

FIELD GUIDE TO THE WILLOWS OF EAST-CENTRAL IDAHO

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The authors welcome comments or additional information on habitats or distributions of eastern Idaho willows. When rare willows or species significantly beyond indicated ranges are located, we would appreciate dried, pressed specimens and location/habitat data. Send them to:

*Research Herbarium
College of Forestry, Wildlife and
Range Sciences
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INTRODUCTION

The largest and most widely-distributed group of woody plants in Idaho are the willows, the genus *Salix*. They are important sources of food and cover for many species of wildlife, especially ungulates (deer, elk) and beavers. Willows provide forage and cover for domestic sheep and cattle, but can also usurp wet meadows valued for their production of forbs and graminoids. They have a major role in streambank stabilization and watershed protection and their presence along streams is often an important part of the fisheries habitat. Despite the importance of willows, their identification, distribution and ecology remain an enigma to land managers.

Willow identification is difficult for land managers and professional botanists alike because existing floras emphasize short-lived flower and fruit characteristics not present during much of the field season. The scarcity of information on local distribution and ecology of the 35 *Salix* taxa native to Idaho has further hampered the identification and management of these plants. Our observations prior to 1981 indicated that a field-oriented willow study might provide new habitat, distribution and morphologic data that would simplify identification.

We chose east-central Idaho for this study because of its diversity of wetland habitats and willow species. This field guide is a compilation of the major findings of our field and herbarium studies from 1981 through 1983. It identifies those willows present in the region, explains how to recognize them in the field, and provides information on their abundance, distribution, and ecological relationships. We believe that this work will be a significant step in aiding those managing the willows of east-central Idaho.

STUDY AREA

This field guide describes the willows of the upper Salmon River drainage in east-central Idaho (Fig. 1). This area of about 8,000 square miles (20,700 sq. km.) extends from the headwaters of the Salmon River to the mouth of the Middle Fork, including the Yankee Fork, East Fork, Pahsimeroi River, Lemhi River, North Fork, Panther Creek and numerous smaller tributaries. Two isolated streams that are part of the Snake River watershed, Birch Creek and the Little Lost River, are included in the southeastern corner of the study area.

The region is predominantly mountainous, with elevations ranging from 3050 ft. (930 m) in the deeply-incised Salmon River Canyon to 12,662 ft. (3860 m) at the summit of Mt. Borah in the Lost River Range. The area is traditionally included in the Northern Rocky Mountain physiographic province (Fenneman 1931). It is possible to further divide the study area into four sections of relatively similar geologic structure and geomorphic history (Steele et al. 1981). These are briefly delineated as follows:

Southern Batholith Section This section comprises the western part of the study area, including the Sawtooth Valley and adjacent Sawtooth Range to the southwest and Salmon River Mountains to the north. The valley lies from 6500-7000 ft. (1980-2135 m) in elevation, while peaks and ridges rise to an average of 8000-9000 ft. (2440-2740 m) in the north and over 10,000 ft. (3050 m) in the southwest. Granitic rock of the Idaho and Sawtooth Batholiths underlies most of the section.

Challis Section The Challis Section extends through the center of the study area, encompassing the White Cloud Peaks, the East Fork drainage, and a narrow corridor along the main stem of the Salmon River north to the vicinity of the town of Salmon. The White Cloud Peaks is an area of high mountains composed primarily of Paleozoic, calcareous, sedimentary rock. Several peaks reach over 11,500 ft. (3500 m) in this area. The remainder of the section consists of river canyons and small adjacent drainages underlain by tertiary volcanic rock.

Salmon Uplands Section The northwestern corner of the study area falls within the Salmon Uplands section. This includes the mountains and canyons drained by the Salmon River and tributaries between its North and Middle Forks. Elevations range from 3050 ft. to over 10,000 ft. (930-3050 m). The area is underlain by two major substrates: Granitic rock of the Idaho Batholith; and metamorphosed sediments, mostly quartzite, of Precambrian age.

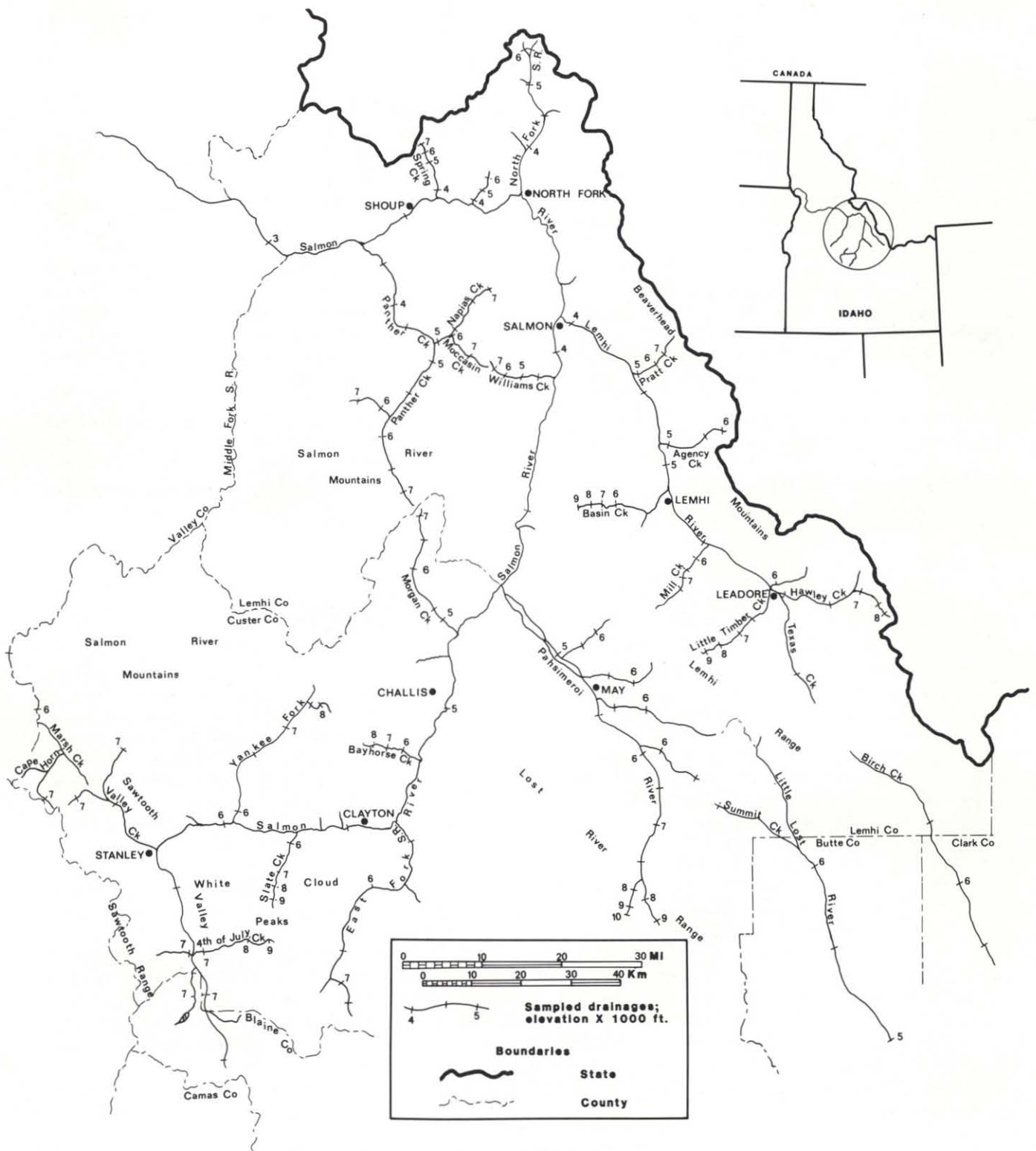


Figure 1—Study Area

Open Northern Rockies Section This section encompasses the eastern half of the study area. The area is characterized by "basin and range" topography with three sub-parallel, faulted mountain ranges separated by broad valleys (Ross and Savage 1967). These mountains, averaging over 10,500 ft. (3200 m) in elevation, are the Lost River Range, Lemhi Range, and Beaverhead Mountains, the southern extension of the Bitterroot Range. The valleys have base elevations of about 5000 ft. (1525 m). Precambrian quartzite and Paleozoic limestone and dolomite are the major types of rock constituting the three ranges.

A more detailed account of these sections is provided by Steele et al. (1981).

Climate

The study area lies in a region of transition between the maritime climate characteristic of northern and western Idaho, and the more continental climate of the southeastern part of the state.

During winter and early spring, a prevalent westerly and southwesterly flow of marine air brings frequent precipitation and relatively moderate temperatures to much of the Pacific Northwest. Data from weather stations in the northern and western part of the study area (Shoup, Stanley) show a December-January precipitation peak characteristic of this maritime climate. Winter high pressure over the Great Basin brings frequent clear skies, more extreme temperatures and low December-January precipitation to southeastern Idaho. This more continental climate is seen in data from weather stations at May and Leadore in the southeastern part of the study area.

During the summer months, high pressure brings a predominance of clear skies to the state, although afternoon thunderstorms frequently occur in the study area.

This climatic summary was condensed from the following sources, which should be consulted for more detailed information (Ross and Savage 1967, Steele et al. 1981, Lahey 1979).

Vegetation

The considerable physiographic and climatic diversity of the study area is reflected in its wide variety of vegetation.

The arid, low elevations of the region are dominated by shrub-steppe vegetation. This is often referred to as the sagebrush/grass zone. *Artemisia tridentata* ssp. *wyomingensis* (Wyoming big sagebrush) in association with bunchgrasses such as *Agropyron spicatum* (bluebunch wheatgrass) is the predominant vegetation in the lower elevations of the zone. Two other broad vegetation types are common at low elevations: salt desert shrub (*Atriplex* spp. and others) on drier and/or alkaline or saline soils; and *Artemisia arbuscula* (low sagebrush) in association with grasses on relatively shallow soils. *Artemisia tridentata* ssp. *vaseyana* (mountain big sagebrush) in association with grasses such as *Festuca idahoensis* (Idaho fescue) cover large areas in cooler and moister parts of the zone, and extend high into the forested zone on drier exposures. The sagebrush/grass zone, as here delineated, can be further divided into a large number of habitat types (Daubenmire 1970, Hironaka et al. 1983).

Tall shrub communities containing species such as *Cercocarpus ledifolius* (mountain-mahogany) or *Amelanchier alnifolia* (serviceberry) frequently occur in transition areas between the sagebrush/grass and the lower forested zone.

The upland forests of the study area are divisible into 7 units (series) named for their climax-dominant tree (from low to high elevation)—*Pinus flexilis* (limber pine), *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas-fir), *Picea engelmannii* (Engelmann spruce), *Abies lasiocarpa* (subalpine fir), *Pinus contorta* (lodgepole pine), and *Pinus albicaulis* (whitebark pine). These can be further divided into numerous forest habitat types (Steele et al. 1981). Most of the forest vegetation of the region, however, can be placed into two zones: the Douglas-fir zone (*Pseudotsuga menziesii* series) - the warm, dry, lower elevation band of forest; and the cool, moist, high elevation subalpine or spruce-fir zone (*Abies lasiocarpa* and *Pinus albicaulis* series). *Pinus contorta* is a major seral species, especially in the northern and western part of the study area.

On the higher mountains of the area, trees of the subalpine zone have a climatically determined upper elevational limit (approx. 9500 ft (2900 m)). Above this timberline, dwarf alpine plants form a variety of plant communities. Alpine vegetation is particularly well-represented on the high mountains of the Open Rocky Mountain section, and the White Cloud Peaks in the Challis section.

Wetland vegetation occurs from the lower elevation of the study area to high into the alpine zone. Willows and sedges (*Carex* spp.) are major components of this diverse vegetation. Many aspects of wetland vegetation in the area are discussed elsewhere in this field guide.

PREVIOUS WORK

Literature on the ecology of east-central Idaho willow species is extremely limited. The only major source of autecological information has been the brief, generalized ecological statements found in regional floras. Two recent wetland classification studies have contributed information on willow synecology. Tuhy (1981) and Tuhy and Jensen (1982) described riparian communities, some containing willows, and associated soil features from a small portion of the study area. No other species-specific literature on willow ecology pertinent to our region is known.

There has been a long history of taxonomic work on Rocky Mountain willows. Most of this work had a broad geographic emphasis, and was based primarily on herbarium specimens gathered by numerous collectors since the early nineteenth century. Willow specimens from east-central Idaho, collected by at least a dozen botanists, have contributed to previous works. The most significant efforts at interpreting the willows of the study area in recent decades were: Ball's treatment in *Flora of Idaho* (Davis 1952); Cronquist's new approach to the genus in *Vascular Plants of the Pacific Northwest* (Hitchcock et al. 1964); and Dorn's synthesis of recent taxonomic opinions in *Willows of the Rocky Mountain States* (1977). Biosystematic studies (Argus 1965, Dorn 1975b) have also clarified several confusing problems that existed in older works.

METHODS

This study involved both field and herbarium investigation. Field work was carried out during the 1981, 1982, and 1983 field seasons. Field activity centered on examination of willow populations during the entire growing season and on establishment of elevational transects in representative drainages throughout the study area. Relatively uniform riparian communities, or willow stands, were selected and each one sampled was termed a plot. There was considerable variation in plot size and shape due to the irregular vegetation patterns typical of riparian communities. A series of plots were located along each transect to document changes in vegetation and habitat from the stream mouth to the head of the drainage (Figure 2). An attempt was made to place plots in typical willow communities at regular intervals along the drainage, however, deviations from a strictly systematic placement were often necessary in order to obtain a representative and expedient sample. Some drainages were partially sampled due to time and access constraints.

At each plot location the following information was gathered: description of the site (physiography, aspect, slope, etc.) and wetland plant community; list of willow taxa, size and relative abundance, list of over- and understory plant associates; description of adjacent upland vegetation; general soil description (depth, texture and moisture of horizons and depth to water table) determined on most plots from the examination of one or more soil pits; and finally, photographs of species and communities. The distribution, habitat and community information presented in this field guide is based primarily on these plot data.

In the course of field sampling, approximately 300 voucher specimens were collected for later herbarium study. Data from the first field season revealed a number of taxonomic problems that required additional study, primarily in areas of disagreement in the taxonomic literature. During the second and third field season, therefore, special efforts were made to examine and make collections of problem taxa.

In the herbarium (Research Herbarium, College of Forestry, Wildlife and Range Sciences, University of Idaho - IDF), specimens were examined and were compared with one another and with published species descriptions. Additional specimens from within and outside the study area were examined at other herbaria (ID, UC, WS,) to check taxonomic interpretations. A number of taxa were sent to Robert D. Dorn, a specialist in willow taxonomy, for confirmation. A draft of this field guide was reviewed during 1984 by a number of professionals including four authorities on willow taxonomy. The draft also was field tested by several workers. (See Acknowledgments)

TAXONOMIC CONSIDERATIONS

We recognize 22 species and a total of 27 willow taxa in the study area based on analyses of herbarium specimens, field data and the large body of previous taxonomic literature. We follow the taxonomy in the most recent flora of the region (Hitchcock et al. 1964) except in 7 species that have been redefined by recent biosystematic work. There is disagreement in the recent literature on several other species that have not been adequately studied. For these species, we have chosen the interpretation that conforms best with study area data. The taxonomic discussions accompanying

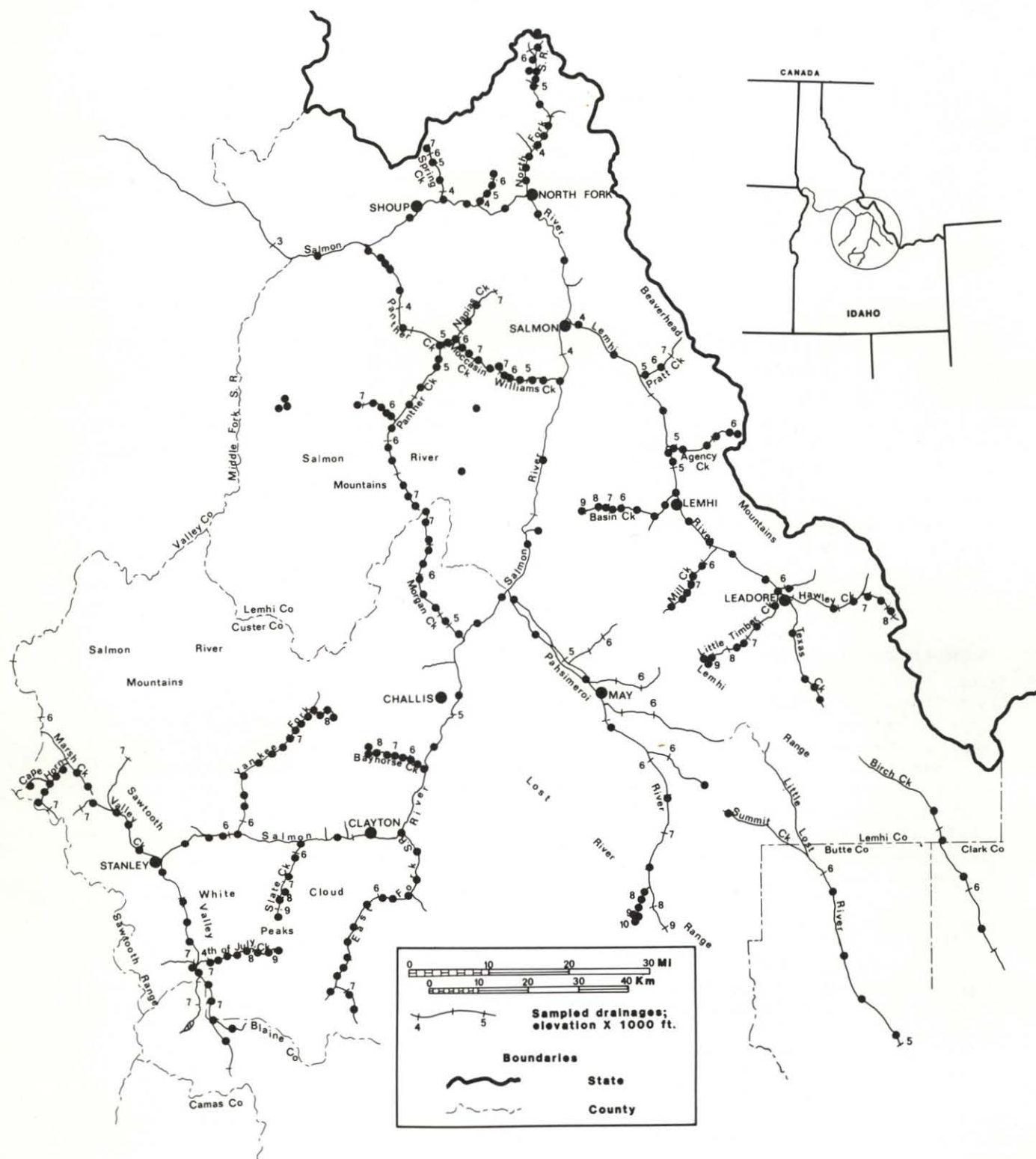


Figure 2—Plot Localities

each species in this guide provide details on a number of uncertainties that appear to need further study. Although several major taxonomic questions exist in the willows of Idaho, most of the problems we have identified within the study area are below the level of species, and, therefore, should not have a major impact on routine identification.

USE OF THIS FIELD GUIDE

This field guide contains a variety of elements useful in the identification of willows in the study area, including keys, line drawings, color photos, leaf shape photos, identification and habitat discussions, distribution maps and tables and technical descriptions. We recommend that several of these be consulted to help assure positive identification. The following explanatory notes are important for the most effective use and interpretation of the information in this field guide.

Keys—Two identification keys are presented: one for plants with pistillate aments, and a second for use on vegetative material with fully-expanded leaves. Pistillate material provides the surest means of identifying willows. However, pistillate plants of some species are difficult to identify very early in the season before leaves have expanded. Stature, twig characteristics, habitat and distribution aid in the early season identification of these taxa. Staminate plants are best identified by comparison with nearby pistillate plants, which are more abundant than staminate plants in most populations. Staminate aments are generally quickly deciduous after flowering; once leaves have fully expanded, staminate plants can be identified using the vegetative key.

Unless otherwise specified, leaf features (shape, pubescence, margins, glaucous bloom) mentioned in the keys and elsewhere in the field guide refer to mature, fully-expanded leaves that developed after the first few leaves of the season. First leaves generally differ in many respects from those formed later and seldom provide distinctive identification features.

Hand Lens—Small features such as hairs, glands, floral bracts, etc., should be examined with at least 10 x magnification. A lens is particularly important in examining previous-year twigs for remnants of pubescence, or glaucous bloom.

Species Descriptions—The technical descriptions of each species are derived primarily from study-area specimens, collected mostly by the authors. Various published descriptions were consulted for comparison, especially Dorn 1975b, 1977, Argus 1965, Hitchcock et al. 1964, and Davis 1952. Measurement ranges indicate sizes observed on study-area plants, except for a few rare species where supplemental published data were also used. Numbers in parentheses indicate atypical extremes either observed in the area or reported in the literature. Sizes identified as "average" are common or modal rather than mathematical means.

Maps—Distribution maps are based on plot data from sampled drainages and other herbarium data from the region. The entire distribution of each species is unknown, of course, but the distributions of common species in unsampled drainages can be inferred by extrapolating from nearby sampled drainages with similar characteristics. The map of the study area (Fig. 1) contains names of drainages, towns, mountain ranges and other information lacking on the distribution maps.

Leaf Size and Shape—A photo illustrating the variation in size and shape of leaves within the study area is presented for each species. Each contains a range from the small first leaves of the season through the normal ones of middle and late season, to the large leaves of vigorous shoots. The variation in shape reflects differences between plants, as well as the seasonal changes on a single plant. In many species, early-season leaves often have rounded apices, while later leaves have more acute apices. The common shapes that characterize each species (generally middle- and late-season leaves) are labeled with a "C". The leaves are shown actual size in each photo and show the upper and lower surface alternately, starting with the lower surface of the largest leaf. Lower surfaces are often lighter in tone, especially leaves with a glaucous bloom.

WILLOW TERMINOLOGY

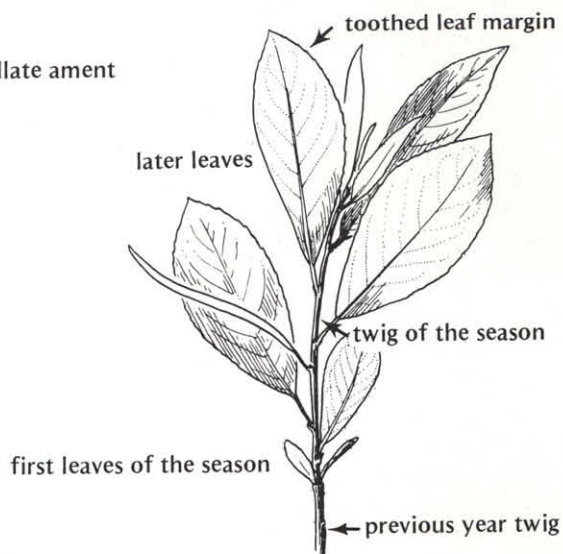
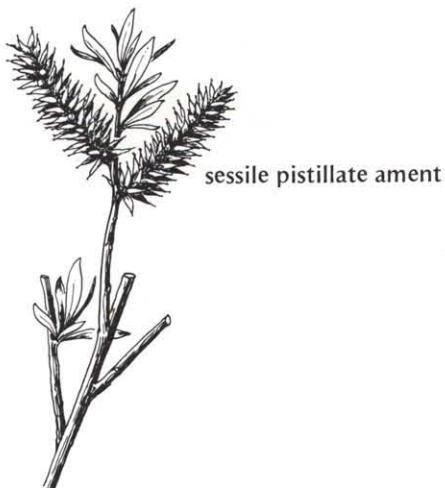
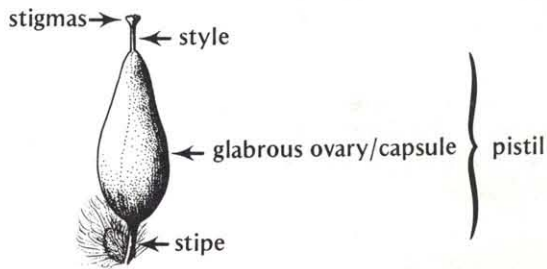
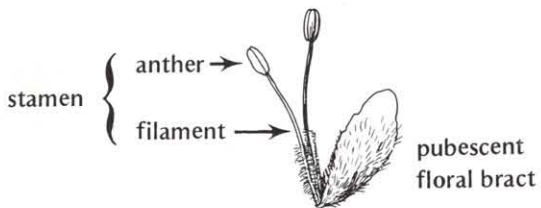
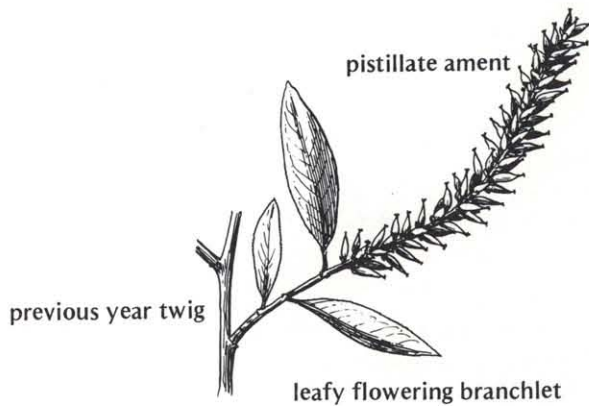
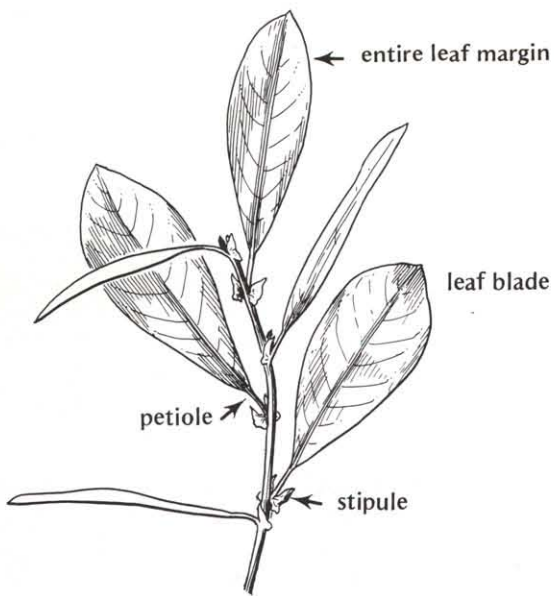


Figure 3—Parts of a Willow

Synonymy—Since we have not undertaken a detailed systematic study of any species or had the opportunity to study type specimens, we have not provided a complete list of synonymous scientific names. This is available in several of the references cited in this work. We have, however, listed synonyms used in recent literature and presented a taxonomic discussion of each species.

Terminology—Figure 3 illustrates the meaning of most of the important morphological terminology used throughout this field guide. A glossary also is included (p. 82). To increase the usefulness of the work, we have limited our use of technical botanical terms. We have, for example, eliminated many of the technical terms for plant hairs (pubescence) and substituted common adjectives. With a group of plants as complex as willows, however, some terminology is needed to efficiently communicate plant features. Terms requiring special discussion follow:

Glaucous refers to the thin, grayish, waxy layer on lower leaf or twig surfaces. A glaucous layer or bloom has a distinctive dull appearance under magnification and it can be removed by rubbing with the fingers to reveal a darker green surface. Since the presence or absence of a glaucous bloom is of major importance in the identification of willows, special attention to this feature is necessary. Glaucous lower leaf surfaces are sometimes confused with surfaces that are merely pale green, but the latter do not darken when rubbed. Since glaucous development is delayed in some species, fully-expanded leaves of middle and late season should be examined for the identifying glaucous layer.

Glaucous twigs can be particularly difficult to interpret since the bloom on twigs of previous years may be largely worn away. Early in the season, before current-year twigs mature, remnants of a glaucous bloom should be sought on protected parts of stems, such as behind lateral buds. Some authors use the term pruniose for the glaucous condition on twigs.

Flowering branchlets are twigs of the season that are terminated by aments. These vary in length from quite short and without green leaves, or bracts, (the aments are thus sessile), to extremely long, leafy branches. In most species, flowering branchlets arise from lateral buds away from the tip of the previous year's twigs. *Salix nivalis* and *S. tweedii*, however, are distinctive in producing aments at or near the tip of the twig. *Salix exigua* is unique in having late-forming aments below the terminal ament on the flowering branchlets.

Stipes are the stalks that support the ovary and capsule in many species (Fig. 3). This structure is called a pedicel by some authors (including Davis 1952, Hitchcock et al. 1964). We follow recent workers (Argus 1973, Dorn 1975b, 1977) in using the more technically correct term.

Floral bracts are the small, generally nongreen bracts subtending each flower in an ament. These are called scales, or simply bracts, in many references. We chose the more descriptive term to avoid confusion with the leafy bracts found on the short, flowering branchlets of some species.

HYBRIDIZATION

There is a widely accepted notion that hybridization is very common in willows and this is a source of many identification problems. We were, therefore, surprised (not to mention relieved) that we rarely observed apparent hybrids in the study area. Other recent workers (Argus 1973, Dorn 1974) have also noted the infrequency of hybrids in their studies of North American willows, and have discussed the subject in detail.

Our studies provide many examples of species separated by habitat or elevational distribution. These add support to the theory that ecological isolation is important in preventing hybridization. In fact, the only apparent hybridization we observed was in small areas of overlap between closely-related species that have mostly separate elevational distributions.

Apparent hybrids we have seen include: *Salix wolfii* X *S. commutata*, *S. wolfii* X *S. eastwoodiae*, *S. boothii* X *S. barclayi*, and *S. geyeriana* X *S. lemmonii*. Our observations also indicate that the flowering times of associated willows are largely distinct. Other workers also have reported phenological isolation in willows (Argus 1964, 1965, Dorn 1974).

WILLOW ECOLOGY

One of the fundamental characteristics of willow habitats in the study area is the high availability of soil moisture throughout the growing season. Although soils become dry at the surface in some riparian sites, moist soil associated with a shallow water table remains within reach of roots. A high moisture requirement limits willows to habitats along rivers, streams and canals (riparian); around lakes, ponds and springs (lacustrine); in bottomlands with a high water table (wet meadows, bogs, fens, and swamps); and in association with melting snowbanks at high elevation. *Salix scouleriana* is capable of tolerating drier sites than any of our other willow species, but even its driest upland habitats are moist compared with most uplands in the region.

Since willow habitats are distributed in the study area from elevations of 3300 to over 11,500 feet (1000-3500 m) major gradients exist in the amount of heat available during the growing season and in temperature extremes during the year. The 23 major native willow taxa included in our study differ in the portion of the temperature/elevation gradient they tolerate. Three are centered at low, 10 at middle, and 10 at upper elevations (Fig. 4). Although there is considerable variation in amplitude, most species span 2,000 to 3,000 vertical feet (610-915 m). The several species associated at a given elevation tend to occupy different portions of the habitat, most apparently segregated on the basis of differences in soil moisture and texture. The discussions that follow under **willow communities** provide many examples of this soil texture and moisture-related habitat segregation. Three other soil factors—temperature, aeration and nutrients—are apparently interrelated with soil moisture and texture in determining species distribution. More study is needed to document their relative ecological importance.

Soil Temperature—Preliminary measurements in 1982 indicated, as expected, that soil temperatures generally decline with increased elevation. Seasonal patterns of temperature in the soil are likely to be as important as those in the air in controlling the distribution of willow species, although this has not been documented. Differences in soil temperature may also be important in segregating species at a single site. Along the upper West Fork of the Pahsimeroi River at an elevation of 8575 feet (2615 m), for example, the wet sandy stream edge soil dominated by *Salix drummondiana* was 2.8° C (5.1° F) colder at 30 cm on July 14 than the drier, silty soil of the immediately adjacent bench totally occupied by *S. wolfii*.

Soil Aeration—Variation in aeration is related directly to differences in soil texture and water movement. It is probably very important in some of the distribution patterns we observed. One apparent example involves *Salix barclayi*, which commonly grows along swiftly flowing subalpine streams, but rarely occurs in subalpine habitats with a more stagnant water table.

Soil Nutrients—The similarity of willow distribution patterns on the several geologic parent materials of the study area suggests that variation in soil nutrients is not a major ecological factor. Nutrients may be important, however, in determining the species composition of some habitats such as alkaline or saline meadows and boggy sites with acidic soil. *Salix brachycarpa*, for example, appears to be exceptionally tolerant of saline conditions.

While many of our species appear to occupy a similar habitat throughout their elevational range, a number of species exhibit a notable shift with respect to soil moisture or texture. One common pattern is for species to inhabit moister sites at lower elevations than in the upper part of the range. *Salix scouleriana*, for example, shifts from low elevation riparian sites to upland habitats at higher elevations. In many cases, habitat shifts may be simply changes in soil moisture optima related to differing transpiration rates along the temperature/elevation gradient (Daubenmire 1943). More details on habitat shifts are given in the species habitat discussions that follow, for example, *S. brachycarpa*, *S. bebbiana*, and *S. wolfii*.

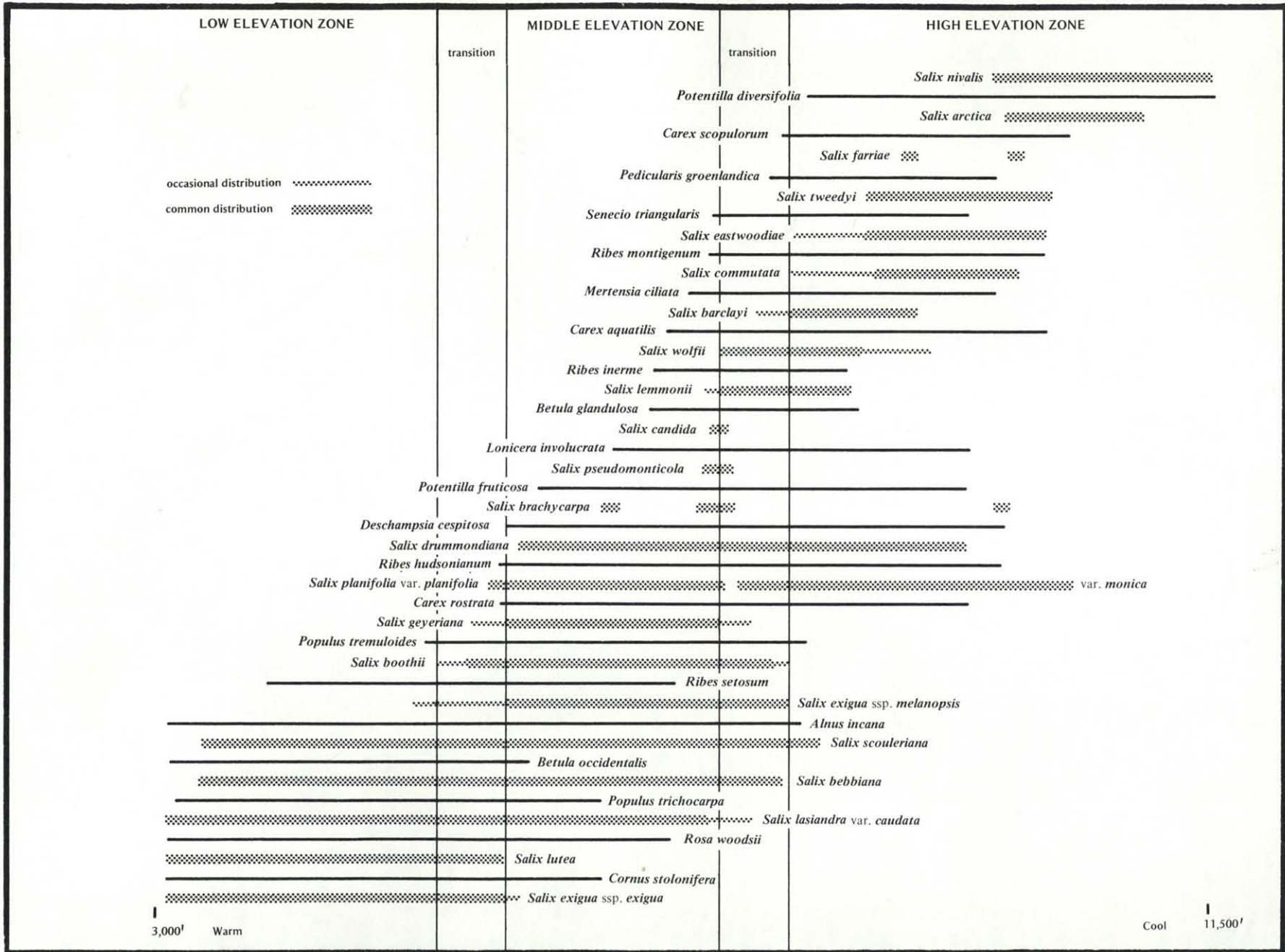


Figure 4—Relative elevational amplitudes of willows and selected associated plants in the mountains of east-central Idaho. Specific elevations vary due to differences in climate and other factors. See figures 5, 6, and 7 for elevations of zones and transitions in sampled drainages.

The inability of willows to tolerate shade is often important in determining their distribution patterns. Within the sagebrush zone, *Populus trichocarpa* (black cottonwood) is the only major source of shade and willows are rare or absent beneath dense stands. Open stands, however, do not appear to inhibit associated willows. Within the forested zone, willows are mostly in openings. They are abundant in naturally open meadows and stream bottoms devoid of trees due to regular flooding or a high water table. They also flourish in openings created by disturbance such as fire, logging, or beaver activity.

Shade intolerance in willows can lead to their elimination from habitats that are eventually dominated by taller species. The important successional role of willows in five major Alaska habitats has been summarized by Argus (1973). In our area, the clearest examples of willow succession are found in openings in forested zones where regeneration of conifers, such as Engelmann spruce, is evident among the willows. However, in some streambottom habitats, it is difficult to interpret whether scattered conifers indicate a successional trend, or merely the presence of suitable, scattered microsites. The scattered occurrence of black cottonwood groves leaves willows unchallenged in their dominance of many sagebrush/grass zone wetlands. Our data show that cottonwood-dominated sites have coarser soil textures than those dominated by willows.

Most of our willow communities appear to be relatively stable seral stages maintained by the nature of the habitat (high water table, flooding) and/or frequent disturbance. In most years, low velocity spring flooding is not, in itself, a disturbance to riparian communities. Such floods charge the soil with moisture and nutrients, and in some habitats probably prevent the establishment of coniferous tree species (Teskey and Hinckley 1977). The physical scouring by floods, however, does cause localized habitat disturbances in most years, and major disturbance less frequently. Whatever the scope or cause of the disturbance, willows are able to quickly colonize suitable sites to re-establish a former community or to create a new one attuned to the new or altered substrate. Efficient colonization is aided by the production of abundant, light-weight, wind/water disseminated seed. Argus (1973) has reviewed other ecological, reproductive and evolutionary characteristics that make willows successful colonizers.

WILLOW COMMUNITIES

Since willows are common in moist habitats throughout the region and the various species have different temperature/elevation distributions, many serve as reliable indicator species for wetland vegetation and habitat classification. Wetland habitats of east-central Idaho can be divided into three broad zones spanning low, middle and high elevations. These three zones are roughly correlated with Wyoming big sagebrush, Douglas-fir, and subalpine/alpine upland vegetation, respectively. Each zone is characterized by a distinct assemblage of willow species and differences in over- and understory associates. Variation in climate, aspect, drainage gradient and shape, soil characteristics and water table depth produces a variety of wetland habitats, each with its own vegetation structure and composition. The various plant communities of each elevation zone, however, are all composed of one or more willow species indicative of the zone in association with broader-ranging species.

Because streamside habitats are usually continuous from low to high elevations, transitions exist between the major zones. When the transition—apparently determined largely by temperature—falls on a steep-gradient stream, the change in species can be relatively abrupt. In a valley with little gradient, the transition can be complex and can occur over a considerable distance. Cold air pooling in these valleys may further complicate the transition since the valley bottom may actually be cooler than adjacent lower mountain slopes.

Low Elevation Zone

The low elevation zone encompasses the lowest, warmest parts of the study area (Fig. 5). Adjacent uplands are dominated by Wyoming big sagebrush or low sagebrush until reaching the higher elevations of the zone, where fringes of Douglas-fir forest may approach streambottoms. Below the North Fork, in the Salmon River canyon, Douglas-fir forests are well developed on the slopes in the low elevation zone. Here, on drier exposures, bunchgrasses such as *Agropyron spicatum* predominate. *Salix lutea* and *S. exigua* ssp. *exigua* are the principal indicators of the zone.

The typical community of the low elevation zone is illustrated in photos #56-59. It consists of an overstory of *Populus trichocarpa*, a midstory of *Salix lasiandra* var. *caudata* and often *Alnus incana* and/or *Betula occidentalis*, and a dense shrub layer of *S. lutea*, *S. exigua*, *Cornus stolonifera*, *Rosa woodsii* and *Ribes setosum*. *Salix bebbiana* and *S. scouleriana* are occasional associates in cooler parts of the zone. When the black cottonwood overstory is dense, the associated shrubs are largely restricted to the fringes of the stand, especially adjacent to the river channel. This typical community is common throughout the zone, but not continuous in some areas due to unsuitable soil conditions.

Most variant communities simply lack one or more elements of the typical community. Black cottonwood, for example, is lacking in many communities. In at least some of these cases (e.g., lower Pahsimeroi River, Birch Creek), our data suggests that soil textures are too fine to support cottonwood. *Betula occidentalis* is predominant on many of these sites. Along miles of the Salmon River, dry upland habitats on steep canyon walls extend down to near river level. The narrow or intermittent riparian fringe in these areas is composed of various low elevation zone species, especially *S. exigua*. On sand and gravel bars at and below the high-water line, *S. exigua* is often the only shrub species that survives the annual flooding.

The transition from low to middle elevation zones is usually first indicated by the presence of *Salix boothii*, which has the broadest amplitude of the middle elevation species. As elevation increases in a transition area, there is a continual rise in the abundance of middle elevation species, while *S. exigua* and *S. lutea* continually decrease in abundance. In valley bottoms with little gradient (e.g., Lemhi River, East Fork Salmon River), transitions often involve a rather predictable segregation of species. The common pattern is for the low elevation assemblage to follow the stream edge far up into the transition, while middle elevation species, especially *S. boothii* and *S. geyeriana*, predominate in adjacent meadows (photo #60). In these situations, the stream edge habitats typically have sandy or gravelly soils, and the adjacent meadows are underlain by silts and clays. The species segregation described above does not occur in many areas, however, especially where soils are less clearly differentiated.

LOW ELEVATION ZONE

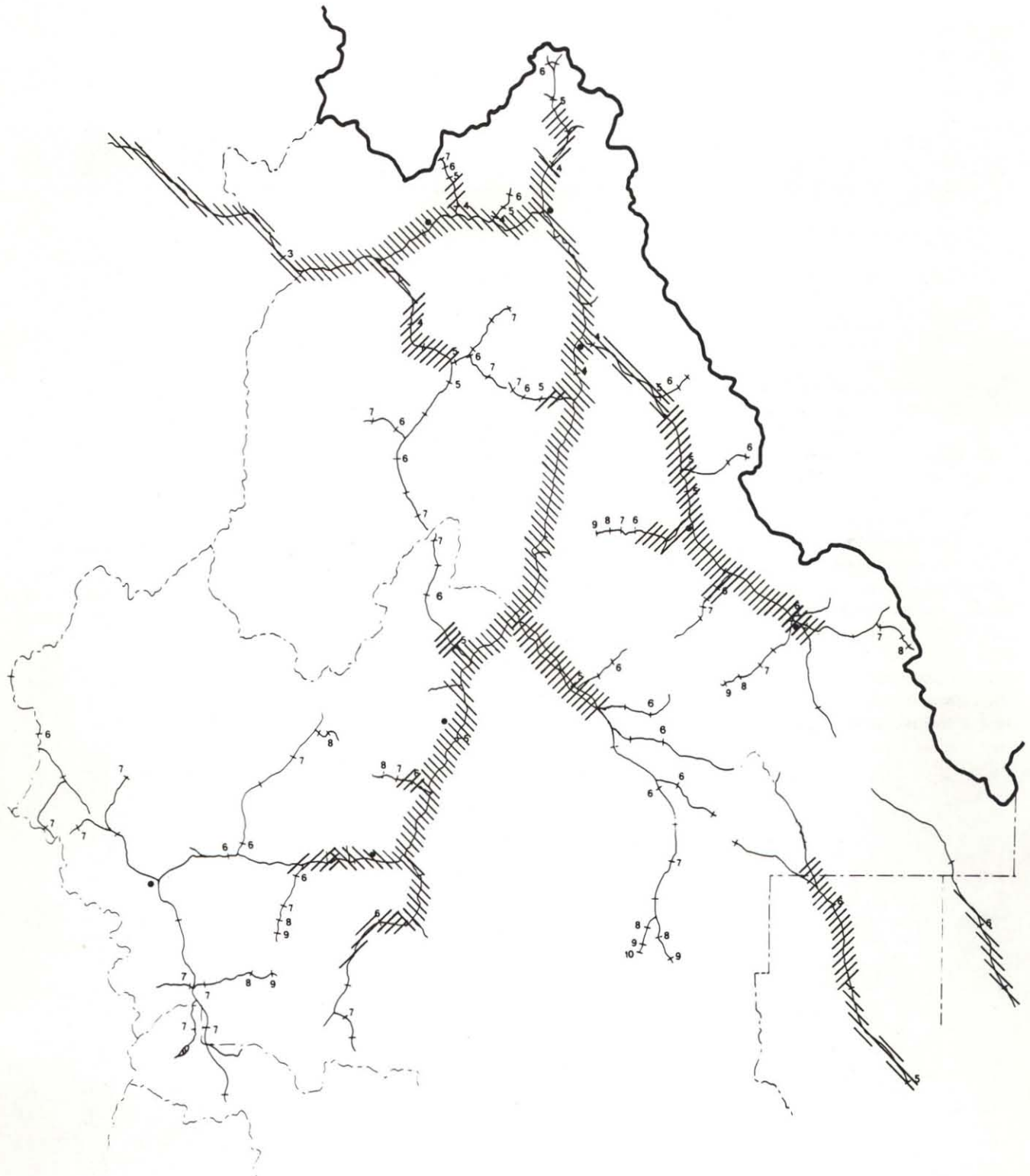


Figure 5—Low elevation zone (\\) and low/middle transition areas (//) in sampled drainages. Numbers represent elevations x 1,000 ft.

Middle Elevation Zone

The middle elevation zone is distributed throughout the study area as shown in Fig. 6. It is most closely associated with mountain big sagebrush and Douglas-fir upland vegetation. *Salix boothii* and *S. geyeriana* are the principal indicators of the zone. Other willow species that occur include:

Salix bebbiana - Common; immediate streambanks to drier portions of valley bottoms

Salix drummondiana - Common; generally restricted to stream edges and other moist sites

Salix exigua ssp. *melanopsis* - Occasional; sand and gravel deposits at stream edges

Salix lasiandra var. *caudata* - Common; generally restricted to stream edges and other sites with a high water table

Salix scouleriana - Occasional; drier parts of the riparian and mesic forest habitats on upland sites

Salix brachycarpa, *S. candida*, *S. planifolia* var. *planifolia*, *S. pseudomonticola* - Rare; see species discussions

Middle elevation zone habitats range from broad valley bottoms, generally associated with low-gradient streams, to narrow, forested sites associated with steep-gradient streams. Broad stream bottoms are usually dominated by willows and lack an overstory, or contain only scattered individuals or small groves of *Populus tremuloides*, *Alnus incana*, *Betula occidentalis*, *Pseudotsuga menziesii*, *Pinus contorta* or *Picea engelmannii*. Rarely present is *Populus trichocarpa*.

One of the more typical community types of the middle elevation zone is shown in photos 61-64. *Salix boothii* and *S. geyeriana* are usually the clear dominants. *Salix geyeriana* tends to inhabit drier sites than *S. boothii*, but in some cases no segregation of the species may be evident. Associated species in these communities include *Rosa woodsii*, *Ribes setosum*, *Lonicera involucrata*, *Potentilla fruticosa*, *Fragaria virginiana*, an assortment of graminoids and forbs, and any of the trees or middle elevation willows listed above.

Communities in narrow, forested streambottoms are often not greatly different in species composition from that described above, except that *S. geyeriana* is generally absent or uncommon. Where the riparian strip is an abrupt transition to the forested upland, forest shrubs such as *Amelanchier alnifolia*, *Philadelphus lewisii* and *Prunus virginiana* are frequently present in the community. Densely-forested streambottoms generally contain willows only in scattered openings. The shade-intolerant willows are probably only seral species in these riparian communities.

The occurrence of *S. barclayi* in steep-gradient, forested habitats marks the upper limit of the middle elevation zone, and the lower limit of the high elevation zone or an often narrow zone of transition. In more open valley-bottoms, *S. wolfii* and/or *S. lemmonii* indicate the beginning of a usually more gradual transition to the upper zone. Frequent associates in transitional communities include *S. boothii*, *S. exigua* ssp. *melanopsis* and *S. drummondiana*. Transitions are somewhat complicated in valleys where cold air drainage, or pooling, produces subalpine temperatures at lower than usual elevations. Parts of the Sawtooth Valley, for example, contain *S. planifolia* var. *monica* communities that are typical of the high elevation zone more than 1,500 feet (460 m) below their usual elevation in the study area. Many other parts of this valley, especially along the Salmon River, contain willow communities that are clearly more transitional since they have an abundance of mid-elevation *S. boothii*.

MIDDLE ELEVATION ZONE

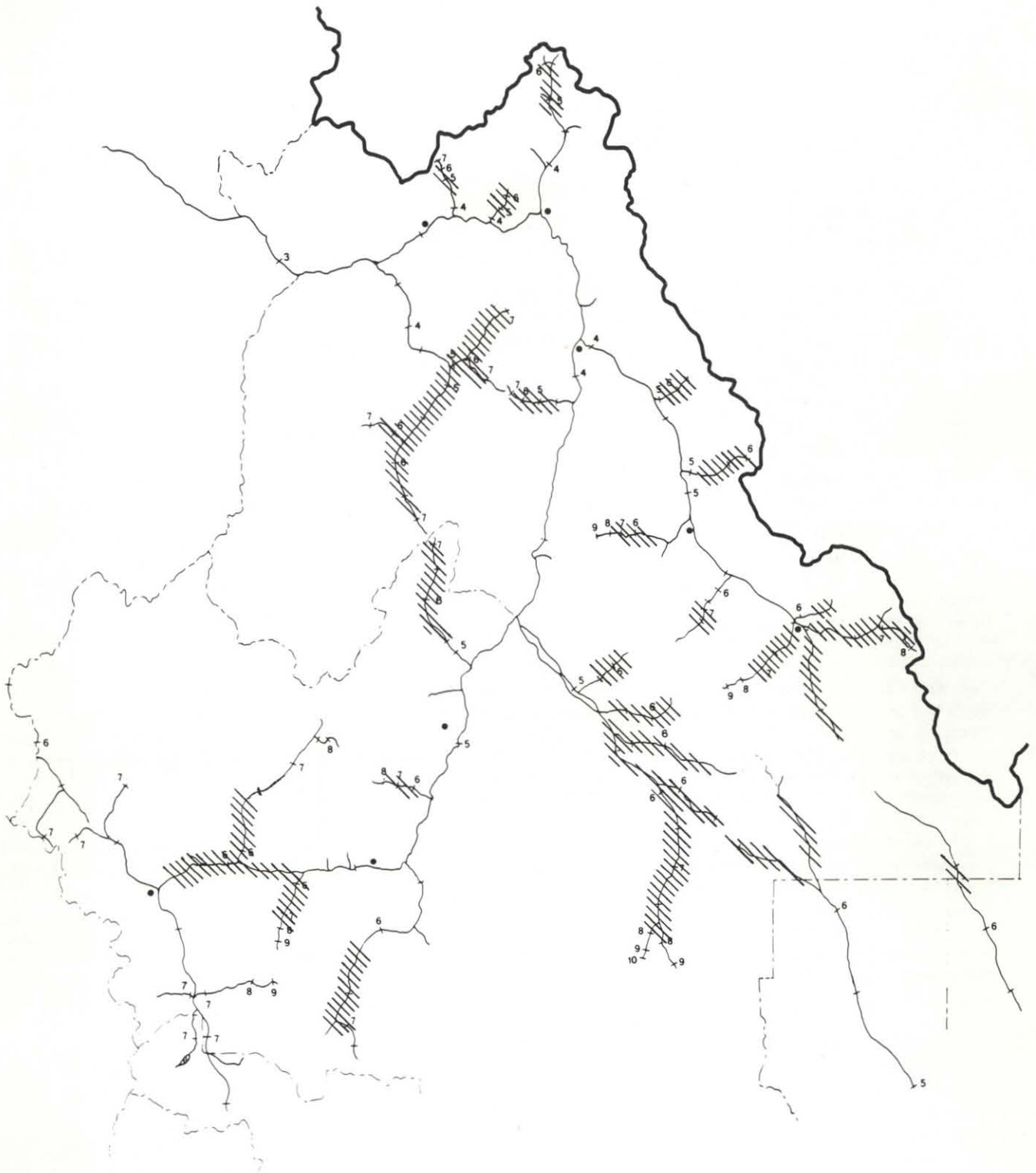


Figure 6—Middle elevation zone in sampled drainages. Numbers represent elevations x 1,000 ft.

High Elevation Zone

The high elevation zone of the study area includes a wide variety of moist habitats, most of which support willows.

Ten of the taxa treated in this field guide are restricted to this zone and its transitional communities and thus serve as indicators. These include *S. arctica*, *S. barclayi*, *S. commutata*, *S. eastwoodiae*, *S. farriae*, *S. lemmonii*, *S. nivalis*, *S. planifolia* var. *monica*, *S. tweedyi* and *S. wolfii*.

Three additional species extend into the zone from lower elevations:

Salix brachycarpa - one population near timberline in the Pahsimeroi River drainage

Salix drummondiana - common in streamside communities

Salix scouleriana - occasional in upland forest openings

The lower boundary of the high elevation zone, as delineated by the distribution of the willow indicators, corresponds closely to the lower limits of subalpine forests and associated mountain big sagebrush vegetation. The upper limits encompass the dwarf alpine willow communities above timberline on the highest mountains of the region. Figure 7 illustrates the study area distribution of the high elevation wetland zone and its transitional communities.

One of the more common wetland habitats in the upper zone is found in forested, steep-gradient streambottoms. In this habitat, willow communities are confined mostly to stream edges, abandoned stream channels, and other gaps in the *Abies lasiocarpa*, *Picea engelmannii* and/or *Pinus contorta* overstory. A typical community includes *S. barclayi*, *S. drummondiana*, *Ribes montigenum*, *R. hudsonianum*, *Senecio triangularis*, *Saxifraga arguta*, and one or more of the overstory species listed above. *Salix planifolia* var. *monica*, *S. commutata* and *S. wolfii* are occasional associates. This community is the primary habitat of *S. tweedyi*, which is usually uncommon (Photo #67).

Most of the remaining high elevation communities occur in open, relatively flat meadows associated with lakes, streams, seeps and snowbanks. These sites are apparently two wet to support coniferous trees, or are above timberline (Photos #69-71). They are dominated by willow, sedges and a variety of other high-montane species. Many of these habitats are relatively uniform in their soil moisture and texture; this appears to be the reason many support communities that contain only a single willow species. *Salix wolfii*, *S. planifolia* var. *monica*, *S. eastwoodiae*, *S. commutata*, and *S. nivalis* commonly form such communities. The habitat descriptions provided for each species characterize kinds of environments these communities occupy.

Where moisture differences exist in a meadow due to topographic gradients or soil changes, shifts in willow dominance are generally evident. Under some conditions one species may completely replace another within a short distance, resulting in relatively discrete communities. In parts of the Sawtooth Valley, for example, abrupt community changes occur from pure *Salix wolfii*/sedge to pure *S. planifolia*/sedge. The latter occurs on finer-textured soils. In other situations, the shift in willow dominance is gradual, producing large stands with mixed species composition. The most common species mixtures in meadow habitats of the zone are: *S. wolfii* and *S. planifolia*; *S. wolfii* and *S. lemmonii*; or *S. commutata* and *S. planifolia*.

Throughout the high elevation zone, sedges are the most constant and abundant associates in willow communities. *Carex aquatilis* and *Carex rostrata* predominate at lower elevations, while *Carex scopulorum* is, by far, the most abundant willow associate in the high subalpine. More study is needed of the autecology and synecology of sedges in the region.

Near and above the timberline, moist habitats sometimes contain communities dominated by dwarf, matted willows (photo #72). The most common species in these communities is *S. nivalis*, though *S. arctica* is occasionally associated on moister sites. Additional associates include *Potentilla diversifolia*, *Caltha leptosepala*, *Phyllodoce glanduliflora*, *Carex scirpoidea* and numerous others.

HIGH ELEVATION ZONE

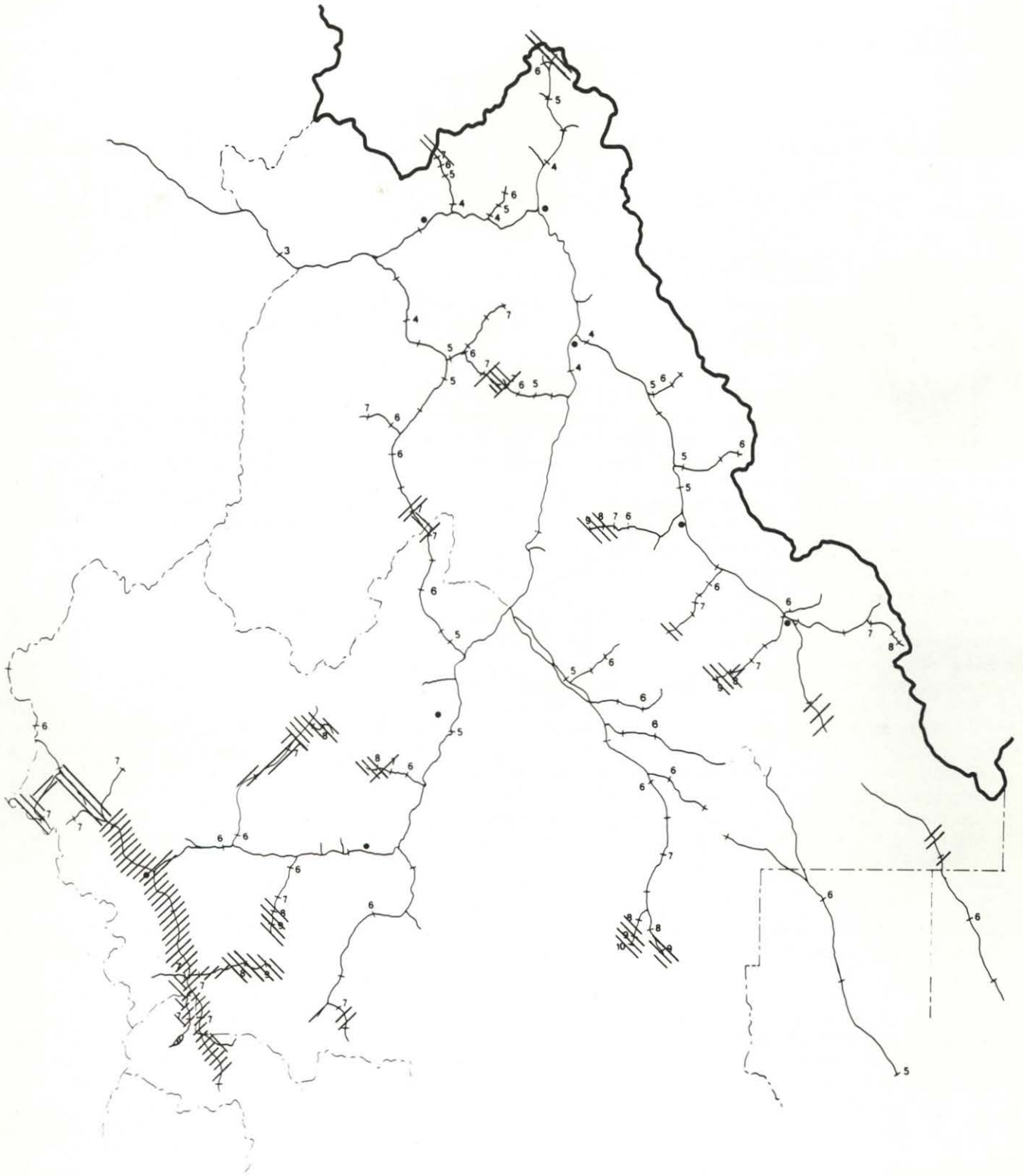


Figure 7—High elevation zone (//) and middle/high transition area (//) in sampled drainages.

KEY TO THE WILLOWS OF EAST-CENTRAL IDAHO
FOR USE ON PLANTS WITH PISTILLATE AMENTS*

(10 x hand lens needed for some determinations)

1a Ovaries and capsules pubescent (1b - bottom p. 19)

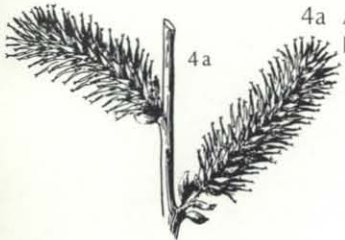
2a Plants matted, less than 1 dm tall

3a Floral bracts dark, brown to black, long-hairy on both sides; aments 10-30 (40) mm long, styles .5-1.3 (2) mm long *S. arctica* (p. 77)

3b Floral bracts pale, green to yellow, glabrous on outer surface; aments 5-10 (12) mm long; styles .1-.4 mm long *S. nivalis* (p. 77)

2b Plants erect shrubs or trees, 2 dm to 15 m tall

4a Aments sessile, and without subtending leaves; or aments occasionally borne on short flowering branchlets less than 1 cm long, without or with only a few small, narrow, inconspicuous leafy bracts



5a Early season plants—aments present but vegetative shoots poorly developed

6a Twigs of previous season glaucous, at least on protected surfaces such as behind lateral buds

7a Mature capsules 3.0-4.0 mm long *S. drummondiana* (p. 58)

7b Mature capsules 4.5-6.5 mm long (occasional plants have slightly glaucous twigs) *S. planifolia* var. *planifolia* (p. 60)

6b Twigs of previous season not glaucous

8a Plants slender-stemmed, low to medium shrubs; twigs of previous season glabrous; styles generally about 1 mm long (.4-1.5) *S. planifolia* (p. 60)

8b Plants thick-stemmed shrubs or small trees; twigs of previous season often puberulent at least on protected surfaces such as behind lateral buds; styles generally about 0.5 mm long (.3-.8) *S. scouleriana* (p. 47)

5b Later season plants—leaves expanded

9a Leaves silvery below with short, dense pubescence that totally obscures the surface *S. drummondiana* (p. 58)

9b Leaves with fine, appressed hairs below, through which glaucous surface clearly visible (see also 8a 8b)

10a Twigs of the season short-hairy *S. scouleriana* (p. 47)

10b Twigs of the season glabrous or sparsely hairy *S. planifolia* (p. 60)

4b Aments on leafy flowering branchlets 5 mm to 20 cm long, the small to large leaves conspicuous, but occasionally deciduous by late season, leaf scars then visible



11a Leaf blades evidently glaucous beneath, often also pubescent

12a Twigs of previous season glaucous at least on protected surfaces such as behind lateral buds; twigs of the season glaucous at maturity

*Staminate plants are best identified by comparing leaves and twigs with nearby pistillate plants *or*, if mature leaves are present, by using the vegetative key on page 21.

13a Mature leaves glabrous above; twigs of the season glabrous or sparsely hairy; floral bracts broad, dark, long-hairy *S. lemmonii* (p. 54)

13b Mature leaves hairy above; twigs of the season moderately to densely hairy; floral bracts narrow, pale, short-hairy *S. geyeriana* (p. 54)

12b Twigs not glaucous

14a Leaves long and narrow, more than 4x longer than broad

15a Floral bracts persistent; leaves and twigs pubescent with long, tangled, matted hairs; plants less than 1 m tall; boggy habitats *S. candida* (p. 40)

15b Floral bracts deciduous; leaves and twigs pubescent with short, appressed hairs; plants 2-8 m tall, shorter on sand and gravel bars below high water line on river sides; various non-boggy habitats *S. exigua* ssp. *exigua* (p. 29)

14b Leaves shorter or broader, less than 4x longer than broad

16a Shrubs less than 1.5 m tall; stipes less than 0.5 mm long; styles 0.5-1.0 mm long *S. brachycarpa* (p. 42)

16b Shrubs or small trees greater than 2 m tall; stipes 2-4 (5) mm long; styles 0.1-0.4 mm long *S. bebbiana* (p. 44)

11b Leaf blades not glaucous beneath; *or* lower surface not visible due to dense pubescence

17a Twigs and lower leaf surfaces obscured by dense, white, felt-like pubescence composed of long tangled hairs; upper leaf surfaces green, thinly hairy to glabrous *S. candida* (p. 40)

17b Twigs and leaf surfaces pubescent, but hairs shorter, not as dense and not at all felt-like

18a Leaves narrow, less than 1 cm broad, plants commonly much taller than 2m; low elevations *S. exigua* ssp. *exigua* (p. 29)

18b Leaves greater than 1 cm broad (except first few of season); plants generally less than 2 m tall; middle to upper elevations

19a Leaf margins entire; mature pistillate aments 1-2 cm long (average about 1.5 cm) *S. wolfii* (p. 74)

19b Leaf margins gland-toothed (at least those of early and mid-season); aments 1.5-5 cm long (average >2.5 cm)

20a Pubescence of twigs, petioles and leaf blades loosely appressed, the hairs curly to wavy *S. eastwoodiae* (p. 72)

20b Pubescence of twigs, petioles and most leaf blades erect-spreading, the hairs straight to wavy *S. commutata* (p. 70)

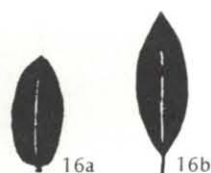
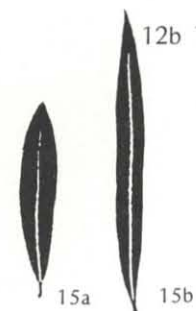
1b Ovaries and capsules glabrous

21a Floral bracts yellow or greenish, deciduous; shrubs and trees

22a Leaf blades lanceolate; styles .3-1.0 mm long

23a Leaves glaucous beneath; cultivated trees *S. alba* (p. 24)

23b Leaves not glaucous beneath although often paler green beneath; native shrubs or small trees *S. lasiandra* var. *caudata* (p. 26)





22b

22b Leaf blades linear or narrowly elliptic; styles essentially lacking; colonial shrubs

S. exigua complex (p. 29)

21b Floral bracts brown to black, persistent; shrubs



24a

24a Aments sessile and without subtending leaves; or aments occasionally borne on short flowering branchlets less than 1 cm long, without or with only a few small, narrow inconspicuous leafy bracts

25a Styles (1.0) 1.5-2.5 (3.0) mm long; aments (all or at least some) terminal on previous year's twigs; scattered in subalpine habitats

S. tweedyi (p. 68)

25b Styles .5-1.0 (1.1) mm long; aments lateral on previous year's twigs; rare, known only from the upper Lemhi River and Birch Creek valleys

S. pseudomonticola (p. 38)



24b

24b Aments on leafy flowering branchlets, the small to large leaves conspicuous, but occasionally deciduous by late season, leaf scars then visible

26a Leaf blades glaucous beneath at maturity

27a Leaf margins mostly entire, those of vigorous growth sometimes toothed; plants less than 2 m tall

S. farriae (p. 66)

27b Leaf margins mostly toothed; plants generally more than 2 m tall

28a Plants of low elevations; flowering branchlets 2-8 mm long at maturity; styles less than 0.7 mm long; stipes 2-4.5 mm long; mature twigs grayish

S. lutea (p. 34)

28b Plants subalpine; flowering branchlets 8-25 mm long at maturity; styles greater than 0.7 mm long; stipes less than 1.5 mm long; mature twigs red or brown

S. barclayi (p. 64)

26b Leaf blades not glaucous beneath at maturity, although often paler green

29a Leaves essentially glabrous at maturity; twigs of the season glabrous or appressed-hairy; flowering branchlets less than 10 mm long; middle elevation plants greater than 2 m tall

S. boothii (p. 50)

29b Leaves and twigs of the season strongly spreading-hairy; flowering branchlets 10-25 mm long; high elevation plants less than 2 m tall

S. commutata (p. 70)

VEGETATIVE KEY TO WILLOWS OF EAST-CENTRAL IDAHO FOR USE ON PLANTS WITH FULLY EXPANDED LEAVES

(10 x hand lens needed for some determinations)

1a Leaves glaucous beneath, glabrous or thinly hairy enough so waxy, gray surface clearly visible



2a Plants matted shrubs less than 1 dm tall

3a Leaf blades gradually tapered to the petiole, margins commonly ciliate

S. arctica (p. 77)



3b Leaf blades abruptly contracted to the petiole, margins glabrous

S. nivalis (p. 77)

2b Plants erect shrubs or trees over 1 dm tall

4a Margins of most leaves toothed (except sometimes the first few of the season)

5a Cultivated trees; leaves long acuminate at tip

S. alba (p. 24)

5b Native mid- to tall shrubs; leaves acute to rounded at tip

6a Leaf blades gradually tapered to the petiole, generally less than 1.5 mm broad

7a Petioles less than 5 mm long

S. exigua (p. 29)

7b Petioles more than 5 mm long—rare toothed forms of

S. planifolia var. *planifolia* (p. 60)

6b Leaf blades more abruptly contracted to petiole, often more than 15 mm broad

8a Older twigs (third- and fourth-year) pale, grayish

S. lutea (p. 34)

8b Older twigs darker, generally brown to reddish

9a Plants of forested zones (upper Douglas-fir and subalpine fir); young expanding leaves green; common throughout region

S. barclayi (p. 64)

9b Plants of open sagebrush bottomlands; young expanding leaves red-tinged; known in the region only from valleys of the upper Lemhi River and Birch Creek

S. pseudomonticola (p. 38)

4b Margins of most leaves entire or inconspicuously few-toothed (vigorous late season growth sometimes strongly toothed - especially on *S. bebbiana* and *S. scouleriana*)

10a Twigs of the season hairy (study under 10 x magnification)

11a Second-year and mature first-year twigs glaucous

S. geeyeriana (p. 54)

11b Twigs never glaucous

12a Leaves long and narrow, more than 4 x longer than broad

13a Hairs of leaves and twigs long, tangled and matted—sparsely hairy plants of

S. candida (p. 40)

13b Hairs of leaves and twigs short, straight and appressed

S. exigua (p. 29)



13a



13b

12b Leaves shorter or broader, less than 4 x longer than broad

14a Plants 2 m or less tall

15a Mature leaves evidently hairy

S. brachycarpa (p. 42)

15b Mature leaves glabrous or sparsely hairy

S. farriar (p. 66)

14b Plants greater than 2 m tall

16a Pubescence of lower leaf surfaces partly red-tinged, that of petioles and young twigs short and erect to appressed (**compare leaf shapes of this species and the following**):
S. scouleriana (p. 47)

16b Pubescence of lower leaf surfaces white, that of petioles and young twigs longer, wavy or curly, tangled, loosely to tightly appressed
S. bebbiana (p. 44)

10b Twigs of the season glabrous or very sparsely hairy

17a Older twigs (third- and fourth-year) pale, grayish; plants of low elevations—scarcely toothed extremes of

S. lutea (p. 34)

17b Older twigs darker, red to brown; plants of higher elevations (except for *S. planifolia* var. *planifolia* in the Lemhi River Valley)

18a Leaves (except first few of season) glabrous while expanding and at maturity, if hairy only slightly so above
S. farriar (p. 66)

18b Leaves hairy at least while expanding, more densely so below than above

19a First- and second-year twigs strongly glaucous; lateral veins of leaves not pronounced on upper surface; leaves mostly smaller and narrower than the following
S. lemmonii (p. 54)

19b First- and second-year twigs not glaucous (or, rarely, weakly so); lateral veins of leaves generally pronounced against dark green upper surface
S. planifolia (p. 60)

1b Leaves not glaucous beneath, though sometimes paler green; or lower surfaces totally obscured by pubescence

20a Mature leaves essentially glabrous

21a Glands present on upper side of petiole near base of leaf blade, and on leaf margins

S. lasiandra var. *caudata* (p. 26)

21b Glands present only on leaf margins

22a Leaf blades narrow, less than 10 mm broad

23a Blades less than 5 mm broad

S. exigua ssp. *melanopsis* var. *tenerrima* (p. 29)

23b Blades not less than 7 mm broad—narrow-leaved extremes of

S. boothii (p. 50)

22b Leaf blades broader, 10 mm or greater

24a Young twigs spreading-hairy—glabrous-leaved extremes of

S. tweedyi (p. 68)

24b Young twigs glabrous to appressed-hairy

S. boothii (p. 50)

20b Mature leaves notably hairy on at least one side



- 25a Pubescence of leaves extremely dense below (the leaf surface not visible), much thinner or absent above
- 26a Hairs of lower leaf surface long, tangled, matted, white; twigs with similar felt-like pubescence
S. candida (p. 40)
- 26b Hairs of lower leaf surface very short, dense, silvery; twigs glabrous and glaucous
S. drummondiana (p. 58)
- 25b Pubescence equally dense on both surfaces, or denser above than below
- 27a Margins of leaves entire
- 28a Leaves narrow, less than 1 cm broad except if extremely vigorous; plants generally more than 2 m tall, may be shorter on sand and gravel bars below high-water line
S. exigua ssp. *exigua* (p. 29)
- 28b Leaves broad; those of middle and late season at least 1 cm broad; plants generally less than 1.5 m tall
S. wolfii (p. 74)
- 27b Margins of leaves gland-toothed
- 29a Leaf blades, less than 1 cm broad, except if extremely vigorous—occasional plants of
S. exigua ssp. *exigua* (p. 29)
- 29b Leaf blades over 1 cm broad, except for those of early season
- 30a Petioles and young twigs with spreading, straight hairs
- 31a Mature leaves glabrous or sparsely hairy below, evidently hairy above especially along midrib
S. tweedyi (p. 68)
- 31b Mature leaves evidently hairy above and below
S. commutata (p. 70)
- 30b Petioles and young twigs with loosely- to tightly-appressed curly or wavy hairs
S. eastwoodiae (p. 72)

Salix L. willow

Description of the genus

Generally mid- to tall, erect shrubs, occasionally trees and less commonly matted high-elevation subshrubs; leaves simple, alternate, stipulate, deciduous, the margins entire or toothed; winter buds covered by a single scale; plants dioecious; flowers numerous in unisexual aments (catkins) which are either sessile or borne on flowering branchlets on the twigs of the previous season; aments develop before (precocious), at the same time as (coetaneous), or after the leaves (serotinous); each flower subtended by an entire bract (variously called a scale or bract, here called a floral bract); perianth reduced to one or several glands (nectaries); staminate flowers with 2 stamens (3-8 in *S. lasiandra*); pistillate flowers with a single pistil which is sessile or borne on a stipe (pedicel); stigmas 2 on a common style, or stigmas and/or style bifid; fruit a two-valved capsule with numerous, tiny seeds each enveloped by a tuft of long, silky hairs.

Salix is one of two genera in the widely distributed family *Salicaceae*, the other being the ubiquitous *Populus*. While estimates vary, there appears to be from 300 and 500 willow species, chiefly in North Temperate regions.

Salix alba L.

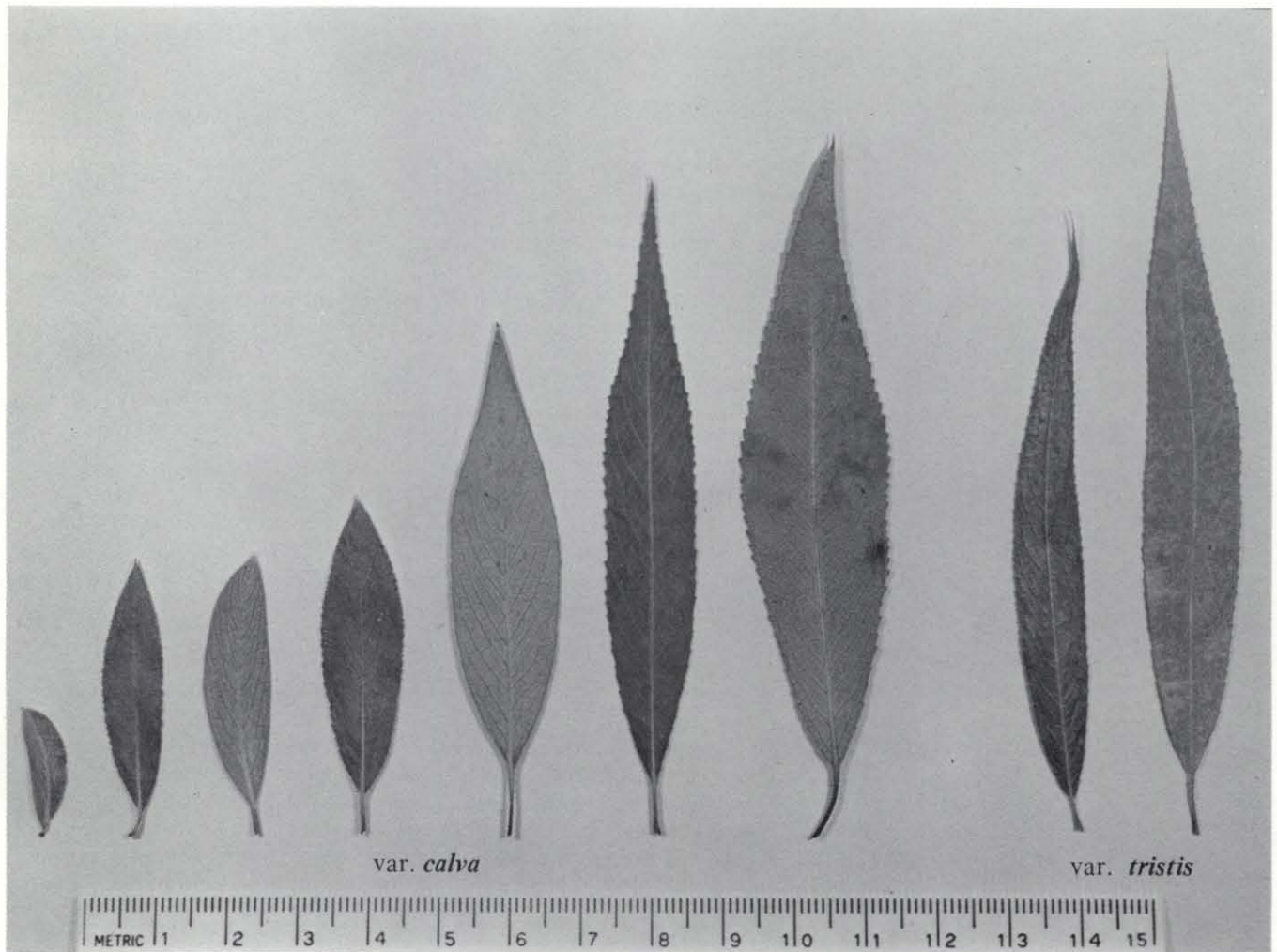
white willow

variety *calva* G.F.W. Mey.variety *tristis* Gaud.

weeping willow

Description

Introduced, upright tree to 25 m tall (var. *calva*) or a weeping willow up to 15 m tall (var. *tristis*) having long, pendulous branches; with a single trunk or with several large main stems up to 6 dm in diameter; twigs finely appressed-hairy at least on portions developing in middle and late season, pubescence partially persisting through second year; mature leaf blades shiny green above, pale and strongly glaucous beneath except early leaves of the season, margins serrulate with fine, gland-tipped teeth; first leaves of the season glabrous above and hairy below with long, silky, deciduous hairs; later leaves finely appressed-hairy on both surfaces while expanding, glabrous or sparsely hairy (esp. below) at maturity; petioles 2-10 mm long, puberulent at least above, occasionally with a pair of glands on the upper side near the base of the blade (as in *S. lasiandra*, but smaller); stipules minute and inconspicuous, even on vigorous shoots; staminate aments up to 5 cm long, expanding with the leaves on leafy flowering branchlets up to 8 mm long; stamens 2; pistillate aments up to 6 cm long, expanding with the leaves on leafy flowering branchlets 1-3 (4) cm long; capsules glabrous, borne on stipes .5-8 mm long; styles .3-.6 (.7) mm long; floral bracts yellow or greenish, pubescent, deciduous.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

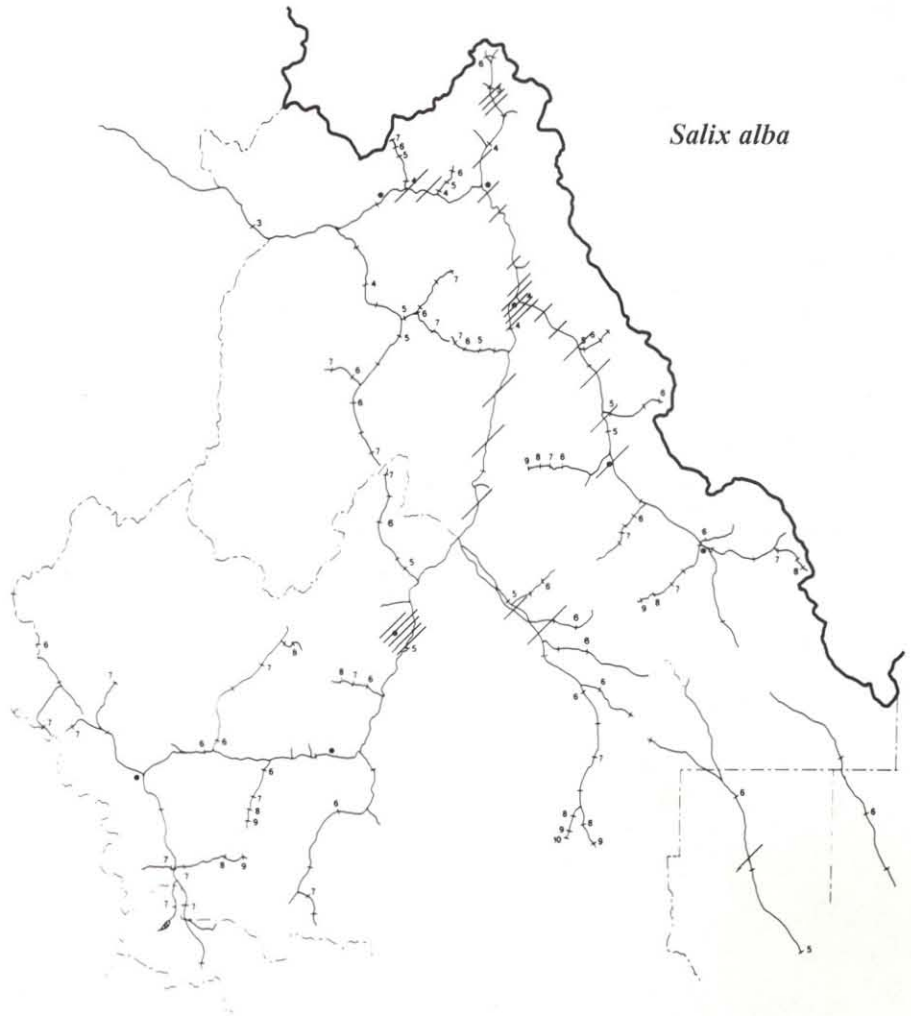
Identification and Taxonomy

Salix alba is a native of Europe and western Asia planted primarily at low elevations in our region. Two major forms of the species are established, neither appears to have escaped or become naturalized in the study area. The taxonomy of this and closely related species (*S. fragilis* and *S. babylonica*) is complicated by horticultural selection and hybridization. We follow Rehder (1960) in assigning the tentative names used below:

Salix alba var. *calva* is the large upright tree commonly seen on homesteads, particularly in and around Salmon, Idaho. It was also planted (and individuals are persisting) along about one mile of the North Fork of the Salmon River in the vicinity of Deep Creek (4950 ft; 1510 m). This planting was initiated for fisheries improvement, to replace riparian vegetation and thermal cover lost through highway construction. Plants we have examined in the region are all staminate, except along the North Fork, where both sexes are present. Staminate plants have yellow-brown twigs, while the twigs of pistillate plants are generally green-brown. This suggests that a mixture of cultivars may have been planted, including perhaps *S. alba* var. *vitellina*. Although study area plants appear to be closest to *S. alba* on technical grounds, Rechinger (1964) describes a commonly cultivated hybrid (*S. alba* X *S. fragilis*) with apparently similar morphology.

Salix alba var. *calva* is identified in the field by its nonweeping habit, large stature, long-accuminate leaves with glaucous lower surfaces, and 2 stamens per flower. It resembles the native *Salix lasiandra* var. *caudata*, a smaller tree in our area, which has similarly shaped, but nonglaucous leaves and 3-8 stamens per flower. All of our other native willows are either smaller plants or have considerably different leaf shapes.

Salix alba var. *tristis* is the easily recognized weeping willow occasionally planted in towns and on homesteads in the area. This variety has slightly narrower leaves and long, pendulous, yellow or yellow-green branches. We have seen only staminate trees in the region. Our plants are distinguished from *Salix babylonica*, another common weeping willow cultivar, by their yellowish rather than olive or brown branches, pubescent leaves (Rehder 1960, Rechinger 1964), and by the fact that *S. babylonica* should not be cold-hardy in our area (Wyman 1965). Rechinger, however, describes a frequently planted hybrid (*S. alba* X *S. babylonica*) with characteristics similar to study area plants.



Salix lasiandra Benth.

variety *caudata* (Nutt.) Sudw.

Synonymy: *Salix caudata* (Nutt.) Heller

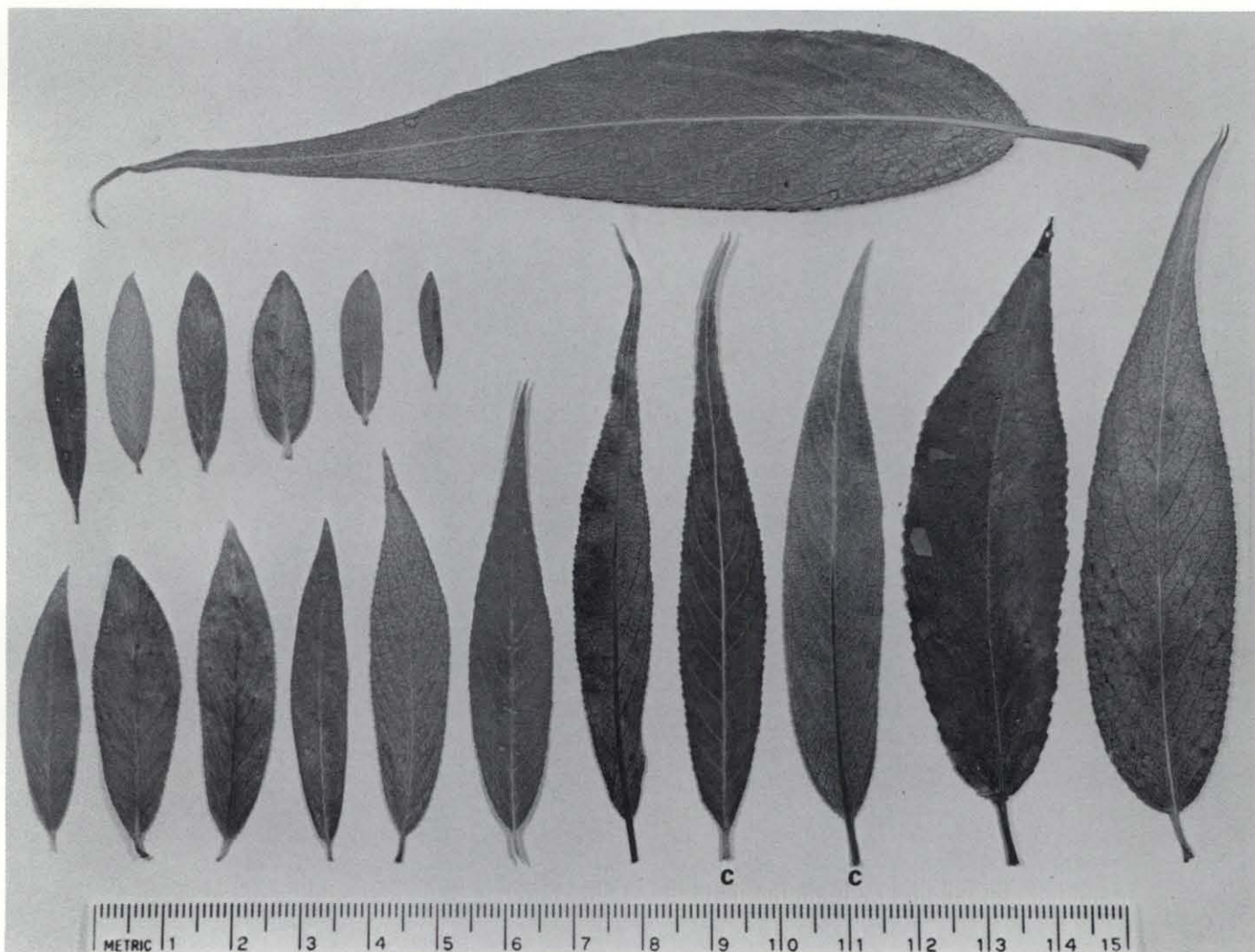
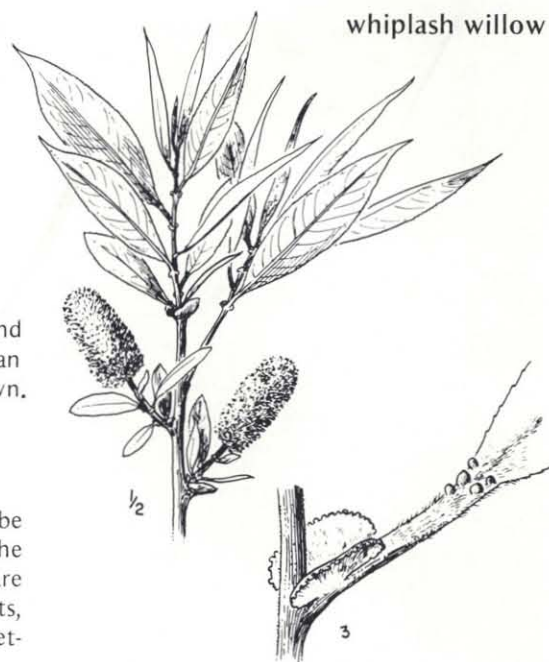
whiplash willow

Identification

Salix lasiandra var. *caudata* is easily distinguished by its tree stature and shiny, green, distinctively shaped leaves with glands on the petioles. It can generally be identified at a distance by its stature and dense, green crown.

Similar Species

Salix boothii has certain narrow-leaved forms which can easily be confused with shrubby specimens of whiplash willow. These species are the only two at low-to-middle elevations with essentially glabrous leaves that are green on both sides. *Salix boothii* differs in its dark, persistent floral bracts, thicker, more intricately veiny (smaller vein islets) dull green leaves, and petioles lacking glands near the base of the blade.



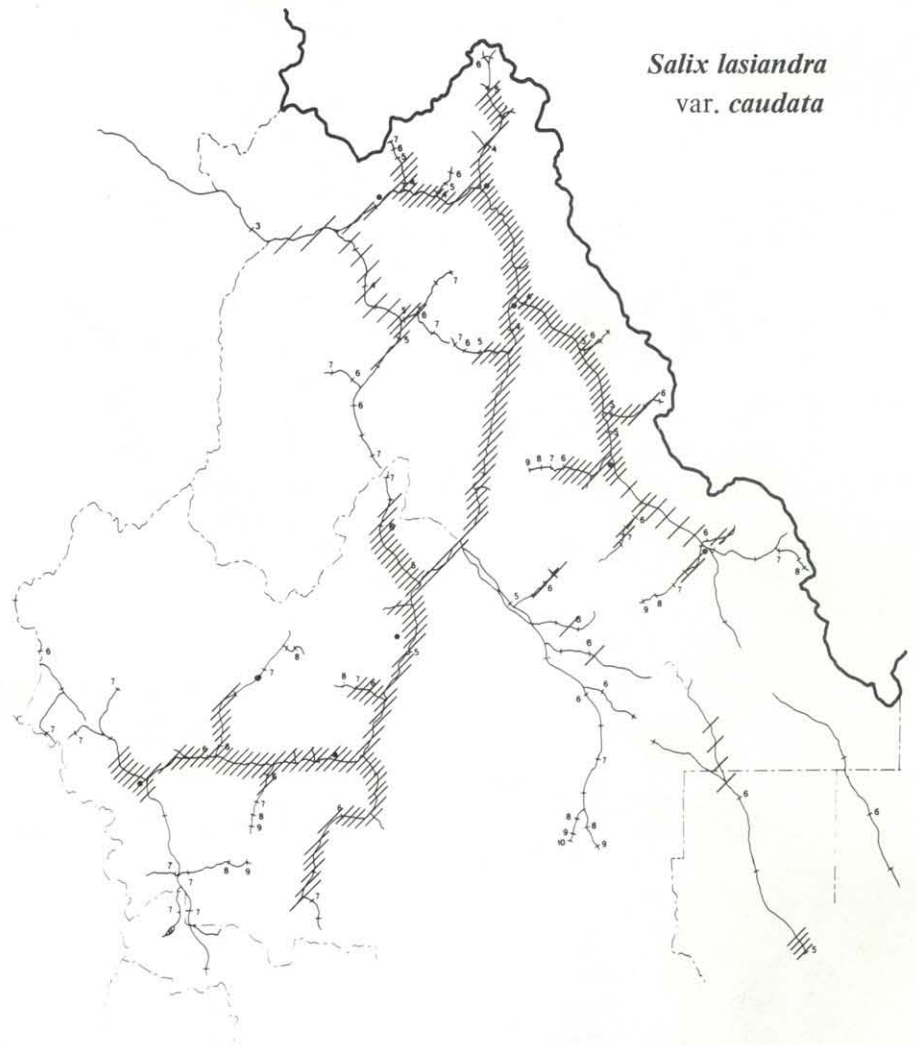
Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Range: British Columbia and Alberta south to California and New Mexico

Distribution and Habitat: *Salix lasiandra* var. *caudata* is common throughout much of the study area at low to middle elevations, generally below 6500 feet (1980 m). It occurs in riparian habitats associated with Wyoming big sagebrush, Douglas-fir and mountain big sagebrush vegetation zones. This willow usually grows in moist, sandy or gravelly soils, so it is frequently found close to the stream edge or the high-water line on greatly fluctuating streams, such as the Salmon River. Abandoned river or stream channels provide additional habitat of similar character.

At low elevations where whiplash willow forms a medium-sized tree, it commonly occurs in open black cottonwood stands or as a fringe around dense cottonwood stands. Fine-textured substrates that do not support cottonwood generally lack whiplash willow (e.g., Pahsimeroi River, Birch Creek). Other common associates at low elevation include *Salix lutea*, *Cornus stolonifera* and *Rosa woodsii*.

At middle elevations this species has a more shrubby stature and occurs at stream edges with *Salix boothii*, *S. drummondiana* and *Alnus incana*.



Description

Tree with several main stems commonly 10-30 (47) cm in diameter and up to 16 m tall, more shrubby with increased elevation; **twigs** of the season moderately to densely pubescent with spreading hairs, or occasionally nearly glabrous, pubescence persisting during second or third year, at least in bud axils; mature **leaf blades** green on both surfaces, usually paler beneath, but not glaucous, surfaces shiny, especially the lower, margins with fine, gland-tipped teeth, sprout leaves more coarsely toothed; **first leaves** of the season glabrous above and pubescent below with long, straight, quickly deciduous hairs; **later leaves** finely pubescent on both sides while expanding, eventually glabrous, often except for the basal part of the upper midrib; **petioles** very short (1-2 mm) on first leaves, later mostly 6-8 mm long, or up to 2 cm on vigorous shoots, spreading-hairy at least above, bearing 2 or more large irregular glands (most obvious on vigorous growth) on the upper side near the base of the blade; **stipules** strongly gland-toothed, quickly deciduous, small (.5-1.0 mm) on regular growth, up to 5 mm and leafy on vigorous shoots; **aments** expanding with the leaves on leafy flowering branchlets 10-35 (45) mm long; **staminate aments** 1.5-3.0 cm long, densely cylindrical or conic; stamens 5 (3-8) per flower, filaments hairy toward the base; **pistillate aments** 2-4.5 cm long; capsules glabrous, borne on stipes .7-2.0 mm long at maturity; styles .4-.7 (1.0) mm; floral bracts yellow, pubescent on lower portion, glabrous distally, deciduous.



Taxonomy

Two major forms of *Salix lasiandra* occur in the Pacific Northwest: var. *lasiandra*, with leaves glaucous beneath, grows mostly west of the Cascades and in parts of eastern Washington, northern Idaho and northwestern Montana; var. *caudata*, with nonglaucous leaves, grows east of the Cascades, especially in the Rocky Mountains.

The two varieties are so distinctive that Ball (Davis 1952) and other early workers considered them to be separate species, *S. caudata* and *S. lasiandra*. Ball recognized three varieties of *S. caudata* in Idaho: the typical variety with hairy twigs, budscales and petioles; var. *bryantiana*, a glabrous phase; and var. *parvifolia*, a small, narrow-leaved, higher elevation phase. Cronquist (Hitchcock et al. 1964) considered these varieties to be merely forms of var. *caudata*. Our plants are mostly hairy as in Ball's typical variety, but a few, seemingly random individuals (or populations) are essentially glabrous, as in var. *bryantiana*. This latter variety, however, does predominate in some parts of Idaho. None of our plants can clearly be referred to var. *parvifolia*. A study of the variation in *S. lasiandra* var. *caudata* over a wide geographic area is needed.

George Argus (pers. comm.) plans to propose *caudata* and *lasiandra* as two subspecies of the eastern *Salix lucida* Muhl. With this interpretation, the varietal rank is available if Ball's varieties, or any others, are shown to be worthy of recognition.

Salix exigua Nutt.

subspecies *exigua*

subspecies *melanopsis* (Nutt.) Cronq.

variety *melanopsis*

variety *tenerrima* (Hend.) Schneid.

coyote willow

sandbar willow

dusky willow

Synonymy: *Salix melanopsis* Nutt.

The *Salix exigua* Complex

The *Salix exigua* complex is represented in the study area by three major forms, two that are commonly recognized at the species or subspecies rank (*exigua* and *melanopsis*) and a third distinctive, but somewhat intermediate, entity here treated as a variety of *ssp. melanopsis*.



Identification

The three major forms of *Salix exigua* are distinguished as follows:

ssp. exigua by its narrow, gray-green or silvery pubescent, entire leaves with short petioles; late expanding, often clustered aments; and narrow, acute floral bracts.

ssp. melanopsis (typical forms) by its stream edge habitat; relatively narrow, toothed leaves that are glaucous below (weakly glaucous or merely paler early in the season); glabrous capsules; and pale, deciduous, blunt floral bracts.

ssp. melanopsis var. *tenerrima* by its extremely narrow, green, glabrous, nonglaucous leaves.



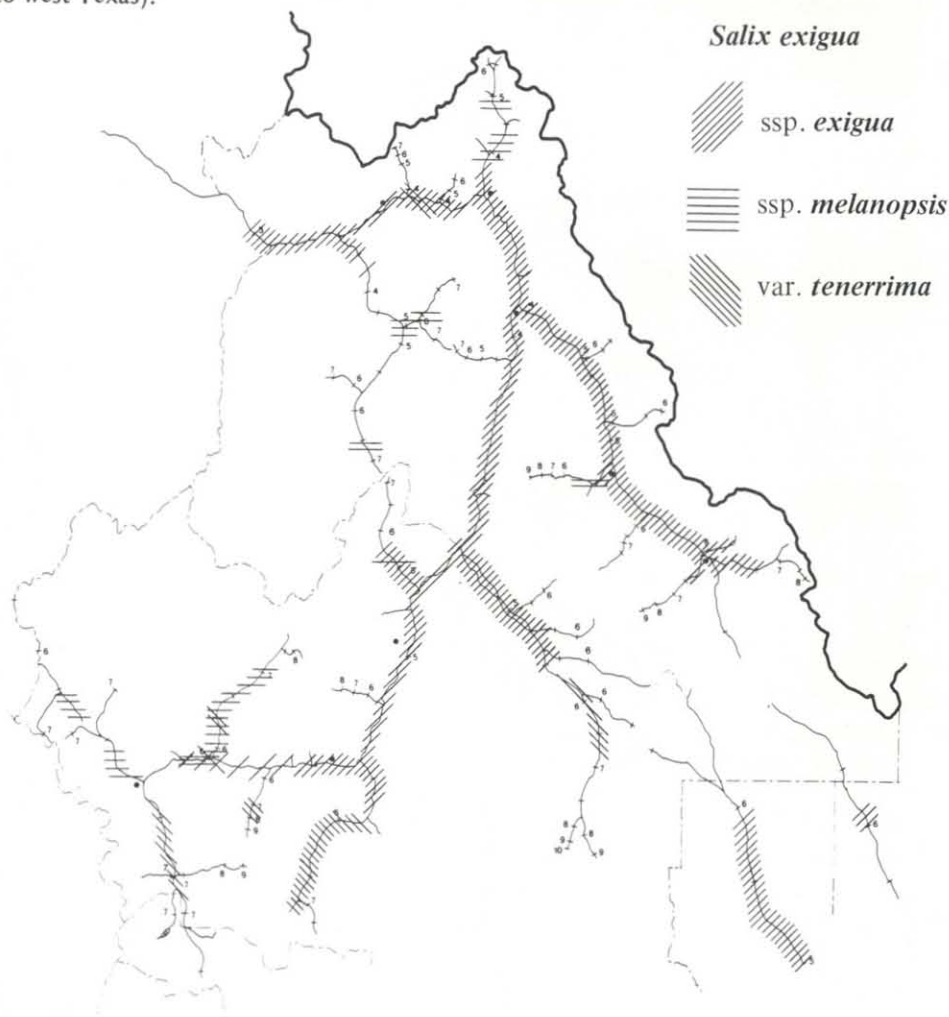
ssp. melanopsis



Range: *Salix exigua*, with its three subspecies, is distributed throughout most of North America. The two western subspecies (*exigua* and *melanopsis*) range from Alberta and British Columbia east of the Cascades, south to Colorado and California (ssp. *exigua* also ranges from Arizona to west Texas).

Distribution and Habitat: Subspecies *exigua* is a constant and often abundant member of low elevation riparian communities throughout the study area. It is primarily distributed within the Wyoming big sagebrush zone, below 6000 feet (1830 m) elevation. In the lower and middle parts of its elevational range it occupies a wide variety of habitats, including: sand and gravel bars below the high-water line; rocky, gravelly and sandy stream edges; and moist, well-drained benches and bottomlands. In its upper elevational reaches, on the other hand, it is generally confined to streamside communities. Associated with ssp. *exigua* through most of its distribution are *Salix lutea*, *S. lasiandra*, *Cornus stolonifera*, *Ribes setosum* and often *Populus trichocarpa* and/or *Betula occidentalis*.

Subspecies *melanopsis* is distributed entirely above ssp. *exigua* and mostly below 7000 feet (2130 m) elevation in study area drainages, except for small areas where the two subspecies overlap, and for a single anomalous population of var. *tenerrima* on the lower Salmon River near Spring Creek. It occurs in open riparian habitats within forest communities and in mountain big sagebrush-dominated valleys within and just below the forest zone. This subspecies appears to be almost always confined to sandy or gravelly soils at stream edges and on bars below the high-water line. *Salix drummondiana* and *S. boothii* are common associates.



Similar Species

Species that are sometimes confused with members of the *Salix exigua* complex are contrasted below.

ssp. *exigua*

Salix geyeriana somewhat resembles ssp. *exigua*, but is a clumped shrub with glaucous twigs, longer petioles, a different leaf shape, and shorter aments with persistent floral bracts.

ssp. *melanopsis* (except var. *tenerrima*)

Salix planifolia differs by its mostly entire leaves, longer petioles, glabrous twigs, sessile aments with hairy capsules and dark floral bracts.

Salix lemmonii differs by its glaucous twigs, mostly entire leaves, longer petioles, hairy capsules and dark floral bracts.

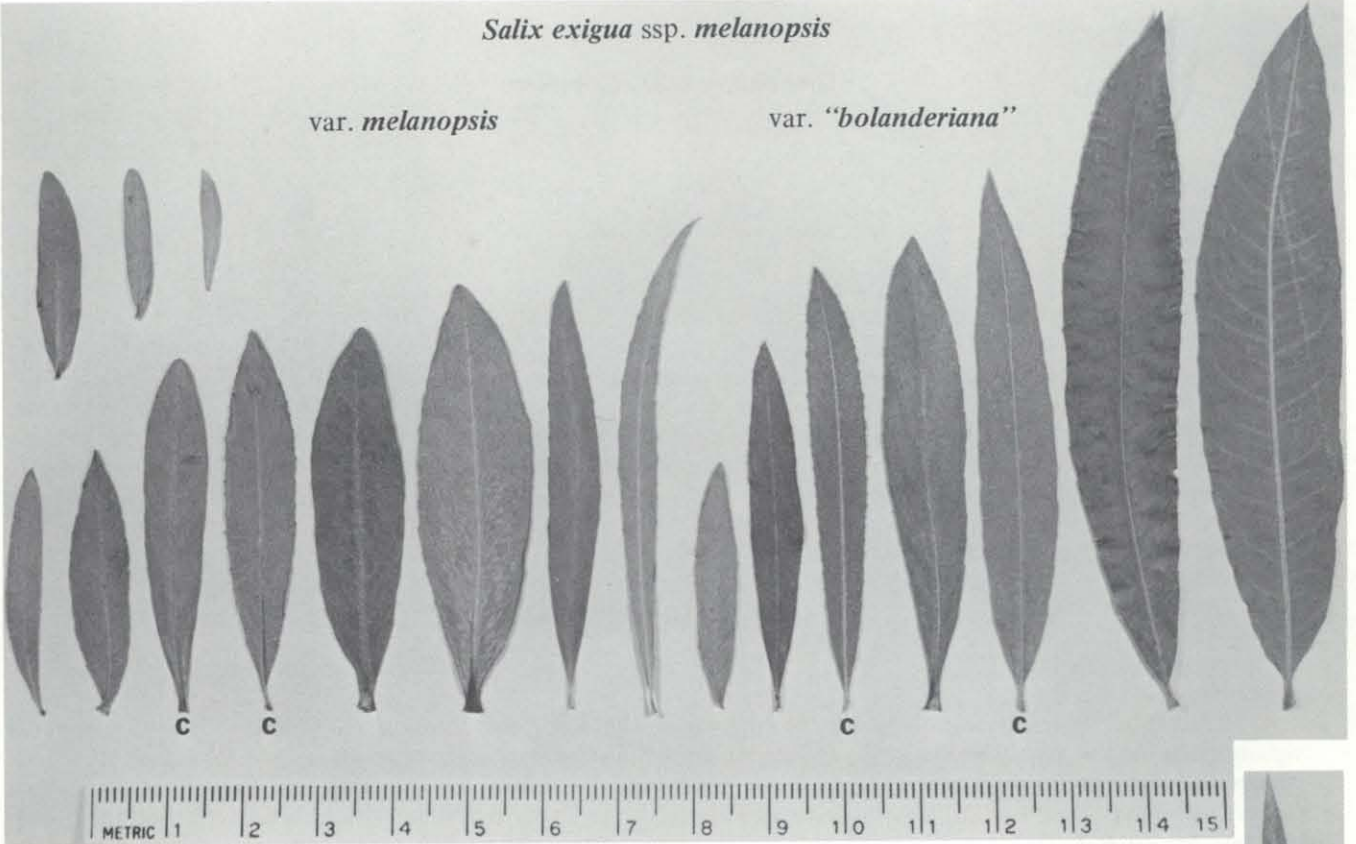
Salix drummondiana differs by its glaucous twigs, entire leaves with velvety pubescence beneath, and sessile aments with hairy capsules and dark floral bracts.

ssp. *melanopsis* var. *tenerrima* resembles only ssp. *exigua*.

Salix exigua ssp. *melanopsis*

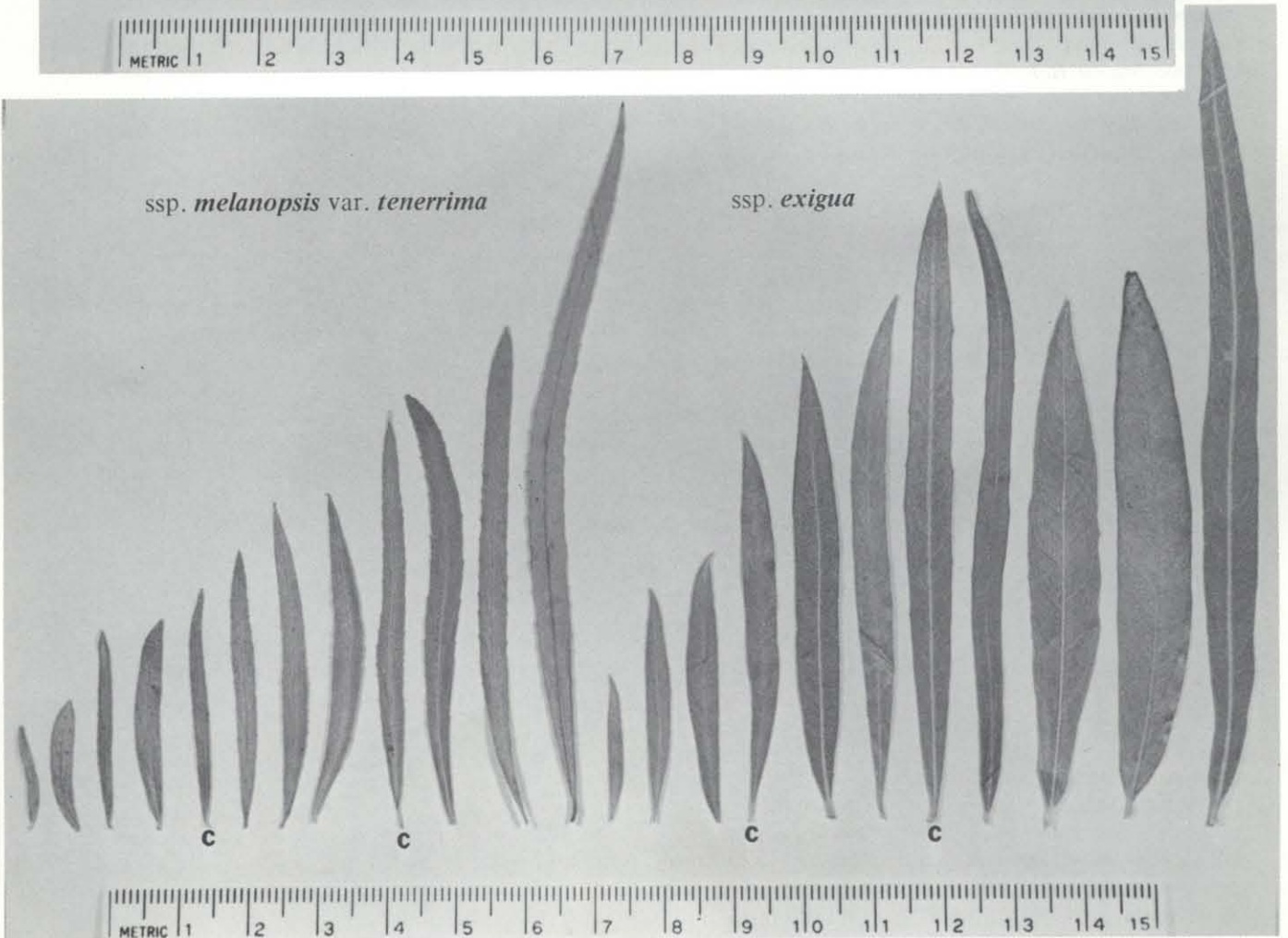
var. *melanopsis*

var. "*bolanderiana*"



ssp. *melanopsis* var. *tenerrima*

ssp. *exigua*



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

The *Salix exigua* Complex

Description

The complex as a whole has the following characteristics:

Colonial shrubs with numerous slender stems, spreading underground and forming thickets sometimes many meters in dimension; mature **leaves** long and narrow with short petioles averaging 1-2 mm long or rarely up to 5 mm long on vigorous shoots; **stipules** quickly deciduous, most < 1 mm, but up to about 3 mm on vigorous shoots; **aments** developing over a prolonged period, the first expanding with the leaves on short, leafy, flowering branchlets, aments continuing to develop during the season terminally on long lateral branches, and sometimes in a cluster from axillary buds just below terminal aments; stamens 2, filaments hairy on lower half; stigmas essentially sessile on the ovary; floral bracts yellow, soon deciduous.

subspecies *exigua*

Shrubs up to 8 m tall, occasionally tree-like; **twigs** of the season thinly to densely pubescent with straight, appressed hairs; second year twigs essentially glabrous and red-brown or brown; **leaves** entire or few-toothed, silvery white expanding, with appressed straight hairs, evidently pubescent at maturity and gray-green to silvery in aspect, pubescence of upper surface often slightly more dense; leaf surfaces generally visible through the pubescence (with magnification)—the upper shiny green, the lower dull and glaucous; **aments** commonly clustered on lateral branch tips; flowering branches from 1 cm to over 20 cm long; ovaries and capsules densely to moderately pubescent (var. *exigua*) or sparsely hairy to glabrous (var. *stenophylla*), borne on stipes up to .5 mm long; floral bracts generally narrow and acute, densely hairy often except for a glabrous tip, deciduous.

subspecies *melanopsis*

Shrubs up to 4 m tall; **twigs** of the season sparsely to moderately pubescent with loosely appressed wavy to curly hairs; second year twigs essentially glabrous and generally dark red-brown (average darker than ssp. *exigua*); mature **leaves** evidently gland-toothed, green in aspect above, glaucous or at least pale below (early leaves often not strongly glaucous); **first leaves** of the season glabrous above and with long, silky, appressed, deciduous hairs below; **later leaves** finely tomentose while expanding, the hairs loosely appressed, wavy and tangled, more dense on upper surface; leaves glabrous when fully expanded or persistently hairy at least on the midvein; **aments** rarely clustered on lateral branch tips; **staminate aments** 1.5-3.5 cm long, borne on leafy flowering branchlets (.3) .5-1.0 (1.5) cm long; **pistillate aments** 2-4 cm long, borne on flowering branchlets (.5) 1-3 (4) cm long; ovaries and capsules glabrous, borne on stipes up to .7 mm long; floral bracts generally broad and blunt, glabrous often except for marginal cilia, deciduous.

subspecies *melanopsis* variety *tenerrima*

This distinctive form has the floral characteristics of ssp. *melanopsis* and a number of the vegetative features of ssp. *exigua*. It is so significantly different from the other forms of ssp. *melanopsis* and ssp. *exigua*, we are treating it here separately.

Plants up to 5 m tall; **twigs** glabrous from the start, or rarely, sparsely hairy at first, varying in color at maturity from paler red-brown or brown as in ssp. *exigua*, to darker shades as in ssp. *melanopsis*; mature **leaves** prominently toothed (early season leaves often inconspicuously so or entire), narrower than in all other forms of the species, green on both surfaces, not glaucous beneath, **first leaves** of the season glabrous; **later leaves** sparsely hairy or glabrous while expanding, and glabrous at maturity; **aments** occasionally clustered on lateral branch tips; flowering branches .5-5.5 cm long; **staminate aments** 1-3 cm long; **pistillate aments** 2-3 (3.5) cm long; ovaries and capsules glabrous, borne on stipes up to .9 mm long; floral bracts mostly broad and blunt as in ssp. *melanopsis*, but occasionally more narrow and acute as in ssp. *exigua*, pubescent as in ssp. *melanopsis*, but occasionally approaching ssp. *exigua* (this variation is independent of bract shape), deciduous.

Taxonomy

The two major western phases of *Salix exigua* have been variously interpreted as either subspecies (Cronquist in Hitchcock et al. 1964) or distinct species (Ball in Davis 1952, Dorn 1976). The degree of morphologic and ecologic differentiation between typical members of the two phases (*exigua* and *melanopsis*) is clearly comparable to that between many accepted species in the genus; thus separate species status seems warranted.

However, our narrow-leaved form, here tentatively called *ssp. melanopsis* var. *tenerrima*, appears to bridge the gap in the variation between the two major phases. It was the recognition of many apparent intermediates that led Cronquist to propose subspecific rather than specific status for the three major forms of *Salix exigua* (the third is *ssp. interior* of central and eastern North America). A detailed study of the complex is badly needed, but based on our current understanding of the variation, we follow Cronquist's treatment in this bulletin.

subspecies *exigua*

Two varieties of *ssp. exigua* can be recognized in the study area: var. *exigua*, a more northerly form with densely to moderately pubescent ovaries and capsules; and var. *stenophylla*, a southern form with sparsely pubescent to glabrous ovaries and capsules. Several populations from the middle and upper Lemhi River drainage appear to be var. *stenophylla*. The remainder of our plants are var. *exigua*, or have intermediate amounts of capsule pubescence. No other way of separating these varieties has been discovered. Since the geographic ranges of the varieties apparently overlap in our region, it may not always be possible or meaningful to distinguish them.

subspecies *melanopsis*

Three different but intergrading forms of this subspecies can be distinguished in the region, though Cronquist recognized only a typical variety in the Pacific Northwest.

1. In the northern part of the study area (e.g., North Fork Salmon River and Panther Creek), plants have broad, persistently hairy leaves that are strongly glaucous beneath. This form resembles the common phase in northern Idaho, which has been called var. *bolanderiana*. (Ball in Davis 1952—*S. melanopsis* var. *bolanderiana* (Rowlee) Schneid.)

If additional study shows var. *bolanderiana* to be worthy of recognition, the name will have to be published as a variety of *Salix exigua*. We do not here propose the new combination.

2. Western and central plants have leaves much less pubescent at maturity, and subtly different in shape and texture; this is var. *melanopsis*.
3. Southern plants are the unique narrow-leaved form described in detail above. We refer them to this subspecies largely on the basis of their similar floral features and habitat. They closely match descriptions of var. *tenerrima* (Henderson 1900, Schneider 1919b; Ball in Davis 1952—*S. melanopsis* var. *tenerrima* (Hend.) Ball). The single, isolated low elevation population of var. *tenerrima* in the northern study area (Spring Creek) is enigmatic in its habitat, but is noteworthy in its flowering period, which is earlier than that of the associated *ssp. exigua*. Though this variety is distinctive, it grades into narrow-leaved extremes of var. *melanopsis* (e.g., plants in the lower Yankee Fork are confusingly intermediate), and also into *ssp. exigua* in some places where they meet (e.g., Pahsimeroi River). Additional study is needed to confirm the validity of the name we have applied and to clarify its relationship to other plants in the complex.

Key to the *Salix exigua* Complex

- 1a) Mature leaves and first year twigs moderately to densely pubescent with tightly appressed straight hairs; leaf blades entire or inconspicuously toothed; floral bracts narrow, acute and pubescent. *ssp. exigua*
- 1b) Mature leaves and twigs glabrous, or if pubescent, hairs loosely appressed, wavy and tangled; leaf blades evidently toothed; floral bracts generally broader, more blunt, and glabrous except for marginal cilia. *ssp. melanopsis*

Salix lutea Nutt.

yellow willow

Synonymy: *Salix rigida* Muhl.

Identification

Salix lutea is distinguished from other willows in the area by its low elevation habitat in conjunction with its glabrous leaves that are glaucous below, yellowish-white to gray older twigs (generally), and long-stipitate, glabrous capsules.



Similar Species

Salix pseudomonticola, a rare species, known in Idaho only from the upper Lemhi River and Birch Creek valleys, strongly resembles *S. lutea*, but has dark brown, generally hairy twigs, larger stipules, red-tinged expanding leaves, aments generally sessile and without green subtending bracts, shorter stipes and longer styles.

Salix barclayi occurs at much higher elevation (subalpine), has long, leafy flowering branchlets, and longer styles.

Salix bebbiana and *S. scouleriana* both differ in having entire, hairy leaves of distinctive shape, and hairy capsules.



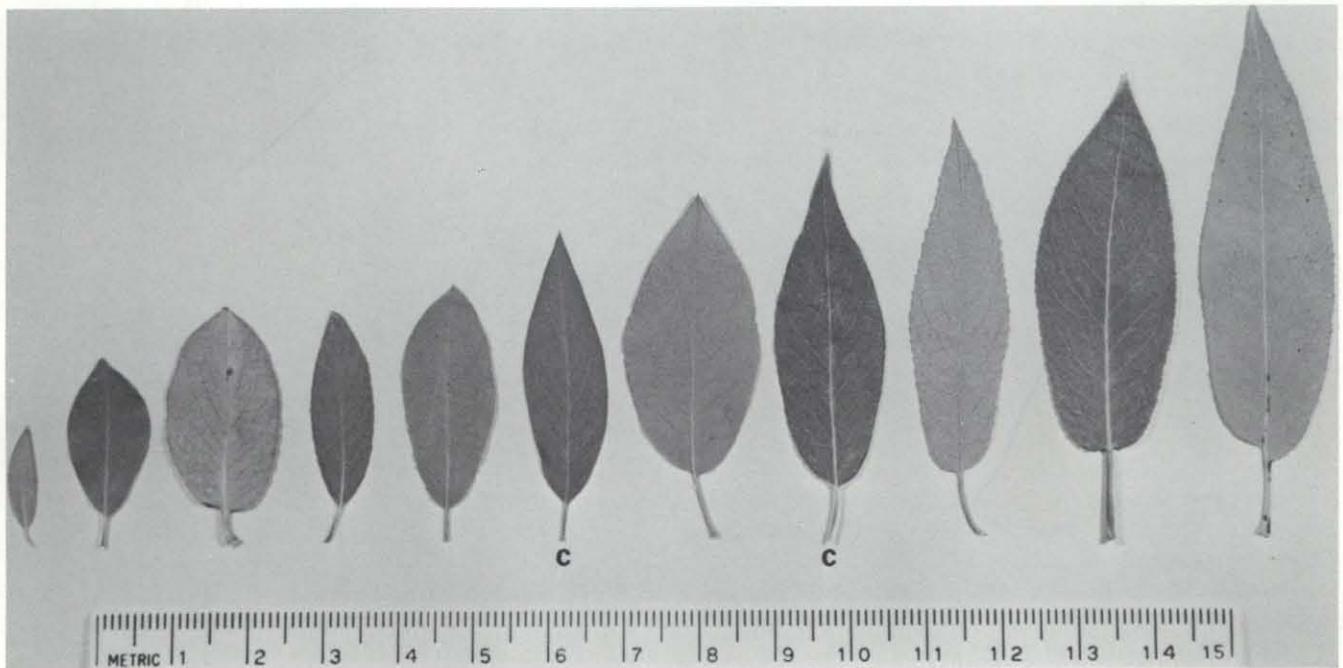
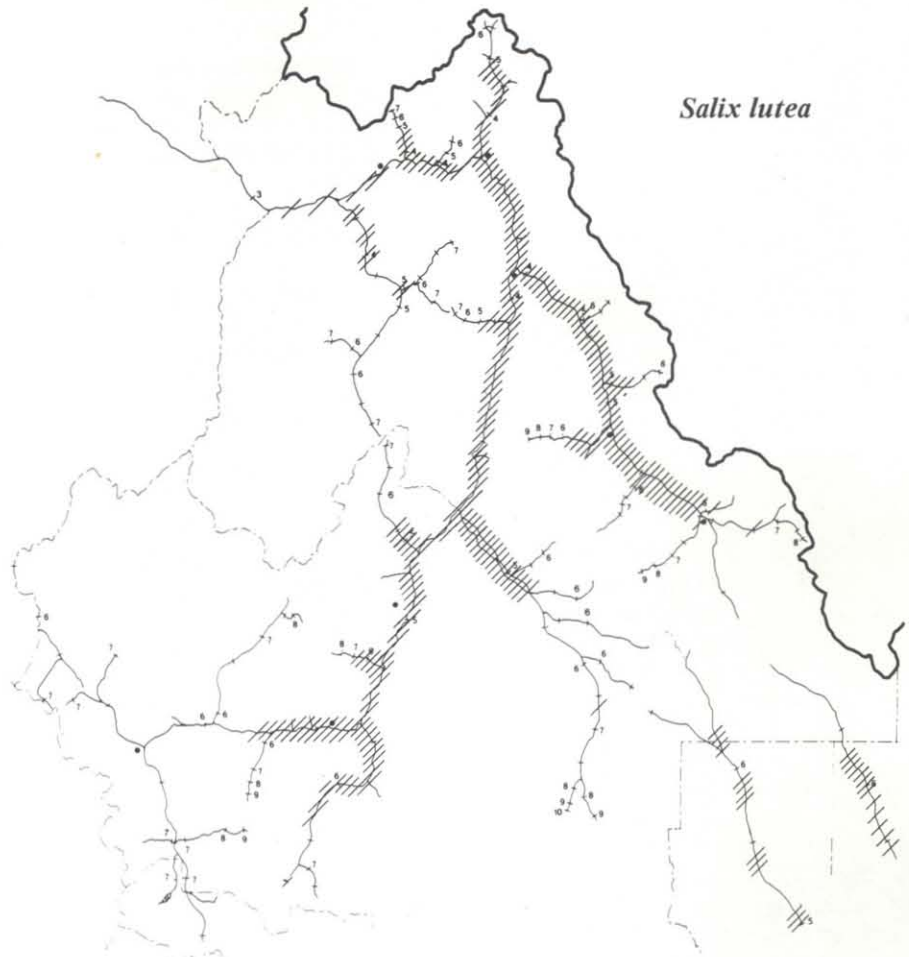
Description

Rounded shrub 3 - 6 (8) m tall, occasionally becoming a multi-stemmed tree, with stems up to 2 dm thick; **twigs** of the season glabrous or very sparsely puberulent; older twigs glabrous, yellowish-white, gray, or occasionally brownish; mature **leaf blades** green above, pale and glaucous beneath; margins finely toothed except near the apex, sometimes inconspicuously toothed or entire; **first leaves** of the season glabrous above and pubescent beneath with long, appressed, silky, deciduous hairs; **later leaves** with fine, appressed hairs while expanding, more dense above than below, glabrous at maturity, except for the slightly puberulent upper midrib; **petioles** 2-20 mm long, commonly about 10 mm long, somewhat puberulent especially above; **stipules** small and inconspicuous, or larger (up to 8 mm) on vigorous shoots, eventually deciduous; **aments** expanding with the leaves on short, leafy flowering branchlets 2-7 (8) mm long; **staminate aments** up to 3 (5) cm long; stamens 2; **pistillate aments** up to 4 (6) cm long; capsules glabrous, borne on long stipes 2-4.5 mm long at maturity; styles (.3) .4-.5 (.7) mm long; floral bracts brown to blackish-red, at least the upper two-thirds generally glabrous and standing above the matted tomentum of the axis, the margins occasionally ciliate with long hairs, persistent.

Range: Washington, Alberta and Manitoba south to Nebraska, Colorado and California.

Distribution and Habitat: This species is a major component of riparian vegetation at elevations below 5000-6000 feet (1520-1830 m) in the study area. It is generally confined to moist habitats within open Wyoming big sagebrush/grass vegetation, seldom extending far into the forest zone, and also avoiding cooler mountain big sagebrush habitats. Throughout the lower and middle part of its elevational range it occupies a wide range of riparian habitats from rocky river edges to moist benches with deep sandy or silty soil. In its upper elevation reaches, *Salix lutea* is generally found near the edge of streams, while adjacent meadowlands tend to support middle elevation species such as *S. boothii* and *S. geyeriana*. These stream sides often have coarser soils than the adjacent meadowlands.

Salix lutea is commonly associated with *S. exigua*, *S. lasiandra*, *Cornus stolonifera*, *Rosa woodsii*, *Ribes setosum*, and where substrates are suitable, an overstory of *Populus trichocarpa* and/or *Betula occidentalis*.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Taxonomy of *Salix lutea* Nutt.

The willows we have just described as *Salix lutea* Nutt. are part of a poorly understood complex of about six taxa distributed throughout much of North America. Two major interpretations of the complex have been presented in the literature. One interpretation lumps all of the taxa into a single species with about six varieties. The other recognizes each segregate taxon as a distinct species.

Cronquist (Hitchcock et al. 1964) is the principal proponent of the single-species concept. This interpretation is based on his observation that the segregate taxa (his varieties) appear to intergrade to a high degree, and are thus not well-marked enough to be considered separate species. The complex thus bears the name of the first validly named taxon—considered by Cronquist to be *S. rigida* (the eastern North American phase).

The alternative view was held by Ball (Davis 1952) and earlier workers, and was proposed again recently by Dorn (1975b, 1976, 1977). By this interpretation our plants belong to *S. lutea*, one of the three or four western species in the complex. Dorn argues that the western taxa (his "*S. lutea* complex") are in need of study and may not all be valid species, but they are not conspecific with *S. rigida* (*S. eriocephala*—see below), which differs substantially in its distribution, flavonoid chemistry and (to a lesser degree) morphology.

Argus (1980) recently reported that the name *S. eriocephala* Michx, has priority over *S. rigida* as the correct name for the wide-ranging North American species (*sensu* Cronquist), or the eastern North American species (*sensu* Dorn et al.). This invalidates Cronquist's varietal combinations for western taxa. There are currently no published names for western varieties of *S. eriocephala*.

In light of all of the above, and recognizing that a thorough study of the complex is needed, we here choose to use the name *S. lutea* for study area plants. The material we have seen is relatively homogeneous and apparently corresponds to var. *watsonii* recognized by both Ball and Cronquist. This variety is distinguished primarily by its gray or yellowish-white older twigs.

Salix pseudomonticola Ball

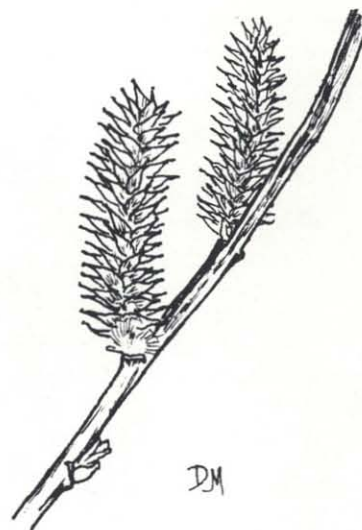


Salix pseudomonticola Ball
(*Salix monticola* Bebb in Flora of the Pacific Northwest)

false mountain willow

Identification

Salix pseudomonticola is recognized by its sessile or subsessile aments that expand before the leaves; glabrous capsules; well-developed stipules; and leaves that are red-tinged while expanding, and are distinctively shaped, glaucous beneath, essentially glabrous and toothed at maturity.



Similar Species

Salix lutea strongly resembles this species but differs in having glabrous twigs becoming pale gray with age, smaller stipules, expanding leaves not red-tinged, pistillate aments on short leafy flowering branchlets, longer stipes, shorter styles, and in growing on warmer, better drained sites.

Salix barclayi differs in having smaller stipules, aments on long leafy flowering branchlets, longer styles (on the average), and in occurring in different, generally higher-elevation habitats.

Salix bebbiana has red-tinged expanding leaves but differs, along with *S. scouleriana*, in having entire, pubescent leaves of a different shape, and pubescent capsules.

Description

Rounded shrub up to 5 (6) m tall; **twigs** of the season very sparsely to densely spreading-hairy, sometimes partly persistent on the dark red to brown second year twigs; mature **leaf blades** rather thick and leathery, green and generally shiny above, glaucous beneath, margins coarsely to finely toothed; **first leaves** of the season essentially glabrous above and pubescent beneath with long, straight, silky, deciduous hairs; **later leaves** red-tinged and pubescent while expanding, the fine appressed hairs dense above; glabrous at maturity, generally except for the puberulent upper midrib; **petioles** up to 1 cm long, hairy like the stem, or at least puberulent on the upper surface; **stipules** well developed on most shoots, generally larger than 2 mm and up to 1 cm on vigorous shoots; **staminate aments** 1-3 (4) cm long, expanding before the leaves, sessile; stamens 2; **pistillate aments** 1-5 (9) cm long, expanding before the leaves, sessile or on short flowering branchlets up to 5 mm long, without, or only occasionally with, small green bracts; capsules glabrous, borne on stipes .5-2.0 (2.5) mm long; styles .5-.9 (1.8) mm long; floral bracts brown to black, sparsely to densely long hairy on both surfaces, persistent.

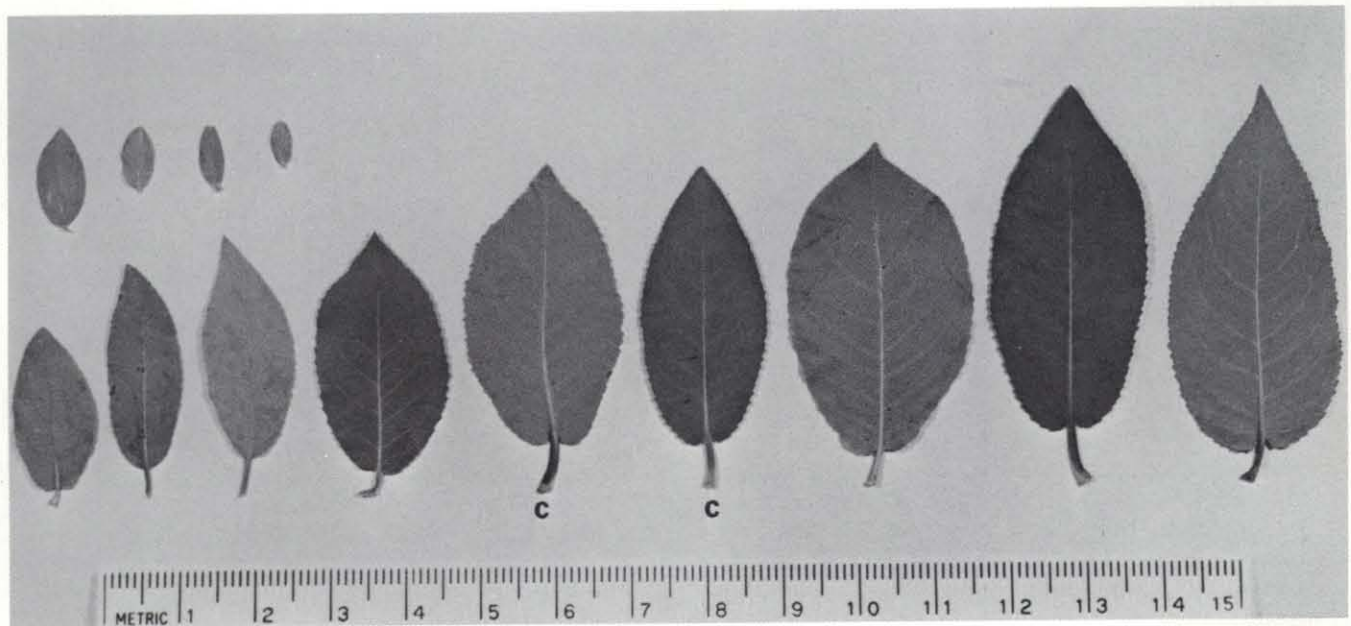
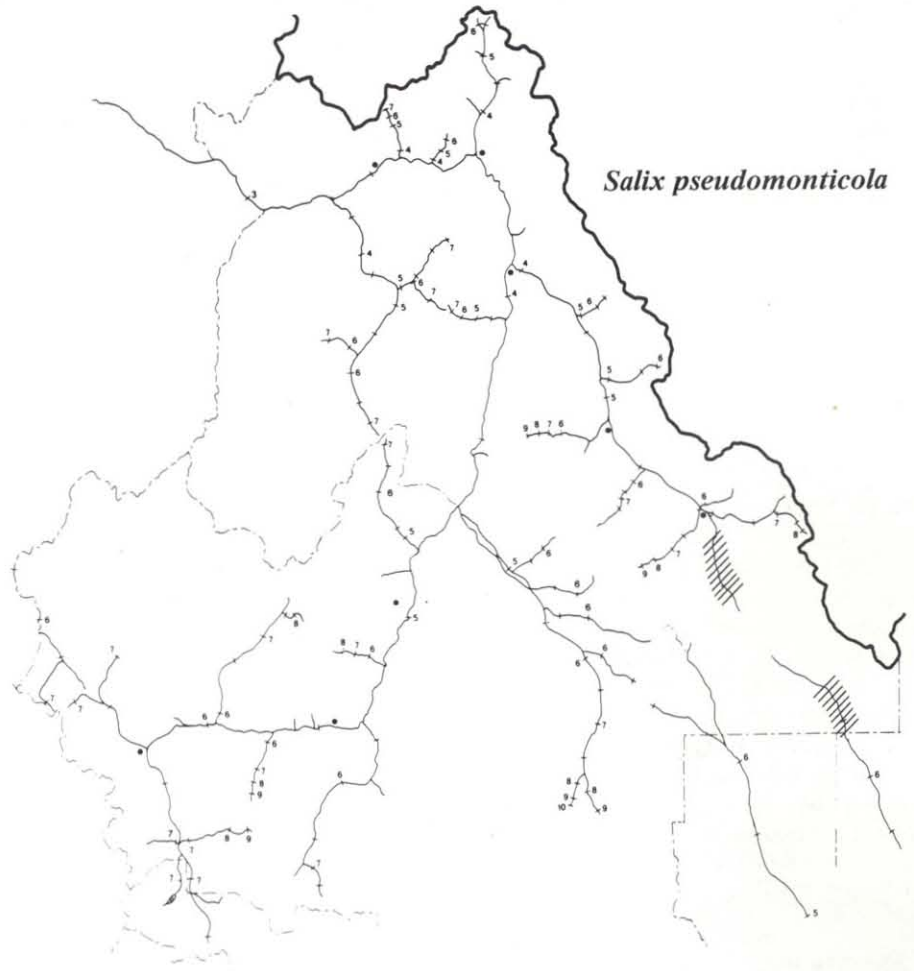
Taxonomy

This willow has, in past floras of the region, been considered conspecific with *S. monticola* Bebb, a morphologically similar central and southern Rocky Mountain entity. Ball (Davis 1952) used his name, *S. pseudomonticola* for the taxon, whereas Cronquist (Hitchcock et al. 1964) used the older name *S. monticola*. Dorn (1975b) has since shown that *S. monticola* is a hexaploid with a different flavonoid chemistry, slightly different morphology and a separate, more

southerly range than the diploid *S. pseudomonticola*. Ball recognized a typical *S. pseudomonticola*, as well as a form with longer, leafy flowering branchlets (var. *padophylla* (Rydb.) Ball) for central Idaho (Davis 1952). Dorn found that the recognition of this variety is biologically and nomenclaturally incorrect, since the type (*S. padophylla* Rydb.) is actually a specimen of *S. monticola*. The central Idaho plants referred to by Ball were apparently *S. barclayi*.

Range: Alaska east to western Quebec, south to Idaho, northern Wyoming, South Dakota and Ontario.

Distribution and Habitat: *Salix pseudomonticola* is known in Idaho only from the two study area localities southeast of Leadore: upper Birch Creek and Texas Creek. Both are moist to wet bottomlands between 6300 and 6700 feet (1920 - 2040 m) elevation in broad sagebrush-covered valleys. The locations both contain a range of habitats from wet, quaking, hummocky swamp/meadows to more mesic sites on slightly higher ground. In wet habitats *Salix pseudomonticola* is an occasional associate of *Salix planifolia*, *S. candida* and *Potentilla fruticosa*. Most plants occur on raised hummocks and attain a height of 1-2 m. Soils in these habitats are highly organic for 1 dm or more at the surface, below which lies wet silty muck generally more than 1 m deep. *Salix pseudomonticola* is generally more abundant on mesic sites where it associates with *Salix geyeri*, *S. bebbiana* and *S. boothii* and reaches a height of 4-5 m. Soils in these mesic habitats are silty loams and clays overlying gravel.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Salix candida Fluegge

hoary willow

Identification

Salix candida is readily distinguished by its short stature and dense, white, feltlike tomentum on lower leaf surfaces and twigs. Plants we have seen from outside the study area (northeast Washington and northern Idaho) develop dense tomentum on all leaves except the first few of the season (which have straight silky hairs beneath). Most plants in our area, however, produce a number of thinly tomentose leaves early in the season (after the first few) and only later, by mid-season, produce densely tomentose leaves. The development of twig tomentum is similarly delayed. Thinly tomentose early leaves are evidently glaucous beneath, and so, early in the season these plants somewhat resemble *Salix brachycarpa*, which is similar in its habitat, stature and floral morphology. *Salix candida*, however, has notably longer and narrower leaves.



Description

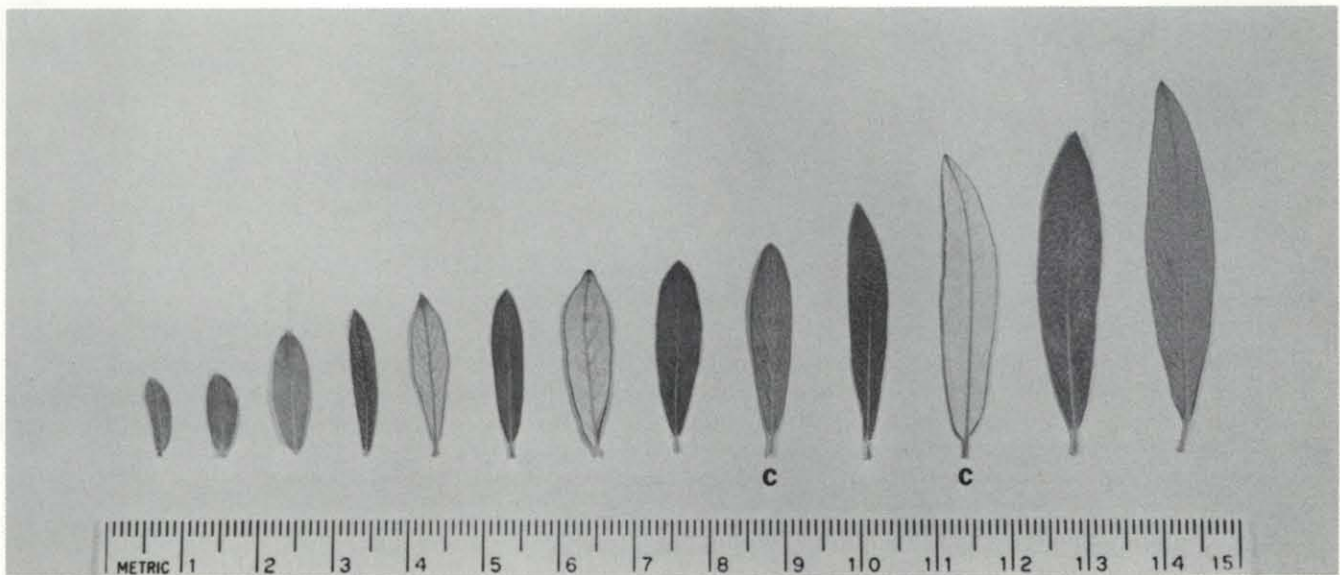
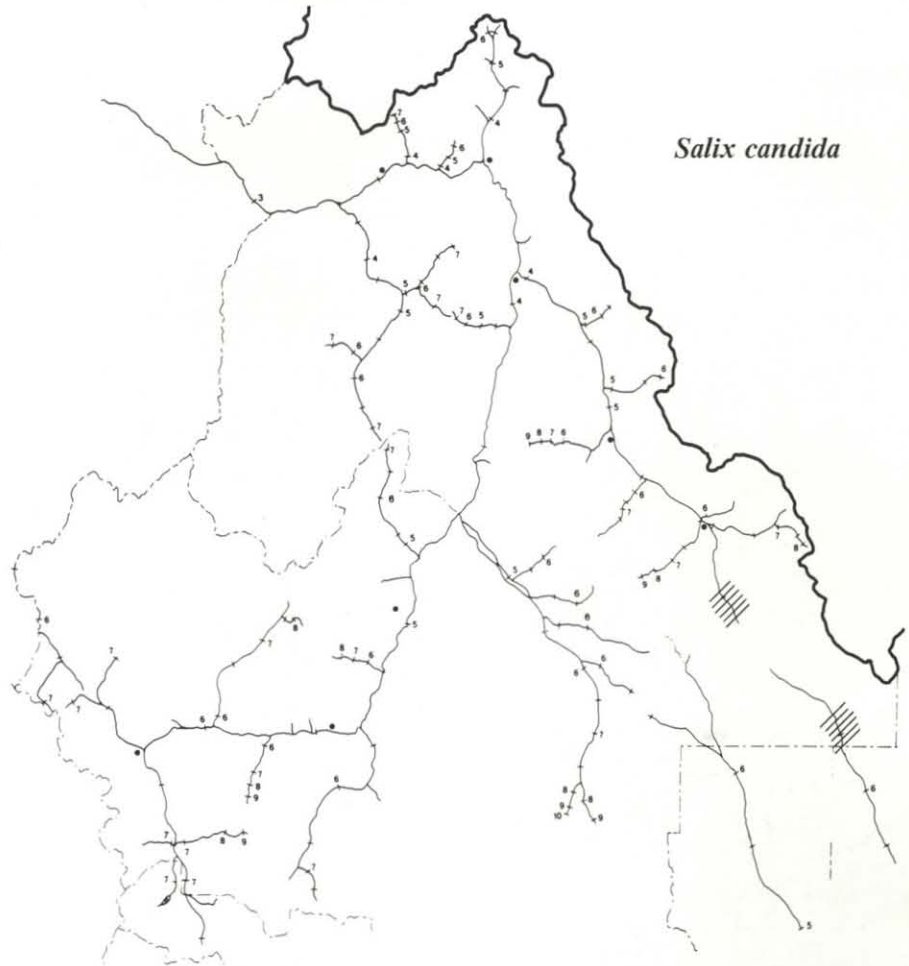
Shrub .2-1.0 m tall; **twigs** of the season thinly to moderately tomentose on early season growth, becoming extremely dense (obscuring the surface) on late season growth, the hairs very fine, tangled and matted; pubescence thinner, but evident on two and often three-year-old twigs; mature **leaf blades** with revolute, entire or inconspicuously gland-toothed margins; **first leaves** of the season glabrous above and densely pubescent beneath with long silky, appressed hairs; **later leaves**: upper surface green and rugose, tomentose with extremely fine, tangled hairs, becoming thinly tomentose or glabrous; lower surface thinly tomentose on early season leaves (those expanding after the first few) and the glaucous surface visible through the hairs, tomentum thicker on middle and late season leaves, forming a thick, white felt obscuring the surface; **petioles** less than 1 mm long on first leaves of season, to about 5 mm on later season growth, or up to 10 mm on vigorous shoots; **stipules** minute (< .5 mm) on normal growth, larger (up to 5 mm) on vigorous shoots; **aments** expanding with the leaves on leafy flowering branchlets 1-5 (7) mm long; **staminate aments** 1-1.5 (2.5) cm long; stamens 2; **pistillate aments** 1-3 (5) cm long; ovaries and capsules tomentose, borne on stipes .5-2 mm long; styles and stigmas red or reddish at flowering, the style (.2) .5-1.2 (1.7) mm long; floral bracts pale to dark brown, pubescent with hairs 1-1.5 mm long, persistent.

Range: Alaska and Canada south to northeastern Washington, Colorado, Iowa and New Jersey; rare in Idaho.

Distribution and Habitat: *Salix candida* is known from two locations in the study area: streambanks along upper Birch Creek, and bottomlands of upper Texas Creek, south of Leadore, Idaho. Both sites are wet, hummocky, quaking swamp/meadows or fens, with low shrubs (*Salix planifolia* and *S. candida* dominant) mostly occupying the hummocks, and sedges (*Carex aquatilis*, *C. rostrata* and others) dominant in the standing water between hummocks. The soils consist of a layer of peat 1 dm or more thick, overlying wet silty muck more than 1 m deep. The sites are in broad open valley-bottoms with mountain big sagebrush and low sage on the upland.

Taxonomy

Study area plants differ from other populations we have examined in having a number of thinly tomentose, glaucous early leaves. Cronquist (Hitchcock et al. 1964) refers to an extreme form of the species, named var. *denuda* Anderss., which he describes as having "tomentum rather quickly deciduous and leaves glaucous beneath." This variety is said to be common elsewhere, but is not yet reported from the Pacific Northwest. Further study is needed to determine whether our material belongs to this variety.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Salix brachycarpa Nutt.

short-fruit willow

Identification

Salix brachycarpa is easily identified by its short stature; tomentose twigs; small, distinctively shaped, tomentose leaves that are glaucous beneath (leaf surfaces clearly visible through pubescence); and small, rounded aments.



Similar Species

Salix candida is normally differentiated by the dense, white mat of tomentum that covers twigs and lower leaf surfaces; however, some *S. candida* specimens have thinly tomentose early leaves, thus resembling *S. brachycarpa*. *S. candida* has longer, narrower leaves. No other short-statured species in our area has hairy leaves that are glaucous beneath, except occasional dwarf specimens of *S. geyeriana*, which have glaucous twigs and narrower leaves.

Description

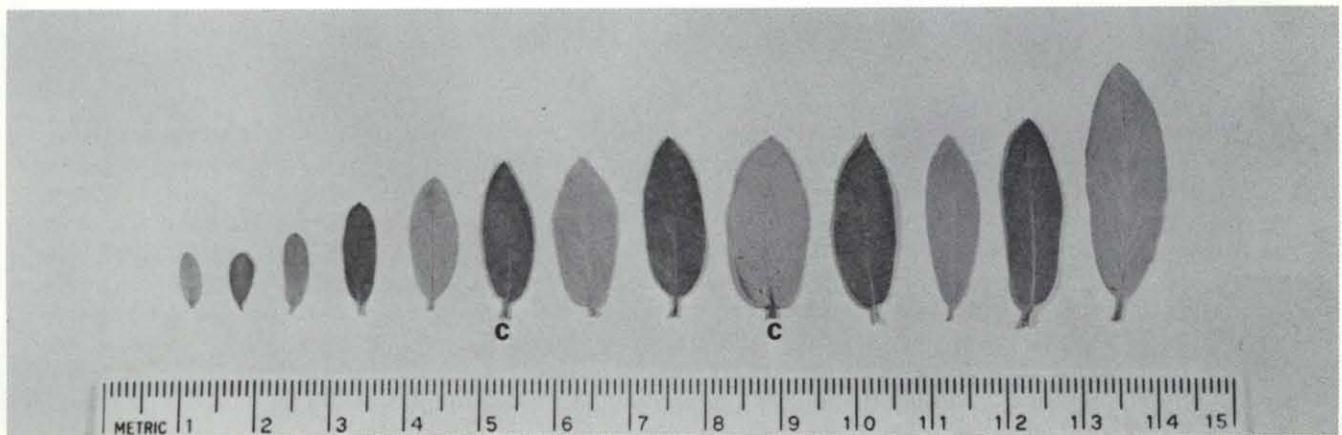
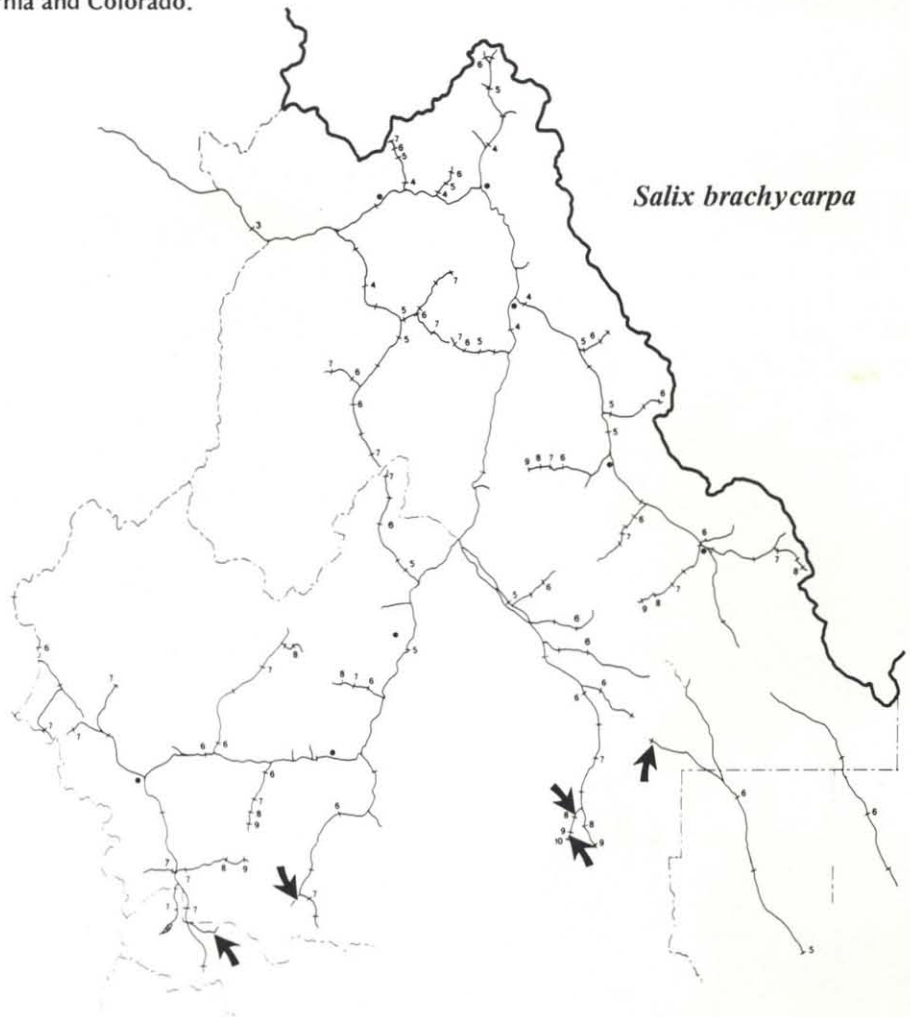
Shrub .3-1.0 (1.5) m tall, forming a low, compact hemisphere when browsed, more erect and open when protected; **twigs** of the season reddish under moderate to dense tomentum; older twigs glabrate or persistently hairy through the second or third season; **leaf blades** strongly glaucous beneath, margins entire; **first leaves** of the season glabrous above, and with long silky, appressed hairs beneath; **later leaves** pubescent on both surfaces with fine, loosely appressed tomentum; **petioles** short, .5-3.0 (4.0) mm long, often reddish or occasionally yellow; **stipules** typically small (.5 mm), larger (up to 2 mm) on vigorous shoots, hairy like the stem, inconspicuously gland-toothed, deciduous; **aments** expanding with the leaves; **staminate aments** 4-10 mm long, borne on leafy flowering branchlets 1-5 mm long; stamens 2; **pistillate aments** 12-20 mm long at maturity, borne on leafy flowering branchlets 2-13 mm long; capsules densely pubescent, sessile or on short stipes up to .5 mm long; styles .5-1.0 mm long; floral bracts yellow or greenish to light brown, sometimes with a reddish tip, pubescent on both surfaces with hairs .3-.7 mm long, persistent.

Range: Alaska to Quebec, south to California and Colorado.

Distribution and Habitat: *Salix brachycarpa* is known from five localities distributed across the southern fringe of the study area. Two types of habitat can be distinguished: four of the populations are in open, mid-elevation stream-bottom meadows adjacent to Douglas-fir, lodgepole pine and/or mountain big sagebrush upland vegetation. (The lowest elevation site is in Wyoming big sagebrush near the transition to mountain big sagebrush). These sites have highly organic, moist to wet soils, and two of them are evidently saline; the other habitat is a subalpine meadow just below timberline (head of West Fork Pahsimeroi River, 9300 ft; 2834 m). *Salix brachycarpa* dominates the relatively dry portions of this meadow, which have deep soil composed mostly of silt and sand. Wetter portions of the same meadow, with generally much thinner, more organic soil, are dominated by *Salix farriae*.

Taxonomy

The taxonomy of this species has been studied in detail by Argus (1965). Plants of the study area, like those in most of western North America (except Alaska), belong to ssp. *brachycarpa* (sensu Argus) or var. *brachycarpa* (sensu Cronquist in Hitchcock et al. 1964). A dwarfed form of the species, var. *sansoni* Ball, was reported to occur in the study area by Ball (Davis 1952). Argus, however, found this taxon to be within the normal range of variation of the subspecies and not worthy of recognition.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

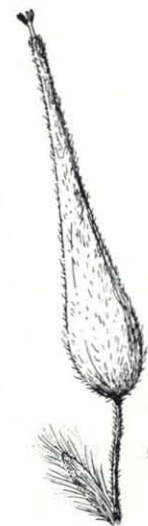
Salix bebbiana Sarg.

Bebb willow

Identification

Salix bebbiana is readily identified by its long-beaked, hairy capsules on long stipes and pale floral bracts, in conjunction with leaf characteristics (glaucous lower surfaces, mostly entire margins, distinctive shape), stem pubescence, and large shrub or small tree stature. While its vegetative appearance is distinctive, some plants can be confused with *S. scouleriana* in the absence of their distinctly different aments.

All other glaucous-leaved willows in our flora differ from *S. bebbiana* (and *S. scouleriana*) in one or more of the following aspects: they have either glaucous or essentially glabrous twigs, they have more obviously toothed leaves, or they average 1 m or less in height.

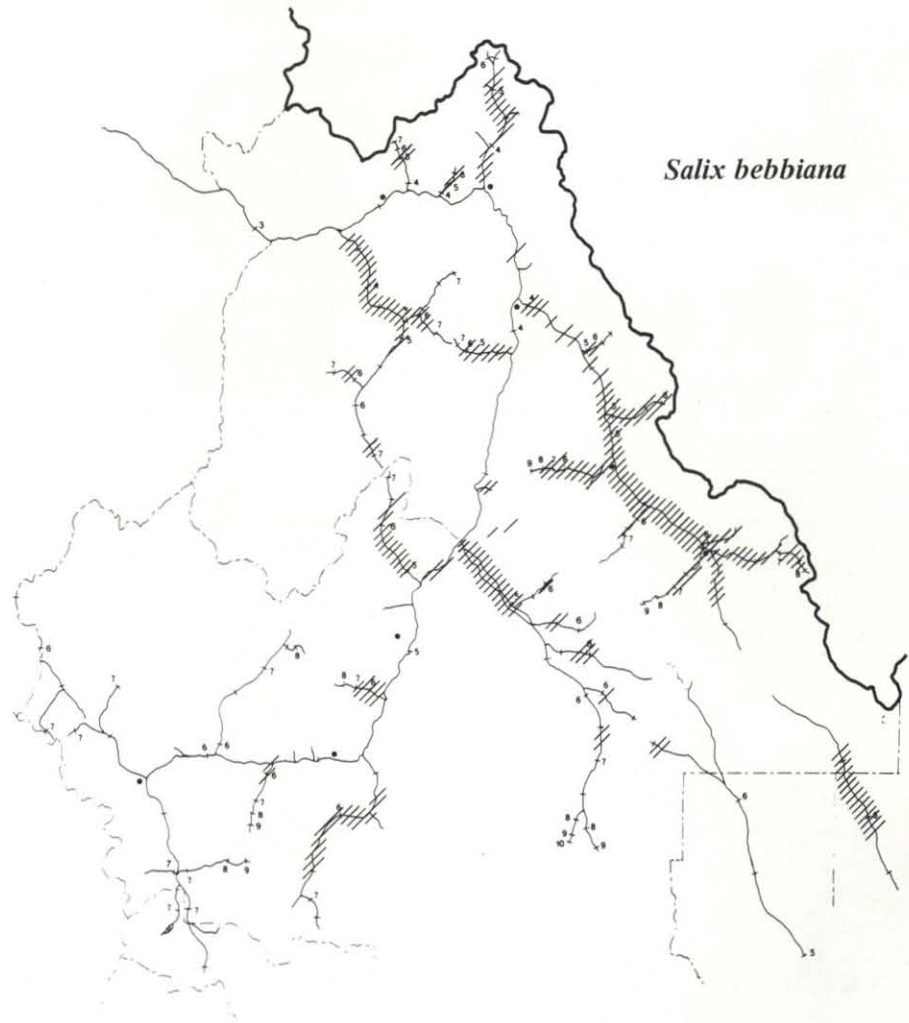


Description

Shrub or small multi-stemmed tree up to 9 m tall with stems up to 2 dm thick, most commonly a large shrub 5-6 m tall with stems up to 1 dm thick; twigs of the season pubescent with fine, wavy or curly, sometimes tangled hairs, tightly to loosely appressed, partly persisting on the usually reddish twigs of the previous year; mature leaf blades green above, glaucous beneath (at least when fully expanded), margins entire or inconspicuously gland-toothed, sometimes coarsely toothed on vigorous shoots; first leaves of the season glabrous above and with long, straight, silky, appressed hairs beneath; later leaves red-tinged and moderately hairy on both surfaces with fine appressed hairs while expanding, sparsely appressed-hairy on both surfaces at maturity, occasionally becoming essentially glabrous; petioles 2-12 mm long, pubescent like the stem; stipules minute and inconspicuous, less than 1 mm, or up to 5 mm on vigorous shoots, sooner or later deciduous; staminate aments 1-2 cm long, expanding with the leaves on leafy flowering branchlets 2-5 mm long; stamens 2; pistillate aments 1.5-6 cm long at maturity, expanding with the leaves on leafy flowering branchlets 3-15 mm long; capsules short-hairy, distinctively long-beaked, borne on stipes 2-4 (5) mm long; styles .1-.4 mm long; stigmas (.2) .3-.4 (.5) mm long; floral bracts narrow, yellow or light brown, sparsely to densely long or short hairy, persistent.

Range: Eurasia, Alaska and Canada south to California (east of the Cascades), New Mexico, Indiana and New Jersey.

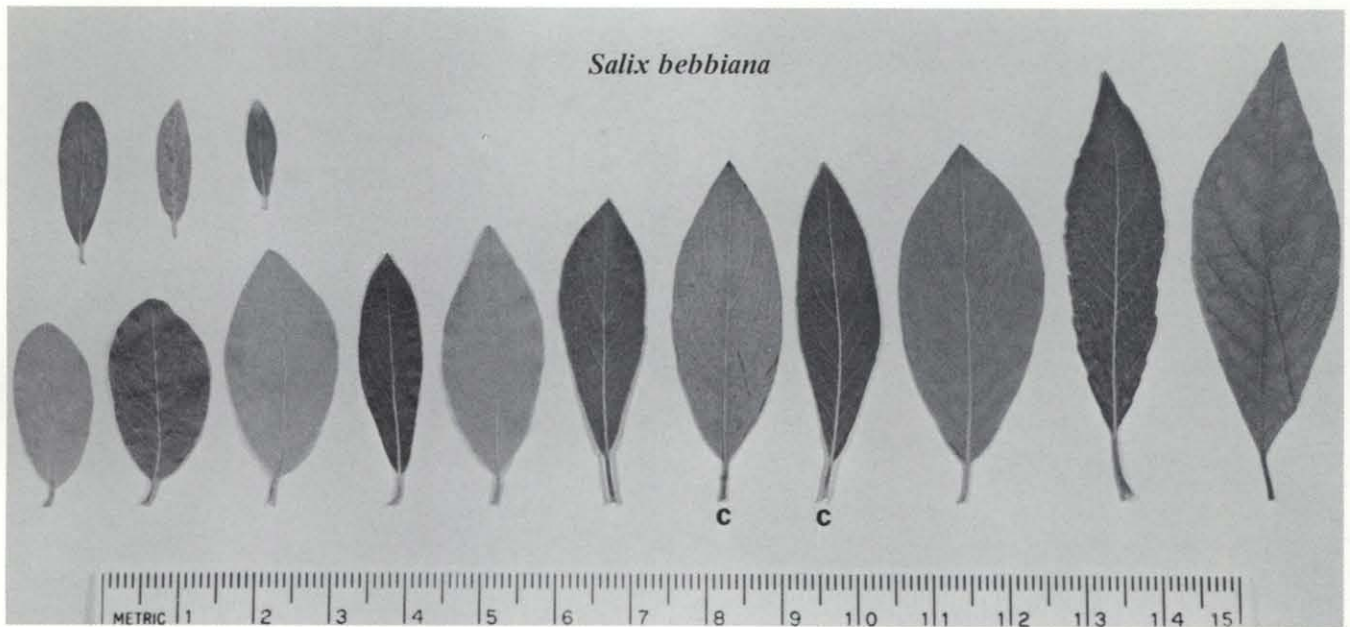
Distribution and Habitat: *Salix bebbiana* is widely distributed in the study area and ranges from low to upper middle elevations (3300-7900 ft; 1010-2410 m). It is notably rare in the hot canyon bottom of the Salmon River and often present, but seldom abundant in other Wyoming big sagebrush zone riparian communities. Bebb willow is best represented in riparian communities within the Douglas-fir zone and nonsubalpine mountain big sagebrush habitats, although it is only occasionally the dominant willow. *Salix bebbiana* is apparently absent from the subalpine zone, but it does sometimes occur in cool Engelmann spruce-dominated streambottoms in the upper Douglas-fir zone. Through most of its elevational span quaking aspen, water birch, and black cottonwood (lower elevations) are its most common overstory associates. As with several of our other species, Bebb willow exhibits a shift in habitat with increasing elevation. In its warm, generally lower elevation sites it grows in moist to wet soils, varying from heavily organic to silty, sandy or gravelly in texture. At upper elevations it tends to inhabit relatively dry riparian sites, often associating with *S. scouleriana*. *Salix bebbiana* apparently does not occur in truly upland habitats in the study area.



Taxonomy

Most early workers recognized two varieties of *S. bebbiana* with var. *perrostrata* the common Rocky Mountain phase. Current workers do not consider the varieties worthy of recognition (Dorn 1977, Argus and Cronquist pers. comm.).





Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

CONSPECTUS

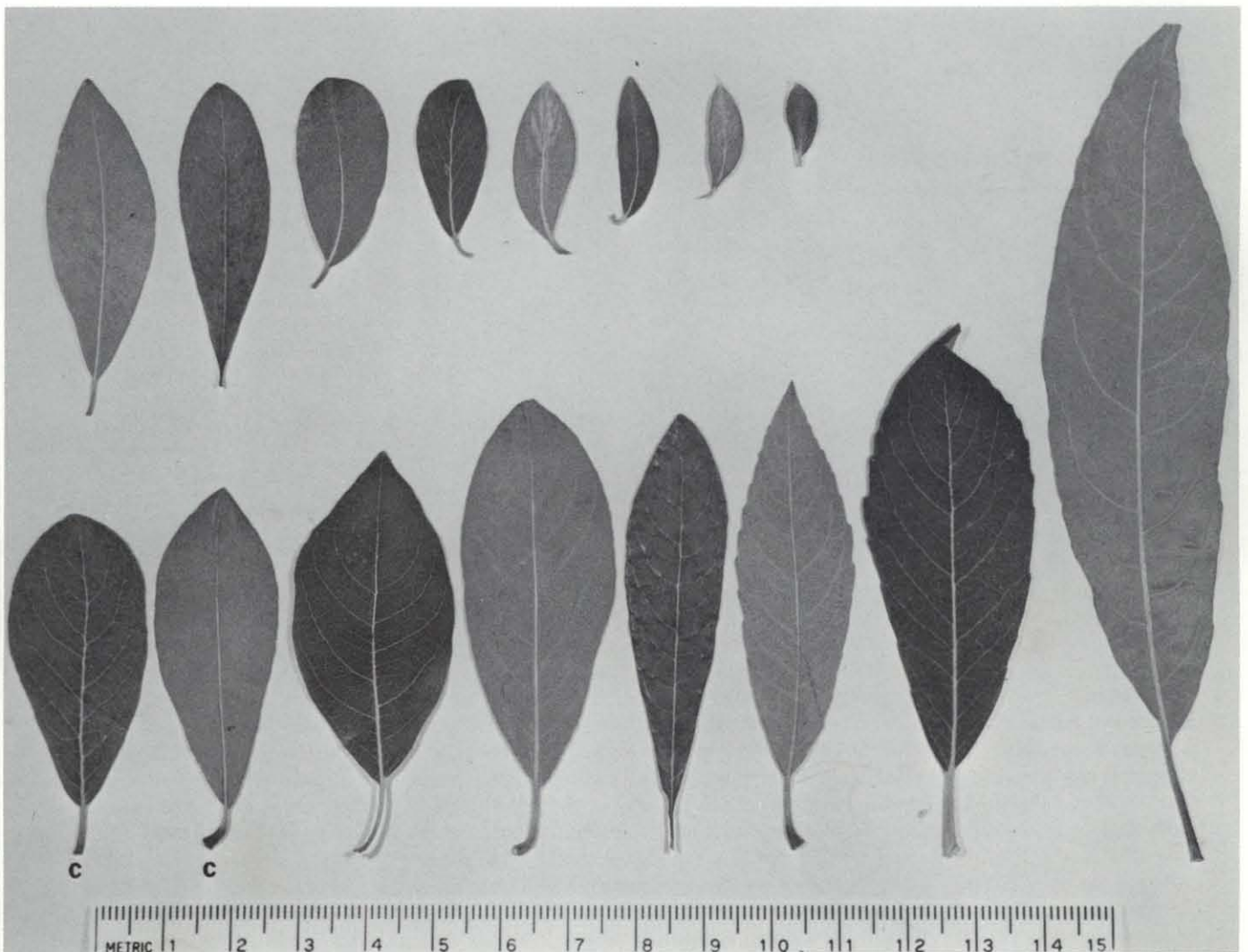
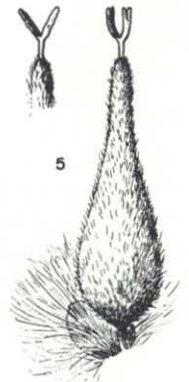
	<i>Salix bebbiana</i>	<i>Salix scouleriana</i>
Floral		
Aments	expand with the leaves on leafy flowering branchlets	expand before the leaves; without or with only small leafy bracts on the short flowering branchlets
Capsules	on stipes 2-4 (5) mm long	on stipes less than 2 mm long
Stigma length	(.2) .3-.4 (.5) mm	.5-1.0 mm
Floral bracts	yellow to light brown	dark brown to black
Vegetative		
Leaf shape	narrower; more acute apex	broader; more obtuse or rounded apex
Lower leaf pubescence (mature, nonsprout)	longer, loosely appressed white hairs	short, appressed hairs, some red-tinged
Twig color (second year)	generally reddish	green-yellow to dark brown or red
Petiole and first/second year twig pubescence	hairs longer, wavy or curly, tangled, loosely or tightly appressed	short, spreading or appressed hairs

Salix scouleriana Barratt

Scouler willow

Identification

Scouler willow is recognized by its generally large shrub or tree stature, distinctively shaped leaves with appressed, reddish hairs on the glaucous lower surface, and puberulent twigs. A useful field test for the species is to strip the bark from segment of young twig (2nd year) and smell its distinctive odor, often described as "skunky" for want of a better comparison. Early in the season Scouler willow is identified as a "pussy willow" (aments expand before the leaves) with beaked, hairy capsules; long stigmas; skunky bark odor; and often distinctive stature and habitat.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Similar Species

Salix scouleriana

Salix bebbiana differs greatly from *S. scouleriana* in its floral characteristics, but is very similar in habitat, stature, and vegetative features. Bebb willow generally has narrower, more acute leaves without reddish hairs beneath, different twig pubescence, and no skunky bark odor. See Bebb willow discussion for a more detailed comparison (page 46).

Salix planifolia var. *planifolia*, the tall form of the species, somewhat resembles Scouler willow in its leaves and aments, but differs in being a shorter, small-stemmed shrub, with essentially glabrous twigs, different leaf shape, and generally longer styles.

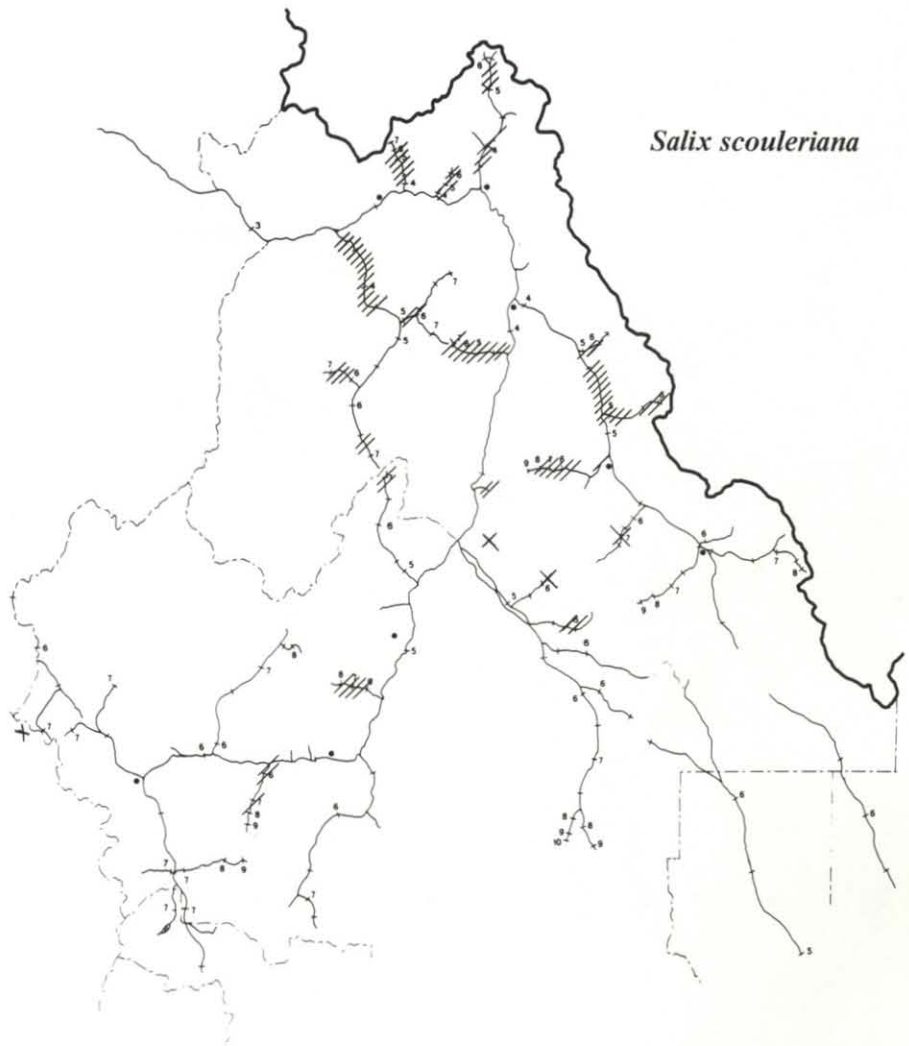


Description

Large shrub to multi-stemmed tree to 15 m tall (commonly 6-10 m) with stems commonly to 1 dm thick near base and occasionally to 2 dm; **twigs** of the season puberulent with short, relatively straight, appressed to spreading hairs, second year twigs glabrous or with some persistent puberulence, freshly stripped bark with a skunky odor; **mature leaf blades** green above and glaucous beneath; margins slightly revolute, entire or with few inconspicuous glandular teeth, or sometimes coarsely toothed on vigorous shoots; **first leaves** of the season glabrous above and densely pubescent below with long, silky hairs; **later leaves** densely pubescent while expanding (more dense below than above), with short appressed hairs, mature leaves generally glabrous above, except for the puberulent midrib, and sparsely to moderately appressed puberulent beneath (occasionally glabrous), hairs generally in part red-tinged; **petioles** 2-20 mm long (average 5-10 mm), densely puberulent like the stem, especially on the upper surface; **stipules** small and inconspicuous, less than 2 mm or up to 6 mm on vigorous shoots, quickly deciduous; **staminate aments** 1-3 cm long, expanding before the leaves, sessile or on short flowering branchlets less than 5 mm long, without green bracts or with small green bracts less than 5 mm long; **stamens** 2; **pistillate aments** 1.5-6 cm long, expanding before the leaves, on short flowering branchlets 3-10 (15) mm long, without green bracts or with small, narrow green bracts less than 7 mm long; **capsules** long-beaked, densely short-hairy, borne on stipes up to 2 mm long; **styles** .3-.7 (.8) mm long; **stigmas** notably long, .5-1.0 mm; **floral bracts** dark brown to black, pubescent on both sides with long silky hairs, persistent.

Range: Alaska to Manitoba, south to California and New Mexico.

Distribution and Habitat: *Salix scouleriana* occurs over a broad elevational range in the study area (3300-8000 ft; (1010-2440 m) and is especially abundant in the northern half of the region. It is absent from the Salmon River canyon-bottom, but inhabits other Wyoming big sagebrush zone valleybottoms (e.g., portions of the Lemhi River Valley) and extends up to the lower subalpine forest zone. From low to middle elevations, Scouler willow grows in moist riparian habitats and generally attains small tree stature. There it is frequently associated with an overstory of quaking aspen, water birch, thinleaf alder and/or black cottonwood. At higher elevations, Scouler willow usually becomes a medium to large shrub and tends toward inhabiting relatively drier sites. These habitats range from dry parts of the riparian zone, often with an open overstory of aspen, Engelmann spruce, Douglas-fir or lodgepole pine, to uplands such as Douglas-fir, lodgepole pine and subalpine fir forest openings created by fire or logging. Scouler willow occurs on about 25 forest habitat types of central Idaho (Steele et al. 1981). It is our only willow species that grows on truly upland sites. *Salix scouleriana* has *S. bebbiana* as an associate over most of its distribution (except uplands), and grows with *S. lutea*, *S. exigua*, *S. lasiandra*, *S. boothii* and *S. geeyeriana* at lower to middle elevations.



Taxonomy

Ball (Davis 1952) reported two varieties of *S. scouleriana* from our region; the typical variety and var. *thompsonii* Ball, a form with smaller, narrower leaves. Cronquist (Hitchcock et al. 1964), however, did not recognize var. *thompsonii* as a valid taxon. We have not observed any variation in leaf size and shape in the study area that we consider taxonomically significant. *Salix discolor* Muhl., an eastern North American species closely related to *S. scouleriana* was reported for Idaho by Ball (Davis 1952) and Dorn (1977), but doubts remain about its occurrence in the state (Cronquist in Hitchcock et al. 1964). *Salix discolor* is distinguished primarily by its elliptic, toothed leaves and glabrous twigs, but the characteristics of this species and *S. scouleriana* can often both be found on the same plant in our area. A thorough study of these species is needed.

Salix boothii Dorn

Booth willow

Synonymy: *Salix myrtillofolia* Anderss. (in Hitchcock et al. 1964)
Salix pseudocordata (Anderss.) Rydb.

Identification

Salix boothii is recognized throughout most of the season by its non-glaucous, essentially glabrous leaves of variable, but generally distinctive shape. All of our other species (except *S. lasiandra*) have leaves that are either persistently hairy or glaucous on the lower surface.



Identification problems are greatest early in the season before leaves have fully expanded. At this time a glaucous bloom may not yet be evident on leaves of *S. lutea* or *S. barclayi*, which have generally similar aments with glabrous ovaries and capsules. *Salix lutea* is distinguished by its grayish twigs (*S. boothii* generally has yellow, orange or brown), nearly glabrous floral bracts, and eventually longer stipes. *Salix barclayi* has longer flowering branchlets and styles.



Similar Species

Salix lasiandra var. *caudata* differs in its longer, shinier, acuminate leaves with distinctive petiolar glands. (Both species have glands on the margins of the blades). This species also has more than two stamens per flower and yellow, deciduous floral bracts. Variants of *S. eastwoodiae* and *S. tweedyi* with sparsely hairy or glabrous leaves can strongly resemble *S. boothii*. See these species for further discussion.

Range: southern British Columbia and Alberta, south to California and Colorado.

Distribution and Habitat: *Salix boothii* is one of the most common willows throughout the study area. It is predominately a middle-elevation species distributed from sagebrush/grass valleybottoms to lower subalpine forests. Hot canyon bottoms and cool highlands above about 8000 feet (2440 m) are the only parts of the region where *Salix boothii* is absent. Within its elevational limits, it is able to occupy a wide range of riparian sites from rocky or gravelly ones near the water table to drier benches with deep fine-textured soils. It is most abundant on moister sites. *Salix geyeriana* is a common associate in open bottomlands, while *S. drummondiana* frequently is associated in forested streambottoms.

Salix boothii is replaced at low elevations by a closely related species, *Salix lutea* (*S. rigida*). Where their ranges overlap (e.g., middle Lemhi River, lower Pahsimeroi River), they are often separated by habitat: *S. lutea* in sandy or gravelly soils at streamside; *S. boothii* often in deep, fine-textured soils of adjacent meadows. In the subalpine zone, *S. boothii* is replaced by *S. barclayi* and occasionally *S. tweedyi*, generally with little overlap in range.

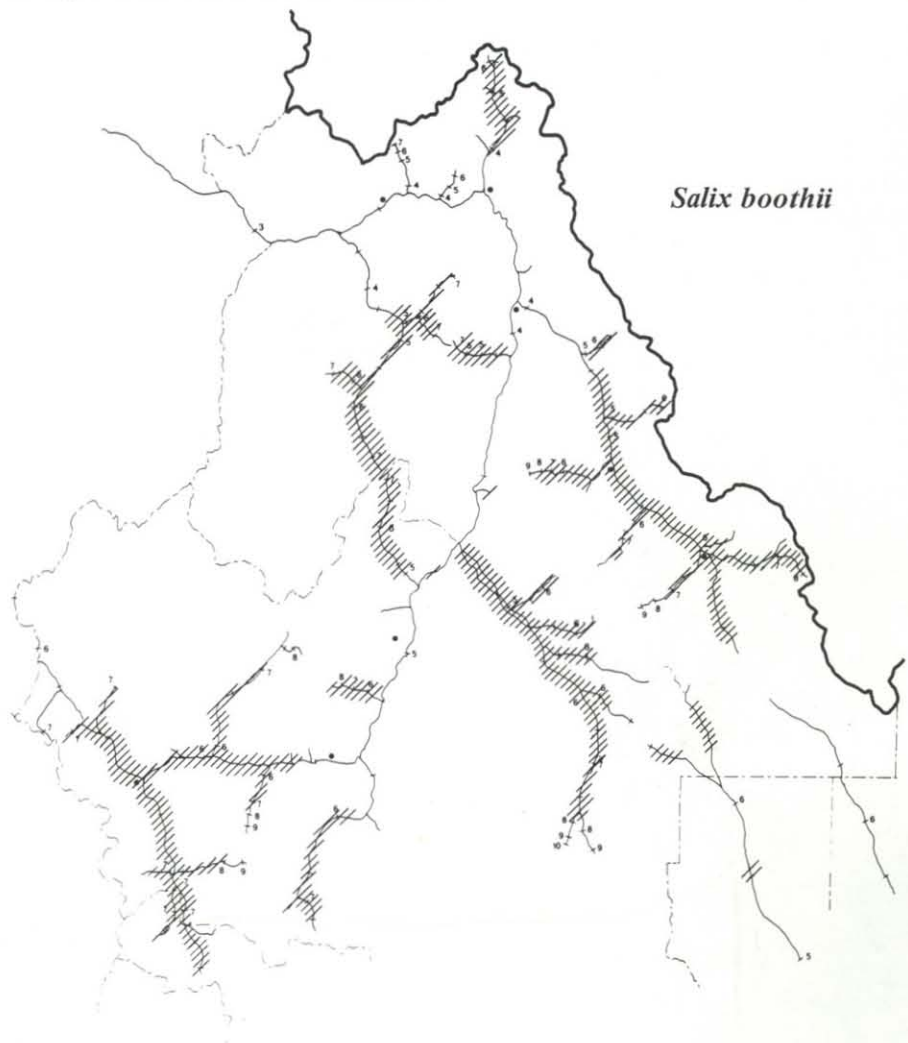
Taxonomy

Although this willow is a relatively distinctive entity in our area, confusion over the name, rank and boundaries of the taxon have caused significant identification problems.

Among the many taxonomic interpretations proposed in the past, the following two names, now reduced to synonymy, are pertinent in our area.

Salix pseudocordata—the name used by Ball in *Flora of Idaho* (Davis 1952). This name is apparently invalid under the rules of botanical nomenclature (Dorn 1975b).

Salix myrtillifolia—the name used by Cronquist in *Vascular Plants of the Pacific Northwest* (Hitchcock et al. 1964). Cronquist considered our plants to be members of a southern variety (lacking a valid name) of this wide-ranging Alaskan and Canadian species. It was distinguished from



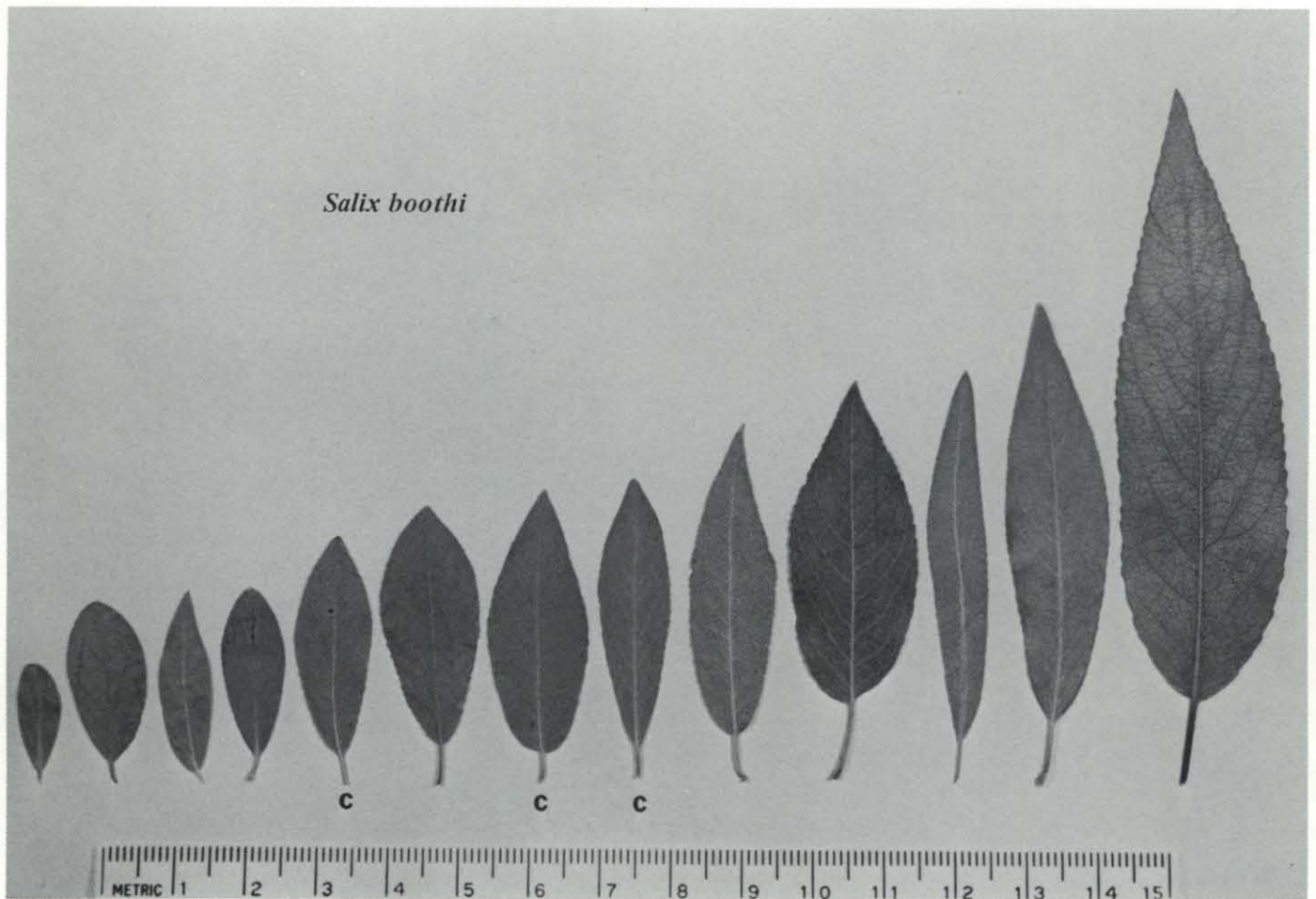
nonglaucous-leaved forms of *S. rigida* (*S. lutea*) in this flora primarily on the basis of a difference in pedicel (stipe) length. Since this character varies significantly within many study area populations, and is not well correlated with other morphological characters or habitat, identification of these taxa was often extremely uncertain. Cronquist called for a thorough study to clarify the taxonomy of this complex group.

Dorn's (1975b) study of this and closely related species of the section *Cordatae* revealed that there are ample chemical, morphological, cytological and geographical grounds for recognizing this willow as a species distinct from *S. myrtillifolia*. He proposed the name *Salix boothii* for the species, as no other valid name was available.

Study is still needed to clarify the relationship between *S. boothii* and *S. monochroma*, the nonglaucous-leaved form of *S. lutea* (*S. rigida*). None of the plants we have seen in the study area appears to be referable to *S. monochroma*.

Description

Many-branched, rounded shrub (2) 3-6 m tall, with numerous basal stems seldom more than 5 cm thick; **twigs** of the season glabrous or sparsely to moderately pubescent with fine appressed hairs while young, glabrous by second year; **mature leaf blades** rather thick and firm, green on both sides, generally somewhat paler beneath, but not glaucous, margins with fine gland-tipped teeth; **first leaves** of the season glabrous above and covered with long, straight, quickly deciduous hairs beneath; **later leaves** finely tomentose while expanding, more densely so above than beneath, eventually glabrous or nearly so except often along the basal part of the upper midrib; **petioles** short (1-2 mm) on first leaves of season, later usually about 5 mm long or up to 10 mm, persistently puberulent on at least the upper surface; **stipules** .5-12 mm, depending on vigor of shoot, strongly glandular on margins and inner surface; **staminate aments** 1-2.5 cm long, expanding with or slightly before the leaves on small-leaved flowering branchlets 1-3 mm long; stamens 2; **pistillate aments** (1) 2-4 (5.5) cm long, expanding with the leaves on small to large-leaved flowering branchlets (1) 3-6 (8) mm long; ovaries and capsules glabrous, borne on stipes becoming 1-2 (2.5) mm long at maturity; styles .3-.7 (.8) mm long; floral bracts brown to black, pubescent with long, curly, tangled hairs or glabrous at tip, but always submerged in a dense tangle of pubescence which at least partly arises from the axis of the ament, persistent.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

WILLOW MISCELLANY

The word *willow* may be traced through several centuries to the Latin *uoluere*, which meant *to turn*. Apparently this had reference to the turning of willow leaves on swaying branches.

Most sources agree that *Salix* is the ancient Latin name for willows. Yet we've found one source which claims that the word *Salix* is Celtic—from combining *sal* = near and *lis* = water, in reference to the usual willow habitat.

"There is a salix near Dorking in Surrey, in which the julus (catkin) bears a thick cottony substance. A poor body might in an hour's space, gather a pound or two of it, which resembling the finest silk, might doubtless be converted to some profitable use, by an ingenious housewife, if gathered in calm evenings, before the wind, rain and dew impair them; I am of the opinion, if it were dried with care, it might be fit for cushions, and pillows of chastity, for such of old was the reputation of the shade of these trees."

John Evelyn, *Sylva* 1644

Willows have been used for thousands of years for their pain-relieving and fever-lowering properties. Western American Indians are known to have used several species of willows as medicinals. The active ingredient is *salicin*, which is found in the fresh bark of all willows. In the human system, *salicin* likely decomposes to *salicylic acid*, a compound very closely related to the synthetic pain reliever known as *aspirin*.

Salix geyeriana Anderss.

Geyer willow

variety *geyeriana*

Description

Shrub up to 6 m tall (average 3-4 m), with numerous slender, straight, nearly erect stems arising in a tight basal cluster; **twigs** of the season densely puberulent, becoming strongly glaucous; older twigs glabrate, evidently glaucous at least the second year; mature **leaf blades** entire or inconspicuously toothed, glaucous beneath; **first leaves** of the season glabrous above and covered with long, silky, appressed hairs beneath; **later leaves** densely appressed-hairy on both surfaces while expanding, remaining thinly to moderately hairy at maturity, the blades silvery or gray-green above and paler beneath due to the glaucous bloom visible through the pubescence; **petioles** average 3-5 mm long (shorter on early season leaves), sparsely to densely puberulent; **stipules** minute and inconspicuous; **aments** expanding with the leaves; **staminate aments** 1-1.5 (1.8) cm long on leafy flowering branchlets up to 5 mm long; **stamens** 2, filaments hairy on lower half; **pistillate aments** 1-1.5 (2.0) cm long on leafy flowering branchlets up to 1 cm long at maturity; capsules pubescent; stipes short at flowering, expanding to up to 2.5 mm long at maturity; **styles** (.1) .2-.3 (.4) mm long; floral bracts narrow, lanceolate, more than twice as long as broad, yellow to light brown, occasionally with a dark brown or red tip or wholly dark brown to black, puberulent with hairs generally less than .5 mm long, persistent.



S. geyeriana

Salix lemmonii Bebb

Lemmons willow

Description

Shrub 1-3 m tall (average 2-2.5 m), with numerous slender crooked stems arising in a loose basal cluster. **Twigs** of the season glabrous or sparsely pubescent, becoming strongly glaucous; older twigs glabrous, evidently glaucous at least the second year; mature **leaf blades** entire or inconspicuously toothed, especially on vigorous shoots, green and shiny above in sharp contrast to the pale glaucous lower surface; **first leaves** of the season glabrous above and densely pubescent beneath, with appressed, usually reddish hairs; **later leaves** finely pubescent on both surfaces while expanding, the hairs reddish and white, appressed, the upper surface essentially glabrous at maturity, and the lower surface remaining sparsely to moderately hairy; **petioles** average 3-5 mm long (shorter on early season leaves), sparsely to densely puberulent; **stipules** minute and inconspicuous; **aments** expanding with or slightly before the leaves; **staminate aments** 1-1.5 (2) cm on leafy flowering branchlets up to 5 mm long; **stamens** 2, filaments hairy on lower half; **pistillate aments** 1-2.5 cm long on leafy flowering branchlets up to 1 cm long; capsules pubescent; stipes short at flowering, expanding up to 2.5 mm long at maturity; **styles** (.3) .4-.5 (.6) mm long; floral bracts broad, obovate, less than twice as long as broad, dark brown or black, sparsely to moderately long-hairy, the hairs commonly 1 mm or longer, persistent.



S. lemmonii

Range: *Salix geyeriana* — southern British Columbia to Montana, south to Colorado and California.

Distribution and Habitat: *Salix geyeriana* is common in middle elevation riparian habitats throughout most of the study area. It is found between 4000 and 8000 feet (1220 and 2440 m) elevation, but is generally confined, in any one drainage, to a stream segment spanning less than 2000 vertical feet (610 m). This distribution ranges from the upper part of the Wyoming big sagebrush zone to the upper Douglas-fir or middle mountain big sagebrush zone. It is absent from lower elevation riparian communities and is rare in the sub-alpine zone.

Geyer willow is typically found in drier parts of the riparian zone, often on benches well above the stream level. These sites generally have deep, predominantly fine-textured soils, and lack an overstory or have only a light overstory of water birch, thinleaf alder, or lodgepole pine. The species is less abundant or absent on moister sites. Thus it is generally not well represented within its elevational limits along steep gradient streams (e.g., Williams Creek, Bayhorse Creek) which often have a moist, narrow riparian strip. Only at its

lower elevational limits (e.g., lower Pahsimeroi River, middle Lemhi River) does *S. geyeriana* inhabit notably wet, fine-textured soils. *Salix boothii* is a constant associate of *S. geyeriana*, but it differs in reaching its greatest abundance in moist streamside habitats and in being less abundant on drier, Geyer willow-dominated sites.

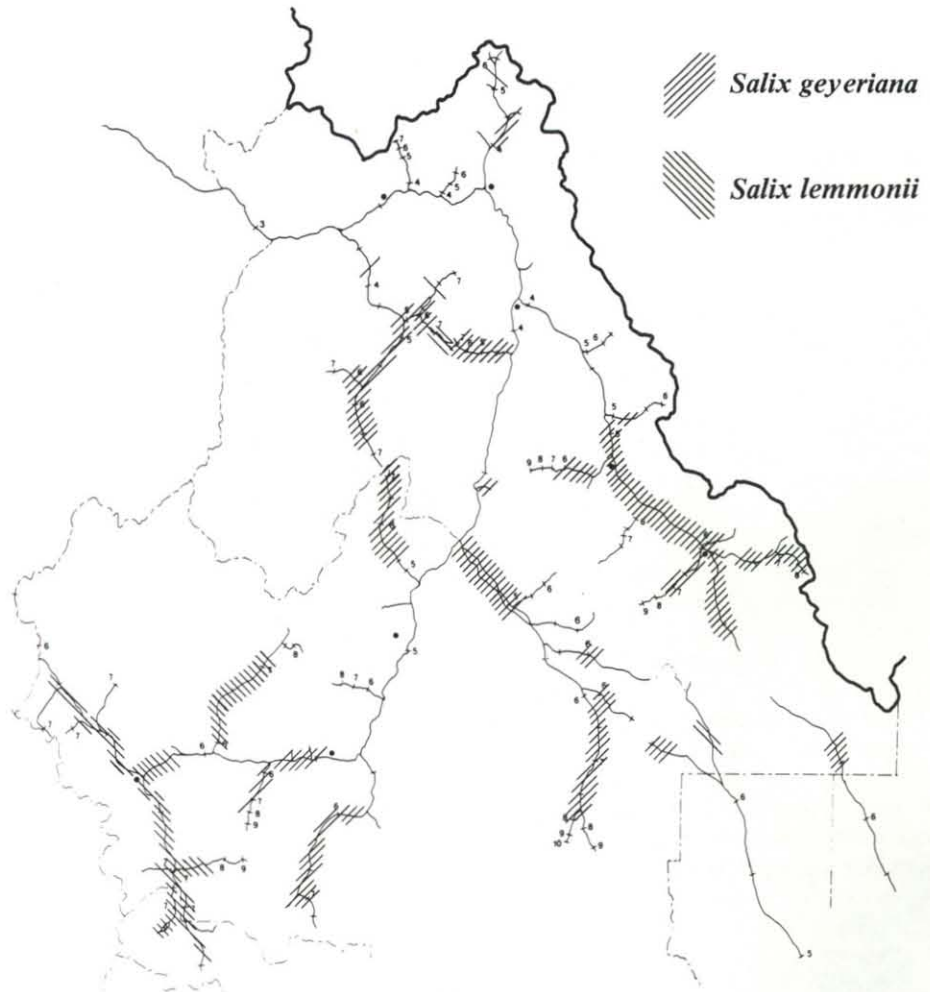
Range: *Salix lemmonii* — Oregon, Idaho and Montana south to Colorado and California.

Distribution and Habitat: This species is locally abundant in the western quarter of the study area and in a few other isolated localities. It occurs in upper-middle elevation riparian habitats from the upper part of the Douglas-fir zone to the lower subalpine zone. Like *S. geyeriana*, it inhabits relatively dry portions of the riparian zone, but, within a given drainage, it always grows at higher elevations than Geyer willow. Most of its habitats are in frosty bottomlands dominated by mountain big sagebrush or forests of lodgepole pine. Soil comparisons consistently showed *Salix lemmonii* to be growing in well-drained gravelly or sandy soils, while common associates such as *Salix wolfii*, *S. planifolia*, *S. boothii*, *S. drummondiana* or *Betula glandulosa* were in wet, fine-textured soils or coarse soils near the water table.

Taxonomy

Salix geyeriana and *S. lemmonii* are closely related species whose taxonomy is still poorly understood. Recent floras (Davis 1952, Hitchcock et al. 1964) recognize a typical variety of *Salix geyeriana* (var. *geyeriana*) in our area, and also report the scattered presence of *S. geyeriana* var. *meleiana* Henry, a form primarily distributed west of the Cascades. Descriptions of this latter variety do not clearly differ from those of

Salix lemmonii. Thus, study is needed to determine whether the two are synonymous. Since *Salix lemmonii* was not reported for our region (Davis 1952, Hitchcock et al. 1964), plants of this description were in the past generally referred to *S.g.* var. *meleiana*. These plants, however, more closely match descriptions of *S. lemmonii* and differ from *S. geyeriana* in a number of respects. Robert Dorn recently examined several specimens from the study area and came to the same conclusion (Pers. Comm.).



Identification

Salix geyeriana is a tall shrub with straight, erect stems, recognized by its glaucous twigs; relatively narrow leaves that are hairy above and glaucous and hairy below; and small aments with pale, short-hairy floral bracts.

Identification

Salix lemmonii is a medium shrub generally with crooked stems, recognized by its glaucous twigs; leaves that are green and glabrous above and thinly hairy and glaucous beneath; and aments with dark, long-hairy floral bracts.

CONSPECTUS

	<i>Salix geyeriana</i>	<i>Salix lemmonii</i>
Leaf shape	lanceolate	elliptic—lance-elliptic
Leaf pubescence	persistent on upper and lower surface	becoming glabrous on upper surface
Leaf pubescence color	white	partially or wholly red-tinged
Young twig pubescence	moderate to dense	glabrous to sparse
Floral bracts		
Shape	narrow, lanceolate	broad, obovate
Color	yellow & light brown	dark brown to black
Pubescence	short-hairy	long-hairy
Style length	(.1) .2-.3(.4) mm	(.3) .4-.5(.6) mm
Elevation	middle	upper-middle

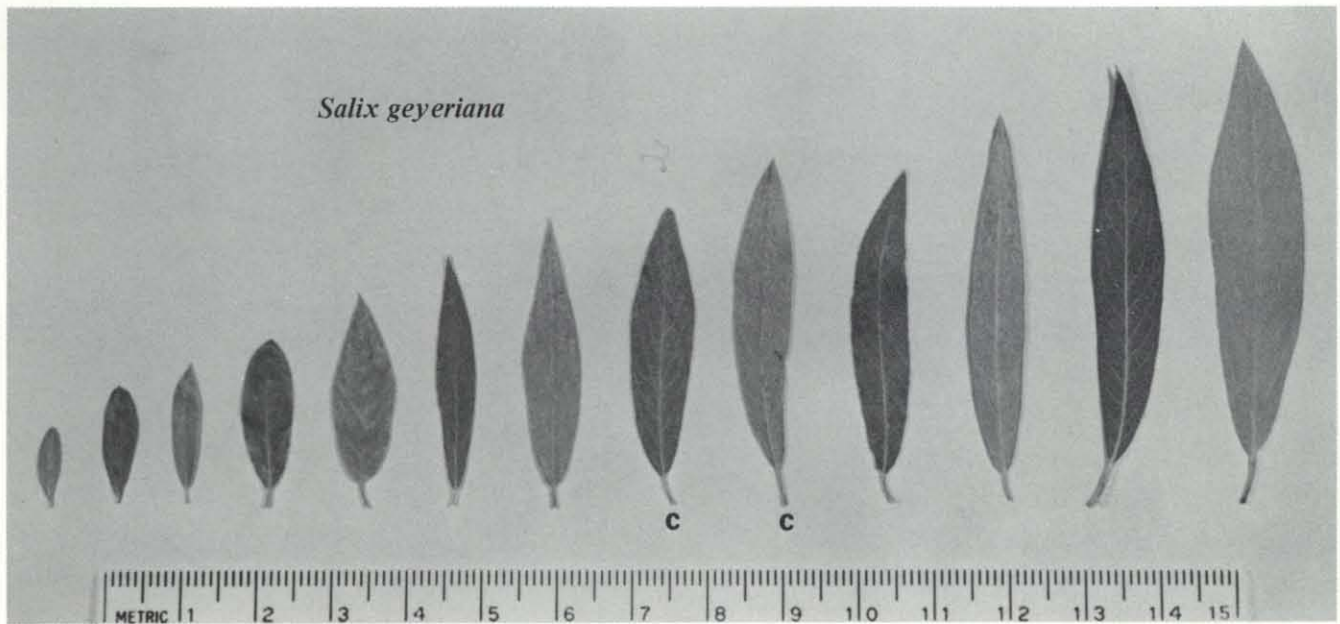


S. geyeriana



S. lemmonii

Although these two species are distinct in both their morphology and ecology, identification is complicated by apparent hybridization between the two at areas of contact. In the upper East Fork of the Salmon River, for example, at least one population has floral bracts typical of *S. lemmonii*, but the plants otherwise resemble *S. geyeriana*. In upper Moccasin Creek the two species meet at about 6600 feet (2010 m), resulting in a mixed population that also contains many plants with varying intermediate morphology. It appears that floral features and leaf pubescence color are the most readily transferred hybrid characters.

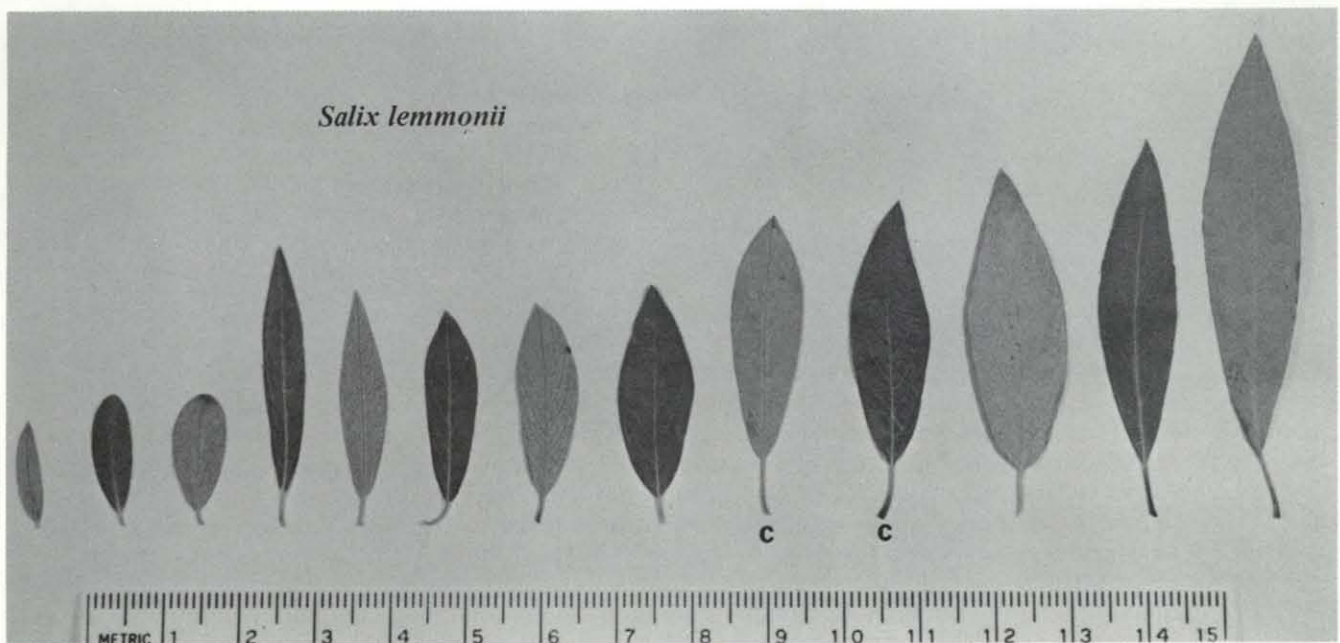


Similar Species

Salix drummondiana is similar to *S. lemmonii* in its general appearance, but it has dense, velvety pubescence on lower leaf surfaces, and long, densely-flowered aments.

Salix planifolia can also resemble *S. lemmonii*, but it has broader leaves, rarely has glaucous twigs, and has long, densely-flowered aments.

Salix exigua ssp. *exigua* is sometimes confused with *Salix geyeriana* in that both have narrow, silvery-hairy leaves. *Salix exigua* has narrower leaves with shorter petioles, nonglaucous twigs, a colonial habit, longer flowering branchlets, and occurs at generally lower elevations.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Salix drummondiana Barratt

Drummond willow

Identification

Salix drummondiana is a distinctive species easily recognized by its leaf shape and silver-velvety lower leaf pubescence, glaucous twigs, and long, densely-flowered aments that are nearly sessile on the previous year's twigs. It should be noted that the unique velvety leaf pubescence is so dense and close that it can, at a glance, be mistaken for a merely glaucous underside.



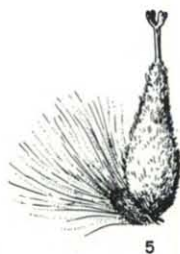
Similar Species

Salix planifolia is the closest relative in the area, and the two species are very similar in flowering characteristics. Early in the season, before leaves have expanded, they differ in *S. planifolia* having nonglaucous twigs (generally), and longer-beaked capsules (especially var. *planifolia*). Later in the season Drummond willow has dense lower leaf pubescence, which is sparse or absent in *S. planifolia*.

Salix lemmonii and *S. geyeriana* can be confused with *S. drummondiana*, but they differ in their small, loosely-flowered aments, leafy flowering branchlets, and glaucous, thinly hairy lower leaf surfaces.

Taxonomy

Salix drummondiana was subdivided into several species or varieties by early workers (Rydberg 1917, Schneider 1919a, Ball in Davis 1952), but segregates from the Rocky Mountains were reduced to synonymy in recent treatments (Cronquist in Hitchcock et al. 1964, Dorn 1976, 1977). Study area plants vary considerably in leaf shape, but are otherwise quite homogeneous. Plants we have seen from northern Idaho and eastern Washington, however, appear to be clearly distinct at some taxonomic level. We agree with Dorn (1977) that more study of this group is needed.

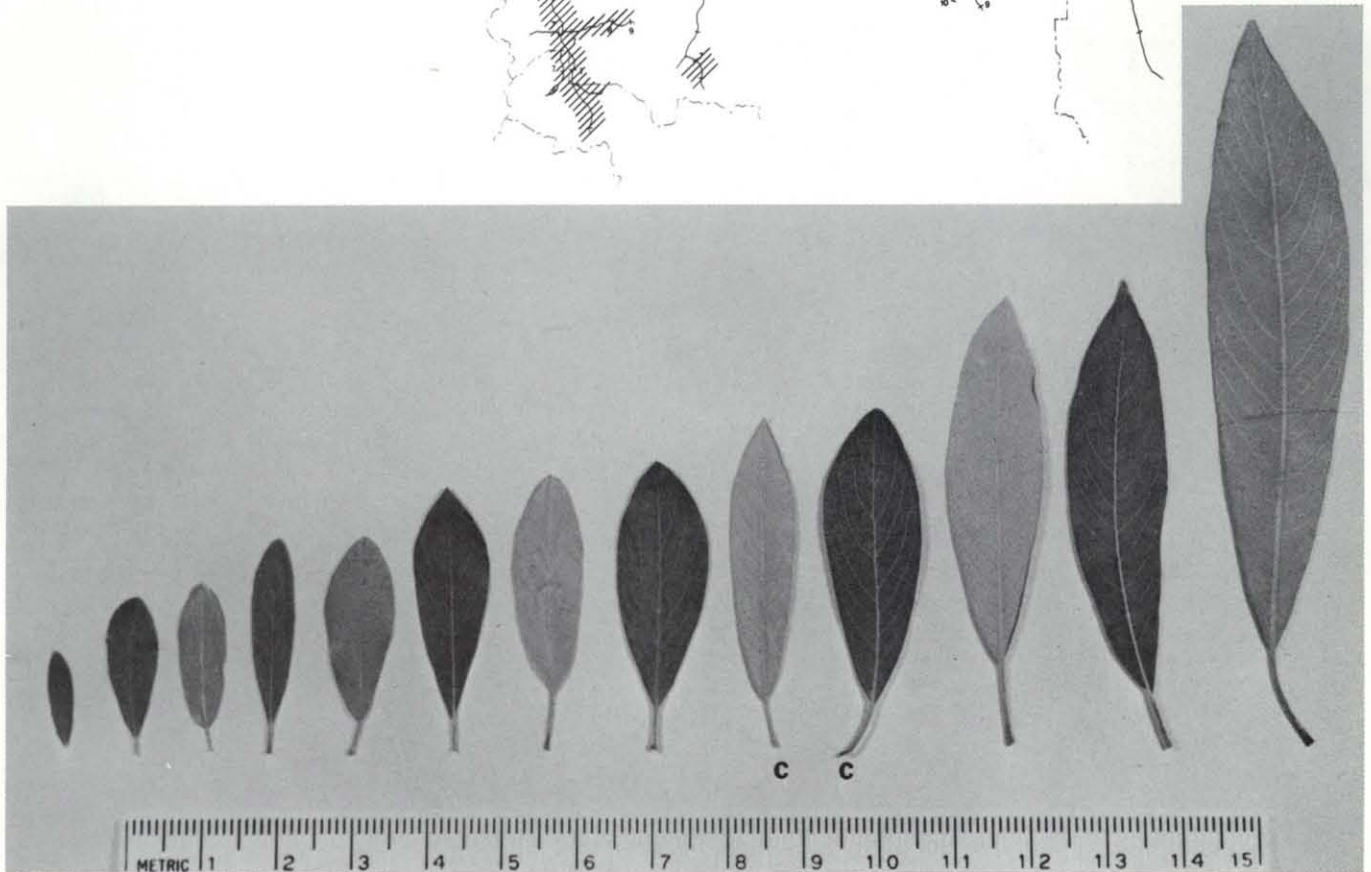
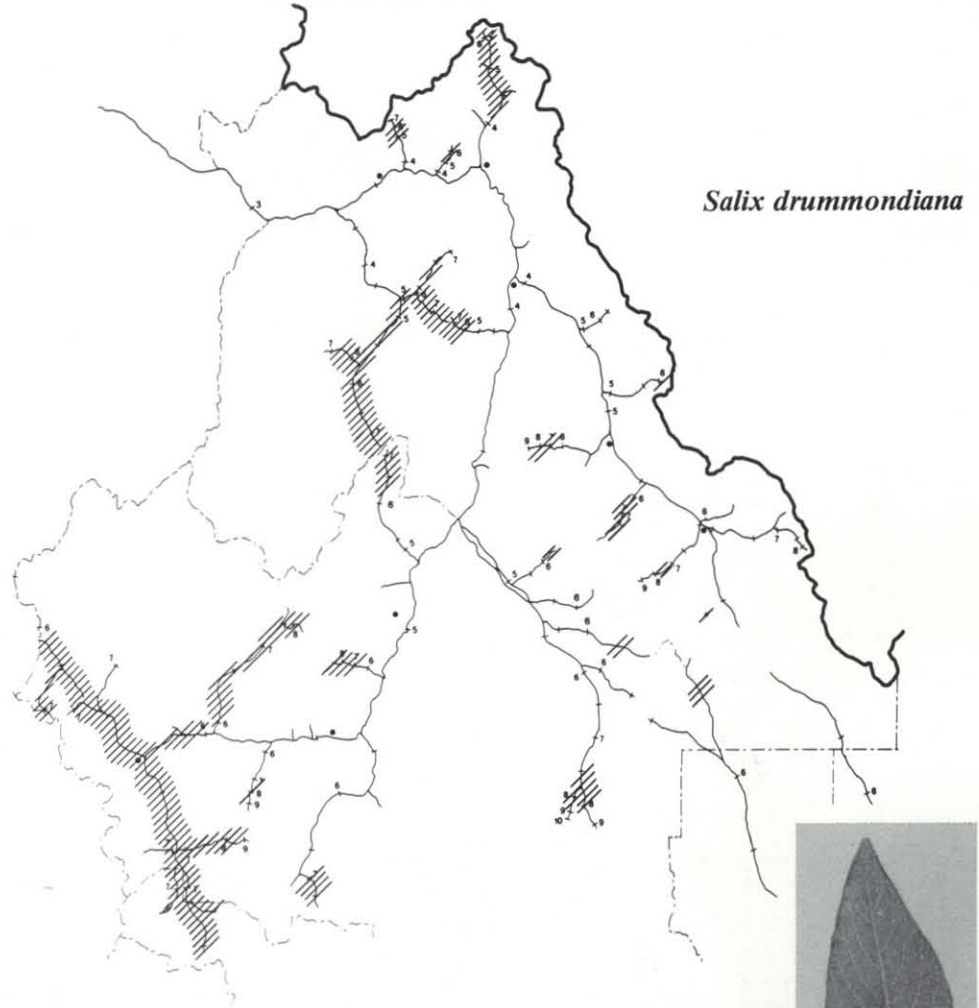


Description

Shrub commonly 2-4 m (occasionally to 6 m) tall; twigs of the season green to purple, glabrous or with sparse pubescence, and soon strongly glaucous; older twigs glabrous, and glaucous for 1-2 years; mature leaf blades with entire, somewhat revolute margins; first leaves of the season glabrous above and with long, silky appressed hairs beneath; later leaves silvery beneath, with short, dense, somewhat appressed, velvety, puberulence through which the leaf surface is not visible, upper surface green, moderately pubescent with loosely appressed, wavy hairs while expanding, remaining pubescent or becoming glabrous with age; petioles loosely appressed-pubescent, 2-13 mm long, depending on vigor (average 4-6 mm); stipules quickly deciduous, mostly small, < 1 mm, but up to 5 mm on vigorous shoots; aments expanding before or with the leaves on short flowering branchlets commonly only 1-2 mm long with no leafy (green) bracts, or occasionally up to 5 mm long with 1-3 narrow leafy bracts seldom more than 5 mm long; staminate aments 1-2.5 cm long; stamens 2; pistillate aments 1.5-4 (6) cm long; capsules 3.0-4.0 (4.5) mm long, densely short-hairy, closely spaced on short stipes < .6 mm long; styles .7-1.2 mm long; stigmas .2-.6 mm long; floral bracts dark brown or black, long-hairy, persistent.

Range: southeastern Yukon to Saskatchewan, south to California and New Mexico.

Distribution and Habitat: Drummond willow is common in the study area from the lower fringe of the forested zone up to about the middle of the subalpine zone. It is absent from lower elevation sagebrush-grass zone bottomlands and absent or rare in high subalpine and alpine habitats. In the lower, warmer portion of its distribution, within Douglas-fir forests and mosaics of Douglas-fir and big sagebrush, it is seldom very abundant and is generally confined to the immediate edge of streams, typically in moist sandy or gravelly soil. Drummond willow is usually more abundant in its higher elevation stream-bottom habitats, which are generally dominated by Engelmann spruce or subalpine fir. It occupies moist, well-aerated soils in these cooler habitats, with associates such as *Salix barclayi*, *Ribes inerme*, *R. montiginum*, *Lonicera involucrata* and *Senecio triangularis*.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Salix planifolia Pursh

planeleaf willow

subspecies *planifolia*

variety *planifolia*

variety *monica* (Bebb) Jeps.

Synonymy: *Salix phyllicifolia* L. ssp. *planifolia* (Pursh) Hiitonen

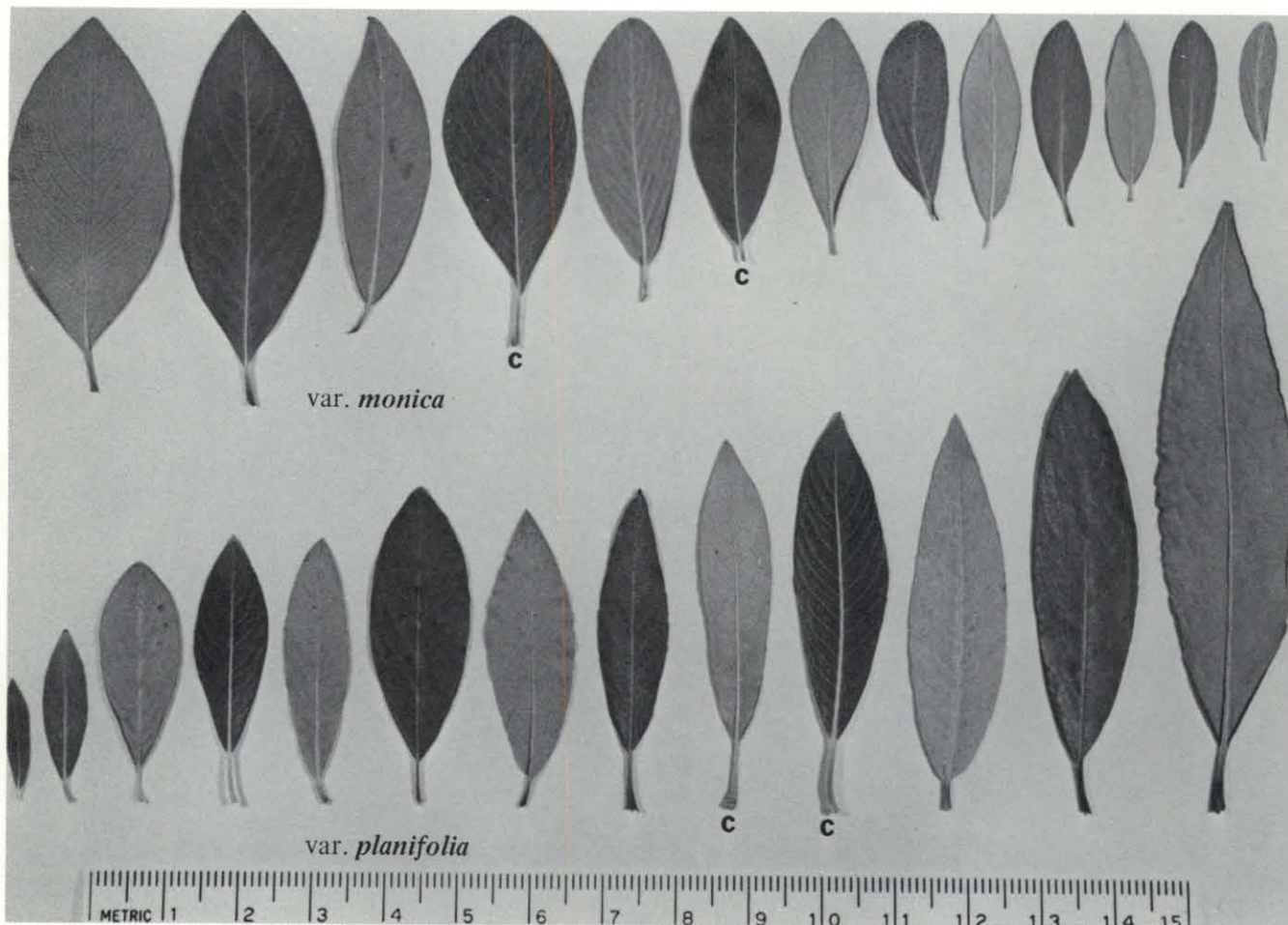
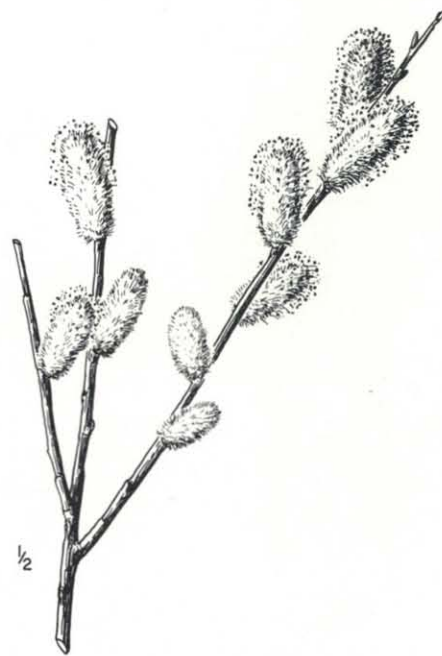
Identification

Salix planifolia is identified by its essentially glabrous leaves—dark green and shiny above, and glaucous below, with predominantly entire margins; glabrous twigs; and nearly sessile, closely-flowered aments. Ball (Davis 1952) called the species “parallel-veined willow” because of the prominent, partially parallel lateral veins of its leaves. These contribute to the distinctive appearance of the species, but are not unique enough to aid significantly in identification.

The two relatively distinct forms of *S. planifolia* in our area are distinguished as follows:

Variety *monica* grows at higher elevations (relatively), is less than 1 m tall, and has broader leaves.

Variety *planifolia* grows at lower elevations; is generally 2-4 m tall, and has longer, narrower leaves, often with red-tinged, sparse pubescence. Late season leaves are often somewhat toothed.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter “C”.

Range: Yukon to Labrador, south to California, New Mexico, Minnesota and New Hampshire.

Distribution and Habitat: The two varieties of *Salix planifolia* are distributed as follows:

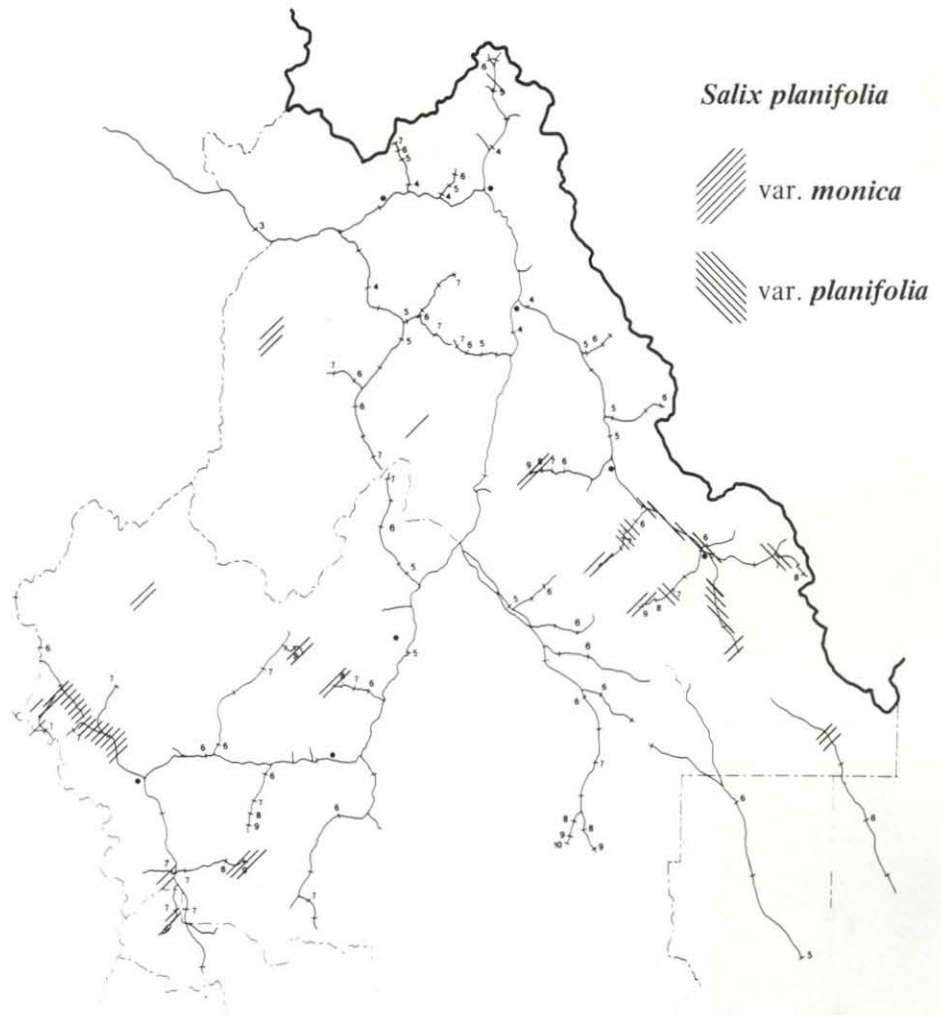
Variety *monica* occurs in moist open areas of the middle and upper subalpine zone, generally above 8000 feet (2440 m) elevation, and also at somewhat lower elevations in valley bottoms where there is significant cold air pooling (e.g., upper Stanley Basin, northwest of Stanley, Idaho). It grows in lake and streamside meadows, often in the wettest terrestrial sites available. These tend to have permanently saturated soils with highly organic surface horizons overlying clays, silts, sands, or occasionally gravels. Common associates include *Salix wolfii*, *S. commutata*, *Carex scopulorum*, *C. rostrata*, *Erigeron peregrinus*, *Vaccinium occidentale*, *Pedicularis groenlandica* and *Antennaria corymbosa*.

Variety *planifolia* is confined to the eastern portion of the study area, primarily in the upper Lemhi River Valley. There it occurs at lower elevations than var. *monica*, ranging from about 5500-7700 feet (1680-2350 m) elevation. It is well represented in the moist stream-sides and bottomlands of the broad sagebrush/grass zone valley surrounding the town of Leadore, Idaho. This variety also grows in riparian habitats within the lower Douglas-fir zone of adjacent montane slopes. Plot data indicate that var. *planifolia* occupies a wide range of soils from deep silts or clays to sands or gravels. It is commonly associated with *Salix boothii*, *S. geyeriana* and *S. bebbiana*, and occurs with *S. lutea* and *S. exigua* at its lowest elevation along the Lemhi River. The association of var. *planifolia* with middle and low elevation willow species attests to its warmer habitat than var. *monica*.

In the upper Lemhi Valley (Texas Creek), var. *planifolia* grades somewhat abruptly into var. *monica*, with a full range of heights represented. It is unclear whether the change in stature represents a genetic difference or merely a response to the environment.

Description

Low shrub .4-1 m tall (var. *monica*) or medium shrub 2-4 m tall (var. *planifolia*); twigs of the season glabrous or occasionally sparsely hairy; older twigs dark red or brown, glabrous (occasionally slightly glaucous on var. *planifolia*); leaf blades dark green and shiny above, glaucous beneath, margins somewhat revolute, entire or toothed on vigorous shoots (especially on var. *planifolia*); first leaves of the season glabrous above, and with long, silky appressed hairs beneath; later leaves finely appressed hairy while expanding, more densely so below than above, eventually glabrous above and sparsely appressed hairy beneath (hairs often red-tinged on var. *planifolia*), or occasionally glabrous beneath; petioles 1-10 mm long (average 5-8 mm); stipules minute, less than 1 mm, or up to 2 mm on vigorous growth, eventually deciduous; aments expanding before or with the leaves on short flowering branchlets 1-3 (6) mm long, commonly without green bracts or occasionally with 1-3 small green bracts; staminate aments 1-3 cm long; stamens 2; pistillate aments (1.5) 2-4 (6) cm long; capsules beaked, 3.5-5.5 mm (var. *monica*) or 4.5-6.5 mm (var. *planifolia*) long at maturity, short-hairy, borne on short stipes up to 1 (1.5) mm long; styles .4-1.5 mm long (average about 1mm); stigmas .3-.7 mm long (average .4-.5 mm); floral bracts black to dark brown, long-hairy, persistent.

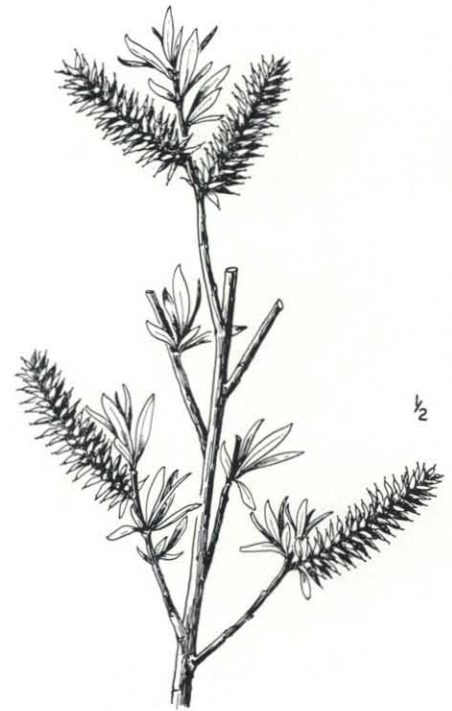
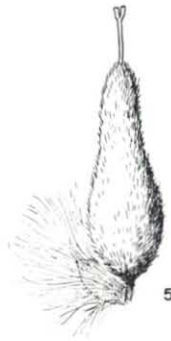


Similar Species

Species most easily confused with our two varieties of *S. planifolia* are contrasted below:

Salix planifolia variety *monica*

Salix farriae differs in having glabrous capsules in aments borne on leafy flowering branchlets; generally hairy twigs; and expanding leaves that, if pubescent, are more densely so above than below.



Salix planifolia variety *planifolia*

Salix drummondiana differs in having leaves that are silvery hairy below, strongly glaucous twigs, and shorter capsules in aments that are otherwise very similar to those of var. *planifolia*.

Salix lemmonii differs in having loosely-flowered aments borne on longer, leafy flowering branchlets; longer stipes; shorter styles; strongly glaucous twigs; and different leaf venation.

Other generally similar species have either evidently hairy twigs, strongly differing leaf shapes, or produce prominently toothed leaves throughout the season.

Taxonomy

This taxon has been interpreted as either *Salix phyllicifolia*, a circumboreal species represented in North America primarily by ssp. *planifolia* (Hiitonen 1950, Cronquist in Hitchcock et al. 1964); or *Salix planifolia*, a distinct species confined to North America (Ball in Davis 1952, Argus 1973, Dorn 1977). Cronquist followed Hiitonen on the basis of the relatively small morphological difference between the European *S. phyllicifolia* and our plants. More recently, however, Suda and Argus (1968) and Dorn (1975a) published chromosome counts that reveal that North American

plants are tetraploid ($2N=76$), while three different numbers have been counted in European plants ($2N=88, 114, 152$). Argus (1973) has discussed this taxonomic problem in detail. We agree with Argus that the cytological, geographical and known morphological differences provide ample grounds for considering *S. planifolia* a distinct species, "at least until the group can be studied monographically." Two subspecies of *S. planifolia* have been recognized, ssp. *planifolia* and ssp. *pulchra* (Argus 1969). Our plants belong to ssp. *planifolia*, the common phase south of northern British Columbia.

WILLOW MISCELLANY

"The willow grows easily anywhere and often on a bank . . . Chang Ch'ao counts the willow among the four things in the universe which touch man's heart most profoundly, and why he says the willow tree makes a man sentimental . . . There are places in China where willows are planted for miles around and then when a wind blows over them, the effect of the combination is spoken of as willow waves . . ."

Lin Yutang, *The Importance of Living*, 1937

Osier—(noun) - pliable twigs used in making baskets, furniture, etc. The word *osier*, from French *osiere*, is thought to come from Latin *aqua*, meaning water; probably from *ausaria* which referred to plants growing near water. Hence we have *white osiers*, formed from various willows, and *red osiers* from red osier dogwood, *Cornus stolonifera*.

"The important thing about willows is that their branches hang down, for if they didn't hang down, they would not be willows. It is important that the branches be long, for otherwise they cannot sway gracefully in the wind. What then would be the use of their hanging down? . . . It is to the credit of this tree that we often hear music in the air and do not feel lonely in summer. Especially this is the case with tall willow trees. In short, the planting of willow trees is not only to please the eye, but also to please the ear as well."

Li Liweng, 1611-1679

Salix barclayi Anderss.

Barclay willow

Identification

Salix barclayi is easily identified because it is the only upper elevation species in our area with evidently toothed leaves that are glaucous beneath (glaucous bloom often not well developed early in the season; if plants are near flowering, compare with *S. boothii*). It is further distinguished by its relatively long, leafy flowering branchlets; glabrous capsules, and dark, long-hairy floral bracts.

Similar Species

Salix farriae differs from *S. barclayi* in having entire or only inconspicuously toothed leaves, shorter flowering branchlets, styles and anthers; and a generally shorter stature.

Salix pseudomonticola differs in having sessile or subsessile aments, shorter styles, larger stipules and a different habitat (at least in the study area).

Salix lemmonii differs in having glaucous twigs; narrower, entire leaves; and hairy capsules.

Salix boothii resembles *S. barclayi*, but has nonglaucous leaves, shorter styles and flowering branchlets, and grows at generally lower elevations.

Salix exigua spp. *melanopsis* has narrower leaves; pale, deciduous floral bracts; and grows at lower elevations.

Taxonomy

Past floras of the region differed considerably in their treatment of this species and its close relatives. Plants considered here key to either *Salix barclayi* or *Salix pseudomonticola* var. *padophylla* in Flora of Idaho (Ball in Davis 1952), and to *Salix monticola* in Vascular Plants of the Pacific Northwest (Cronquist in Hitchcock et al. 1964). Biosystematic work by Dorn (1975b) revealed chemical, cytological, morphological and geographical patterns that clarified the taxonomy of the group. *Salix barclayi* is the proper name for the common subalpine willow described here. The taxon differs morphologically from its close relatives primarily by its long, leafy flowering branchlets (specimens from the study area confirmed by Dorn). *Salix pseudomonticola* is a distinctly different entity known in Idaho and the study area only from Birch Creek and Texas Creek valleys; while *S. monticola* is a central Rocky Mountain species apparently not entering Idaho.

Description

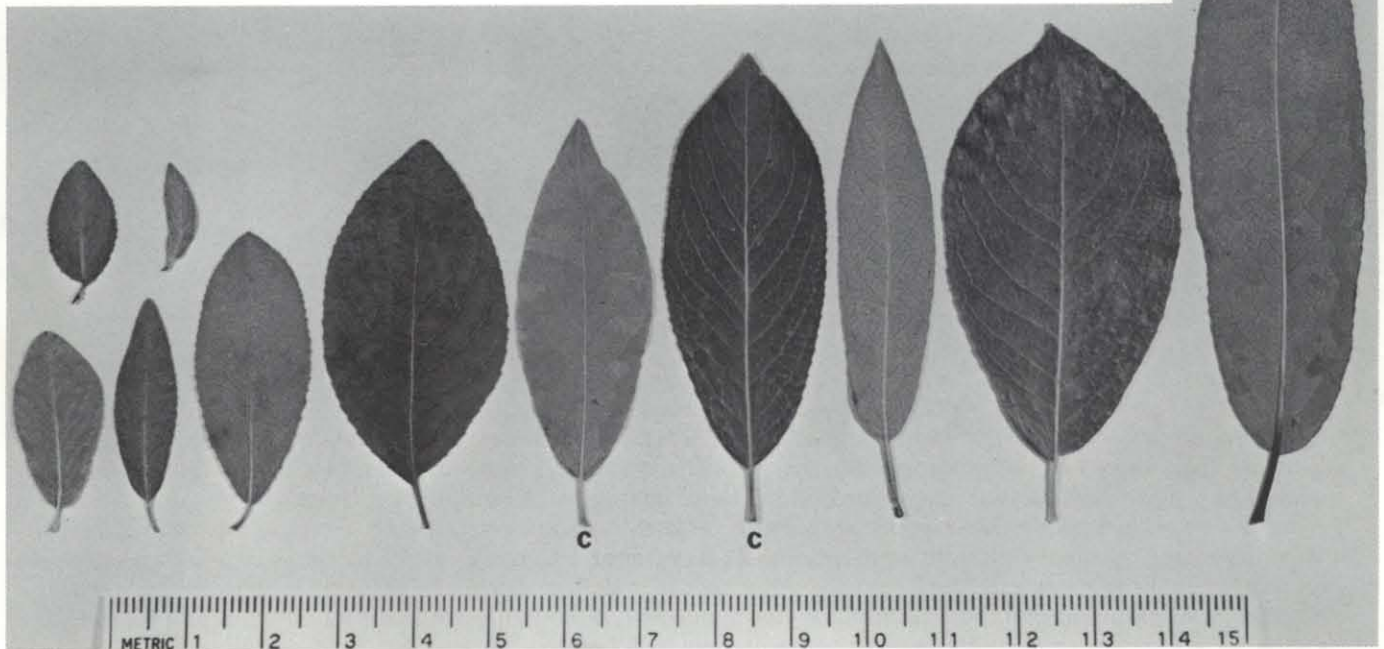
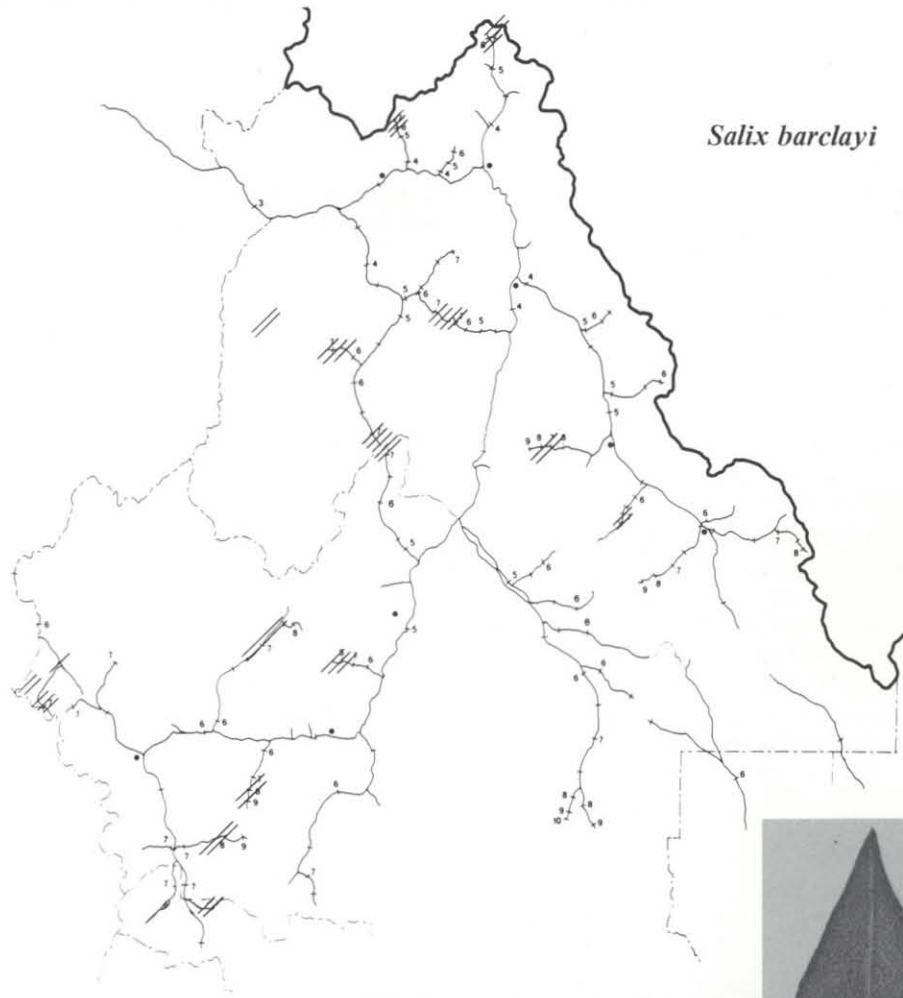
Shrub up to 3.5 m tall, commonly at least 2 m tall; twigs of the season glabrous to moderately pubescent with loosely appressed hairs; older twigs glabrous; mature leaf blades green above, glaucous beneath (especially so on later leaves), margins finely to coarsely serrate with gland-tipped teeth; first leaves of the season essentially glabrous, later leaves sparsely to densely appressed-hairy above and sparsely hairy below while expanding, essentially glabrous on both surfaces at maturity except for the dense band of short hairs along the upper midrib; petioles 2-15 mm long, commonly 5-8 mm, puberulent on at least the upper side; stipules small and inconspicuous on normal growth, larger and foliaceous, up to about 1 cm long, on vigorous shoots, eventually deciduous; staminate aments 1-3 (4) cm long, expanding with the leaves on leafy flowering branchlets 2-8 (11) mm long; stamens 2, anthers (.5) .6-1.1 mm long; pistillate aments (1) 3-5 (8) cm long, expanding with the leaves on leafy flowering branchlets (4) 8-25 mm long at maturity; capsules glabrous, borne on an often short-hairy stipe up to 1.5 (3) mm long; styles (.5) .7-1.5 (2) mm long; floral bracts brown or black, generally with long silky hairs, persistent.



Range: Alaska to District of Mackenzie, south to Washington, Idaho and northwestern Wyoming.

Distribution and Habitat: *Salix barclayi* occurs in subalpine habitats throughout much of the study area. It is most commonly found in streamside openings in bottomland forests of Engelmann spruce, subalpine fir or lodgepole pine. These habitats occur within the subalpine zone and also in streambottom stringers that follow cold air drainage down into the upper Douglas-fir zone. *Salix barclayi* grows in moist, gravelly soils that often have an organic and/or silty mantle up to several decimeters thick. Common associates in this riparian habitat include *Lonicera involucrata*, *Salix drummondiana*, and *Ribes hudsonianum*.

Salix barclayi is also known from a few lakeside habitats, but generally in well-drained soils near the upland border. Subalpine sites with permanently saturated soils (often dominated by *Salix planifolia* or *S. commutata*) appear to be unsuitable for this species.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Salix farriae Ball

Farr willow

Identification

Salix farriae is recognized by its low stature; essentially glabrous, entire or inconspicuously toothed leaves that are glaucous beneath; and glabrous capsules in aments borne on leafy flowering branchlets.

Similar Species

Salix planifolia differs in having less hairy twigs, sparsely hairy lower leaf surfaces, pubescent capsules, and sessile or subsessile aments.

Salix barclayi differs in having toothed leaf margins, longer flowering branchlets and styles, and larger anthers; it is commonly at least 2 m tall.

Salix pseudomonticola differs in having sessile aments and toothed leaf margins.

Salix lemmonii differs in having glaucous twigs and hairy capsules.

Taxonomy

Plants from the Slate Creek population have larger leaves with more persistently hairy upper surfaces and more toothed margins (though inconspicuously so) than the higher elevation Pahsimeroi population. Robert Dorn has examined specimens from the population and considers them (Pers. Comm.) to be within the typical range of variation for *S. farriae*, except for the persistent leaf pubescence.



Description

Low shrub up to 1 m tall (or rarely 2 m); **twigs** of the season sparsely to moderately pubescent with loosely appressed hairs; older twigs brown or reddish, sooner or later glabrous; mature **leaf blades** entire or sometimes inconspicuously toothed (esp. on vigorous shoots), green above and glaucous beneath; **first leaves** of the season glabrous above and with a few long straight, deciduous hairs below; **later leaves** finely appressed hairy above and glabrous below while expanding, essentially glabrous on both surfaces at maturity, except usually for puberulence along upper mid-vein, or occasionally for sparse pubescence over upper surface; **staminate aments** .8-1.5 (2) cm long expanding with the leaves on leafy flowering branchlets up to 5 mm long; stamens 2; anthers .3-.6 mm; **pistillate aments** 1-2.5 (3) cm long, expanding with the leaves on leafy flowering branchlets up to 1.5 cm (ave. about 8 mm) long; capsules glabrous, borne on stipes .2-1.0 (1.5) mm long; styles .4-.7 mm long; floral bracts brown or black, from nearly glabrous to long-silky-hairy on both surfaces, persistent.

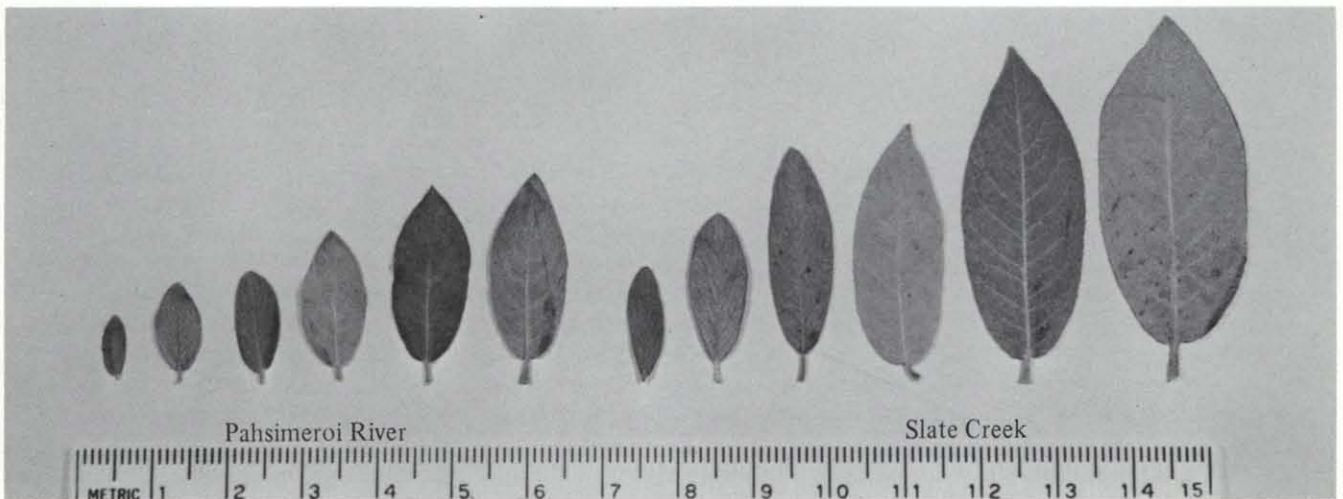
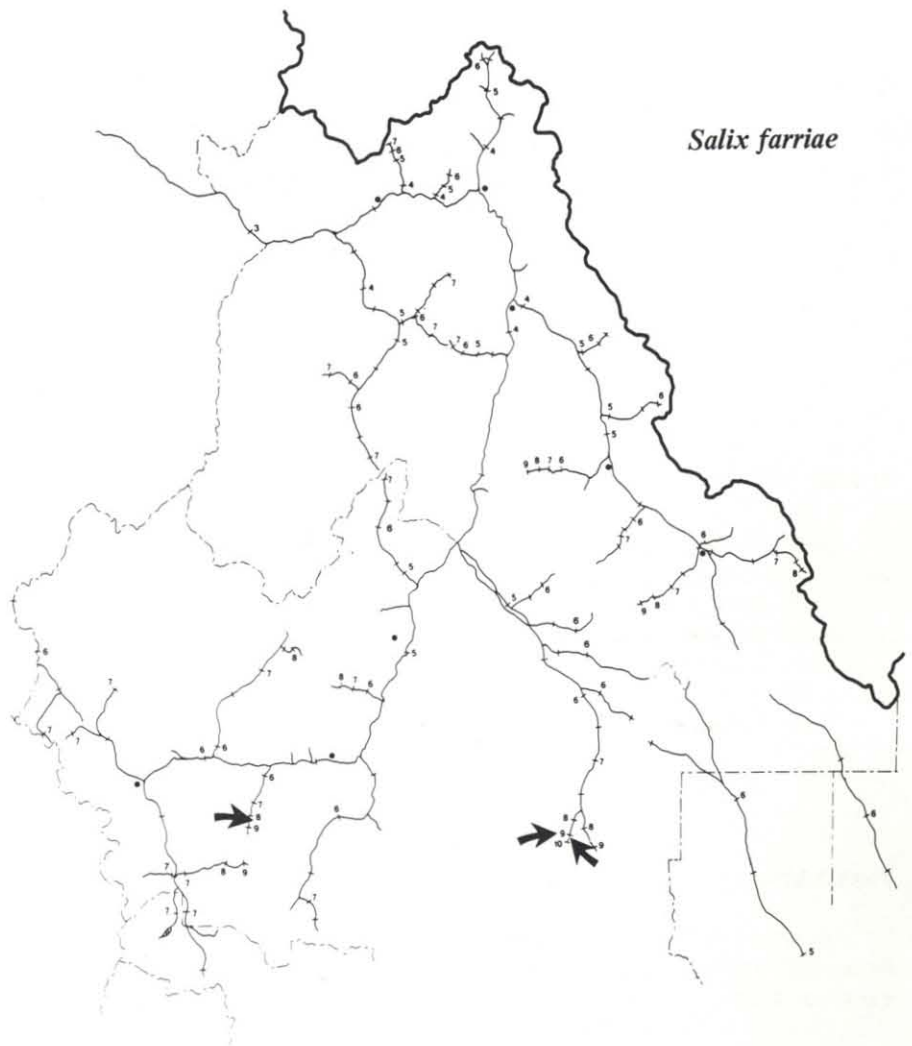
Range: Southern British Columbia and Alberta, northeastern Oregon, Idaho, western Montana and northwestern Wyoming.

Distribution and Habitat: *Salix farriae* is known from three moist subalpine sites in Idaho, all within the study area.

One locality is an open, willow-dominated meadow near timberline at the head of the West Fork of the Pahsimeroi River (9250 ft; 2820 m). Farr willow occupies the wetter portions of the meadow, near stream edges and in seepy areas where soils are shallow and highly organic. *Carex aquatilis* and *Caltha leptosepala* are associates. Adjacent drier sites with deep soils elevated well above the water table are dominated by *Salix brachycarpa*.

A smaller, second population in the upper West Fork of the Pahsimeroi River drainage near Merrimam Lake has not been studied. Other small populations are likely to be found in this drainage.

In 1983 we discovered *Salix farriae* in a seepy, willow dominated opening in a subalpine fir forest on a slope above upper Slate Creek (8100 ft; 2470 m). *Betula glandulosa*, *Salix drummondiana*, *Carex aquatilis*, *C. rostrata*, *Pedicularis groenlandica* and *Swertia perennis* are common associates in the thin, wet, organic soil. The presence of this species in a rather ordinary subalpine habitat suggests that it is probably more abundant in Idaho than was previously thought.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Salix tweedyi (Bebb) Ball

Tweedys willow

Identification

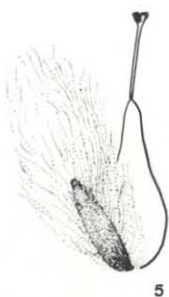
Salix tweedyi is a distinctive species recognized by its subalpine habitat; broad, green leaves, pubescent above and essentially glabrous below at maturity; long, spreading twig pubescence; well-developed, persistent stipules; long, thick aments, some of which are terminal on the previous year's twigs; and long styles on glabrous capsules.

Similar Species

Salix commutata resembles *S. tweedyi* in having broad, gland-toothed leaves and spreading-hairy twigs; the two sometimes occur in the same habitat (*S. tweedyi* upper elevations). *Salix commutata* has more abundant and persistent pubescence on both leaf surfaces; long, leafy flowering branchlets; and shorter styles.

Salix eastwoodiae also occurs with *S. tweedyi*, but differs in its narrower, more densely hairy leaves; more appressed twig pubescence; long, leafy flowering branchlets; and hairy capsules with shorter styles.

Salix boothii resembles glabrous-leaved extremes of *S. tweedyi*, but has smaller leaves; glabrous or loosely appressed-hairy twigs; smaller, more quickly deciduous stipules; smaller aments; shorter styles; and generally a lower elevation habitat.

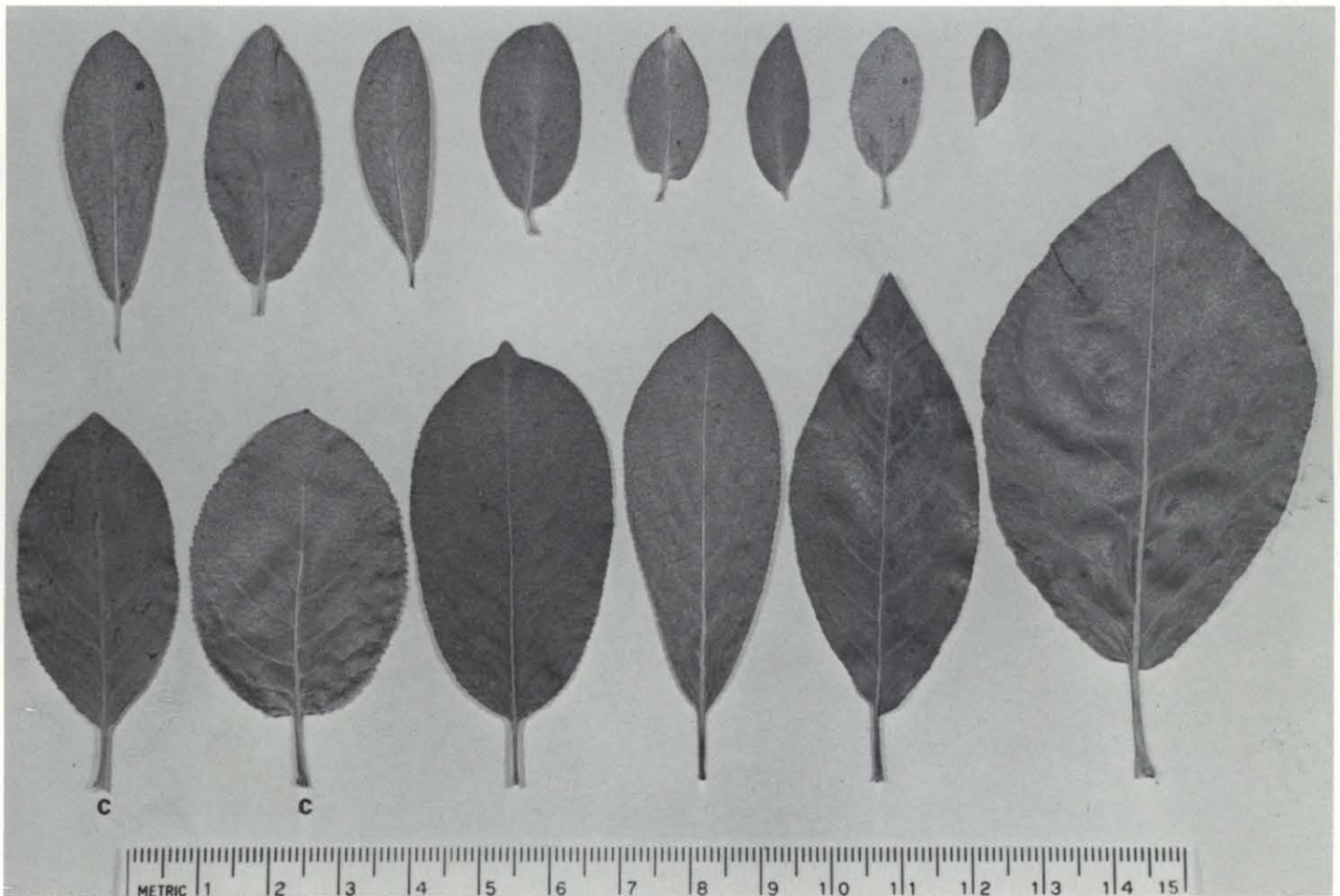
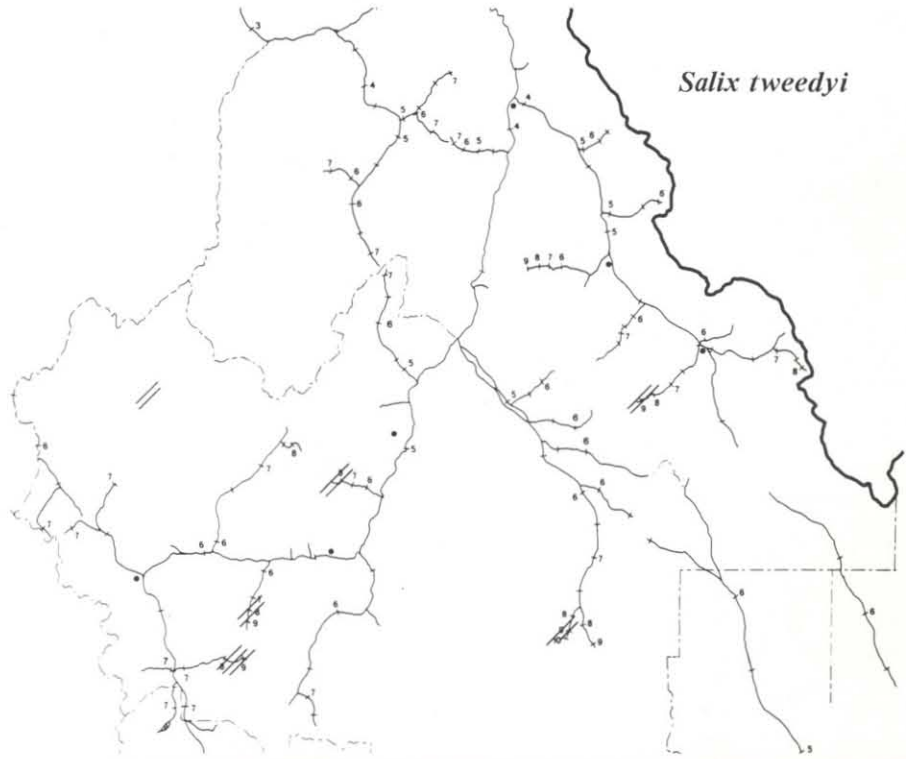


Description

Shrub to 4 m tall; twigs stout, those of the season with long, spreading, dense pubescence which in part persists into the second year, though becoming matted; mature leaf blades green on both surfaces, often somewhat paler beneath, but not glaucous, margins finely serrulate with gland-tipped teeth; first leaves of the season densely hairy beneath with long, straight, silky hairs, and glabrous or only sparsely hairy above; later leaves tomentose with loose tangled hairs while expanding, mature leaves more densely hairy above than below, lower surfaces essentially glabrous or sparsely hairy, at least along the midrib, upper surfaces moderately to sparsely hairy, the loose tomentum especially dense along the midrib; petioles up to 15 mm long, spreading hairy like the twigs; stipules well-developed, broad and leafy, commonly more than 5 mm long and occasionally up to 15 mm, persistent during season, often some persist (brown) on second year twigs (large size and persistence unique among our willows); aments expanding with or before the leaves, some terminal on twigs of previous year, sessile or on short flowering branchlets less than 1 cm long, generally without green leafy bracts; staminate aments 2-4 cm long; stamens 2; pistillate aments 3-9 cm long; capsules glabrous, borne on short stipes less than 1 mm long; styles (1.0) 1.5-2.5 (3.0) mm long; floral bracts dark brown to black, densely to sparsely long-hairy, persistent.

Range: Southern B.C. and north-central Washington to Idaho, western Montana and Wyoming.

Distribution and Habitat: *Salix tweedyi* is known in our area from moist streamside and lakeside habitats from 8000 to 9300 feet (2440 to 2840 m) in elevation. It is said to be rare over most of its range, but we found it in six drainages (though not abundant in any), and expect it to be present in upper elevations throughout much of the western study area. While most of the known populations are within the subalpine zone, the species also follows cold air drainage down into the upper Douglas-fir zone in Engelmann spruce-dominated streambottoms. Soils occupied by *Salix tweedyi* are primarily moist, well-drained and coarse-textured. Common associates include *Abies lasiocarpa*, *Picea engelmannii*, *Salix barclayi*, *S. drummondiana*, *Lonicera involucrata* and *Ribes montiginum*.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Salix commutata Bebb

undergreen willow



Identification

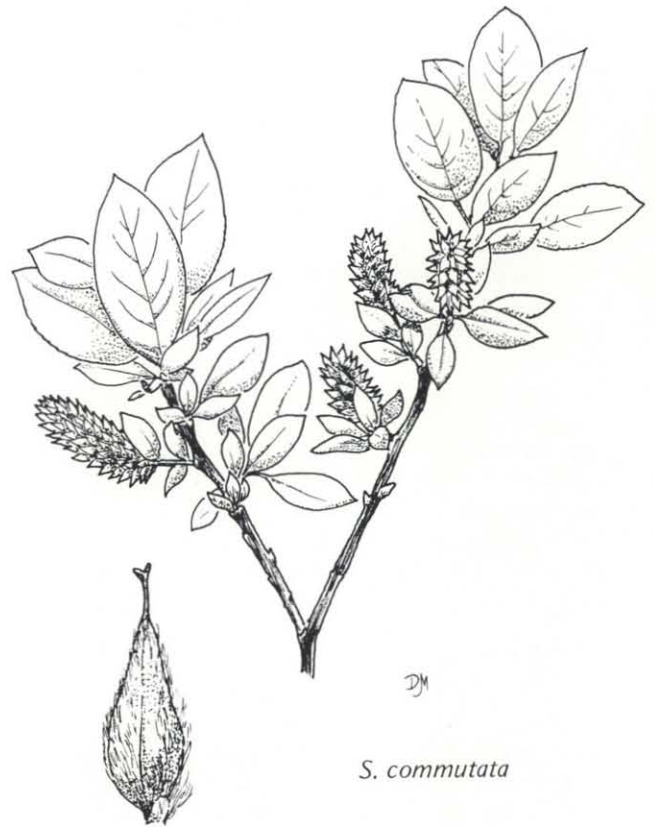
Salix commutata is a low to medium shrub with broad, gland-toothed leaves; spreading-erect pubescence (on twigs, petioles and leaf blades); and aments on relatively long and leafy flowering branchlets. See Conspectus page 76.

Similar Species

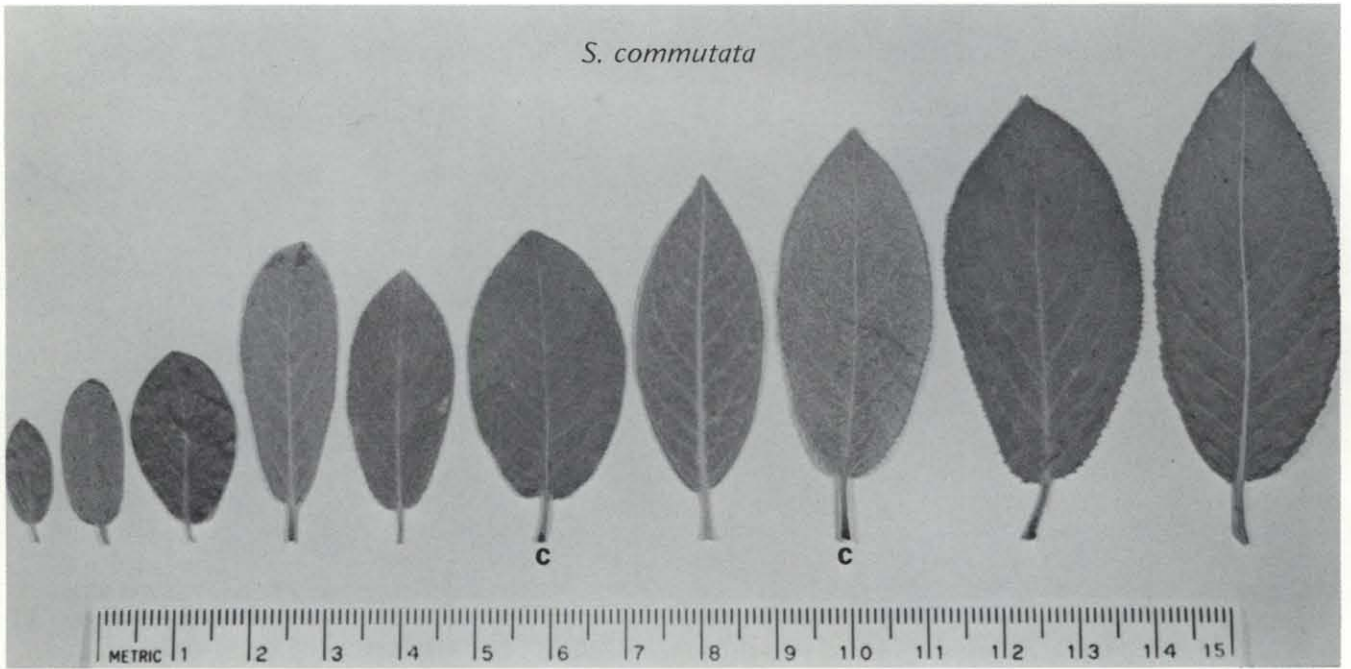
Salix eastwoodiae differs from *Salix commutata* in having narrower, less prominently gland-toothed leaves; more appressed pubescence; and generally smaller leaves on the shorter flowering branchlets.

Salix tweedyi has spreading pubescence similar to *S. commutata*, but has glabrous lower leaf surfaces and sessile aments.

Salix wolfii differs in having narrower, entire leaves; appressed pubescence; and small aments on short flowering branchlets.



S. commutata



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Range: *Salix commutata* - Alaska east to District of Mackenzie, south to Oregon, Idaho and western Montana.

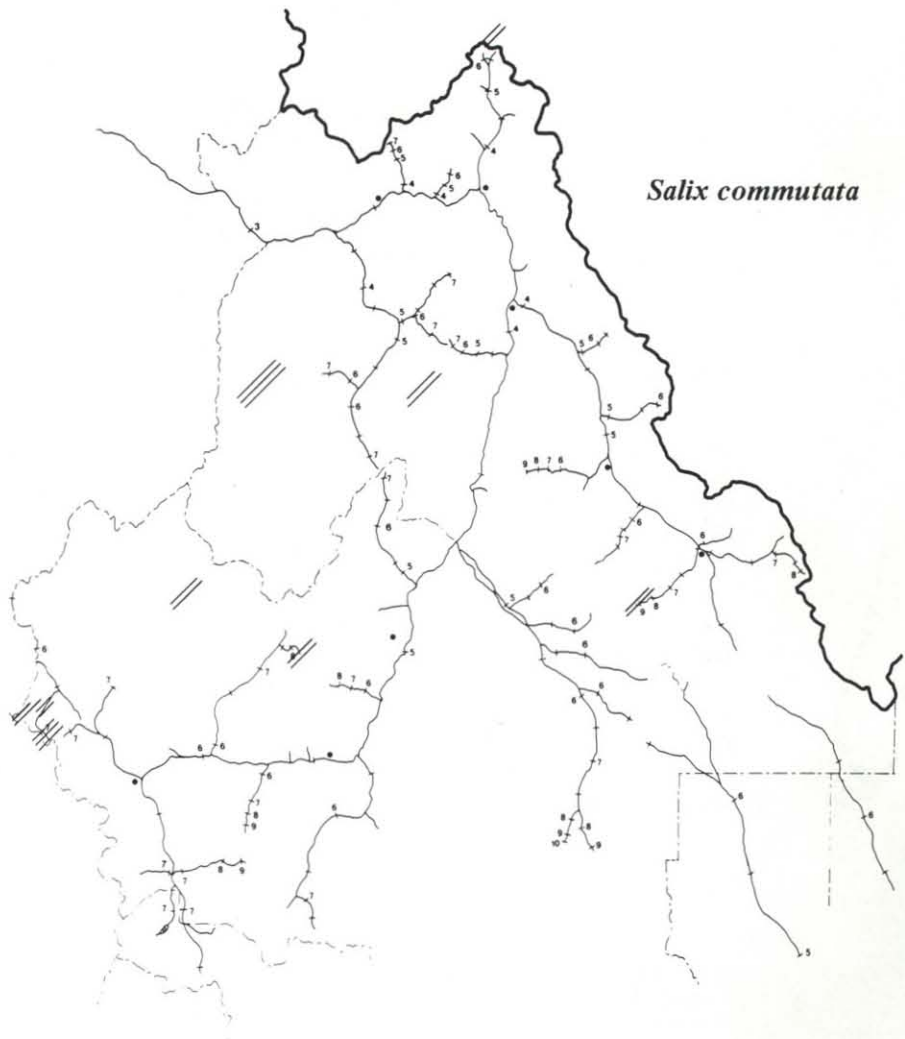
Distribution and Habitat: *Salix commutata* is known from about ten high elevation sites scattered throughout the study area. Known localities range from 7000-9000 feet (2130-2740 m) elevation, but all are perennially moist habitats within subalpine forests of lodgepole pine, Engelmann spruce and subalpine fir. The habitats are primarily low willow and sedge meadows adjacent to lakes, streams, and springs, and have wet, highly organic soils. *Carex scopulorum* and *Salix planifolia* are common associates. At a single location (Banner Creek) the species was found in relatively gravelly soils along a steep gradient subalpine stream.

Taxonomy

There are two forms of *Salix commutata* in our area: the typical form of the species (var. *commutata*) with glabrous capsules, known only from Lost Trail Pass Bog (Montana, ¼ mile north of Idaho border) and our common form with pubescent capsules, for which the name var. *puberula* Bebb, is available. Robert Dorn has examined specimens from two of our populations and considers them "somewhat anomalous" (*S. commutata*), in that they are intergradational to *S. eastwoodiae*. The relationships between our common form, (var. *puberula*), and both typical *S. commutata* and *S. eastwoodiae* need further study.

Description

Low to medium shrub, commonly .5-1.0 m tall, but up to 3 m in less severe habitats; **twigs** of the season densely pubescent with long, relatively straight spreading-erect hairs; especially dense on young growth; twig pubescence persisting, but strongly matted, in second or third year; mature **leaf blades** gray-green to silvery in aspect (due to pubescence), margins evidently gland-toothed, the glands especially large on early season leaves of both vegetative and flowering branches; **first leaves** of the season covered on both surfaces with long, straight, appressed silky hairs that are soon deciduous; **later leaves** silvery with dense spreading pubescence while expanding, and covered with erect, tangled hairs at maturity, the hairs particularly dense along the lower midrib and occasionally somewhat appressed on the upper surface; **leaf surfaces** (visible through pubescence) green, the lower not glaucous though occasionally paler green than the upper; **petioles** pubescent like the twigs, 1-2 mm long on the first leaves of the season, up to about 1 cm on vigorous shoots; **stipules** 1.5-10 mm long depending on the vigor of the shoot, strongly glandular on the margins and inner surface, sooner or later deciduous; **staminate aments** (1) 1.5-2.5 cm long, expanding with the leaves on leafy flowering branchlets .8-1.5 cm long, stamens 2; **pistillate aments** 3-5 cm long at maturity, expanding with the leaves on leafy flowering branchlets 1-2.5 cm long; capsules sparsely to densely hairy or glabrous, borne on stipes up to 1 mm long; styles .5-1.6 mm long; floral bracts light to dark brown, pubescent with long, wavy hairs, persistent.



Salix eastwoodiae Cockerell
ex Heller

Eastwood willow

Identification

Salix eastwoodiae is a low to medium shrub with gland-toothed leaves (glands sometimes inconspicuous, generally best developed on early season leaves); loosely appressed pubescence (on twigs, petioles and leaf blades); and aments on leafy flowering branchlets. See page 76.

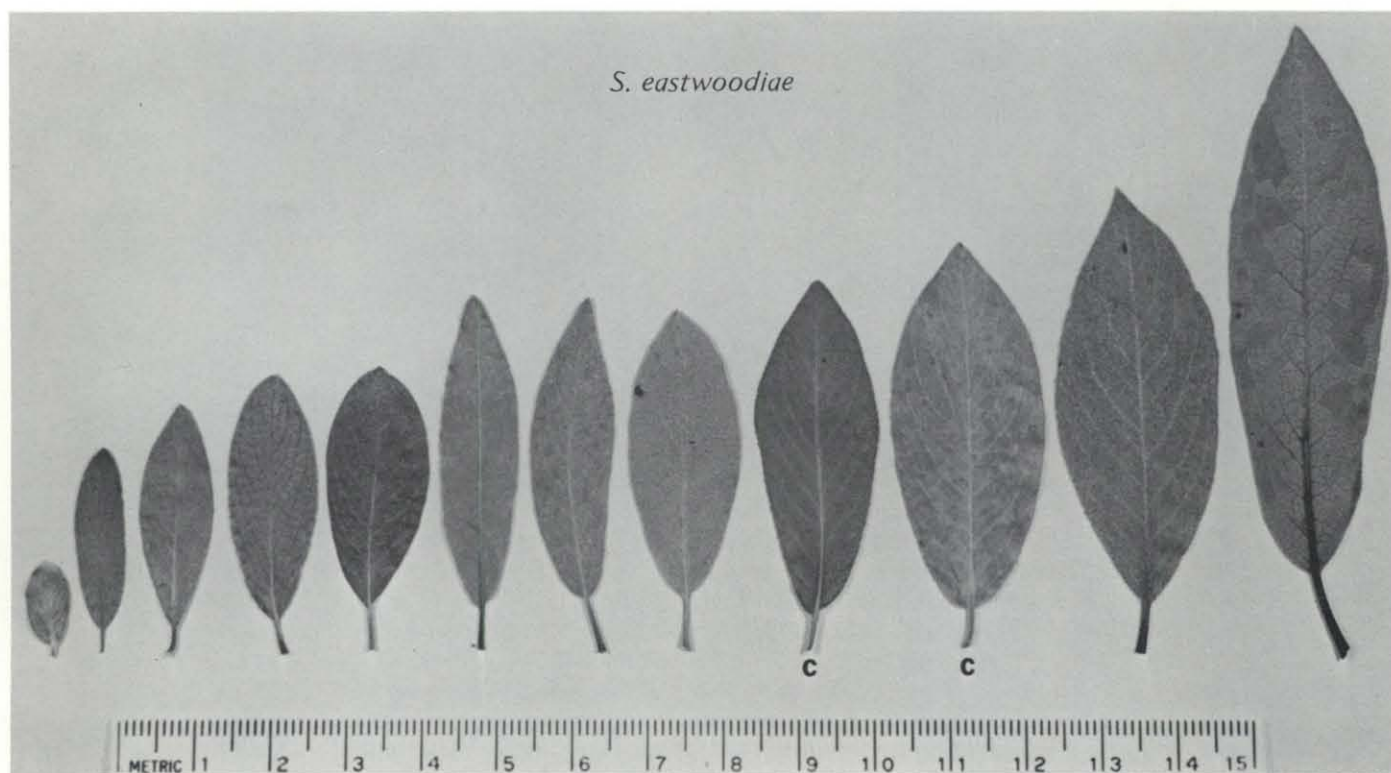
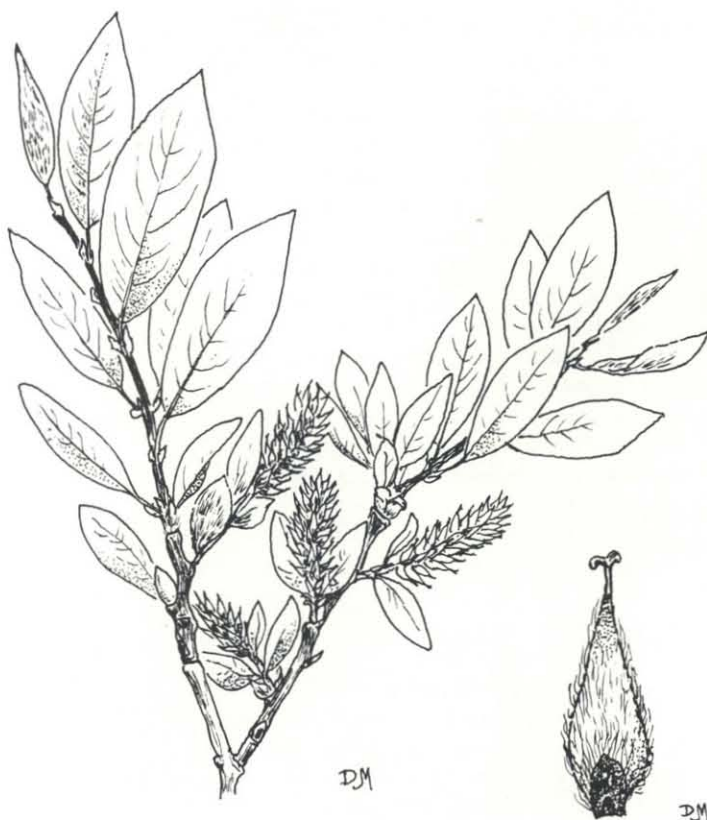
Similar Species

Salix wolfii differs from *S. eastwoodiae* in having entire margins, shorter aments and more closely appressed pubescence.

Salix commutata differs primarily in its spreading-erect pubescence.

Salix boothii differs from *S. eastwoodiae* in having essentially glabrous leaves and capsules, and in being distributed at generally lower elevations. Sparsely pubescent extremes of *S. eastwoodiae* without aments can be difficult to distinguish from this species.

Salix tweedyi differs in its broader leaves, spreading pubescence (especially on twigs and petioles) and sessile aments with glabrous capsules.



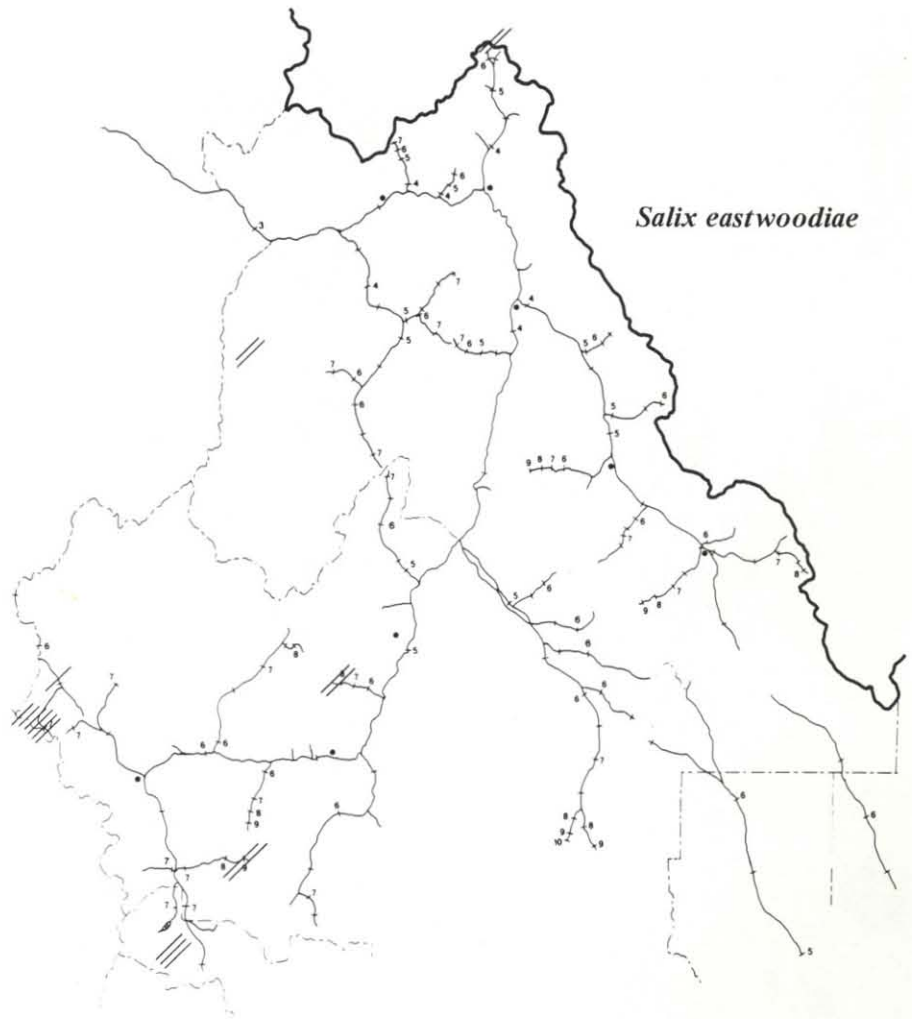
Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Range: *Salix eastwoodiae* - Oregon east to southwestern Montana, south of California, Nevada and Wyoming.

Distribution and Habitat: *Salix eastwoodiae* is well represented only in the western third of the study area, where it occurs in subalpine habitats from 7000-9400 feet (2130-2870 m) elevation. It inhabits open streambottoms and lake edges in moist, but well-drained and often gravelly soils. These habitats are often intermingled with or adjacent to low lying sites with more saturated soils dominated by *Salix planifolia* and sedges. *Salix eastwoodiae* is replaced in the lower subalpine by *Salix wolfii*, though there is often some overlap in their distributions.

Taxonomy

Before Dorn's detailed biosystematic study (1975b), *Salix eastwoodiae* was thought to occur only in California and adjacent Nevada and Oregon. It was therefore not reported for Idaho by Ball (Davis 1952) or Cronquist (Hitchcock et al. 1964). Past collections from the region, which were few in number, were generally referred to either *S. commutata* or *S. wolfii*. The range of the species is now known to extend east to northwestern Wyoming and southwestern Montana. It appears from recent collecting that the species is common in central Idaho, especially west of the study area.



Description

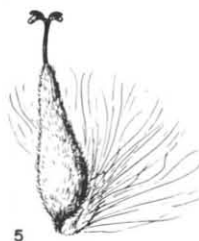
Low to medium shrub, 1-2 m tall; **twigs** of the season sparsely to densely pubescent with loosely appressed curly or wavy hairs; twig pubescence more or less persistent for 2-3 years; mature **leaf blades** gray-green to silvery in aspect (due to pubescence), margins gland-toothed especially on early season leaves, later season leaves often obscurely toothed or entire; **first leaves** of the season essentially glabrous above and pubescent beneath, with long, straight, silky, deciduous hairs; **later leaves** densely pubescent on both surfaces while expanding, the hairs loosely appressed and wavy, leaves sparsely to densely pubescent at maturity, generally more densely hairy on the upper surface than the lower; leaf surfaces visible (with magnification) through the pubescence, the lower sometimes paler green than the upper, but not glaucous; **petioles** pubescent like the twigs, 1-2 mm long on first leaves of the season, up to about 1 cm on vigorous shoots; **stipules** 1.5-8 mm long, depending on the vigor of the shoot, strongly glandular on the margins and inner surface, sooner or later deciduous; **staminate aments** 1-2 (3) cm long, expanding before or with the leaves on leafy flowering branchlets 1-5 (7) mm long; **stamens** 2; **pistillate aments** (1) 1.5-4 cm long, expanding with the leaves on leafy flowering branchlets (3) 8-15 mm long; **capsules** sparsely to densely hairy or rarely glabrous, borne on stipes up to 1.5 mm long; **styles** (.4) .7-1.5 (1.9) mm long; **floral bracts** dark brown or black, pubescent with long wavy hairs, persistent.

Salix wolfii Bebb

Wolfs willow

Identification

Salix wolfii is an easily identified low shrub with entire, silvery, appressed-hairy leaves and small aments. See Conspectus page 76.

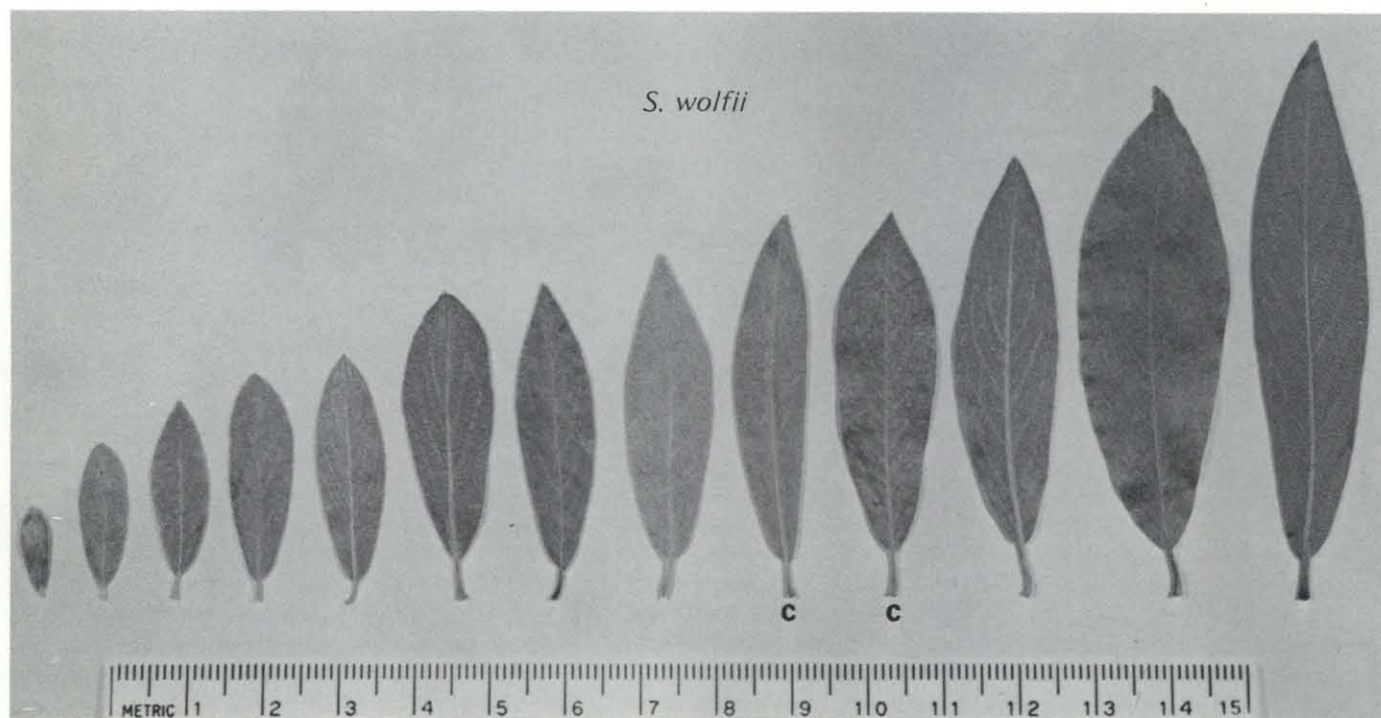


S. wolfii var. *idahoensis*

Similar Species

Salix eastwoodiae differs from *S. wolfii* primarily in its gland-toothed leaves and longer aments.

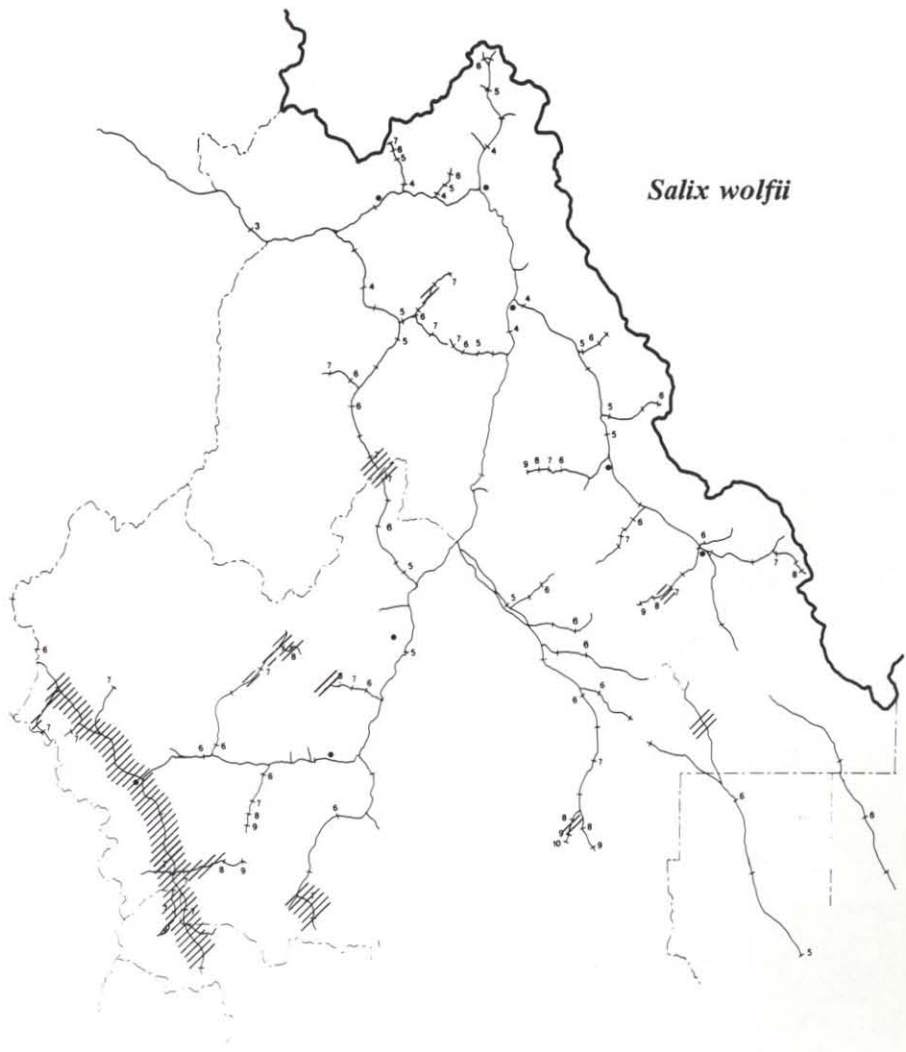
Other species with appressed-hairy leaves have leaf blades that are either much narrower or are evidently glaucous beneath.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

Range: *Salix wolfii* - Northeast Oregon east to Montana, south to Nevada, Utah and Colorado.

Distribution and Habitat: *Salix wolfii* is abundant in the western half of the study area and in scattered localities in the east. It is primarily found in open streambot-toms in the lower subalpine zone, and at somewhat lower elevations within the Douglas-fir zone, where cold air pooling produces subalpine-like conditions (e.g., Stanley Basin). This species occupies an inter-mediate position in the array of riparian habitats within its eleva-tional range (6200-8600 feet (1980-2620 m). For example, it favors habitats moister than the well-drained, gravelly sites held by *Salix lemmonii* and *Salix geyeriana*, but drier or better drained than the wet, fine-textured soils dominated by *S. planifolia*, though the habi-tats of these species somewhat overlap. Thus, depending on the topography and elevation of the riparian habitat, *Salix wolfii* may be found in relatively wet sites (espe-cially in its lower elevations), intermediate sites, or relatively dry sites (especially in its higher elevations). It inhabits soils that are well-drained, or at least well-aerated, and often sandy-textured (varying from silty sand to gravelly sand). *Salix wolfii* is replaced in colder habitats higher in the subalpine zone by *S. eastwoodiae*.



Taxonomy

Plants of the study area apparently all have pubescent capsules and therefore belong to var. *idahoensis* Ball. Variety *wolfii*, with glabrous capsules, is the southern phase of the species, which extends north into southeastern Idaho.

Description

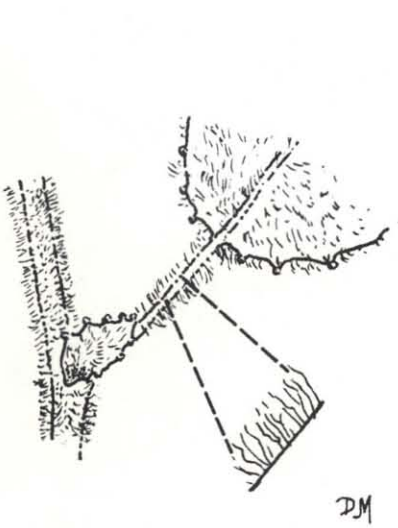
Low shrub commonly (.2) .4-1.0 m tall, occasionally reaching 2 m tall when intermingled with taller shrubs (and appar-ently escaping browsing); **twigs** of the season sparsely to densely pubescent with loosely appressed, wavy or curly hairs; twig pubescence more or less persistent for 2-3 years; **leaf blades** gray-green to silvery in aspect (due to pubescence), margins entire; **first leaves** of the season essentially glabrous above, and pubescent below with long, straight, silky, appressed, deciduous hairs; **later leaves** densely silvery pubescent on both surfaces while expanding, the hairs wavy and appressed, leaves evidently hairy at maturity, slightly more densely so on the upper surface than the lower; leaf surfaces visible (with magnification) through the pubescence, the lower surface not glaucous; **petioles** pubescent like the twigs, 1-2 mm long on the first leaves of the season, up to about 1 cm on vigorous shoots; **stipules** 1-7 mm long depending on the vigor of the shoot, glandular on the margins and inner surface, sooner or later deciduous; **staminate aments** 5-15 mm long, expanding with the leaves on leafy flowering branchlets 1-3 mm long; stamens 2; **pistillate aments** (8) 10-20 mm long, expanding with the leaves on leafy flowering branchlets up to 13 mm long; capsules pubescent borne on short stipes usually less than .5 mm long; styles .5-1.0 mm long; floral bracts brown to dark brown, often paler at base, pubescent with long straight or tangled-wavy hairs, persistent.

Identification

Salix commutata, *S. eastwoodiae* and *S. wolfii* are closely related species with generally short stature (commonly about 1 m tall) and obviously hairy, nonglaucous leaves. *Salix commutata* and *Salix wolfii* represent the two extremes in the variation of the group, and thus are easily separated. *Salix eastwoodiae*, however, shares characteristics of both *S. wolfii* and *S. commutata*, and therefore is sometimes confused with both. The three can be confidently identified using the information presented here, although in a few areas where species meet (especially the Cape Horn region) some possibly hybrid individuals are difficult to categorize.

CONSPECTUS

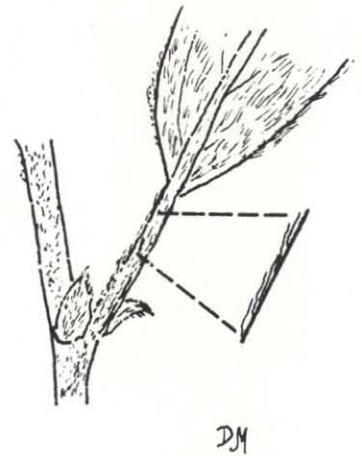
	<i>S. commutata</i>	<i>S. eastwoodiae</i>	<i>S. wolfii</i>
Leaf Margins	Strongly gland-toothed	Moderately gland-toothed (esp. early lvs.)	Entire
Leaf & Petiole pubescence	Spreading-erect	Loosely appressed	Appressed-loosely appressed
Pistillate ament length	3-5 cm (ave. 3)	1.5-4 cm (ave. 2.5-3)	1-2 cm (ave. 1.5)
Flowering branchlets	1-2.5 cm long with well-developed leaves	.8-1.5 cm long with moderately well-developed leaves	.4-1.3 cm long with reduced leaves
Capsule	Glabrous or pubescent	Pubescent	Pubescent
Stipe length	Up to 1.0 mm	Up to 1.5 mm	Less than .5 mm
Style length	.5-1.6 mm	(.4) .7-1.5 (1.9) mm	.5-1.0 mm



S. commutata



S. eastwoodiae



S. wolfii var. *idahoensis*

Salix arctica Pall.

arctic willow

variety *petraea* Anderss.

Synonymy: *Salix anglorum* Cham.

var. *antiplasta* Schneid.

var. *araioclada* Schneid.

Description

Matted shrub 1-5 (8) cm tall, widely spreading by creeping stems at or below ground level; twigs glabrous or with a few scattered long hairs, especially below aments; mature leaf blades green above, glaucous beneath, margins entire or inconspicuously toothed; first leaves of the season glabrous above and sparsely hairy below with long silky hairs; later leaves glabrous from the start, or commonly ciliate with tangled hairs; petioles 1-5 (7) mm long, glabrous or sparsely hairy like the stem; stipules absent or minute and not visible without magnification; aments expanding with or slightly after the leaves on leafy flowering branchlets 5-20 (35) mm long, arising from lateral buds on previous year's twigs ("terminal" buds vegetative); staminate aments 1-2 cm long; stamens 2, filaments glabrous; pistillate aments 1-3 (4) cm long; capsules pubescent, sessile or on stipes up to .5 mm long; styles .5-1.3 (2) mm long; stigmas .4-.5 mm long; floral bracts brown or black, long hairy on both surfaces, persistent (see Conspectus, page 79).

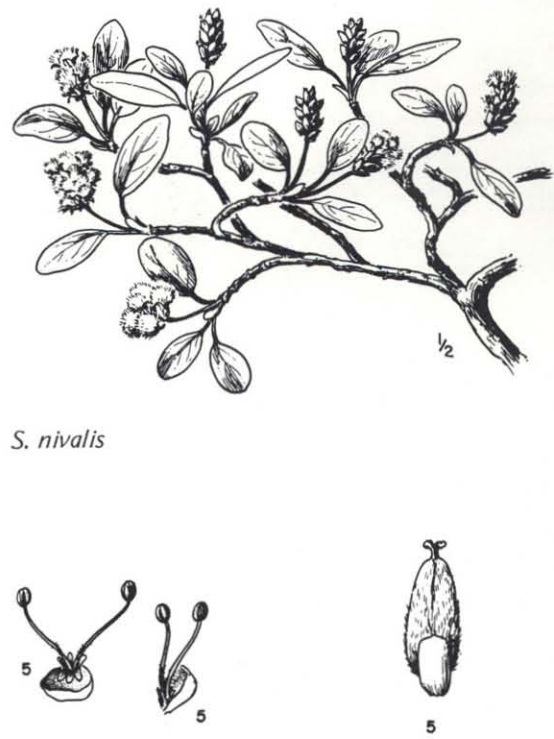
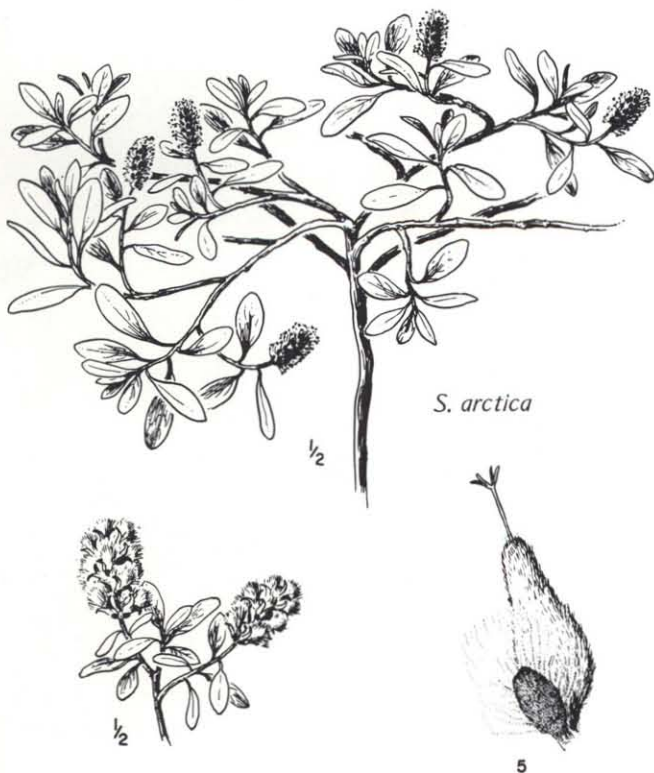
Salix nivalis Hook.

snow willow

Synonymy: *Salix reticulata* L. ssp. *nivalis* (Hook.) Love et al.

Description

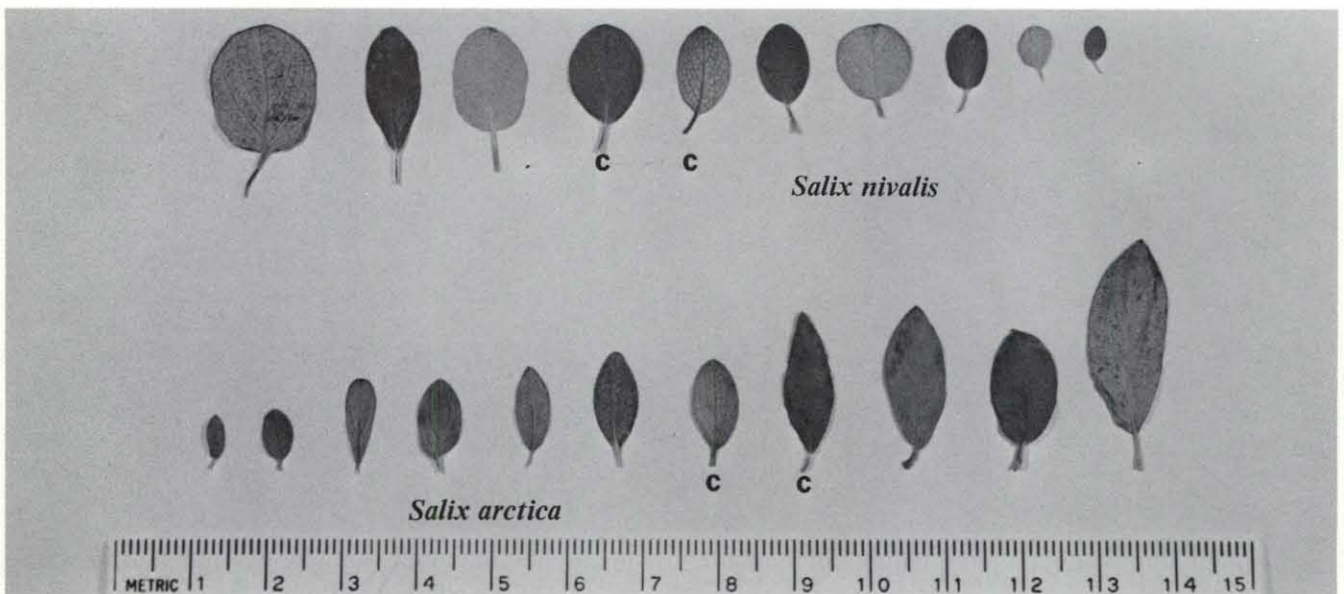
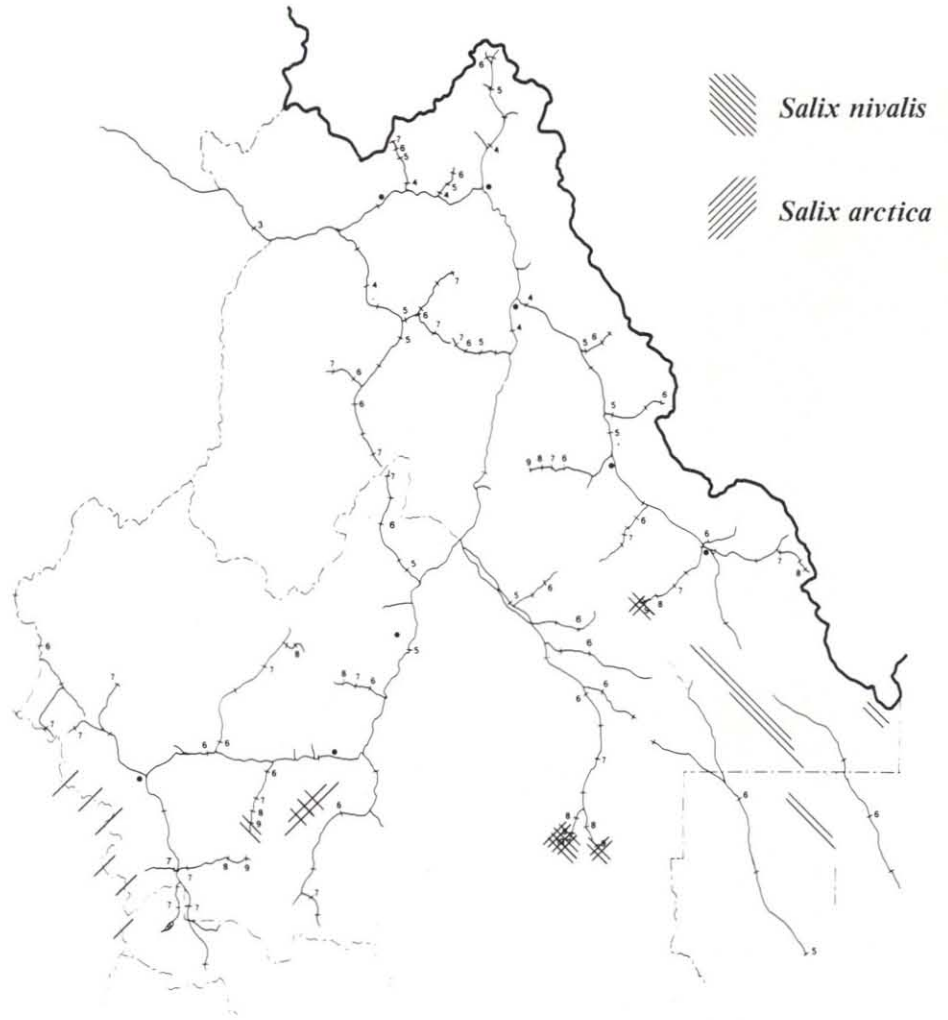
Matted shrub 1-4 (8) cm tall, widely spreading by creeping stems at or below ground level; twigs glabrous, except sparsely hairy just below aments; leaf margins entire; leaf blades green above, strongly glaucous beneath, glabrous from the start or lower surfaces with long, silky, quickly deciduous hairs; petioles 1.5-7 (10) mm long, glabrous or with a few scattered hairs; stipules minute; bud scales persistent (as long as 15 years), sometimes giving stems a scaly appearance (bud scales seldom persist beyond first season in *S. arctica* or any other of our species); aments expanding with or after the leaves on basally leafy flowering branchlets 3-15 (20) mm long, arising from terminal-most buds on previous year's twigs, and occasionally from lateral buds (lateral buds mostly vegetative or all buds on a shoot vegetative); staminate aments 4-8 mm long; stamens 2, filaments hairy at base; pistillate aments 5-10 (12) mm long; capsules pubescent, sessile or on stipes up to .5 mm long; styles .1-.4 mm long; stigmas .2-.4 mm long; floral bracts green to yellow and often tinged with red, glabrous on outer surface, generally finely hairy within and along margins, persistent (see Conspectus, page 79).



Range: *Salix arctica* - circumpolar, in western North America south to California and New Mexico.

Range: *Salix nivalis* - southern British Columbia and Alberta, south to California, Nevada, Utah, and New Mexico

Distribution and Habitat: *Salix arctica* and *S. nivalis* grow in moist places in the alpine zone and also in moist open subalpine habitats just below timberline. Arctic willow is known from scattered locations in the study area, all between 9000 and 10,000 feet (2740 and 3050 m), but is reported as low as 8000 feet (2440 m) in the Sawtooth Mountains (Ball in Davis 1952). Snow willow is more common in our area and is known to range between 8900 and 10,500 feet (2710 and 3200 m) elevation. Common habitats for both species include lake and streamside meadows, seeps, "snowflush" sites associated with melting snowbanks, and various moist microsites in boulderfields and rocky slopes. The species both form dense mats that tend to dominate portions of the habitat. At every known *S. arctica* site, *S. nivalis* was found in close proximity. Though the two often partially intermingled, *S. nivalis* appeared to be more abundant on relatively drier sites. Both species occur on soils with a highly organic surface horizon, but *S. nivalis* is also found on moist, sandy or gravelly soils. The tolerance of snow willow for somewhat drier conditions and more diverse substrates may explain its greater abundance in the study area.



Leaf variation from plants collected in the study area. Specimens show the range from small, early leaves to vigorous late-season leaves. Common mature leaves are denoted by the letter "C".

ALPINE WILLOW CONSPECTUS

	<i>Salix arctica</i>	<i>Salix nivalis</i>
FLORAL		
Ament length		
Staminate	10-20 mm	4-8 mm
Pistillate	10-30 (40) mm	5-10 (12) mm
Floral bract		
Color	Dark-brown to black	Pale-green to yellow
Pubescence	long-hairy on both sides	glabrous on outer surface, fine-hairy within and on margins
Style		
Length	.5-1.3 (2) mm	.1-.4 mm
VEGETATIVE		
Leaf Blade		
Lower surface	Weakly to moderately glaucous, weakly reticulate- veiny	Strongly glaucous, strongly reticulate- veiny
Pubescence	Commonly with ciliate margins at maturity	Essentially glabrous at maturity
Shape	Commonly narrower; tip acute or as in <i>S. nivalis</i> ; gradually tapered to petiole	Broader; obtuse, retuse or rounded at tip; abruptly contracted to petiole

Taxonomy

Identification

Salix arctica and *S. nivalis* both form a low, dense, carpetlike groundcover, sometimes not immediately identified as a willow. The two are so similar in vegetative appearance and habitat that a "hands and knees" examination is generally required to separate them. They are most quickly and surely distinguished by the great difference in the length of both staminate and pistillate aments. They can also be identified with some difficulty using vegetative characteristics.

Taxonomy

Salix arctica from the study area was segregated by Ball (Davis 1952) into a narrow-leaved form (*Salix anglorum* var. *antiplasta*) and a broader-leaved form (var. *araioclada*). Cronquist (Hitchcock et al. 1964), however, considered all of our material to be part of the western cordilleran *S. arctica* var. *petraea*. Though there is some variation in leaf shape in our area, we here follow Cronquist's interpretation. More study of the species' many infraspecific taxa is needed (Dorn 1977).

Salix nivalis has traditionally been treated as a species of the western cordillera, closely related to the circumpolar species *S. reticulata* (Rydberg 1917, Ball in Davis 1952, Cronquist in Hitchcock et al. 1964). More recently Dorn (1977) chose subspecific rank for our plants (*S. reticulata* ssp. *nivalis*) on the basis of their lack of differentiation in chromosome number, flavonoid chemistry and (in many plants) morphology. Until more information becomes available, we somewhat reluctantly follow the taxonomic consensus (including George Argus (Dorn 1976)).

Two varieties of *S. nivalis* have been recognized for our area (Ball in Davis 1952, Cronquist in Hitchcock et al. 1964): var. *nivalis* with 7-15 mm long leaves and small pistillate aments less than 1 cm long and with 12 or fewer fruits; and var. *saximontana* with larger leaves, the better developed ones 15-30 (35) mm long, and sometimes larger aments up to 2 cm long with up to 25 fruits.

Most of our material clearly belongs to var. *nivalis*, but somewhat larger-leaved plants approaching var. *saximontana* are encountered, often mixed with var. *nivalis*. There appears to be little variation in ament size in our region. We do not consider study area plants with slightly larger leaves to be varietally distinct. More study is needed, especially testing the response of leaves to varying environments.

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GLOSSARY

Definitions are specific to the use of the terms in this field guide. See also Fig. 3, page 7, and Terminology, page 8.

Acuminate - gradually tapering, pointed leaf tip

Ament - a dense, elongate cluster of numerous, small, unisexual reduced flowers; a catkin; see pistillate and staminate

Autecology - the ecology of the individual plant

Bract - a reduced leaf below an ament on a flowering branchlet; see floral bract

Catkin - see ament

Ciliate - fringed with hairs on the margin

Deciduous - falling off after completion of normal function or after a certain season or stage of growth

Entire (leaf margin) - without teeth or glands on the edge of the leaf

Floral bract - the small, nongreen structure associated with each flower in an ament; sometimes called a scale

Flowering branchlet - a short to long, sometimes leafy stem that bears an ament at its tip

Forb - a broadleaved, herbaceous plant

Glabrous - without hairs or glands, not pubescent

Glaucous - covered with a removable, waxy layer that gives a whitish cast to the surface

Graminoid - any grass-like plant including grasses, sedges, rushes, etc.

Leaf blade - the expanded portion of the leaf

Mesic - moderately moist, neither very wet nor very dry

Petiole - a leaf stalk

Pistil - the female part of a flower, generally differentiated into ovary, style and stigma

Pistillate - a female ament or plant, i.e. one with pistils but no stamens

Pubescent - having hairs of any kind

Sessile - attached directly by the base, without a stalk

Stamen - the male part of a flower, divided into anther and filament

Staminate - a male ament or plant, i.e. one with stamens but no pistils

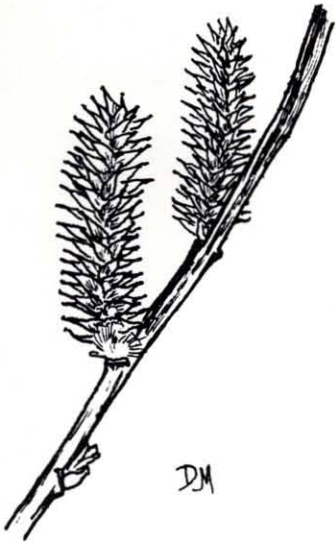
Stipe - the stalk that pistils are borne on in many willow species; sometimes called a pedicel

Synecology - ecology of communities of plants

Taxon (plural taxa) - any taxonomic entity of whatever rank, e.g. genus, species, subspecies, variety.

Tomentose - covered with tangled, or matted, wooly hairs

NOTES





1— *Salix alba* var. *calva*: cultivated in vicinity of Salmon, Idaho.



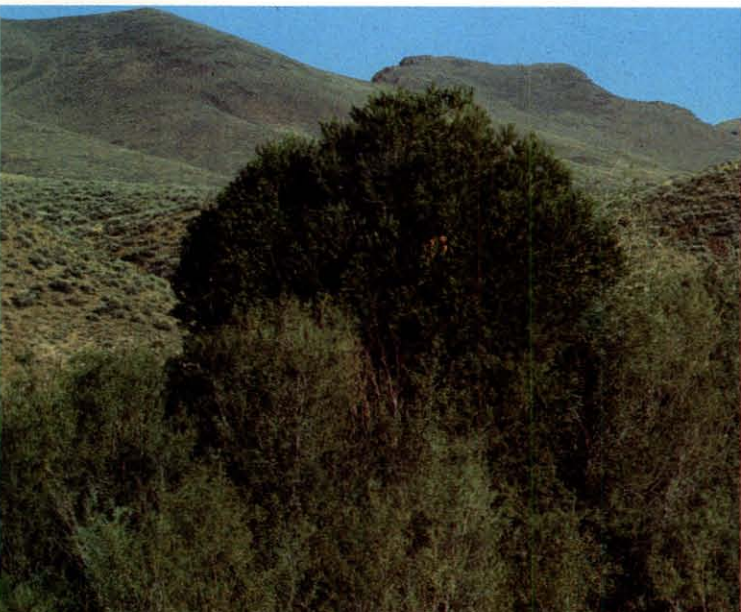
2— *Salix lasiandra* var. *caudata*: pistillate ament with capsules shedding seeds.



3— *Salix lasiandra* var. *caudata*: pistillate aments on leafy flowering branchlets; glabrous capsules on long stipes; floral bracts deciduous.



4— *Salix lasiandra* var. *caudata*: staminate aments on leafy flowering branchlets; flowers with 3 to 5 stamens (unique in our area).



5— *Salix lasiandra* var. *caudata* surrounded by *Salix exigua* ssp. *exigua* near Challis, Idaho (See Photos 55–60, 62, 64).



6— *Salix exigua* ssp. *exigua*: staminate aments on long, leafy branchlets; note unique clustering of aments at left; flowers with 2 stamens.



7— *Salix exigua* ssp. *melanopsis* var. *tenerrima*: leaves glabrous and not glaucous; twigs glabrous.



8— *Salix exigua* ssp. *melanopsis*: leaves pubescent, glaucous beneath; illustrates pubescent phase (var. *bolanderiana*); Napias Creek.



9— *Salix exigua* ssp. *melanopsis* var. *tenerrima* (left) and ssp. *exigua* (right) growing together on Spring Bar above Shoup on Salmon River.



10— *Salix lutea*: typical form; Salmon River bottomland near Challis (See Photos 55–60).



11— *Salix lutea*: glabrous capsules on long stipes; dark floral bracts; leafy flowering branchlets.



12— *Salix lutea*: essentially glabrous leaves, glaucous beneath.



13— *Salix pseudomonticola*: sessile pistillate aments expanded before leaves on previous season twigs; capsules glabrous.



14— *Salix pseudomonticola*: leaves finely toothed, glaucous beneath; Birch Creek population.



15— *Salix bebbiana*: pistillate aments on leafy flowering branchlets; long-beaked, pubescent capsules borne on long stipes.



16— *Salix bebbiana*: red, pubescent twigs without a "skunky" odor (when crushed); apex of leaves acute (See Photo 58).



17— *Salix scouleriana*: green twigs with a "skunky" odor (when crushed); apex of leaves obtuse or rounded (See Photo 65).



18— *Salix scouleriana*: mature pistillate ament on short leafless branchlet; beaked, pubescent capsules on short stipes.



19— *Salix boothii*: staminate ament; leaves green and essentially glabrous on both surfaces, margins finely toothed.



20— *Salix boothii*: pistillate ament on short, leafy flowering branchlet (See Photos 45, 60–64, 66).



21— *Salix brachycarpa*: leaves pubescent on both surfaces, glaucous below; twigs pubescent; (some leaves withering on flowering branchlets).



22— *Salix brachycarpa* (center) with *Potentilla fruticosa*; *Betula occidentalis* dominant behind; Summit Ck., Little Lost R. (See Photo 70).



23— *Salix candida*: leaves longer and narrower than *S. brachycarpa*, but pistillate aments very similar.



24— *Salix candida*: leaves with dense, white tomentum below, virtually glabrous above; twigs white-tomentose (See Photo 68).



25— *Salix geyeriana*: twigs glaucous; leaves pubescent above, glaucous below.



26— *Salix geyeriana*: short pistillate aments on leafy flowering branchlets.



27— *Salix geyeriana*: typical form; 4.5 m tall; 5900 ft. elevation, Morgan Creek (See Photos 60–64)



28— *Salix lemmonii*: typical form; 2.5 m tall; 6800 ft. elevation, Moccasin Creek, Panther Creek drainage (See Photo 69).



29— *Salix lemmonii*: leaves glabrous above, glaucous below.



30— *Salix lemmonii*: twigs glaucous; pistillate aments longer than *S. geyeriana*.



31— *Salix drummondiana*: vigorous vegetative shoots; twigs glaucous; leaves with silver-velvety pubescence beneath.



32— *Salix drummondiana*: sessile pistillate ament with pubescent capsules; glaucous twig (See Photos 64, 66).



33— *Salix planifolia* var. *monica*: short-statured form (<1 m); sessile pistillate aments with pubescent capsules.



34— *Salix planifolia* var. *monica*: leaves shiny green above, glaucous beneath (See Photos 68, 69, 71).



35— *Salix planifolia* var. *planifolia*: tall form (2-4 m); sessile pistillate aments with pubescent capsules; Lemhi River, near Leadore.



36— *Salix planifolia* var. *planifolia*; leaves shiny green above, glaucous beneath.



37— *Salix barclayi*: pistillate ament on long, leafy flowering branchlet; leaves glaucous beneath.



38— *Salix barclayi*: leaves finely toothed; capsules glabrous (See Photo 67).



39— *Salix farriae*: plant about 1 m tall; subalpine seep, Slate Creek population (See Photo 70).



40— *Salix farriae*: leaves glabrous, lower surface glaucous, margins entire; pistillate ament on short leafy flowering branchlet.



41— *Salix tweedyi*: leaves broad; spreading pubescence on petioles and twigs; large stipules (See Photo 71).



42— *Salix tweedyi*: pistillate ament terminal on previous year twig (bottom).



43— *Salix wolfii*: leaves entire, covered with silvery pubescence on both surfaces. (See Photos 67, 69).



44— *Salix wolfii*: flowering branchlets short, with small leaves; capsules pubescent.



45— *Salix wolfii*: typical form, low and silvery; *Salix boothii* (green) on right of photo; West Fork Pahsimeroi River.



46— *Salix eastwoodiae*: leaves finely toothed, slightly broader than *Salix wolfii* (See Photo 71).



47— *Salix eastwoodiae*: leaves with loosely appressed, silvery pubescence on both surfaces.



48— *Salix commutata*: (center) in bloom, leaves not expanded; 1 m tall; China Springs, Salmon River Mountains.