

Managing Wild Bog Blueberry, Lingonberry, Cloudberry and Crowberry Stands in Alaska



Introduction

Berry picking is a cherished tradition among all Alaskans that provides important recreational activities for young and old alike. It has been an integral part of subsistence activities for thousands of years. Alaska is rich in wild edible berries that provide essential nutrients, especially vitamin C and other antioxidants, for northern inhabitants.

Despite their importance, berry harvesting can be a frustrating experience. Favored berry picking sites have abundant fruit one year and none the next. Wide fluctuations in yields have led some countries such as Sweden, Germany and United States to

This publication summarizes some possible practices for managing wild berry stands in Alaska. The goal is to stimulate local experimentation with practices that have been useful elsewhere in the circumpolar North.

attempt commercial cultivation, while others have attempted various methods of enhancing wild stands to improve berry production. The wild blueberry industry in New England, the northern Great Lakes states, and eastern Canada is based upon intensive management of wild stands.

There have been no long term trials on managing wild berry stands in Alaska, although some information has been garnered from short-term experiments at the University of Alaska Fairbanks. However, throughout the circumpolar North many attempts have been reported to manage wild stands of berries for nutritional, recreational and medicinal uses.

The discussion is divided into two sections: plant biology and management. An understanding of reproductive cycles and the factors that influence flowering and fruit production are essential to good management for increased berry production.

This paper focuses on four berries (*Empetrum nigrum*, *Rubus chamaemorus*, *Vaccinium vitis-idaea*, and *Vaccinium uliginosum*) identified by the U.S. Department of Agriculture Natural Resources Conservation Service as important to berry harvesters in interior Alaska. This report does not address the blueberry species *Vaccinium ovalifolium* or *Vaccinium alaskaense*, which are commonly known as highbush blueberry, early blueberry, huckleberry or Alaska blueberry.

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Crowberry (*Empetrum nigrum*)

General:

An evergreen ground cover.

Ecology

Grows in a variety of habitat types from dry, rocky alpine soils to open conifer forests. It is common in shrub habitats, open muskegs and shorelines and grows both on acidic soils and those with a neutral pH. Crowberry cannot tolerate wet and waterlogged soils.

Propagation

The plant forms large clumps, up to 10 inches (25 cm) tall and spreads by above ground, creeping stems. The branching stems spread along the ground and send out roots forming large, shallowly rooted mats. Wild populations of crowberry are a mixture of plants originating from seed and from creeping stems that root along the ground (natural layering).

Some crowberries (ssp. *nigrum*) have two separate plant types: male plants and female plants. This subspecies grows in coastal Alaska from the southeastern panhandle to the Aleutians and does not produce nearly as much fruit as the subspecies *hermaphroditum* which has mostly one plant type where all flowers include both male and female flower parts.

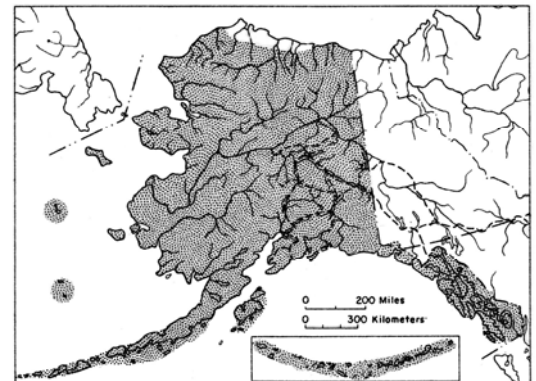
Hermaphroditum is the most common subspecies and grows throughout northern, interior, southwestern and western Alaska, and produces the most reliable quantity of fruit from year to year. Flowers are mostly solitary in the axils of the needle-like leaves. They are pink or purplish and inconspicuous, often buried near the ground beneath spiking branches. Flowering occurs on the previous season's growth, so fruit is usually found singly or in small clusters along the sides of the branches rather than at the tips.

Pollination by wind may be critical for fruit production, but others do not rule out insects, particularly flies. Self pollination is considered impossible or so slight that fruit yield is significantly reduced if cross pollination does not occur.

Plants may be propagated by seeds or stem cuttings. Seeds do not germinate right away, but need a cold stratification period before germinating. In natural plantings direct seeding for plant establishment does not work. Seedlings are uncommon in wild stands, and plant establishment can take decades. Leafy stem cuttings taken in mid-summer root easily in peat. Plant growth following rooting is rapid. Plants do not regenerate from root cuttings or prostrate leafless stems.

Fruit

The fruit is 0.15 to 0.40 inch (4–10 mm) in diameter and consists of a black drupe with six to nine white seeds or nutlets. Raw berries are small, mealy and often considered tasteless when eaten alone. They are often mixed with



other berries or cooked into jelly or pies. In Lapland, crowberries are used as an extender for blueberry products and as a coloring agent. Crowberry is very high in vitamin C and other antioxidants and has significant medicinal properties.

Cloudberry, salmonberry (*Rubus chamaemorus*)

General

A herbaceous ground cover.

Ecology

Grows in black spruce bogs, moist tundra, and many shrub-dominated habitats. Sites are usually poorly drained and acidic.

Propagation

Plants spread by underground rhizomes that can reach up to 32 feet (10 m) long. The rhizomes are usually 4 to 6 inches (10–15 cm) beneath the surface in the peaty organic mat. Buds are formed along the rhizomes, and shoots are produced annually that arise 6 to 10 inches (15–25 cm) above the ground.

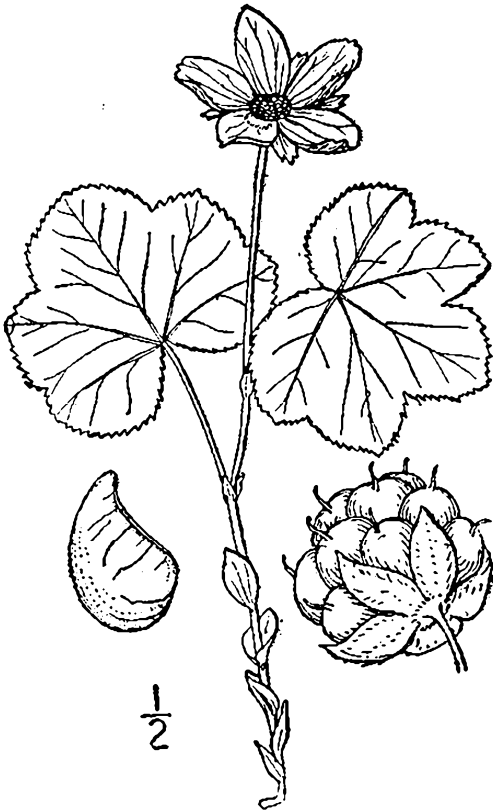
Each shoot consists of a single stem with one to four leaves. The shoots may be vegetative or topped with a single flower. There are two separate plant types: ones with only male flowers and a second with only female flowers. This trait encourages cross pollination between clones, but it can also lead to poor fruit production.

Huge patches of cloudberry may bloom profusely, but they may consist of a single plant of one sex. Entire fields can be made up entirely of male flowers that produce no fruit. There are no records in Alaska on typical population ratios of male to female plants in wild stands or the optimum ratios needed for good fruit set. In some northern Norway bogs, fewer than 25 percent of the flowering shoots are female. Even among seedling populations, there is a greater percentage of male plants than female.

Male and female flowers appear similar, and only careful examination of the flowers will show which plants can produce fruit. Male flowers open earlier than female flowers and attract potential insect pollinators with nectar.

In Labrador, cloudberrries are pollinated by several species of flies, bumblebees, and solitary bees with flies being the most important for fruit set. Wind pollination may also be important in coastal regions.

Cloudberry seeds are difficult to germinate, and few seedlings are found in wild stands. Seeds require acid scarification plus six to eight months of cold stratification to germinate. Fruit production does not begin until seven years after seed germination. Vegetative propagation by rhizomes is dominant in wild stands, and rhizome cuttings may be used to propagate the plant commercially. Rhizome cuttings 3 to 8 inches (7–20 cm) long and



collected in May or August are best. For large scale production, shoot tip micropropagation is used.

Fruit

Each fruit is an aggregate of drupelets containing four to twenty fruits, each having a single seed. The fruit is red when immature but becomes amber and very soft when ripe. Berries are rich in antioxidant flavonoids, phenolic acid and vitamin C. Historically, the cloudberry was important throughout the circumpolar North in the prevention of scurvy.

Lingonberry, lowbush cranberry (*Vaccinium vitis-idaea*)

General

An evergreen ground cover.

Ecology

Grows in diverse habitats from dry roadside slopes to acid-peat bogs, and from mature spruce-hardwood forests to exposed arctic and alpine tundra. It grows in dense mats, 8 to 12 inches (20–30 cm) tall in deep shady forests but also forms ground-hugging mats scattered among the rocks of exposed alpine outcrops. Fruit is most abundant in exposed sites that have acid soils with a high organic matter content.

Propagation

Lingonberries spread from rhizomes located within the top 12 inches (30 cm) of the substrate surface. The evergreen shoots arise from subterranean buds on the rhizomes and are interspersed with a fine, hair-like root system.

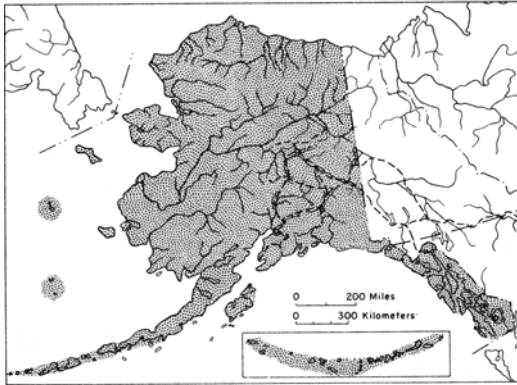
Usually one to three terminal buds develops into flower buds beginning when the plant is three to five years old.

Plants in shady habitats rarely produce flowers although the stems may be thick and abundant. Each flower bud may hold up to twenty flowers in tightly-branched racemes, although the number of flowers is usually about five per bud. The flowering shoots may also send up vegetative lateral shoots that may form flower buds in subsequent seasons. Flowers are pink to white, bell-shaped and in clusters at the tips of the branches. Plants have a single flower type with both male and female parts in the same flower.

Self pollination is possible, but cross pollination by insects provides the best fruit production. Pollination by wind is considered a major factor in open tundra and coastal areas, however, wind speeds need to be greater than 10 mph. Below that level, pollen is not released from the anthers.

A consistent, rapid movement of the flower, often called buzz pollination, is required to move pollen out of the anthers. This buzz pollination is





accomplished by the strong vibration by insects. The most important pollinators of lingonberries in interior Alaska are several species of bumblebees.

Despite the abundance of blooms, fruit production varies from year to year. It has been estimated that about 30 percent of the flowers actually produce fruit in any one year, but the range can vary from 0 to 94 percent annually.

Fresh seeds of lingonberries germinate well, but success is greater once the seeds have been cold stratified for thirty days following harvest. Seedlings are rare in wild stands, and direct seeding in the field is not successful. Seedlings grown in cell packs of peat moss transplant well into wild stands as long as they are planted into mineral soil, not the organic mat, and watered well. Stem cuttings root easily in milled peat with or without rooting powder, but the resulting plants may not have the capacity to produce rhizomes.

Some plants do not spread from cuttings but form tiny mounds with limited potential for fruit production. Rhizome cuttings propagate easily when taken in early spring or late summer. Propagation by tissue culture also is well documented.

Fruit

The berries are found singly or in clusters at the tips of the branches. Berries are rich in minerals and antioxidants and are used in a wide variety of sauces, jam, jelly, baked goods, syrups, wines and liqueurs throughout the circumpolar North. The leaves and fruit also are harvested for medicinal extracts especially in eastern Europe. The plant is grown as an ornamental ground cover in the United States.

Bog or lowbush blueberry (*Vaccinium uliginosum*)

General

A deciduous shrub.

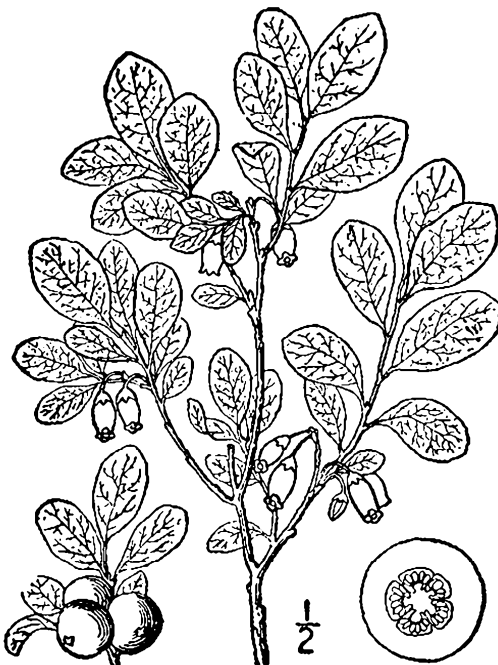
Ecology

Grows on acid, peaty soils throughout Alaska and the circumpolar North. It is an understory shrub in many northern forest types and occurs in bogs, muskegs and open alpine and arctic tundra. It can occur as solitary shrubs or large clones, a product of layering of above-ground shoots that get buried in the organic mat.

Propagation

Bog blueberries do not spread by rhizomes. A single shrub can spread up to 108 feet² (10m²) by layering. The buried horizontal stems occur 6 to 18 inches (15–45 cm) below the surface. The individual bushes range from a few inches tall on windswept tundra to 24 inches (61 cm) in forest habitats.

The flowers are white to pink and appear singly or in small clusters in the axils of the leaves. The fruits hang beneath the branches and are often



harvested from taller plants by beating the bush and allowing the fruit to drop into a bucket. Flowers appear very early in spring and may be self pollinated or visited by insects, especially bumblebees.

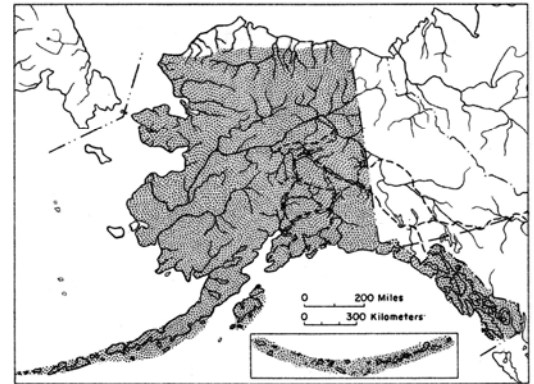
Bog blueberry seeds will germinate immediately upon extraction from the fruit, but germination is better and over a wider range of temperatures following a 30-day cold stratification period. Stem cuttings are not successful, but layered shoots propagate successfully when planted immediately after collection. Seedlings established in peat-filled cell packs grow well when planted in acidic mineral soils with high organic matter content. Micropropagation using young leaves is also possible.

Fruit

The bog blueberry is the most popular wild-harvested fruit in interior Alaska. It is eaten fresh and made into jams, jellies, pies, juice and other products. The leaves and fruit are dried for teas, and they, along with rhizomes, have medicinal properties.

The fruit is a dark blue to black berry with many tiny seeds. Fruit vary considerably in size, shape and color, in part because there are at least two distinct races recognized in Alaska, a diminutive alpine plant and a more robust lowland bog plant.

The fruits of this species are not harvested in any great quantity except in Alaska and parts of Russia because other blueberry species are favored. In central Siberia at least five cultivated selections of bog blueberry have been made, and they are cultivated in rows similar to highbush blueberries.



Factors That Influence Berry Production

Pollination

Adequate pollination is critical to consistent and reliable fruit set. Self pollination might take place in wild berries, and wind pollination may be important in open, exposed coastal areas. At least for lingonberries, winds of less than 10 mph do not promote fruit set.

For all berries in this publication, the most important pollinators are insects: bumblebees in blueberries and lingonberries; flies and bumblebees in cloudberry. Anything that will promote natural insect pollination will increase fruit set as long as weather conditions are good for the flowers and insects. For some wild berries, frosts, rainy weather and cold temperatures during bloom time may not be sufficient to injure the flowers, but they slow or prevent insect pollinators from working the flowers. In Norway, maintenance of windrows leads to an increased activity of pollinating insects and has increased yield of cloudberry.

Several species of bumblebees are native to Alaska. Some bumblebees nest on the ground and others nest in pre-existing holes in the ground such as mouse or vole holes. The queens emerge early in spring and can spend up to two weeks searching for a good nest site. Many berry growers at lower latitudes make nest boxes specifically for bumblebees and either install a captured queen or set the boxes in ideal locations hoping a queen takes up residence. There are several Internet sites for directions on making nest boxes (i.e. http://bumblebeeboosters.unl.edu/artificial_domicile.htm, <http://tomclothier.hort.net/page38.html>). Nest boxes are also commercially available. These boxes have not been tested in Alaska.

Another method of encouraging natural populations of bumblebees is to ensure that they have a reliable food source all season long, not just when the wild berries are blooming. Observing bumblebees throughout the season will provide clues to appropriate plants to maintain for season-long food. It is also important to remove competing flowering species during the time the wild berries are blooming so pollinators concentrate on the crop plant. Some growers purchase packaged bumblebees that consist of small colonies housed in special cardboard boxes. They have a specific life and will die out completely after a few weeks. Boxes must be ordered for delivery just before bloom time.

One experiment conducted in the Tanana Valley (Fairbanks, Delta Junction areas) with bumblebee boxes did not show increased fruit set in lingonberries even though the bumblebees were observed visiting the flowers and collecting pollen. One box of bees per site may have been insufficient for increased pollination.

Timing is critical with the use of commercial boxes because they have a specific life span. They also need to be shipped by the fastest carrier to ensure survival in transit (i.e. <http://www.bugsandbees.com/pollination.htm>).

Bumblebees forage at lower temperatures and under more inclement weather than honeybees. At lower latitudes, honeybee hive placement in fields of blueberries and other fruits is common. Recent problems with honey bees including mite damage and diseases have made this method expensive and sometimes not worth the effort. Honey bees are mostly imported by air freight directly from suppliers or from local distributors. There is considerable startup costs with purchase of hives, bee suits, smokers, etc. Success depends upon the survival of the queen and health of the bees. Depending on the weather in specific localities, honeybees make excellent pollinators of many crops. Like the bumblebees though, timing is critical, and they must be managed for the entire season, not just during flowering.

Another management alternative is working with other natural pollinators such as flies and wasps. Since little is known about specific Alaska pollinators, management of native pollinators will require studies into identification, life cycles, etc.

Vegetation Management and Weeds

Native berries rarely cover the entire ground in any habitat. There may be considerable spaces between plants in which competing vegetation grows. Any benefits from fertilizer, mulching, etc. will be diluted by competing vegetation. To obtain the greatest yields, any field must be managed to remove competing vegetation and encourage the spread and natural propagation of the berry in question.

Depending on the habitat, vegetation removal might include cutting trees. Tree removal will increase light levels, reduce competition for nutrients, and provide better access by pollinators. However, a careful analysis of the soils is necessary before removal. In some forested areas, the berries have a substantial part of their root or rhizome system very close to the soil surface, and much of it could be in the organic mat of mosses or on rotting tree stumps. Tree removal and increased exposure to sunlight and winds dries up these areas, and in many instances, the berry crop dies out. Tree thinning over several years is a better strategy in these habitats.

Lingonberries in particular are sensitive to tree removal. Populations may be reduced because of damage to the organic rooting zone and soil moisture regimes. In Sweden the lingonberry yield was reduced by ten percent each year for the next decade following clear cutting. In areas where trees can be removed, no stumps should remain to facilitate the future use of machinery such as fertilizer spreaders, vehicles.

Please note that existing federal and state wetland regulations prohibit the clearing or draining of existing wetlands. Please contact your local NRCS field office prior to working in any wet areas and NRCS can help you determine if regulated wetlands exist on your property.

A grower near Fairbanks attempted to establish a bog blueberry field by clearing a black spruce bog “covered with blueberries” by blading and windrowing. Despite timing the clearing in late winter so the ground was still frozen and snow covered, nearly all of the blueberries were lost. Less than one percent of the soils were covered with blueberries five years after

the clearing. However, regrowth of the surviving blueberries was significant. The plants that seemed to survive were the original rooted plants, not the layered, spreading plants. They were well branched, forming large mounds that began to produce fruit three years after blading.

In the 1960s, Dr. Arvo Kallio attempted a fertilizer experiment with bog blueberry near Fairbanks. The project was never completed, but Dr. Kallio noted that any benefit from fertilizer was eliminated by an influx of weeds, especially perennial grasses. Management for berry production will require a continuous removal of weeds. Annuals should be removed before they set seed. Perennials need to be cut back or removed several times each season to minimize their impact. Selective herbicides may also be used, but there is no research in Alaska on appropriate chemicals and timing of applications.

Mulching is another alternative to reduce weed growth. Acidic wood chips, peat, and compost can be used as a thick covering to smother existing weeds and provide a good rooting environment for spreading plants. The type of mulch and how much is applied will depend on location.

Fertilizer

No studies in Alaska have shown a relationship between increased nutrient levels and fruit production of wild berries. However, cloudberry, lingonberry and crowberry respond to fertilizer with increased vegetative growth. In a tundra habitat, lingonberry and bog blueberry shoot growth responded to nitrogen and phosphorus fertilizers, not potassium. High fertilizers and increased shade are detrimental to vegetative growth of crowberry. Studies in Norway showed that fertilizer broadcast on the surface of the bog did not produce any effect in cloudberry. Deep applications of fertilizer by drilling the fertilizer into the soils had very good results. Recommendations in northern Norway call for 267 lb/acre (300 kg/ha) application of superphosphate or complete fertilizer. Cloudberry showed the best growth when fertilizer was applied 8 to 16 inches (20–40 cm) below the surface, while crowberry and bog blueberry grew best with a 4 to 10 inches (10–20 cm) depth.

Weather

Lingonberry, bog blueberry and crowberry flower buds begin to form in the summer prior to flowering. For instance in Tanana Valley, lingonberry flower buds begin to form in late June. They develop through the summer until cold temperatures suspend the process. Final flower development and flowering occur the following spring. Because of this long cycle, weather patterns throughout the year can impact flowering and fruit production. Mid summer frosts, cooler than normal summer temperatures, severe early fall frosts, lack of snow cover during winter, and late spring frosts can kill flower buds. In Sweden, a temperature of 29°F (–1.5°C) during blossoming, can kill mature lingonberry flowers, and 26°F (–3.5°C) can prevent development of fruit.

Most methods to alleviate frost damage in commercial fields are not practical for wild stands. In northern Norway cloudberry fields, snow fencing is often installed in windswept areas to increase snow accumulation. This, in turn, delays spring bloom and avoids possible frost

damage to the flowers during bloom time. Fields are often ditched to allow cold air drainage away from flowering and fruiting plants.

Plant Selection and Interplanting

Examination of cloudberry bogs may show an overabundance of male plants. Selection by seed or vegetative propagation of female plants followed by interplanting in existing bogs will change the ratio in favor of fruit production. The most rapid method of changing the ratio is by transplanting large clumps of female plants into the field. Additionally, rhizome cuttings established under culture then transplanted into wild stands may be used to interplant superior clones.

The northern interior crowberry, lingonberry and bog blueberry do not have the same problems with two types of plants, but all can be interplanted for long term productivity. The best method is to select fruit from superior plants, germinate the seeds, and grow the seedlings to 4 to 6 inch plants. Seedlings transplanted early in the season will become established as long as the plants are inserted into mineral soil, not the organic mat. A mulch of wood chips or compost after planting will help keep the seedlings from frost heaving before new roots are formed.

Interplanting and improving wild stands may have marketing implications. In some regions berries harvested in fields that are improved in this manner can no longer be considered “wild berries” for commercial sales. This may be particularly important in the nutraceutical industry.

Burning

Burning fields is a common practice in the annual management of wild blueberry stands in eastern United States and Canada. Burning controls weeds, hastens the breakdown of organic matter, removes old or nonproductive wood, and promotes young, vigorous regrowth. Very little is known about burning and fruit production of the four Alaska species. Most studies have been short term and only reveal vegetative regrowth after fire. Short-term studies point to ample regeneration of new shoots on crowberry, bog blueberry, cloudberry and lingonberry following fire, but the intensity of the fire must be strictly controlled. Severe fires that destroy the organic mat and a lot of the shallow roots and stems also destroys the plants. Crowberry and cloudberry can regenerate after a fire but the process can take many years depending on the severity of the burns. Bog blueberry often responds positively to fire but recovery to pre-fire levels can take more than eight years. In all instances fruit production is reduced, often for many years. The alternate year burning practices for eastern wild blueberry fields are not possible for any of the Alaska wild berries.

Pruning

A light burn that removes above-ground plants yet preserves most of the organic mat and the below ground root and stem system produces the best regrowth on lingonberries and bog blueberries. Pruning the above ground stems to the ground level comes close to the vegetative regeneration of fire. Because regrowth on lingonberries and bog blueberries is very slow over several years, no yield increases would be realized for at least the first three to five years. Pruning may be beneficial in the process of cleaning out



vegetation in newly managed areas or to rejuvenate old bushes of bog blueberry, but there is not enough information for any of the berry species to make pruning recommendations at this time.

Pests

All fruits are subject to disease and insect pests, the control of which would undoubtedly improve fruit production. No systematic study of pests and diseases has occurred in Alaska, and the extent of their impact on fruiting is unknown. Currently, there are no management recommendations for pest control in any of the fruits.

Recommendations for Managing Wild Stands of Berries

1. Search for wild stands that are already productive. Make sure of land ownerships prior to starting any management plans.
2. Evaluate existing vegetation and soils. List competing vegetation, potential weed problems, soils, organic matter. Determine the location of plant roots and rhizomes and identify potential problems with tree and brush clearing.
3. Remove competing vegetation such as trees, shrubs, grasses over many years.
4. Fertilize plants with a complete fertilizer by drilling into the root zone, not by surface application. Fertilizer quantities are unknown.
5. Identify local pollinators. Consider managing pollinators by improving nesting habitats and encouraging favorite pollen and nectar sources.
6. Enhance pollinators with bumblebee nest boxes and commercial bumblebee boxes
7. If “wild” is not important for marketing purposes, consider interplanting wild stands with seedlings or cuttings propagated in flats or containers and transplanted to the site. Plant in spring, and make sure roots are in mineral soil, not the organic mat.
8. Encourage natural spread of existing plants by removing competing vegetation and mulching for weed control.
9. Identify and monitor local disease and pest problems.

Glossary

Clone. A group of plants that have been propagated vegetatively by stem cuttings, root cuttings, layering, or other means. Each plant is genetically identical to the original plant.

Cold stratification period. Many seeds are dormant when they are mature. They need to be exposed to cool, moist conditions (cold stratification) to break the dormancy and promote seed germination. Seeds may be sown outdoors in fields or flats so they are exposed to outdoor chilling temperatures in fall and spring. Soils must be kept moist throughout the time in spring and fall when the soils are not frozen. Alternatively, seeds may be mixed into a plastic bag of moist sand or peat (3:1 by volume sand to seeds), then refrigerated. Freezing seeds does not break dormancy. Seeds like lingonberries require a cold stratification period of 30 days after which they can be sown in containers and germinated at room temperatures.

Drupe (drupelet). A fleshy fruit with a single stony seed. A raspberry is a fruit made up of many individual drupes, each called a drupelet.

Layering. A method of vegetative propagation where cuttings are rooted while they are still attached to the mother plant. Natural layering occurs in many plants where prostrate stems form roots wherever the stem touches the ground. Plants may also be layered by pressing a branch to the ground, holding it in place with a peg, then cutting it from the mother plant once roots have formed.

Raceme. A cluster of flowers arranged along a short axis or stem. Lingonberry flowers appear in a raceme with the lower flowers blooming first.

Rhizome. An underground, mostly horizontal stem that produces roots and above-ground shoots. The lingonberry and cloudberry have long, thin underground rhizomes along which leafy shoots arise to form thick mats of fruit-producing stems.

Shoot tip micro-propagation. A form of tissue culture where very young, actively growing shoot tips are removed from the plant and grown in sterile containers for the purpose of propagating new plants.

Tissue culture. A method of plant propagation that involves placing tiny plant parts such as very young stem tips, seeds, buds, and even individual cells into a test tube or other sterile glass container and promoting the production of many young plants by growing tissues on a medium rich in nutrients and plant hormones.

Credits

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USDA-NRCS PLANTS Database: <http://plants.usda.gov/>

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Photo on Page 3 by Victoria Naegele.

NRCS Field Office Contact Information

The U.S. Department of Agriculture Natural Resources Conservation Service maintains field offices throughout the state that can provide technical assistance in your efforts to manage wild berry stands.

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