

Willows of Southcentral Alaska

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Kenai Watershed Forum

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Disclaimer

This publication is designed to provide accurate information on willows from Southcentral Alaska. If expert knowledge is required, services of experienced botanist should be sought.

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Introduction

Introduction

This guide is written for the novice who would like to learn more about willows, for landowners and landscaping contractors who want to harvest their own willows for riverbank erosion control projects, for biologists who need to identify willows used by wildlife, and for the naturalist in all of us who are simply curious about the diversity of the environment.

In Southcentral Alaska, willows are abundantly distributed from lush coastal meadows to exposed mountain ridges. Their ubiquity can be credited to large numbers of species which, taken as a whole, colonize almost all habitats within this region: extensive thickets of shrubby willows compete for light and space in wetlands, tree-sized species reach for sunlight in the upper canopy of the boreal forest, and bonsai-like dwarfs defy the elements, embedded in crisp lichen mats on weathered rock chips of mountain ridges. Only in the dense coniferous coastal forest are willows sparse or lacking.

Worldwide, 330 to 350 willow species have been described, mostly from temperate and cold regions of the Northern hemisphere. Of the 40 willow species known to occur in Alaska, 26 are found in the Southcentral Alaska area covered by this guide.

The future of willows in Southcentral Alaska looks bright. Willows benefit from disturbance and with increasing population and development, their share of the landscape is only going to expand.

After a disturbance in the forest zone, willows can dominate the vegetation until overtopped by slower growing hardwood and coniferous trees. The ease of propagation of some willows makes them ideal for environmental rehabilitation projects in disturbed zones, such as roadsides and stream banks. Restoration methods using willows and other plants are discussed at length in Streambank Revegetation and Protection: a Guide for Alaska (Muhlberg and Moore 1998).

Biology

Willows are unisexual, with each individual plant bearing either male or female flowers. The minute flowers, reduced to an ovary or a set of anthers with one or two nectaries at their base, are crowded into catkins. Fertilization is done by wind and by visiting insects attracted to the sweet secretions of the nectaries. Early flowering willows provide much of the required sugar for insects, such as bumblebees.

The minute seeds of willows, crowned with long soft hairs that keep them aloft in the slightest breeze, disperse over a broad area but carry few nutrients. Under the best conditions, they remain viable only a few weeks. The diminutive seeds cannot compete against established plants and require moist bare mineral soil in full sunlight for germination.

Some willow species propagate vegetatively, such as those living along stream banks.

Ecology

Willow species differ in their ecological requirements but all require full sun exposure. Some are aggressive colonists that tolerate broad ecological ranges and are found in a variety of habitats, such as *Salix barclayi* and *S. sitchensis*. Others, such as *S. setchelliana* and *S. ovalifolia*, cannot compete in

most habitats but have special features that allow them to thrive in specific high stress habitats where competition is almost nonexistent. Willows can be found in the following habitats:

Lowlands

Willows, along with alders, cottonwoods, fireweeds, legumes, and grasses, form pioneering vegetation communities on disturbed sites in lowlands. These plants are quick to get established, always a step ahead of the rest of the vegetation. But over time, hardwoods and conifers overshadow the established willow shrubs. Within the forest zone where recurrent disturbance or poor growing conditions prevent trees from establishing, willows may persist indefinitely.

River gravel bars

The volume of glacier-fed rivers fluctuates greatly over time. Most of the year the barren river floodplain appears oversized for the trickle contained within narrow channels. But at flood stage, swollen by the summer snowmelt at the headwaters, the silt-laden river overflows the narrow channels and floods the whole breadth of the valley flats. The poorly vegetated gravel bars offer little mechanical resistance to the rushing current that churns the mud, undercuts banks, shuffles gravel and silt, and reorganizes channels, uprooting any vegetation that stands in the way. Soon, the river recedes back to the main channel, leaving the banks high and dry. The gravel bars are colonized by resilient species, always on the move: shrubs and trees are uprooted and rafted downstream. *S. alaxensis*, *S. sitchensis*, and *S. setchelliana* thrive in this habitat with little competition except for cottonwoods (*Populus* spp.) and Yellow Mountain Avens (*Dryas drummondii*) mats.

Coastal thickets

A varied blend of *Salix barclayi*, *S. commutata*, *S. hookeriana*, *S. alaxensis*, and *S. sitchensis* form extensive thickets that compete with alders around coastal estuaries. Elsewhere along the shoreline, the willows are rare where undisturbed lush mature coastal forest reaches down the steep slopes and meets the highest reaches of the tide.

Mixed forests

In the dense mature boreal forest or taiga, only tree-sized *S. scouleriana* survives as long as it is able to keep pace with the surrounding forest, spreading its foliage in the upper canopy to obtain necessary sunlight. At the edge of the forest, *S. scouleriana* and *S. bebbiana* are better represented. Shrubby willow species, such as *S. barclayi* and *S. bebbiana*, invade any clearing where the sunlight reaches the floor.

Wetlands

Most willows favor moist sites, and the genus is well represented in wetlands, both at the margin of acidic muskegs and in more productive sites, such as lake shores and riverbanks. Many species of willows are tolerant of seasonal floods. Plants living in muskegs and fens remain small, barely topping the grasses and sedges.

Treeline thickets

In the mountains above treeline, *S. barclayi*, *S. pulchra*, *S. commutata*, *S. richardsonii*, *S. glauca*, and *S. arctica* form extensive treeline thickets. Willows are especially lush in hollows drained by creeks. Thick snow cover protects these willows from the rigors of winter and heavy browse by moose.

These willow thickets put on little yearly growth.

Alpine sites

The treeline thicket species described above also occupy higher sheltered pockets of the alpine zone, as long as reliable sources of moisture and protection from the elements are available. Exposed mountain ridges are home to dwarfed willows such as *S. arctica*, *S. reticulata*, *S. rotundifolia*, whose stems and leaves hug the rocky substrate.

Human-modified habitats

Under natural conditions, open habitats are the result of disturbance events like forest fire, avalanche, flood, and insect infestation, or the retreat of a glacier. Modification of the landscape by humans creates new opportunities for willows to invade sites that otherwise would be densely forested. On highway right-of-ways regularly cleared by Hydroaxe™ tractors, colonizing willow species are distributed according to moisture gradients. From the driest sites to the wettest sites, willow species assume dominance in the following sequence: *S. bebbiana*, *S. barclayi*, *S. sitchensis*, and *S. pulchra*. This succession of species along the moisture gradient is observed either as one travels away from the relatively dry lowlands of the western Kenai Peninsula situated in the rain shadow of the mountains toward the more maritime zone of Seward or Homer, or locally as one considers relief from high well-drained gravel hills to low saturated wetlands. The ubiquity of these willow thickets along right-of-ways is due to the repeated mowing that prevents the establishment of trees, including arborescent willows.

Willow seedlings readily establish in lawns not treated with dicot-specific herbicides. A few leaves close to the ground survive repeated mowing and feed a root system that will give the plants a head start, should the mowing be interrupted.

Variations

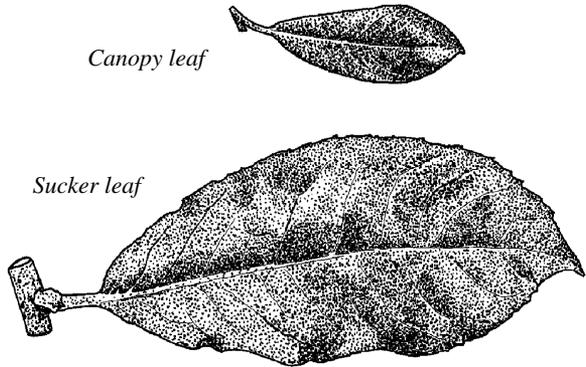
Most willow species vary greatly according to their habitat conditions. This variation can be so great that, at first glance, distinct species within a thicket resemble each other more than specimens of their own species growing under different conditions. Leaf shape, size, plant stature, color, and texture can vary greatly, whereas catkin and pistil characteristics remain fairly constant. Stipule appearance can vary greatly. *S. barclayi*, for example, normally has prominent stipules, but these may be entirely lacking on plants growing in poor conditions.

Slow growing, undisturbed, and unbrowsed “mature” willows usually have small, stiff leaves and show reduced yearly stem elongation. The branchlets develop nodes at the site of leaf attachments and appear knobby. Vigorous growth of willows in disturbed habitats typically produce long annual stems with leaf buds widely separated.

Willow species that reach tree-size at maturity, such as *S. scouleriana* or *S. alaxensis*, first produce long unbranched stems that develop into single or multiple trunks. After a few years, the yearly elongation is reduced, and branching increases to form the canopy. Annual shoot elongation may vary from a few

centimeters to more than 150 cm in length. Two distinct foliages can be observed on mature *S.*

scouleriana. The slow-growing canopy crown of the tree bears small leaves that are toothless at the margin, their underside clothed with short reddish or long clear hairs; fast growing suckers emerging from the base of the trunk bear large, light-green leaves with sparse hairs and coarsely toothed margin.



Salix scouleriana

Willows that grow under unusual conditions can be difficult to identify. During a field trip guided by George Argus in the Glen Alps above Anchorage, we were puzzled by the identity of 60 centimeter high willow shrubs in the alpine tundra. These happened to be *S. scouleriana*, which at lower elevations reach tree size. Conversely, Argus described how the alpine dwarf *S. arctica* can reach two meters on Attu in the Aleutian Islands.

In muskegs, the acidic nature of the soil limits the availability of nutrients and allows only stunted growth. Slow growing muskeg willows tend to branch at ground level and be intertwined with the grasses and sedges that share the habitat.

Alpine willow thickets exist thanks to the winter snow cover that protects the branches from winter abrasion and desiccation and also serves to displace moose to lowlands. The new annual growth is mostly limited to the replacement of dieback and browsed branches. Individual stems die off after a few years and are replaced by new shoots emerging from the root crown.

Plants rooted in rich soil whose above-ground parts have been trimmed produce yearly shoots several feet long, bearing large leaves. The fast-growing *S. barclayi*, which thrives on highly disturbed road right-of-ways at low elevations, appears quite different from its slow-growing kin at treeline.

Hybrids

Willows are infamous for hybridizing. The hybrid plant, besides having characteristics intermediate between parent species, can also be noticed by misshapen or aborted catkins. Hybridization appears to be more common in regions where habitats have been extensively modified by human activities. In Alaska, this does not (yet) appear to be a major problem for identification, because only a very small percentage of specimens appear to be hybrids. In my experience, less than 1% of the willows collected showed evidence of hybridization.

Usages

Because so many species are well adapted to human-modified habitat, willows have always been an important part of the human landscape in North America, Europe, and northern Asia. Willow foliage is good fodder for cattle, goats, and horses, as well as for wildlife, such as moose and deer.

“Wickers” or “osiers,” the previous year’s growth of one-to-four meters long willow suckers, are prime material for the manufacture of utilitarian objects. Amerindian craftsmen in North America and gypsies in Europe wove willow baskets, furniture, and other items, such as beehives, crab pots, snowshoes, and fish traps. At the beginning of the industrial age, upward to 350 cultivars had been developed in France, each with their own mechanical and esthetic properties. Today, although mostly replaced by objects molded out of plastics and other synthetic materials, wickerworks are still manufactured for specialty items, such as hot air balloon baskets, and to some extent, specialty baskets and outdoor furniture.

The soft wood of willow is good for carving and makes good quality artist’s charcoal. In Alaska, diamond willows (see p. 14) are carved into beautiful walking sticks, furniture, decorative balusters, and posts.

Salicin, the chemical that preceded acetylsalicylic acid (aspirin), was first isolated from willow. The bark of some willow species is rich in tannin used for the processing of leather. The primary use of willows today, however, is for reclamation of disturbed sites and stabilization of riverbanks.

In Great Britain and Scandinavia, where fossil fuels are expensive, there is a developing interest in willows as a source of renewable energy; the fast growing shoots are coppiced (harvested) every few years, and the dried chips are sent to electric power plants. This fuel burns clean, leaves little ash, and emits carbon less than or equal to that absorbed from the atmosphere by the willow during growth.

In Southcentral Alaska at Easter time, “pussy willow” bouquets made from cut stems of the felt-leaf willows make wonderful flower arrangements in anticipation of the arrival of spring.

Known usage of specific willows is mentioned in each species description that follows in this guide.

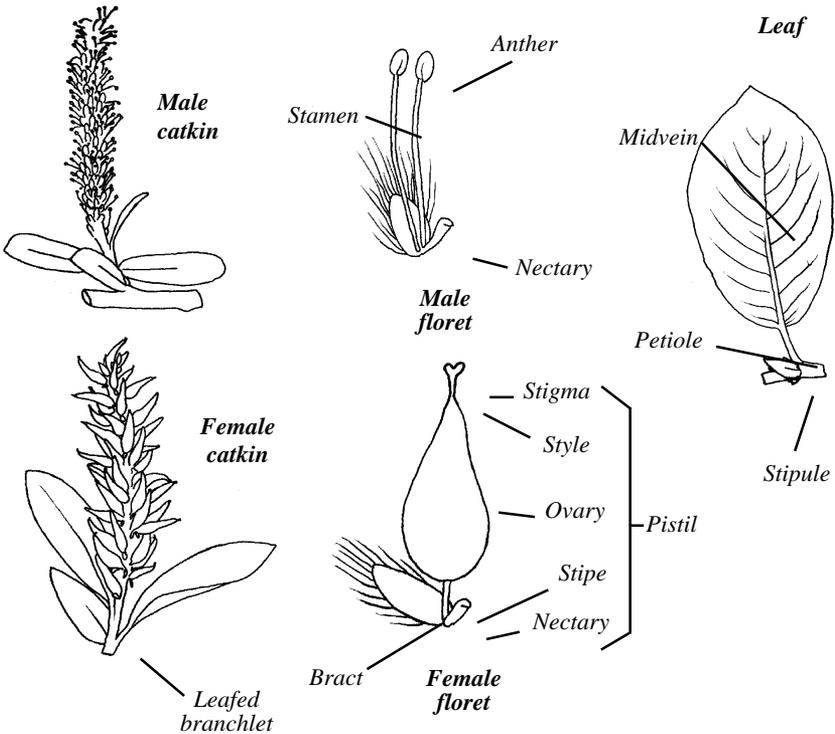
Herbivores

In spite of the fact that willows synthesize bitter chemicals that make them less palatable and harder to digest, scores of herbivores owe their existence to willows. All willows are not equal in their production of bitter substances: *S. barratiana* is one of the most bitter, while *S. alaxensis* and *S. pulchra* are the least bitter. The young leaves of the last two species can even be harvested for human consumption in the spring.

Among the vertebrates, several species of ptarmigan and grouse feed on the buds during winter, and hare, moose, beaver, and caribou often depend on willows for their survival.

How to use this guide

Description of willow catkins and leaves requires the use of specialized names. The usage of technical terms has been kept to a minimum in this guide:



Identification keys

To simplify the identification of willows of Southcentral Alaska, one set of identification keys includes only the willow species found from the Kenai Peninsula to the Matanuska-Susitna valley, while another set of keys covers only those found in the coastal area of Prince William Sound.

During the growing season, willows with catkins can best be identified using the summer keys. If no catkins can be found on the plants, the vegetative key based on stem and leaf characters can be used.

Because revegetation projects require that willow cuttings be harvested during the winter, an additional winter identification key to the willow shrubs is also provided.

To identify a willow using the keys, e.g. page 19, read the first pair of statements (**1.a** & **1.b**) and choose which of the two best applies. For example if the willow is a tall shrub, **1.b** is chosen. The number **13** at the end the statement **1.b** leads to the pair of statements (**13.a** & **13.b**). Repeating the process will lead

to a willow species by elimination. Look up the species description, check the habitat, and the distribution map provided to confirm the identity of that willow species.

A hand lens magnifying 10 times or a dissecting microscope is required to examine small structures of the catkins or leaves.

Species descriptions

Scientific and common name

All plants and animals are given a unique scientific name composed of two words written in *italics*. The first word, the genus name, is common to closely related species. For example, both the domestic dog and the coyote have the same genus name *Canis*, and the genus name of all the true willows is *Salix*. The second word designates the species. Thus *Canis familiaris* is the domestic dog, *Canis latrans* is the coyote, and *Salix alaxensis* is the felt-leaf willow. Common names often vary regionally and are thus not reliable. For instance, *Salix alaxensis*'s common name can be either "Alaska willow" or "felt-leaf willow." Sometimes the common name "willow" is used for non-willow species, which adds to the confusion. The fireweed, *Epilobium angustifolium*, is sometimes referred to as the "willow herb." For this reason, scientific names are used throughout the guide, although a common name is given with the descriptions.

Identification

A brief description of the species is given with more details than the keys. The most important diagnostic characteristics are written in **bold**.

Similar species

Diagnostic characters are compared with those of similar species.

Habitat

This information can help for identification because certain species are restricted to well-defined habitat.

Wetland Indicator Status

The National Wetland Inventory (U.S. Fish and Wildlife Service) publishes the "National List of Plant Species That Occur in Wetlands," (<http://www.nwi.fws.gov/bha>) that assigns a wetland indicator status to each plant species found in wetlands. This describes the frequency of occurrence of an individual species in wetlands versus non-wetlands. Willows species that are considered wetland indicators in Alaska have been rated as follows:

FACW: Facultative Wetland: Usually occurs in wetlands, but occasionally found in non-wetlands.

FAC: Facultative: Equally likely to occur in wetlands or non-wetlands.

FACU: Facultative Upland: Usually occurs in non-wetlands, but occasionally found in wetlands.

Phenology

This section describes the sequence in the development of the willow organs. Usually, whether or not catkins and leaves develop at the same time is consistent for each willow species. The timing of the development of the willow as a whole is usually delayed with increased elevation. In mountain habitats, it is not unusual to observe a willow with fully developed leaves and catkins a few feet apart from another willow of the same species still in winter buds, because it was covered by a slow-melting snow drift.

Notes

General notes about the biology.

Uses

Traditional or modern use of the species.

Insects and diseases

Known species of insects and diseases associated with willows in Southcentral Alaska. Common galls and diseases are illustrated pp. 14-15.

Chrysomelidae- leaf beetles (Coleoptera). Adults and larvae skeletonize the leaves of willow. See p. 96. *Gonioctena* spp. adults look like a yellow and black ladybug, *Chrysomela* spp. adults are orange with black spots or the reverse, black with orange spots, and *Phratora* spp. are metallic green.

Diamond willow- scarring of willow stem or trunk, following prior infection by the fungus *Valsa sordida*, causes sharp contrasted coloration in the heartwood. These diamond willows are highly prized for handicraft.

Dorytomus- snout beetle (Cucurionidae: Coleoptera). The minute larvae bore willow buds or stems.

Euura- sawfly (Tenthredinidae: Hymenoptera). Small wasps that induce stem swellings on willows.

Eriophyiidae- minute mites that induce “pouch galls” on willow leaves.

Itomeyia- gall midge (Cecidomyiidae: Diptera). Small flies that induce “nipple galls” on willow leaves.

Orgyia antiqua- tussock moth. (Lymantriidae: Lepidoptera). The hairy caterpillars feed on leaves of willows and other shrubs. The reddish-brown male moths fly during the day. The female moths are unable to fly because their wings are much reduced.

Phyllocolpa -sawfly (Tenthredinidae: Hymenoptera). Small wasps whose larvae develop inside the fold of willow leaf margin.

Pontania- sawfly (Tenthredinidae: Hymenoptera). Small wasps that induce pear or bean- shaped galls on willow leaves.

Powdery mildew- fungus *Uncinula* sp.

Rabdophaga- gall midge (Cecidomyiidae: Diptera). Small flies that cause galls on stems and buds.

Rust fungus- fungus *Melampsora epitea*. Orange powder masses on the leaves.

Saperda concolor- Long-horned beetle (Cerambycidae: Coleoptera). The larvae bore galleries in large stems.

Tar spot- fungus *Rhystima salicinum*. Black shiny spot on leaves.

Trichiosoma triangulum- cimbicid sawfly (Cimbicidae: Hymenoptera). The caterpillar-like larvae feed on willow leaves; the adults resemble black bumblebees.

Thrypophleus striatulus- willow bark beetle (Scolytidae: Coleoptera). The minute larvae bore under the bark of stems and trunks.

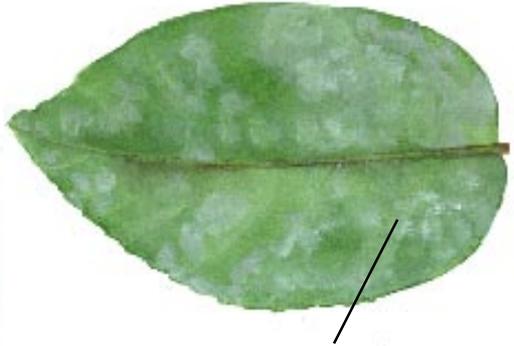
Maps

The distribution maps cover the area included between 58° and 63° N and between 143° and 154° W. Each location on the maps corresponds to specimens identified by botanists experienced with willows and include the following collections: National Herbarium of Canada, Ottawa; University of Alaska Museum Herbarium, Fairbanks; US Forest Service herbarium (Girdwood); Alaska Natural Heritage Program herbarium; Chugach National Forest herbarium (Anchorage); Natural Resource Conservation Service herbarium (Homer); Kenai Fjord National Park herbarium (Seward); Pratt Museum herbarium (Homer); University of Alaska Anchorage herbarium, and the author's collection.

“Diamond willow.” Heartwood scarring following an infection by the fungus *Valsa sordida*



Bark peeled showing decorative color pattern



Powdery mildew (fungus) on *Salix barclayi* leaf



Salix lasiandra leaf skeletonized by leaf beetles (Chrysomelidae)



Tar spot fungus *Rhytisma salicinum* on *Salix barclayi* leaf



Rust fungus *Melampsora* sp. on underside of *Salix bebbiana* leaf



Rabdophaga rosaria
gall midge adult (4 mm)

Cross section
showing the
orange larva

“Willow rose” induced
by *Rabdophaga rosaria*
on *Salix barclayi*

Beaked gall induced by
Rabdophaga rigidae

Stem swelling
induced by
Rabdophaga salicis on *Salix barclayi*

Bud gall induced
by *Rabdophaga sp.*
on *Salix sitchensis*

Cross section
showing the
orange larva

Euura sp. sawfly adult
(4.5 mm)

Spindle gall
induced by
Euura sp. on
Salix bebbiana

Cross section
showing
hollow cavity

Leaf bean galls induced
by *Pontania sp.* (sawfly)
on *Salix barclayi*

Pouch galls induced by eriophyiid
mites on *Salix barclayi* leaf

Identification Keys

Summer Key to willows of the Kenai Peninsula, Anchorage bowl and the Matsu Valley. Adapted from Argus (1973).

Willows differ from other trees and shrubs by their mostly oval leaves arranged alternatively on the stems, their winter bud covered by a single scale, and their flowers bunched in dense catkins.

Use this key only if catkins are present, otherwise use the vegetative key (p. 22). This summer key relies heavily on female catkin characters. Individual willows are either male or female, and the female catkins themselves often remain on the plant only for a short period. Occasionally, dried female catkins or dried leaves remain attached for an extended period and can be useful for identification, but care must be taken to make sure that they are still connected to the plant. Willows of several species frequently grow side by side with their branches entangled. Using dried leaves or catkins collected from the duff under the shrubs may mislead identification.

Catkins that appear before the leaves are usually directly attached to the stems (see p.100) while those that develop simultaneously with the leaves or later are borne on more or less developed leafy branchlets (see p. 102). The best way to obtain a full set of characteristics for willows whose catkins and leaves are not present at the same time is to tag a branch from which samples are collected at various time of the year. Make sure that only cuttings from branches observed forking above ground are associated. The branch samples labelled, pressed, and dried between newspapers can be kept indefinitely.



Poplar winter bud covered by several scales



Willow winter bud covered by a single scale

- 1.a Dwarf willow with branches lying flat on the ground, under 20 cm tall. 2
- 1.b Upright shrubs more than 20 cm tall or trees.....13

- 2.a Roundish leaves strongly veined, dark green above and pale beneath; reddish petiole long, at least half as long as the leaf blade.....*S. reticulata*, p. 84.
- 2.b Leaf shape variable, veins not so conspicuous; petiole short.....3

- 3.a Ovary hairy, sometimes only at the beak.....4
- 3.b Ovary hairless.....9

- 4.a Leaves green beneath.....5
- 4.b Leaves pale beneath (pale waxy layer can be scraped with the fingernail revealing green plant tissue beneath).....6

- 5.a Leaf margin with a fringe of hairs; dried skeletonized leaves at the base of the plants.....*S. phlebophylla*, p. 74.
- 5.b Leaf margin hairless; dried leaves at the base of the plant not skeletonized.....*S. polaris*, p. 76.

6.a	Style 0-0.5 mm.....	7
6.b	Style longer than 0.5 mm.....	8
7.a	Ovary red, pear-shaped with short stiff reddish hairs; leaves hairless, dark green glossy above, broadest near the tip; margin of the leaves toothed at the base; flexible branches trailing in the vegetation <i>S. fuscescens</i> , p. 58.	
7.b	Ovary greyish-green, barrel-shaped, densely white hairy; leaves elongated, hairy above and beneath, margin not toothed; shrub erect, branches stiff, greyish black hairy, dull (not shiny).....	<i>S. niphoclada</i> , p. 70.
8.a	Ovary densely hairy; branchlets without roots; some of the leaves with long silky hair forming a “beard” at their tip.....	<i>S. arctica</i> , p. 50.
8.b	Ovary hairless or slightly hairy at the tip; branchlets with roots; no long silky hair forming a beard at their tip of the leaves....	<i>S. stolonifera</i> , p. 96.
9.a	Leaves green beneath.....	10
9.b	Leaves pale beneath (pale waxy layer can be scraped with the fingernail revealing green plant tissue beneath).....	11
10.a	Plant minute, less than 5 cm high; leaves at most 1.5 cm long, roundish, not toothed at the margin; female catkins short, bearing 4 to 15 pistils.....	<i>S. rotundifolia</i> , p. 88.
10.b	Plant 10 cm high or more; leaves oval, more than 1.5 cm long, margin finely toothed.....	<i>S. myrtillifolia</i> , p. 69.
11.a	Leaves hairless and fleshy like a “jade plant;” branchlets woolly; style minute; ovary truncated at the tip. River sand bars and glacier outwash plains.....	<i>S. setchelliana</i> , p. 92.
11.b	Leaves not fleshy, branchlets not woolly. Various habitats.....	12
12.a	Branches short and erect, sometimes trailing, often covered with waxy coating; rooting from the stem; style 0.6-1.6 mm long.....	<i>S. stolonifera</i> , p. 96.
12.b	Branches usually long and trailing, not covered with waxy coating; style 0.2-0.8 mm.....	<i>S. ovalifolia</i> , p. 72.
13.a	Catkins appearing before the leaves open, borne directly on the stem or on short few-leafed branchlets.....	14
13.b	Catkins appearing at the same time as the leaves open or later, borne on developed leafy branchlets.....	18
14.a	Ovary hairless.....	15
14.b	Ovary hairy	16
15.a	Stipules minute to absent; branchlets brittle; long villous hairs at base of the branchlets. Coastal meadows and glacier moraines.....	<i>S. hookeriana</i> , p. 64.
15.b	Stipules well-developed, leaf-like, persisting several years. Upper forest zone, treeline thickets.....	<i>S. richardsonii</i> , p. 86.

- 16.a** Leaves densely white woolly beneath, shiny bright green above.....
.....*S. alaxensis*, p. 46.
- 16.b** Leaves not woolly beneath.....17
- 17.a** Leaves hairless beneath, bright green above; stipules linear, persisting
several years on the stems.....*S. pulchra*, p. 82.
- 17.b** Leaves hairy beneath, often with reddish hair appearing as a reddish hue;
stipules not persisting several years.....*S. scouleriana*, p. 90.
- 18.a** Ovary hairless.....19
- 18.b** Ovary hairy.....23
- 19.a** Leaves lance-shaped; 5 stamens in each male floret; leaf petiole glandu-
lar; large shrub or small tree. Trunk bark blackish, deeply furrowed.
Riverbanks and wetlands*S. lasiandra*, p. 66.
- 19.b** Leaves not lance-shaped; 1 or 2 stamens in each male floret; no glands on
the petiole. Bark variable. Various habitats20
- 20.a** Leaves green beneath21
- 20.b** Leaves pale beneath (pale waxy layer can be scraped with fingernail, show-
ing green plant tissue)*S. barclayi*, p. 52.
- 21.a** Leaves hairy on both sides; ovary green to bright red.....
.....*S. commutata*, p. 56.
- 21.b** Leaves hairless or only slightly hairy; ovary light green to yellow22
- 22.a** Small shrub less than 1 m tall; flexible stems trailing in the vegetation,
leaves hairless; minute stipules 1-2 mm; style 0.3-0.5 mm.....
.....*S. myrtilifolia*, p. 68.
- 22.b** Erect shrub 0.5-4 m; stipules 1-5 mm; styles 0.3-0.5 mm.....
.....*S. pseudomyrsinites*, p. 80.
- 23.a** Stipes 2-5 mm; catkins loose, often a few remaining on the shrub through
the winter; leaves upperside shiny, with veins impressed.....
.....*S. bebbiana*, p.54.
- 23.b** Stipe much shorter; catkins dense; veins not so conspicuous on the
upperside of the leaves.....24
- 24.a** Leaves silky beneath.25
- 24.b** Leaves hairy beneath, but not silky.....26
- 25.a** Leaves narrow, 5-7 times as long as broad, margin toothed, with a small
gland on each tip; 2 stamens in each male floret. *S. arbusculoides*, p. 48.
- 25.b** Leaves elliptic, less than 3 times as long as broad, leaves appear satiny
beneath (like the fur of a seal); 1 stamen in each male floret.
.....*S. sitchensis*, p. 94.
- 26.a** Petioles 3-15 mm long, yellowish. Subalpine thicket, lake shores....
.....*S. glauca*, p. 60.
- 26.b** Petioles short, 1-3mm long, reddish. Coastal meadows and river sand-
bars.....*S. niphoclada*, p. 70.

Vegetative key to willows of the Kenai Peninsula, Anchorage Bowl and the Mat-Su Valley. Adapted from Viereck and Little (1972).

This key is designed to identify live willows with mature leaves but lacking catkins.

- 1.a Dwarf willow with branches lying flat on the ground, less than 20 cm tall.....2
- 1.b Upright shrub over 30 cm tall, or tree.....12
- 2.a Leaves fleshy like a “jade plant,” branchlets woolly. Glacier river sandbars or glacier outwash plains*S. setchelliana*, p. 92.
- 2.b Leaves not fleshy, stem hairy or not. Various habitats.....3
- 3.a Roundish leaves strongly veined, dark green above and pale underneath; long reddish petiole, at least half as long as the leaf blade.....*S. reticulata*, p. 84.
- 3.b Leaf veins less conspicuous, petiole shorter.....4
- 4.a Leaves green underneath.....5
- 4.b Leaves pale underneath (pale waxy layer can be scraped with the finger nail revealing the green plant tissue beneath).....6
- 5.a Plant minute, less than 9 cm tall; leaves less than 2.5 cm long. Alpine sites.....8
- 5.b Shrub taller than 10 cm, branches ascending. Leaves 2-3 times as long as broad. Bogs, fens and subalpine zone..... *S. myrtillifolia*, p. 68.
- 6.a Shrub densely matted, often with a central taproot; leaves less than 2 cm long and untoothed at the margin; stem brown to reddish brown. Dry alpine sites.....*S. rotundifolia*, p. 88.
- 6.b Shrubs forming loose mats usually with long trailing buried branches, stems pale yellow, thin, leaves to 2.5 cm, usually smaller. Alpine snowbed.....7
- 7.a Leaf margins with fringe of hairs; dried skeletonized leaves at the base of the plants.....*S. phlebophylla*, p. 74.
- 7.b Leaf margins hairless; dried leaves at the base of the plant not skeletonized.....*S. polaris*, p. 76.
- 8.a Some of the leaves with long silky hair forming a “beard” at the tip of the leaves.....*S. arctica*, p. 50.
- 8.b None of the leaves with long hair forming a beard at the tip.....9
- 9.a Shrub erect, stiff; branchlets greyish-black, not shiny, leaves elongated with scattered hairs, petiole reddish.....*S. niphoclada*, p. 70.
- 9.b Shrub trailing, not erect; stems flexible; shape of leaves and color of petiole variable.....10

10.a	Creeping shrub with long trailing branches ascending at the ends; leaves more than 2 cm long, broad near apex, often toothed at the base.....	
	<i>S. fuscescens</i> , p. 58.
10.b	Matted or creeping shrub less than 10 cm tall; leaves less than 2 cm, margin toothless.....	11
11.a	Stem glabrous short and erect, sometimes trailing, often covered with a waxy coating, rooting from the stem.....	<i>S. stolonifera</i> , p. 96.
11.b	Branches usually long and trailing, not covered with waxy coating, not rooting from the stem.....	<i>S. ovalifolia</i> , p. 72.
12.a	Upright shrub at most 1 m tall.....	13
12.b	Tall shrub at least 1 m tall or tree.....	20
13.a	Leaves with hairs underneath.....	14
13.b	Leaves without hairs underneath.....	15
14.a	Petioles yellowish, 3-15 mm. Alpine thickets.....	<i>S. glauca</i> , p. 60.
14.b	Petiole reddish, 1-3 mm. Coastal meadows and river sandbars.....	
	<i>S. niphoclada</i> , p. 70.
15.a	Leaves fleshy like a “jade plant”. River sandbar and glacier outwash plains.....	<i>S. setchelliana</i> , p. 92.
15.b	Leaves not fleshy. Various habitats.....	16
16.a	Stipules, if present not persisting several years.....	17
16.b	Stipules persisting several years, (dried stipules can be found on the stem near leaf scars of the previous year).....	19
17.a	Leaves green underneath, stem hairless, plant short.....	<i>S. myrtilifolia</i> , p. 68.
17.b	Leaves pale underneath (pale waxy layer can be scraped with fingernail, showing green plant tissue), stem hairy, plant taller.....	18
18.a	Stipules absent, long straight hairs at the base of the new stem. Coastal lowlands.....	<i>S. hookeriana</i> , p. 64.
18.b	Stipules leaf-like, well developed, no long hairs at the base of new twig. Various habitats.....	<i>S. barclayi</i> , p. 52.
19.a	Twigs brownish black, with many broad dried stipules remaining several years giving a coarse appearance to the shrubs; leaves broad. Thickets at treeline.....	<i>S. richardsonii</i> , p. 82.
19.b	Twigs glossy, hairless after one year; stipules linear; leaves elongated, often with old dried reddish leaves remaining on the shrub. Wet habitats and tundra.....	<i>S. pulchra</i> , p. 74.
20.a	Leaves 3-6 times as long as broad	21
20.b	Leaves less than 3 times as long as broad.....	22
21.a	Leaves narrowly elliptic, hairy underneath; twigs thin, whiplike.....	
	<i>S. arbusculoides</i> , p. 48.
21.b	Leaves lance-shaped, hairless, large; stout twigs waxy to the touch.....	
	<i>S. lasiandra</i> , p. 66.

22.a	Adult leaves hairy underneath.....	23
22.b	Adult leaves hairless underneath.....	28
23.a	Leaves densely woolly underneath.....	<i>S. alaxensis</i> , p. 46 .
23.b	Leaves with straight hairs underneath.....	24
24.a	Leaves densely covered underneath with short stiff hairs, all oriented in the same direction, appearing satiny beneath (like the fur of a seal).....	<i>S. sitchensis</i> , p. 94 .
24.b	Leaves not satiny underneath.....	25
25.a	Lower face of the leaves with sparse short stiff hairs, often with reddish hair visible with the naked eye as a reddish hue. A tree whose canopy leaves are often too high to be reached from the ground.....	<i>S. scouleriana</i> , p. 90 .
25.b	All hairs whitish. Shrub or tree with leaves within arm's reach.....	26
26.a	Leaves green underneath.....	<i>S. commutata</i> , p. 56 .
26.b	Leaves pale underneath (pale waxy layer can be scraped with the fingernail revealing green plant tissue beneath).....	27
27.a	Veins markedly embossed in the glossy green upper surface, wavy white hairs on both leaf faces, twigs often inserted at right angle to the stem. Scraggly many-branched shrub when heavily browsed by moose. Dry and moist sites in the lowlands	<i>S. bebbiana</i> , p. 54 .
27.b	Veins not so impressed on the greenish gray upper surface, lower surface dull gray hairy with straight hairs. Treeline thickets, lake shores.....	<i>S. glauca</i> , p. 60 .
28.a	Stipules remaining on the twigs several years.....	29
28.b	Stipules not remaining more than a year.....	30
29.a	Twigs brownish-black, with many broad dried stipules remaining several years giving a coarse appearance to the shrubs; leaves broad. Thickets at treeline.....	<i>S. richardsonii</i> , p. 86 .
29.b	Twigs glossy, hairless after one year; stipules elongated; leaves elongated, often with old dry reddish leaves remaining on the shrub. Mostly wet habitats.....	<i>S. pulchra</i> , p. 82 .
30.a	Leaves pale green underneath.....	<i>S. pseudomyrsinites</i> , p. 80 .
30.b	Leaves pale underneath (pale waxy layer can be scraped with the fingernail showing green plant tissue).....	31
31.a	Stipules absent; long straight hairs at the base of the new stem. Coastal lowlands.....	<i>S. hookeriana</i> , p. 64 .
31.b	Stipules leaflike, well developed; no long hairs at the base of new twig. Various habitats.....	<i>S. barclayi</i> , p. 52 .

Summer key to willows of Prince William Sound including Valdez, Cordova and Whittier. Adapted from Argus (1973).

- 1.a Dwarf willow with branches lying flat on the ground, under 20 cm tall. **2**
- 1.b Upright shrubs more than 20 cm tall, or trees..... **8**
- 2.a Roundish leaves strongly veined, dark green above and pale beneath; long reddish petiole, at least half as long the leaf blade..... *S. reticulata*, p. **84**.
- 2.b Leaf shape variable, veins not so conspicuous; petiole shorter..... **3**
- 3.a Ovary hairy..... **4**
- 3.b Ovary hairless..... **5**
- 4.a Leaves green beneath, dried skeletonized leaves at the base of the stems.....
..... *S. phlebophylla*, p. **74**.
- 4.b Leaves pale underneath (pale waxy layer can be scraped with the fingernail revealing green plant tissue beneath), no skeletonized leaves at the base of the stems..... *S. arctica*, p. **50**.
- 5.a Leaves less than 14 mm long, circular, green beneath; dwarf matted alpine shrub; female catkin with less than 15 pistils... *S. rotundifolia*, p. **88**.
- 5.b Leaves longer than 20 mm long, pale underneath (pale layer can be scraped with the fingernail revealing green plant tissue beneath); small shrub; female catkins with more than 15 pistils..... **6**
- 6.a Leaves hairless and fleshy like a “jade plant,” branchlets woolly; style minute; ovary tip truncated. River sand bars and glacier outwash plains.....
..... *S. setchelliana*, p. **92**.
- 6.b Leaves not fleshy; branchlets not woolly; ovary tip not truncated. Various habitats..... **7**
- 7.a Branches short and erect, sometimes trailing, often coated with white waxy substance; ovary not coated with whitish waxy substance.....
..... *S. stolonifera*, p. **96**.
- 7.b Branches long and trailing, not coated with white waxy substance; ovary coated with white waxy substance..... *S. ovalifolia*, p. **72**.
- 8.a Catkins appear before the leaves, catkins borne directly on the main stem or on short few-leaved branchlets..... **9**
- 8.b Catkins appearing when the leaves open or later, catkins on developed leafed branchlets **13**
- 9.a Ovary hairless..... **10**
- 9.b Ovary hairy..... **11**
- 10.a No stipules; branchlets brittle with long silky hair at the base.....
..... *S. hookeriana*, p. **64**.
- 10.b Stipules present; branchlets flexible without long silky hair at the base..
..... *S. pseudomonticola*, p. **78**.

- 11.a** Leaves densely woolly underneath, glossy green above.....
.....*S. alaxensis*, p. 46.
- 11.b** Leaves not woolly beneath.....12
- 12.a** Tall shrub or small tree; leaves hairy beneath, often with reddish hair,
appearing as a reddish hue, stipules not persisting several years.....
.....*S. scouleriana*, p. 90.
- 12.b** Small to tall shrub; leaves hairless beneath, bright green above, stipules
linear, persisting several years on the stems.....*S. pulchra*, p. 82.
- 13.a** Ovary hairless.....14
- 13.b** Ovary hairy.....*S. sitchensis*, p. 94.
- 14.a** Leaves green beneath.....*S. commutata*, p. 56.
- 14.b** Leaves pale underneath (pale waxy layer can be scraped with the finger-
nail revealing green plant tissue beneath).....15
- 15.a** No stipules; branchlets brittle with long silky hair at their base. Coastal
thickets.....*S. hookeriana*, p. 64.
- 15.b** Stipules well developed; branchlets flexible. Many different habitats.....
.....*S. barclayi*, p. 52.

**Vegetative key to willows of Prince William Sound including
Valdez, Cordova and Whittier.** Adapted from Viereck and Little (1972).

- 1.a** Low shrubs less than 30 cm tall.....2
- 1.b** Upright shrubs 30 cm tall or higher7
- 2.a** Creeping shrubs, with long branches often rooting, 10 to 30 cm tall;
leaves more than 25 mm long.....3
- 2.b** Shrub forming a mat usually less than 10 cm tall; branches not rooting;
leaves less than 2.5 cm long.....5
- 3.a** Leaves fleshy like a “jade plant,” branchlets woolly.....
.....*S. setchelliana*, p. 92.
- 3.b** Leaves not fleshy, green above, pale underneath (pale layer can be
scraped with the fingernail revealing green plant tissue beneath).....4
- 4.a** Roundish leaves strongly veined, dark green above and pale beneath;
long reddish petiole, at least half as long the leaf blade, none of the
leaves with long silky hairs forming a “beard” at the tip of the leaves
..... *S. reticulata*, p. 84.
- 4.b** Leaf shape variable; veins not so conspicuous; petiole shorter; usually
some of the leaves with long silky hair forming a beard at the tip.....
.....*S. arctica*, p. 50.
- 5.a** Leaves round, green on both surfaces, less than 1.5 cm long; plant minute,

	less than 10 cm high.....	6
5.b	Leaves oval, pale underneath (pale layer can be scraped with the finger-nail revealing green plant tissue beneath)..... <i>S. ovalifolia</i> , p. 72. or <i>S. stolonifera</i> , p. 96.	
6.a	Shrub with numerous dried skeletonized leaves, leaves 1-2 cm long..... <i>S. phlebophylla</i> , p. 74.	
6.b	Shrub without dried skeletonized leaves, leaves less than 1 cm long..... <i>S. rotundifolia</i> , p. 88.	
7.a	Shrub less than 1 meter tall.....	8
7.b	Shrub more than 1 meter tall or tree.....	9
8.a	Leaves fleshy like a “jade plant;” stipules minute or nonexistent; branch-lets woolly. River sandbars.....	<i>S. setchelliana</i> , p. 92.
8.b	Leaves not thick, fleshy; stipules elongated, persisting on the shrub several years. Various habitats.....	<i>S. pulchra</i> , p. 82.
9.a	Adult leaves hairy underneath.....	10
9.b	Adult leaves hairless underneath.....	13
10.a	Hairs dense underneath the leaves, appearing silvery white or gray.....	11
10.b	Lower side of the leaves visible through the hairs.....	12
11.a	Lower surface of the leaves covered with woolly hair, contrasting with the bright green upperside of the leaves.....	<i>S. alaxensis</i> , p. 46.
11.b	Lower side of the leaves with silky hairs all oriented toward the tip of the leaf, shining like silk or like the fur of a seal.....	<i>S. sitchensis</i> , p. 94.
12.a	Shrub 1-2 meters high; margin of the leaves distinctly toothed; leaves green underneath, all hair whitish.....	<i>S. commutata</i> , p. 56.
12.b	Small tree; margin of the canopy leaves untoothed, covered underneath with short white and reddish hair, appearing as a reddish hue when seen with the naked eye.....	<i>S. scouleriana</i> , p. 90.
13.a	Elongated stipules persisting on the stem several years..... <i>S. pulchra</i> , p. 82.	
13.b	Stipules not persisting more than a year.....	14
14.a	Long stiff hair at the base of the branchlets.....	<i>S. hookeriana</i> , p. 64.
14.b	No long stiff hairs at the base of the branchlets.....	15
15.a	Young leaves reddish; petiole reddish; leaves broadly lance-shaped to oval, usually narrowing to a small projection at the tip..... <i>S. pseudomonticola</i> , p. 78.	
15.b	Young leaves green; petiole green; leaves ovate, somewhat blunt at the tip.....	<i>S. barclayi</i> , p. 52.

Winter key to willow shrubs of Southcentral Alaska.

This key is designed for the field identification of willows used in revegetation projects for which stems are harvested during late winter. Correct identification is critical since not all willow species readily root from dormant twigs. Only willows with stems at least 10 mm in diameter and reaching at least 1 m in height are included in this key.

The best technique for identifying willows at an unfamiliar site is first to look for the obvious: dried catkins, leaves, petioles, or galls still attached to the plants. Dried leaves or catkins found on the ground under a willow can be used but with caution as they could come from other shrubs. Once a willow shrub is positively identified, a voucher specimen should be collected, dried between newspapers and labelled. A tag with the plant name should be left on the willow from which the identified cutting was harvested and left in the field for future reference. Confirmation of the identity can be done by rechecking the tagged plant left in the field later in the season when the leaves or catkins are developed, using the summer identification keys in this guide.

Willows recommended for dormant cuttings
S. alaxensis, *S. arbusculoides*, *S. barclayi*, *S. commutata*,
S. lasiandra, *S. pulchra*, *S. sitchensis*.

Willows **not** recommended for dormant cuttings:
S. bebbiana, *S. glauca*, *S. scouleriana*.

No information is available for *S. richardsonii* and *S. hookeriana*.

- | | | |
|-----|--|--------------------------------------|
| 1.a | Shrubs or trees with leaves falling in winter; leaf scars arranged alternately on twigs; winter bud covered by a single scale..... | Willow (<i>Salix</i>) 2 |
| 1.b | Not all these characters..... | not a willow. |
| 2.a | Young stems either densely whitish-yellowish woolly or coated with a bloom, such as found on fresh grapes or plums | <i>S. alaxensis</i> , pp. 32,46. |
| 2.b | Stems hairy or not, but not woolly or coated with bloom..... | 3 |
| 3.a | Stipules persistent on the stem, on either side of the previous year(s)' leaf scars..... | 4 |
| 3.b | No dried stipules remain on the stems..... | 5 |
| 4.a | Stipules elongated..... | <i>S. pulchra</i> , pp. 40, 82. |
| 4.b | Stipules broad, leaflike, numerous, giving the stem a coarse appearance | <i>S. richardsonii</i> , pp. 41, 86. |
| 5.a | Previous year female catkins remain on the shrub over winter..... | 6 |

- 5.b** No dried catkins on winter stems.....**8**
- 6.a** Capsules on the female catkin attached by a long stipe giving the catkin a loose appearance, catkins more or less curled... *S. bebbiana*, pp. **35, 54.**
- 6.b** Capsules attached by a short stipe, giving the catkin a compact appearance.....**7**
- 7.a** Few dried catkins erect at end of stem; large catkin buds; small leaf buds. Coastal thickets only*S. hookeriana*, pp. **38, 64.**
- 7.b** Most mature catkins remain on female plants during winter, often fluffy seeds mass around the dried catkins in early spring; plants densely hairy.....*S. niphoclada*, p. **70** or *S. glauca*, pp. **37, 60.**
- 8.a** Tree with one or several distinct trunks and canopy.....**9**
- 8.b** Shrub branching from the base.....**10**
- 9.a** Catkin buds much larger than the leaf buds, developing in the winter, exposing white catkin silk under the bud scale; bud scale black, roundish, beaked at the tip; stems or buds not waxy; trunk bark gray, smooth.....*S. scouleriana*, pp. **42, 90.**
- 9.b** Catkins buds only slightly larger than the leaf buds, light colored, undeveloped in the spring, flattened; stems and buds waxy; trunk bark grey-black, furrowed*S. lasiandra*, pp. **39, 66.**
- 10.a** Shrub fast-growing, usually not branched near the base, some of the yearly growth over 50 cm. Disturbed sites, road right-of-way.....**11**
- 10.b** Shrub branched near the base, yearly growth usually less than 50 cm. Various habitats.....**13**
- 11.a** Stem reddish or reddish-brown; bud scales red or black, not waxy.....**12**
- 11.b** Stems and winter buds dark in winter, light green in spring, waxy.....
.....*S. lasiandra*, pp. **39, 66.**
- 12.a** Stems reddish brown; catkin buds large, black, well developed or open; leaf buds minute. Rarely large rosette gall; hollow stem swelling multiple-chambered at the end of the stem ...*S. scouleriana*, pp. **42, 90.**
- 12.b** Stems red and buds red; catkin buds small as leaf buds. When present, rosette gall small or hollow stem swelling single-chambered, not at the very end of the stems.....*S. bebbiana*, pp. **35, 54.**
- 13.a** Tips of stem thin, whiplike.....*S. arbusculoides*, pp. **33, 48.**
- 13.b** Tips of stem not whiplike.....**14**
- 14.a** Catkin buds and top of stems densely white-hairy, much larger than leaf bud. Coastal meadows only.....*S. hookeriana*, pp. **38, 64.**
- 14.b** Stems and catkins not so densely hairy or hairless; catkin buds not much larger than leaf buds**15**
- 15.a** Buds brown, green, or yellow, hairy; large round mostly grey “willow rose” galls (20-50 mm diameter) very common, especially in disturbed sites.....*S. barclayi*, pp. **34, 52.**

- 15.b** Buds red or reddish-brown, hairless or with white or red hairs; rosette galls when present not large and grey.....**16**
- 16.a** Branches inserted at sharp angles to the stems, catkin buds elongated, flattened dorsally (duck-billed) in winter, fuller in late spring but showing a lateral pleat; leaf buds blunt tipped...*S. sitchensis*, pp. **43, 94.**
- 16.b** Some of the branches inserted at right angle to the stems; catkins buds round in cross section and leaf buds pointed at the tip.....**17**
- 17.a** Branches flexible at the base; branchlets hairy or woolly; large reddish-brown, egg-shaped, “willow rose” gall.....*S. commutata*, pp. **36, 56.**
- 17.b** Branches stiff or brittle at the base; branchlets more or less densely hairy, not woolly; winter buds red, minute, pointed at the tip; shrubs often stunted by heavy moose browsing; sometimes minute rosette gall at the end of red suckers.....*S. bebbiana*, pp. **35, 54.**

Winter descriptions