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The Reproductive Ecology of Broadleaved Trees and Shrubs: Salmonberry

Rubus spectabilis Pursh

by

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College of Forestry

Forest Research Laboratory
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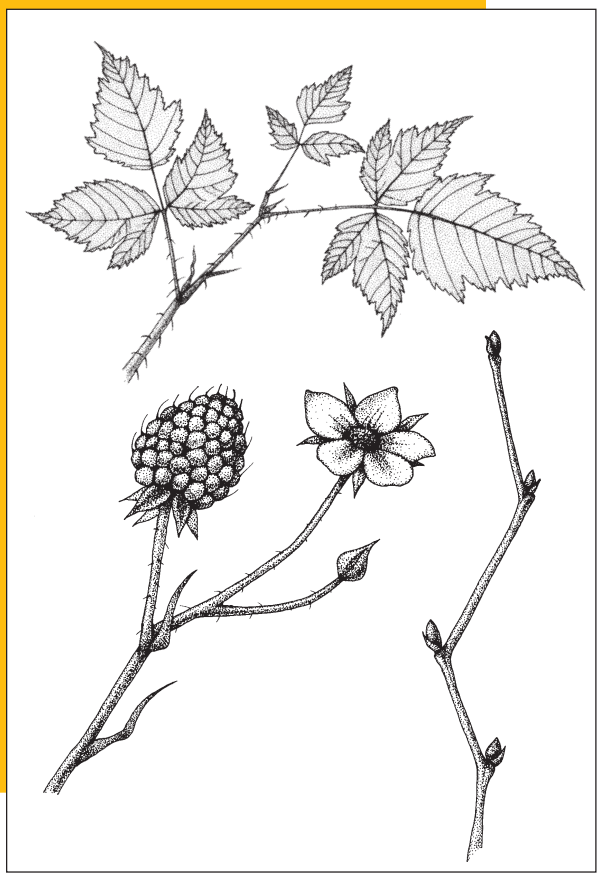
The Reproductive Ecology of Broadleaved Trees and Shrubs: Salmonberry, *Rubus spectabilis* Pursh

Salmonberry is a common broadleaved shrub that grows on cool, moist sites from coastal Alaska through northern California. Because of its ability to rapidly colonize disturbed sites and form extremely dense stands, it is commonly regarded as a nuisance by land managers. However, it also provides important wildlife habitat and helps stabilize soil. Although it does reproduce from seeds, vegetative reproduction is crucial to its distribution and ecology.

Physical Characteristics



Leaves and Stems

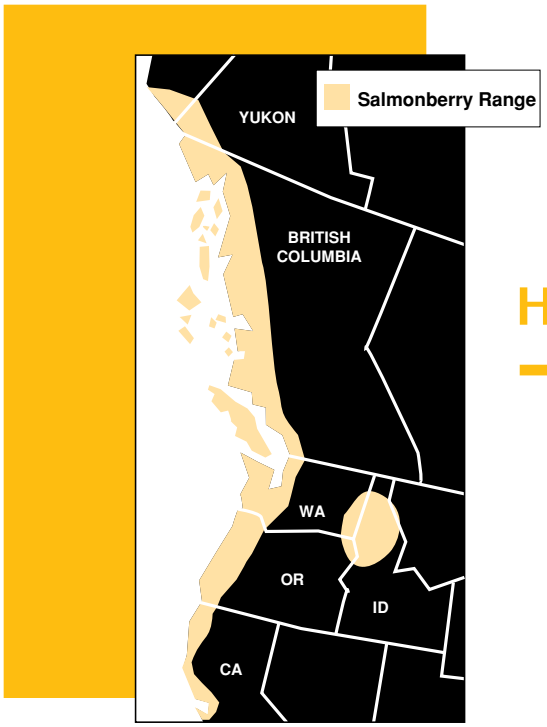
Salmonberry leaves are deciduous, alternate, and pinnately compound, with three leaflets per leaf. Leaflets are typically 1–3 inches long, have doubly-serrate margins, and are dark green above and paler green below; terminal leaflets are ovate and lateral leaflets are "mitten-shaped." Salmonberry stems are erect, range from several to 12 feet tall, and are sparingly branched. Stems are round, have orange-brown bark when mature, and are armed with prickles that fall off with the exfoliating bark.

Flowers and Fruits

Salmonberry flowers occur singly or in clusters of two to three; they range in color from bright pink to dark red. They may appear before or after the leaves unfold. Salmonberry fruits are a raspberry-like aggregate of drupelets that range in color from salmon pink to orange to dark red.

Growth Habit

Salmonberry grows in dense stands, especially on moist sites and along streams. These stands consist of from one to several clones; each clone may be from 10 to 40 feet across. Each clone consists of a number of aerial stems, called ramets,



which commonly grow to be from 3 to 12 feet tall. Sets of ramets are commonly connected to one another by underground stems called rhizomes. Rhizomes occur from several inches to several feet below the soil surface (Tappeiner *et al.* 1991, Zasada *et al.* 1992). Multiple clones are often densely interwoven and are difficult to separate.

Habitat and Range

Salmonberry grows from southeast Alaska to the Santa Cruz Mountains of California, and from the Pacific Ocean eastward into Idaho and Montana. It is especially abundant on moist sites in the Coast Ranges of Washington and Oregon, becoming less common inland and to the south.

Method of Reproduction

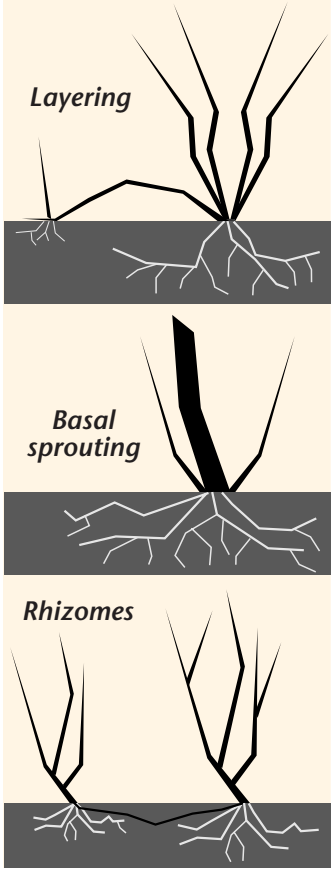
Salmonberry reproduces sexually, often from seeds stored in the soil for long periods of time, and vegetatively, via layering, basal sprouting, and rhizomes.

Sexual Reproduction

Salmonberry's showy simple and perfect flowers are pollinated by insects and hummingbirds (Haeussler *et al.* 1990). The result of successful pollination is an orange to red raspberry-like aggregate of drupelets, commonly (but incorrectly) called a berry. Each drupelet contains a single hard seed. These "berries" are dispersed primarily by animals (*e.g.*, bears, rodents, and birds), which consume the fruits while foraging and pass the seeds through their digestive tracts, effectively transporting the seeds to new sites (Barber 1976). Only a small percentage of salmonberry seeds germinate during the spring following dispersal; most lie dormant in the soil for many years, perhaps even decades, creating a large seed bank. Under natural conditions, salmonberry seeds stored in the forest floor are stimulated to germinate by disturbances such as windthrow or fire or by human activities such as harvesting. For human cultivation, salmonberry seeds can be collected in July or August and planted in October or November. Germination can be increased by chemical scarification followed by stratification. Within several years af-

ter germination, seedling growth approaches 20 to 30 cm per year (Barber 1976, Maxwell 1990, Tappeiner and Zasada 1993).

Vegetative Reproduction



Salmonberry plants contain numerous buds. Some are located above ground along aerial stems and near the base of each stem, while others are located underground in the root crown and along rhizomes. Under the right circumstances, all of these buds have the capacity to produce new plants—through layering of above-ground stems, basal sprouting, and sprouting from rhizomes. Layering occurs when a stem is pinned to the soil surface by objects such as fallen branches or trees; buds on the upper side of the stem form new aerial shoots, while adventitious roots form on the lower surface. Basal sprouting results from buds located near the base of each stem or in the root crown; basal sprouting is especially important in re-establishing plants when aerial stems have been damaged or destroyed. Sprouting from the extensive underground rhizome system is primarily responsible for the rapid spread of salmonberry. Rhizomes typically grow within several feet of the soil surface, but they may be deeper; often they form dense, interwoven mats. Because rhizomes have the potential to produce buds every 1/2 to 1 inch, a single network can contain hundreds of thousands of buds per acre. Rhizomes grow rapidly, often several feet per year, especially following disturbance. All forms of vegetative reproduction are common in salmonberry and occur with and without disturbance.

Salmonberry reproduction can be artificially induced by planting segments of above-ground stems or rhizomes (Maxwell 1990, Zasada *et al.* 1994). Buds on these stems root easily and produce new shoots and rhizomes at a rapid rate; shoots reach heights of 3–4 feet in 2–4 years. Their tops can be cut to stimulate growth.

Role in Succession

Salmonberry is a moderately shade-tolerant understory species that forms dense, continuous cover under red alder stands and in the open. It is capable of persisting in moderately dense conifer stands throughout all stages of succession. During the **stem initiation** stage of conifer stand development, salmonberry most commonly regenerates by basal sprouting or from stems produced by rhizomes; seedling establishment does occur, but does not seem important at this stage (Tappeiner *et al.* 1991, Tappeiner and Zasada 1993). In this stage, salmonberry is capable of fully occupying a site through vegetative regeneration, making it extremely difficult for other species to become established. If conifer seedlings do survive (typically with human assistance), they are likely to eventually overtop the salmonberry, achieving canopy closure. During the **stem exclusion** stage, above-ground salmonberry plants, as well as underground rhizomes, begin to die back as the conifer overstory re-

duces available light. In dense conifer stands, salmonberry may be completely eliminated within 30–40 years of crown closure. Even if salmonberry plants are eliminated, however, seeds stored in the forest floor may permit re-establishment when the stand is disturbed (Tappeiner and Zasada 1993). Events such as thinning or windthrow, which open the stand, encourage salmonberry to persist. During the **stem re-initiation** stage of conifer stand development, overstory trees often self-thin, creating openings in the canopy and increasing light to the understory. Often, this rejuvenates salmonberry. As the conifer stand approaches the **old-growth** stage, salmonberry can maintain itself by building networks of rhizomes and colonies of large clones. When gaps in the stand occur, existing salmonberry plants can extend their rhizomes, making it difficult for other trees and shrubs to become established.

Under canopies of red alder, salmonberry may persist indefinitely, since it can tolerate the light shade of an alder overstory and can outcompete most other species. In addition, salmonberry produces leaves earlier in the spring than many other species and can photosynthesize at low temperatures, giving it an edge over most competitors. In red alder stands, this early leaf-out appears to allow salmonberry to take advantage of the relatively high light intensities that exist before alder produces leaves.

Response to Changes in Environment

Once established in a forest stand, salmonberry responds favorably to any openings that occur. The size of the opening directly affects the magnitude of the response—the larger the opening, the more vigorous salmonberry becomes. Therefore, both thinning and harvest activities tend to keep salmonberry in the stand. The effect of fire on salmonberry varies with intensity. Low-intensity fires that only consume fine material on the forest floor typically stimulate salmonberry to sprout vigorously. High-intensity fires typically inhibit the growth of salmonberry by killing shallow rhizomes and destroying seeds stored in the soil.

Fisheries and Wildlife

Salmonberry is a mixed blessing in forest ecosystems. Because it grows along streams and on moist sites, its dense network of rhizomes contributes to soil stability and may help improve water quality. However, salmonberry also forms dense thickets that inhibit the establishment of conifers; as a result, salmonberry may slow the development of large woody debris needed for fish habitat. Salmonberry thickets also provide an important source of food and hiding cover for small mam-

mals and birds. Both leaves and fruits are highly palatable; periodic cutting may help stimulate forage production. Mountain beavers, deer, elk, rabbits, beavers, bears, chipmunks, deer mice, raccoons, and various birds use salmonberry for cover and forage (Martin *et al.* 1961, Maser *et al.* 1984, Gomez 1992). In British Columbia, black-tailed deer use salmonberry as spring-time forage, while Roosevelt elk browse it year-round (Nyberg and Janz 1990). If salmonberry is desired on a site, animal browsing may actually hinder establishment.

Cultural and Historical Values

Salmonberry has a variety of medicinal properties. Northwest Indians and early settlers made a tea from salmonberry leaves to help sick children relax and sleep (Forlines *et al.* 1992). Tribes such as the Kwakiutl, Quileute, and Quinault used the bark as a poultice or in a powder to soothe burns. The Bella Coola used the root bark to help ease stomach troubles, while the Quinault used salmonberry in various forms to ease labor pains (Moerman 1986).

Management Options

Salmonberry may be desirable as forage for mammals and birds or to help stabilize steep slopes, especially where foot traffic is not wanted. In general, sexual reproduction is uncertain and seedling establishment is likely to be slow. On the other hand, any of the vegetative methods is easy to use, and all are likely to yield an abundance of new plants; methods might include pinning branches to the ground to stimulate layering or cutting above-ground stems to stimulate basal sprouting.

In some cases salmonberry may need to be controlled in order to encourage the growth of other plants. A dense overstory of trees such as western hemlock can be used to create deep shade, preventing initial establishment. If already present, salmonberry sprouts can be sprayed, manually cut, or pulled out of the ground, although cutting and pulling may need to be repeated. In pure stands of salmonberry, the herbicide glyphosate can be used from late summer to early fall to damage or kill the plants (Newton and Knight 1981). Where herbicides cannot be used, cutting during June or July often reduces salmonberry growth enough to allow trees to compete for light; cutting during winter months (January–February) seldom gives sufficient control. Intensive fire can be used to kill the underground rhizomes and seed banks of salmonberry, although intense fires can also result in site degradation. For site preparation in conifer plantations, salmonberry can be burned or treated with glyphosate (Newton and Knight 1981).

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Associated Literature

Additional papers on the ecology and management of salmonberry are listed in the "Associated Literature" section that accompanies this educational package.

Additional Notes

Educational Package

This leaflet is part of a larger educational program on the reproductive ecology of Pacific Northwest broadleaved trees and shrubs. The complete program consists of two audio-visual components—a videotape on the reproductive ecology of broadleaved trees and shrubs and a series of slide-tapes on shrub identification—and four printed components: 1) an overview of plant reproduction, 2) a series of leaflets on PNW trees and shrubs, 3) a glossary of relevant terms, and 4) a list of associated literature. To obtain the complete educational package, contact: Forestry Media Center, College of Forestry, Oregon State University, Corvallis, OR 97331, (503) 737-4702. To obtain only the printed documents, contact: Forestry Publications Office, Forest Research Laboratory, Oregon State University, Corvallis, OR 97331-7401.

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Jensen, E.C., D.J. Anderson, J.C. Zasada, and J.C. Tappeiner II. 1995. THE REPRODUCTIVE ECOLOGY OF BROADLEAVED TREES AND SHRUBS: SALMONBERRY, *RUBUS SPECTABILIS* PURSH. Forest Research Laboratory, Oregon State University, Corvallis. Research Publication 9e. 7 p.

Salmonberry is an integral part of Pacific Northwest forests. This leaflet describes principal identifying characteristics, habitat and range, methods of reproduction, role in succession and response to disturbance, value to humans and wildlife, and management options. This leaflet supports a complete educational package on the natural history and reproductive ecology of Pacific Northwest broadleaved trees and shrubs; other items in the package include a videotape, three slide-tapes, and a series of printed publications.

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