvense* |
| 5. Kinikinnick (Bearberry) | *Arctosaphylos uva-ursi* |
| 6. Pipsissewa | *Chimaphila umbellata* |
| B. Herbs and Spices | |
| 1. Aspen leaves | *Populus tremuloides* |
| 2. Blueberry leaves | *Vaccinium alaskaense* |
| | *Vaccinium caespitosum* |
| | *Vaccinium ovafolium* |
| | *Vaccinium uliginosum* |
| 3. Horsetail | *Equisetum arvense* |
| 4. Labrador Tea | *Ledum palustre* |
| | *Ledum groenlandicum* |
| 5. Stinging Nettle | *Urtica dioica* |
| 6. Pipsisswa | *Chimophila umbellata* |
| 7. Raspberry | *Rubus leucodermis* |
| 8. Rose leaves and hips | *Rosa nutkana* |
| 9. Thistle | *Cirsium edule* |

| VI. Part C. Edible Greens, Roots, or Tubers | |
|---|---|
| 1. Bittercress | *Cardamine bellidifolia* |
| | *Cardamine breweri* |
| | *Cardamine occidentalis* |
| | *Cardamine oligosperma* |
| | *Cardamine pensylvanica* |
| 2. Bracken Fern | *Pteridium aquilinum* |
| 3. Chickweed | *Cerastium arvense* |
| | *Cerastium earlei* |
| 4. Elderberry | *Sambucus racemosa* |
| 5. Fireweed | *Epilobium angustifolium* |
| 6. Goatsbeard | *Aruncus dioica* |
| 7. Lady Fern (fiddlehead) | *Athyrium felix-femina* |
| 8. Maple | *Acer glabrum* |
| 9. Nettle Shoots | *Urtica dioica* |
| 10. Peppergrass | *Lepidium densiflorum* |
| 11. Plantain | *Plantago macrocarpa* |
| 12. Salmonberry | *Rubus spectabilis* |
| 13. Spring Beauty | *Claytonia sibirica* |
| 14. Violet | *Viola adunca* |
| | *Viola birflora* |
| | *Viola glabella* |
| | *Viola langsdorffii* |
| | *Viola palustris* |
| | *Viola renifolia* |
| | *Viola selkirkii* |
| | *Viola sempervirens* |
| 15. Willow | *Salix arbusculoides* |
| | *Salix arctica* |
| | *Salix barclayi* |
| | *Salix commutata* |
| | *Salix fuscescens* |
| | *Salix glauca* |
| | *Salix hookeriana* |
| | *Salix lanata* |
| | *Salix lasiandra* |
| 15. Willow (cont.) | *Salix monticola* |
| | *Salix ovalifolia* |
| | *Salix planifolia* |
| | *Salix polaris* |
| | *Salix reticulata* |
| | *Salix rotundifolia* |
| | *Salix scouleriana* |
| | *Salix setchelliana* |
| | *Salix sitchensis* |
| 16. Wintercress | *Barbarea orthoceras* |
| D. Medicinal Materials | |
| 1. Birch oil | *Betula glandulosa* |
| | *Betula papyrifera* |
| 2. False Hellibore roots | *Veratum viride* |
| 3. Kinikinnick | *Arctosyphylos uva-ursi* |
| 4. Lingonberry | *Vaccinium vitis-idaea* |
| 5. Pipsissewa | *Chimaphila umbellata* |
| 6. Plantain | *Plantago macrocara* |
| 7. Skunk Cabbage root | *Lysichiton americanum* |
| 8. Spruce gum | *Picea sitchensis* |
| 9. Western Yew | *Taxus brevifolia* |
| 10. Yarrow | *Achillea millefolium* |
| **VII. Greenery, Transplants, and Floral Products** | |
| 1. Alder (tops) | *Alnus incana* |
| | *Alnus rubra* |
| | *Alnus viridis* |
| 2. Birch (tops) | *Betula glandulosa* |
| | *Betula papyrifera (bark)* |
| 3. Blueberry | *Vaccinium alaskaense* |
| | *Vaccinium caespitosum* |
| | *Vaccinium ovafolium* |
| | *Vaccinium uliginosum* |
| 4. Cedar (boughs) | *Chamaecyparis nootkatensis* |

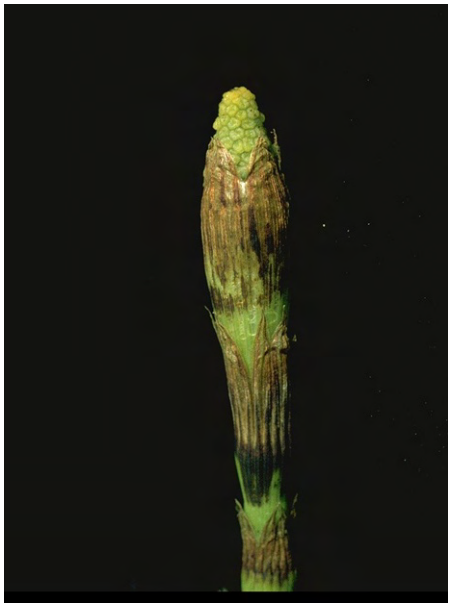
## Appendix A: Southeast Alaska Plant Species with Income Opportunities in Special Forest Products Classified by Marketable Use (Native Species). 

| VII. Greenery, Transplants, and Floral Products (cont.) | |
|---|---|
| 5. Club Moss | *Lycopodium alpinum* |
| | *Lycopodium annotinum* |
| | *Lycopodium clavatum* |
| | *Lycopodium inundatum* |
| | *Lycopodium obscurum* |
| | *Lycopodium selago* |
| | *Lycopodium sitchense* |
| 6. Dogwood | *Cornus canadensis* |
| | *Cornus sericea* |
| 7. Fir (boughs) | *Abies amabilis* |
| | *Abies lasiocarpa* |
| 8. Fireweed | *Epilobium angustifolium* |
| 9. Mistletoe | *Arceuthobium campylopodium* |
| 10. Mountain Hemlock | *Tsuga mertensiana* |
| 11. Peppergrass | *Lepidium densiflorum* |
| 12. Pine (boughs) | *Pinus contorta* |
| 13. Rhododendron | *Aster modestus* |
| 14. Salal | *Gautheria shallon* |
| 15. Spruce (boughs) | *Picea sitchensis* |
| **VIII. Weaving and Dyeing Materials** | |
| 1. Alder | *Alnus incana* |
| 2. Arrowleaf Senecio (Groundsel) | *Senecio triangularis* |
| 3. Aspen | *Populus tremuloides* |
| 4. Aster, purple | *Aster modestus* |
| | *Aster subspicatus* |
| 5. Bluebell | *Mertensia ciliata* |
| 6. Blueberry | *Vaccinium alaskaense* |
| | *Vaccinium caespitosum* |
| | *Vaccinium ovalifolium* |
| | *Vaccinium oxycoccos* |
| | *Vaccinium parvifolium* |
| | *Vaccinium uliginosum* |
| | *Vaccinium vitis-idaea* |
| 7. Bracken Fern | *Pteridium aquilinum* |

| VIII. Weaving and Dyeing Materials (cont.) | |
|---|---|
| 8. Cinqueoil | *Potentilla anserina* |
| | *Potentilla biflora* |
| | *Potentilla elegans* |
| | *Potentilla gracilis* |
| | *Potentilla hookeriana* |
| | *Potentilla hyparctica* |
| | *Potentilla nivea* |
| | *Potentilla novegica* |
| | *Potentilla palustris* |
| | *Potentilla villosa* |
| 9. Cottonwood | *Populus tremuloides* |
| | *Populus balsamifera* |
| 10. Currant | *Ribes bracteosum* |
| | *Ribes glandulosum* |
| | *Ribes hudsonianum* |
| | *Ribes lacustre* |
| | *Ribes laxiflorum* |
| 11. Fireweed | *Epilobium angustifolium* |
| 12. Goldenrod | *Solidago canadensis* |
| | *Solidago multiradiata* |
| 13. Indian Paintbrush | *Castilleja miniata* |
| 14. Kinnikinick (Bearberry) | *Arctostaphylos uva-ursi* |
| 15. Ladysthumb | *Polygonum amphibium* |
| | *Polygonum aviculare* |
| | *Polygonum caurianum* |
| | *Polygonum fowleri* |
| | *Polygonum viviparum* |
| 16. Lupine | *Lupinus arcticus* |
| | *Lupinus nootkatensis* |
| 17. Matweed | *Polygonum aviculare* |
| 18. Mistletoe | *Arceuthobium camplyopodium* |
| 19. Plantain | *Plantago macrocarpa* |
| | *Plantago maritima* |
| 20. Scouring Rush (Horsetail) | *Equisetum arvense* |

## Appendix A: Southeast Alaska Plant Species with Income Opportunities in Special Forest Products Classified by Marketable Use (Native Species). 

| VIII. Weaving and Dyeing Materials (cont.) | |
|---|---|
| 21. Sedge | *Carex spp.* |
| 22. Sweet Pea | *Lathyrus japonicus* |
| | *Lathyrus palustris* |
| | *Lathyrus ochroleucus* |
| 23. Trefoil Clover | *Trifolium wormskjoldii* |
| 24. Wild Rose | *Rosa nutkana* |
| 25. Willow | *Salix arbusculoides* |
| | *Salix arctica* |
| | *Salix barclayi* |
| | *Salix commutata* |
| | *Salix fuscescens* |
| | *Salix glauca* |
| | *Salix hookeriana* |
| | *Salix lanata* |
| 25. Willow (cont.) | *Salix lasiandra* |
| | *Salix monticola* |
| | *Salix ovalatifolia* |
| | *Salix planifolia* |
| | *Salix polaris* |
| | *Salix reticulata* |
| | *Salix rotundifolia* |
| | *Salix scouleriana* |
| | *Salix setchelliana* |
| | *Salix sitchensis* |
| 26. Wiregrass (Arctic Rush) | *Juncus balticus* |
| 27. Yellow (Tufted) Loosestrife | *Lysimachia thyrsiflora* |



*Equisetum arvense,* Common Horsetail.

## Appendix B: Plant Species of Southeast Alaska with Economic Markets. Page 1 of 5

| Species by Family, Genus, and Species. The Roman numerals in the fourth column refer to the species' marketable use as shown in Appendix A | | | |
|---|---|---|---|
| **Clubmoss Family** | | | |
| Lycopodiaceae | *Lycopodium alpinum* | Alpine Clubmoss | VII |
| | *Lycopodium annotinum* | Stiff Clubmoss | VII |
| | *Lycopodium clavatum* | Running Clubmoss | VII |
| | *Lycopodium inundatum* | Bog Clubmoss | VII |
| | *Lycopodium obscurum* | Tree Clubmoss | VII |
| | *Lycopodium selago* | Fir Clubmoss | VII |
| | *Lycopodium sitchense* | Alaskan Clubmoss | VII |
| **Horsetail Family** | | | |
| Equisetaceae | *Equisetum arvense* | Common Horsetail | VIab, IX |
| **Common Fern Family** | | | |
| Polypodiaceae | *Athyirum felix-femina* | Common Lady Fern | VIc |
| | *Pteridium aquilinum* | Bracken Fern | VIc, IX |
| **Cypress Family** | | | |
| Cupressaceae | *Chamaecyparis nootkatensis* | Alaska Yellow Cedar | VII |
| | *Juniperus communis* | Common Mountain Juniper | V |
| | *Thuja plicata* | Western Redcedar | I, III |
| **Pine Family** | | | |
| Pinaceae | *Abies amabilis* | Pacific Silver Fir | VII |
| | *Abies lasiocarpa* | Subalpine Fir | VII |
| | *Picea sitchensis* | Sitka Spruce | I, III, V, VId, VII |
| | *Pinus contorta* | Shore Pine | III, VII |
| | *Tsuga heterophylla* | Western Hemlock | III |
| | *Tsuga mertensiana* | Mountain Hemlock | III, VII |
| **Yew Family** | | | |
| Taxaceae | *Taxus brevifolia* | Western Yew | V, VId |
| **Maple Family** | | | |
| Aceraceae | *Acer glabrum* | Douglas Maple | VIc |
| **Ginseng Family** | | | |
| Araliaceae | *Oplopanax horridum* | Devil's Club | VIa |
| **Sunflower Family** | | | |
| Asteraceae | *Achillea millefolium* | Common Yarrow | VId |
| | *Aster modestus* | Great Northern Aster | IX |
| | *Aster subspicatus* | Douglas Aster | IX |
| | *Cirsium edule* | Edible Thistle | VIb |
| | *Senecio triangularis* | Arrow-leaf Groundsel | IX |
| | *Solidago canadensis* | Canadian Goldenrod | IX |
| | *Solidago multiradiata* | Northern Goldenrod | IX |

## Appendix B: Plant Species of Southeast Alaska with Economic Markets. Page 2 of 5

| | | | |
|---|---|---|---|
| **Birch Family** | | | |
| Betulaceae | *Alnus incana* | Thinleaf Alder | III, IV, VI1, IX |
| | *Alnus rubra* | Red Alder | III, IV, VII |
| | *Alnus viridis* | Sitka Alder | III, IV, VII |
| | *Betula glandulosa* | Glandular Birch | I, VId, VII |
| | *Betula papyrifera* | Paper Birch | I, VId, VII |
| **Borage Family** | | | |
| Boraginaceae | *Mertensia maritima* | Oysterleaf, Bluebell | IX |
| **Mustard Family** | | | |
| Brassicaceae | *Barbarea orthoceras* | Wintercress | VIc |
| | *Cardamine oligosperma* | Little Western Bittercress | VIc |
| | *Cardamine bellidifolia* | Alpine Bittercress | VIc |
| | *Cardamine breweri* | Brewer's Bittercress | VIc |
| | *Cardamine occidentalis* | Western Bittercress | VIc |
| | *Cardamine pensylvanica* | Pennsylvania Bittercress | VIc |
| | *Lepidium densiflorum* | | VIc, VII |
| **Honeysuckle Family** | | | |
| Caprifoliaceae | *Sambucus racemosa* | Pacific Red Elderberry | II, VIc |
| **Pink Family** | | | |
| Carophyllaceae | *Cerastium arvense* | Field Chickweed | VIc |
| | *Cerastium earlei* | Bering Chickweed | VIc |
| **Dogwood Family** | | | |
| Cornaceae | *Cornus canadensis* | Bunchberry | VII |
| | *Cornus sericea* | Red-osier Dogwood | VII |
| **Heather Family** | | | |
| Ericaceae | *Arctosaphylos uva-ursi* | Bearberry (Kinnikinick) | VIad, IX |
| | *Gautheria shallon* | Salal | II, VII |
| | *Ledum palustre* | Narrow-leaf Labrador-tea | VIb |
| | *Ledum groenlandicum* | Common Labrador-tea | VIb |
| | *Rhododendron camtschaticum* | Kamchatka Rhododendron | VII |
| | *Vaccinium alaskaense* | Alaska Blueberry | II, VIb, VII, IX |
| | *Vaccinium caespitosum* | Bog Blueberry | II, VIb, VII, IX |
| | *Vaccinium ovalifolium* | Early Blueberry | II, VIb, VII, IX |
| | *Vaccinium oxycoccos* | Bog Cranberry | II, IX |
| | *Vaccinium parvifolium* | Red Huckleberry | II, IX |
| | *Vaccinium uliginosum* | Dwarf Alpine Blueberry | II, VIb VII, IX |
| | *Vaccinium vitis-idaea* | Mountain Cranberry, Lingonberry | II, VId, IX |
| **Pea Family** | | | |
| Fabaceae | *Lathyrus japonicus* | Beach-pea | IX |
| | *Lathyrus palustris* | Wild-pea | IX |

| | | | |
|---|---|---|---|
| Fabaceae (cont.) | | | |
| | *Lathyrus ochroleucus* | Cream-flowered Pea | IX |
| | *Lupinus nootkatensis* | Nootka Lupine | IX |
| | *Lupinus arcticus* | Arctic Lupine | IX |
| | *Trifolium wormskjoldii* | Coast Clover | IX |
| Currant Family | | | |
| Grossulariaceae | *Ribes bracteosum* | Stink Currant | II, IX |
| | *Ribes lacustre* | Bristly Black Currant | II, IX |
| | *Ribes laxiflorum* | Trailing Black Currant | II, IX |
| | *Ribes glandulosum* | Skunk Currant | II, IX |
| | *Ribes hudsonianum* | Northern Black Currant | II, IX |
| Mistletoe Family | | | |
| Loranthaceae | *Arceuthobium campylopodium* | Dwarf Mistletoe | VII, IX |
| Evening-primrose Family | | | |
| Onagraceae | *Epilobium angustifolium* | Fireweed | VIac, VI1, IX |
| Plantain Family | | | |
| Plantaginaceae | *Plantago macrocarpa* | Seashore Plantain | VIcd, IX |
| | *Plantago maritima* | Goose-tongue | IX |
| Buckwheat Family | | | |
| Polygonaceae | *Polygonum viviparum* | Alpine Bistort | IX |
| | *Polygonum amphibium* | Water Smartweed | IX |
| | *Polygonum aviculare* | Doorweed (Matweed) | IX |
| | *Polygonum caurianum* | Alaska Knotweed | IX |
| | *Polygonum fowleri* | Fowler Knotweed | IX |
| | *Portulacaceae* | Purslane Family | |
| | *Claytonia sibirica* | Siberian Spring-beauty | VIc |
| Primrose Family | | | |
| Primulaceae | *Lysimachia thyrsiflora* | Tufted (Yellow) Loosestrife | IX |
| Wintergreen Family | | | |
| Pyrolaceae | *Chimophila umbellata* | Pisissewa | VIabc |
| | *Pyrola asarifolia* | Large Liverleaf Wintergreen | I |
| | *Pyrola chlorantha* | Greenish Wintergreen | I |
| | *Pyrola minor* | Lesser Wintergreen | I |
| | *Pyrola secunda* | One-sided Wintergreen | I |
| Rose Family | | | |
| Rosaceae | *Amelancier alnifolia* | Northern Serviceberry | II |
| | *Aruncus dioica* | Goatsbeard | VIc |
| | *Fragaria chiloensis* | Beach Strawberry | II |
| | *Potentilla anserina* | Common Silverweed | IX |
| | *Potentilla palustris* | Marsh Cinquefoil | IX |

## Appendix B: Plant Species of Southeast Alaska with Economic Markets. Page 4 of 5

| | | | |
|---|---|---|---|
| Rosaceae (cont.) | *Potentilla villosa* | Villous Cinquefoil | IX |
| | *Potentilla biflora* | Two-flower Cinquefoil | IX |
| | *Potentilla elegans* | Elegant Cineqefoil | IX |
| | *Potentilla gracilis* | Slender Cinquefoil | IX |
| | *Potentilla hippiana* | Woody Cinquefoil | IX |
| | *Potentilla hookeriana* | Hooker Cinquefoil | IX |
| | *Potentilla hyparctica* | Arctic Cinquefoil | IX |
| | *Potentilla nivea* | Snow Cinquefoil | IX |
| | *Potentilla novegica* | Rough Cinquefoil | IX |
| | *Malus fusca* | Oregon Crab Apple | II |
| | *Rosa nutkana* | Nootka Rose | VIb, IX |
| | *Rubus chamaemorus* | Cloudberry | II |
| | *Rubus parviflorus* | Thimbleberry | II |
| | *Rubus spectabilis* | Salmonberry | II, VIc |
| | *Rubus leucodermis* | Western Black Raspberry | II, VIb |
| Willow Family | | | |
| Salicaceae | *Populus balsamifera* | Black Cottonwood | IX |
| | *Populus tremuloides* | Quaking Aspen | VIa, IX |
| | *Salix arctica* | Arctic Willow | VIc, IX |
| | *Salix barclayi* | Barclay Willow | VIc, IX |
| | *Salix commutata* | Undergreen Willow | VIc, IX |
| | *Salix scouleriana* | Scouler Willow | V, VIc, IX |
| | *Salix sitchensis* | Sitka Willow | VIc, IX |
| | *Salix arbusculoides* | Littletree Willow | V, VIc, IX |
| | *Salix fuscescens* | Alaska Bog Willow | VIc, IX |
| | *Salix glauca* | Greyleaf Willow | VIc, IX |
| | *Salix hookeriana* | Bigleaf Willow | VIc, IX |
| | *Salix lanata* | Woolly Willow | VIc, IX |
| | *Salix lasiandra* | Black Western Willow | VIc, IX |
| | *Salix monticola* | Mountain Willow | V, VIc, IX |
| | *Salix ovalatifolia* | Ovalleaf Willow | VIc, IX |
| | *Salix planifolia* | Diamondleaf Willow | VIc, IX |
| | *Salix polaris* | Polar Willow | VIc, IX |
| | *Salix reticulata* | Narrowleaf Willow | VIc, IX |
| | *Salix rotundifolia* | Least Willow | VIc, IX |
| | *Salix setchelliana* | Setchell Willow | VIc, IX |
| Figwort Family | | | |
| Scrophulariaceae | *Castilleja miniata* | Great Red Indian Paintbrush | IX |
| Nettle Family | | | |
| Urticaceae | *Urtica dioica* | Stinging Nettle | VIC |

## Appendix B: Plant Species of Southeast Alaska with Economic Markets. Page 5 of 5

| | | | |
|---|---|---|---|
| **Violet Family** | | | |
| Violaceae | *Viola glabella* | Stream Violet | VIC |
| | *Viola langsdorffii* | Alaska Violet | VIC |
| | *Viola palustris* | Marsh Violet | VIC |
| | *Viola adunca* | Western Dog Violet | VIC |
| | *Viola biflora* | Two-flower Violet | VIC |
| | *Viola renifolia* | Whith Violet | VIC |
| | *Viola sempervirens* | Redwoods Violet | VIC |
| | *Viola selkirkii* | Selkirk Violet | VIC |
| **Arum Lily Family** | | | |
| Cyperaceae | *Lysichiton americanum* | Skunk Cabbage | VId |
| **Sedge Family** | | | |
| Carex | *Carex* spp. | Sedges (28) | IX |
| **Rush Family** | | | |
| Juncaceae | *Juncus balticus* | Arctic Rush (Wiregrass) | IX |
| **Lily Family** | | | |
| Liliaceae | *Veratrum viride* | False Hellebore | VIad |

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## About the Agricultural and Forestry Experiment Station

The federal Hatch Act of 1887 authorized establishment of agricultural experiment stations in the U.S. and its territories to provide sicence-based research information to farmers. There are agricultural experiment stations in each of the 50 states, Puerto Rico, and Guam. All but one are part of the land-grant college system. The Morrill Act established the land-grant colleges in 1862. While the experiment stations perform agricultural research, the land-grant colleges provide education in the science and economics of agriculture.

The Alaska Agricultural Experiment Station was established in Sitka in 1898, also the site of the first experiment farm in Alaska. Subsequent stations were opened at Kodiak, Kenai, Rampart, Copper Center, Fairbanks, and Matanuska. The latter two remain. The Alaska station was not originally part of the Alaska land-grant college system. The Alaska Agricultural College and School of Mines was established by the Morrill Act in 1922. It became the University of Alaska in 1935. The Fairbanks and Matanuska farms are part the Agricultural and Forestry Experiment Station of the University of Alaska Fairbanks, which also includes the Palmer Research Center.

Early experiment station researchers developed adapted cultivars of grains, grasses, potatoes, and berries, and introduced many vegetable cultivars appropriate to Alaska. Animal and poultry management was also important. This work continues, as does research in soils and revegetation, forest ecology and management, and rural and economic development. Change has been constant as the Agricultural and Forestry Experiment Station continues to bring state-of-the-art research information to its clientele.

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University of Alaska Fairbanks
AFES Publications Office
P.O. Box 757200
Fairbanks, AK 99775-7200
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