



Theses and Dissertations

---

1961-06-01

## Classification and distribution of the native trees of Utah

Kimball Steward Erdmann  
*Brigham Young University - Provo*

Follow this and additional works at: <https://scholarsarchive.byu.edu/etd>

---

### BYU ScholarsArchive Citation

Erdmann, Kimball Steward, "Classification and distribution of the native trees of Utah" (1961). *Theses and Dissertations*. 8047.

<https://scholarsarchive.byu.edu/etd/8047>

This Thesis is brought to you for free and open access by BYU ScholarsArchive. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of BYU ScholarsArchive. For more information, please contact [scholarsarchive@byu.edu](mailto:scholarsarchive@byu.edu), [ellen\\_amatangelo@byu.edu](mailto:ellen_amatangelo@byu.edu).

380/2  
Ex 28

CLASSIFICATION AND DISTRIBUTION  
OF THE NATIVE TREES OF UTAH

A Thesis  
Submitted to the  
Department of Botany  
Brigham Young University  
Provo, Utah

In Partial Fulfillment  
of the Requirements for the Degree  
Master of Science

by  
Kimball S. Erdman  
June, 1961.

This thesis, by Kimball S. Erdman, is accepted in its present form by the Department of Botany of Brigham Young University as satisfying the thesis requirement for the degree of Master of Science.

## ACKNOWLEDGMENTS

The author would first like to extend his gratitude to Dr. W. P. Cottam of the University of Utah for his counsel and permission to examine specimens of the herbarium, and to Prof. A. H. Holmgren of Utah State University for his assistance and permission to study the specimens at that herbarium, and to the Regional Forest Service Office at Ogden for access to the plant collections there.

For the sake of time and convenience, the author restricted most of his citations of representative specimens to either those collected by himself or located in the Brigham Young University herbarium. The author would like to express at this time his appreciation to those curators of herbaria and collectors of the state whose work has made this study possible.

The author would like to express special gratitude to Dr. B. F. Harrison whose advice and counsel, and criticism of the thesis manuscript has been invaluable. The author is also very grateful to Mrs. Harrison who has done such an excellent job in typing and preparing this manuscript for publication.

The author would also like to extend his appreciation to Dr. K. H. McKnight, Dr. S. L. Welsh, Dr. E. M. Christensen, and Dr. A. O. Chapman for their helpful suggestions and criticisms of portions of the text.

TABLE OF CONTENTS

	Page
LIST OF PLATES . . . . .	vi
LIST OF ILLUSTRATIONS . . . . .	ix
Chapter	
I. INTRODUCTION AND REVIEW OF LITERATURE . . . . .	1
II. PROCEDURE . . . . .	4
III. DESCRIPTIONS AND KEYS . . . . .	6
Key to the Genera of Trees of Utah . . . . .	6
Pinus . . . . .	9
Picea . . . . .	31
Pseudotsuga . . . . .	39
Abies . . . . .	44
Juniperus . . . . .	51
Yucca . . . . .	59
Populus . . . . .	62
Salix . . . . .	75
Ostrya . . . . .	91
Betula . . . . .	94
Alnus . . . . .	97
Quercus . . . . .	101
Celtis . . . . .	110
Ribes . . . . .	114
Sorbus . . . . .	117

	Page
Amelanchier . . . . .	120
Crataegus . . . . .	129
Peraphyllum . . . . .	134
Purshia . . . . .	137
Cowania . . . . .	141
Cercocarpus . . . . .	144
Prunus . . . . .	152
Acacia . . . . .	158
Prosopis . . . . .	161
Cercis . . . . .	168
Robinia . . . . .	171
Rhus . . . . .	174
Acer . . . . .	180
Rhamnus . . . . .	190
Tamarix . . . . .	194
Cornus . . . . .	197
Fraxinus . . . . .	200
Chilopsis . . . . .	206
Sambucus . . . . .	209
IV. CONCLUSION . . . . .	213
LIST OF REFERENCES . . . . .	216

LIST OF PLATES

Plate		Page
I.	<i>Pinus monophylla</i> Torr. & Frem.	11
II.	<i>Pinus edulis</i> Engelm.	13
× III.	<i>Pinus aristata</i> Engelm.	17
× IV.	<i>Pinus flexilis</i> James	21
× V.	<i>Pinus ponderosa</i> Dougl.	25
VI.	<i>Pinus contorta</i> Dougl.	30
× VII.	<i>Picea engelmanni</i> (Parry) Engelm.	34
× VIII.	<i>Picea pungens</i> Engelm.	38
× IX.	<i>Pseudotsuga menziesii</i> (Mird.) Franco	43
× X.	<i>Abies concolor</i> (Gord. & Glend.) Hoopes	46
× XI.	<i>Abies lasiocarpa</i> (Hook.) Nutt.	50
× XII.	<i>Juniperus monosperma</i> (Engelm.) Sarg.	52
× XIII.	<i>Juniperus osteosperma</i> (Torr.) Little	55
XIV.	<i>Juniperus scopulorum</i> Sarg.	58
XV.	<i>Yucca brevifolia</i> Engelm.	61
× XVI.	<i>Populus angustifolia</i> James	65
× XVII.	<i>Populus fremontii</i> S. Wats.	68
× XVIII.	<i>Populus tremuloides</i> Michx.	74
× XIX.	<i>Salix scouleriana</i> Barratt	78
× XX.	<i>Salix bebbiana</i> Sarg.	80
XXI.	<i>Salix laevigata</i> Bebb.	83

Plate	Page
* XXII. <i>Salix gooddingii</i> Ball	85
* XXIII. <i>Salix amygdaloides</i> Anders.	88
* XXIV. <i>Salix lasiandra</i> Benth.	90
XXV. <i>Ostrya knowltonii</i> Cov.	93
XXVI. <i>Betula occidentalis</i> Hook.	96
XXVII. <i>Alnus tenuifolia</i> Nutt.	100
XXVIII. <i>Quercus turbinella</i> Greene	103
XXIX. <i>Quercus gambelii</i> Nutt.	107
XXX. <i>Celtis reticulata</i> Torr.	113
XXXI. <i>Ribes aureum</i> Pursh	116
XXXII. <i>Sorbus scopulina</i> Greene	119
XXXIII. <i>Amelanchier utahensis</i> Koehne	124
XXXIV. <i>Amelanchier alnifolia</i> Nutt.	128
XXXV. <i>Crataegus rivularis</i> Nutt.	130
XXXVI. <i>Crataegus succulenta</i> Schrad.	133
XXXVII. <i>Peraphyllum ramosissimum</i> Nutt.	136
XXXVIII. <i>Purshia tridentata</i> (Pursh) DC.	140
XXIX. <i>Cowania stansburiana</i> Torr.	143
XL. <i>Cercocarpus ledifolius</i> Nutt.	146
XLI. <i>Cercocarpus intricatus</i> S. Wats.	148
XLII. <i>Cercocarpus montanus</i> Raf.	151
XLIII. <i>Prunus fasciculata</i> (Torr.) Gray	154
XLIV. <i>Prunus virginiana</i> L.	157
XLV. <i>Acacia greggii</i> A. Gray	160
XLVI. <i>Prosopis juliflora</i> (Swartz) DC.	164



Plate	Page
XLVII. <i>Prosopis pubescens</i> Benth.	167
XLVIII. <i>Cercis occidentalis</i> Torr.	170
XLIX. <i>Robinia neomexicana</i> A. Gray	173
L. <i>Rhus trilobata</i> Nutt.	176
LI. <i>Rhus glabra</i> L.	179
× LII. <i>Acer grandidentatum</i> Nutt.	182
× LIII. <i>Acer glabrum</i> Torr.	185
× LIV. <i>Acer negundo</i> L.	189
LV. <i>Rhamnus betulaefolia</i> Greene	193
LVI. <i>Tamarix</i> sp.	196
LVII. <i>Cornus stolonifera</i> Michx.	199
LVIII. <i>Fraxinus anomala</i> Torr.	202
LIX. <i>Fraxinus velutina</i> Torr.	205
LX. <i>Chilopsis linearis</i> (Cav.) Sweet	208
LXI. <i>Sambucus caerulea</i> Raf.	212

61 species

## LIST OF ILLUSTRATIONS

Fig.		Page
1.	<i>Populus angustifolia</i>	63
2.	<i>Salix scouleriana</i>	76
3.	<i>Salix bebbiana</i>	79
4.	<i>Salix laevigata</i>	81
5.	<i>Salix gooddingii</i>	84
6.	<i>Salix amygdaloides</i>	86
7.	<i>Ostrya knowltonii</i>	91
8.	<i>Quercus turbinella</i>	102
9.	<i>Quercus gambelii</i>	105
10.	<i>Celtis reticulata</i>	110
11.	<i>Sorbus scopulina</i>	117
12.	<i>Amelanchier utahensis</i>	122
13.	<i>Amelanchier alnifolia</i>	125
14.	<i>Peraphyllum ramosissimum</i>	134
15.	<i>Purshia tridentata</i> showing one leaf enlarged	137
16.	<i>Cowania stansburiana</i> showing one leaf enlarged	141
17.	<i>Cercocarpus ledifolius</i>	145
18.	<i>Cercocarpus intricatus</i> showing one leaf enlarged	147
19.	<i>Cercocarpus montanus</i>	149
20.	<i>Prunus fasciculata</i>	153
21.	<i>Prosopis juliflora</i>	162

Fig.		Page
22.	<i>Prosopis pubescens</i>	165
23.	<i>Cercis occidentalis</i>	168
24.	<i>Rhus trilobata</i>	175
25.	<i>Rhus glabra</i>	177
26.	<i>Acer grandidentatum</i>	181
27.	<i>Acer glabrum</i>	183
28.	<i>Rhamnus betulaefolia</i>	191
29.	<i>Cornus stolonifera</i>	197
30.	<i>Fraxinus anomala</i>	200
31.	<i>Chilopsis linearis</i>	206
32.	<i>Sambucus caerulea</i>	209

## INTRODUCTION

It is estimated that trees cover over one-third of the land surface of the state of Utah. The trees are generally restricted to the higher plateaus and mountain regions, the lower valleys and plateaus usually supporting only small shrubs or herbaceous plants.

Although a considerable amount of information has already been accumulated on the trees of the state, there is no single study which integrates these data into a unified treatment. This thesis is an attempt to consolidate the known information on the trees of Utah, to extend our knowledge and understanding of these plants, and to determine more accurately the distribution of each species.

Limited discussions of the tree species of Utah have appeared in various works on the flora of the Intermountain region. Rydberg (1922) gave a very brief taxonomic description and general distribution of each species. Tidestrom (1924) limited his treatment of the taxonomic features of the species to the characteristics given in the keys. Sargent (1933) presented a more elaborate and detailed discussion. He described and illustrated many of the trees which are native to the state. Preston (1940) discussed the trees of the Rocky Mountains on much the same level as Sargent except that he included distribu-

tion maps. Peattie (1953) gave a popular account of the trees of the Western States including much of the lore associated with the various trees. Harlow and Harrar (1958) discussed trees of considerable economic importance in the United States and illustrated their work with photographs and maps.

There have been several studies of the vegetation of portions of Utah which include some descriptions of the trees of the area. Among these are Graham's (1937) study of the Uinta Basin, Stanton's (1931) work on the ecology and floristics of the Henry Mountains, Woodbury's (1933) paper on the biotic communities of Zion National Park, McMillan's (1948) study of the floristics and ecology of the Deep Creek Mountains, Preece's (1950) work on the plant communities of the Raft River Mountains, and Burke's (1934) study of the plants of the Wellsville Range. Recently Woodbury and others (1959) have described in detail the vegetation of the Glen Canyon Reservoir site.

Reimschiessel (1951) made a study of the ornamental deciduous trees of Utah and considered many native trees now used in cultivation. Saul (1955) discussed many of the trees and shrubs of Utah in terms of stem anatomy. Miner (1929) described the winter condition of many Utah trees.

Certain groups of trees or individual species have been treated in separate papers. Sudworth (1915, 1916, 1917, 1918, 1934) published several bulletins on the species of conifers and the Salicaceae of the Rocky Mountains. His descriptions are detailed and comprehensive. He also included extensive maps and drawings. Weight (1928) described the taxonomy and ecology

of the willows of Utah County. Bennion (1960) outlined some of the taxonomic problems of various Utah poplars. Thomas (1957) described introgression between *Purshia* and *Cowania* and Cline (1959) discussed the root systems and ecology of these genera. Christensen (1949, 1955), Cottam (1959), and Tucker (1960, 1961) have all treated various species of the oaks of Utah.

## PROCEDURE

The area considered in this study is that within the political boundaries of Utah. Only those species which are native to this area or which are very commonly naturalized are considered. The term tree has been interpreted liberally and includes all woody plants which exceed ten feet in height, two inches in diameter, and have a well-defined stem and crown. There are many plants in Utah which are usually smaller than these standards but which occasionally are of tree size and form. These are also included in this work.

The author first drew up a list of probable species of trees in Utah from the various floras of the intermountain region and from the Brigham Young University herbarium. This served as a preliminary working list of species.

Field work was begun during the summer of 1959 when several local field trips were made. In the spring and summer of 1960 the author did extensive field work in central and southern Utah and in the Uinta Mountains.

A study was made of the tree specimens in the herbaria of the University of Utah, Utah State University, Brigham Young University, and the Regional Office of the United States Forest Service in Ogden. All specimens examined were recorded. Later preliminary maps were constructed using different symbols to represent specimens from each herbaria and from published col-

lections (Graham 1937). The author has also cited up to six representative specimens in each species discussion. The abbreviations used here are BRU (Brigham Young University), UT (University of Utah), and UTC (Utah State University).

An intensive search of the published descriptions and notes was carried on to supplement the information gained from the herbarium and fresh specimens.

The author illustrated details of taxonomic importance of many of the trees. These were drawn at life size and reduced by one-half. A scale of one centimeter was included with each.



DESCRIPTIONS AND KEYS

Key to the Genera of Trees of Utah

	Page
1. Leaves persistent, needle-like or scale-like, seeds not enclosed in an ovary but born nakedly in cones.	
2. Leaves scale-like, less than 1 cm. long, cones berry-like . . . . . JUNIPERUS	51
2. Leaves needle-like, more than 1 cm. long, cones not berry-like.	
3. Leaves born in fascicles of 2-5 or rarely single, base of leaves enclosed by a sheath, cone scales thickened . . . . . PINUS	9
3. Leaves born singly, without a basal sheath, cone scales not greatly thickened.	
4. Leaves 4-angled, sharp-pointed, very stiff, the bases of the leaves remaining as woody sterigmata on the branches . . PICEA	31
4. Leaves flattened, blunt, flexible, leaf base not persistent.	
5. Leaves sessile, leaf scars round, conspicuous, cones erect, scales deciduous . . . . . ABIES	44
5. Leaves petiolate, leaf scars elliptical, inconspicuous, cones pendant, scales persistent, bract 3-pointed, exserted . . . . . PSEUDOTSUGA	39
1. Leaves persistent or deciduous, usually broad and flat, seeds enclosed in an ovary.	
2. Flower parts in threes, stem not differentiated into bark, wood, and pith, leaves bayonet-like, parallel-veined . . . . . YUCCA	59
2. Flower parts in fours or fives, stem differentiated into bark, wood, and pith, leaves netted veined.	
3. Flowers with petals lacking.	
4. Flowers in catkins or catkin-like spikes.	
5. Plants dioecious, pistil of 2 united carpels forming a many-seeded dehiscent capsule, seeds hairy.	
6. Floral bracts irregularly incised at the apex, glandular, buds resinous with several scales . . POPULUS	62
6. Floral bracts entire, without glands, buds not resinous, covered by a single scale . . . . . SALIX	75
5. Plants monoecious, pistil of 1 to several united carpels, fruit an acorn or nutlet, seeds not hairy.	

6. Pistillate flowers in catkins, styles 2, ovary 3-celled, fruit a nutlet.
7. Sepals absent in the staminate flowers, present in the pistillate flowers, nutlets wingless, inclosed in a large papery bract . . . . . OSTRYA 91
7. Sepals present in staminate flowers, absent in the pistillate flowers, nutlets winged or thin-edged, bracts not large and papery.
8. Pistillate catkins solitary, bracts thin, deciduous, with or soon after the nutlets . . . . . BETULA 94
8. Pistillate catkins several in raceme-like clusters, bracts becoming thick and woody, persistent until the following season . . . . . ALNUS 97
6. Pistillate flowers solitary or clustered, not in catkins, 1-celled, 3-carpellate, fruit an acorn partly enveloped by thickened scales . . . QUERCUS 101
- ④ Flowers not born in catkins or catkin-like spikes.
5. Stamens many, fruit an achene with persistent elongate, plumose style, flowers perfect . . . . . CERCOCARPUS ✓ 144
5. Stamens not more than 10, fruit a samara or drupe.
6. Fruit a drupe, leaves alternate, simple . . . . . CELTIS 110
6. Fruit a samara, leaves opposite, often compound.
7. Fruit a two-winged samara, sepals 5, stamens 4-12 . . . . . ACER 180
7. Fruit a single-winged samara, sepals 4 or absent, stamens 2, or rarely 3-4 . . . . . FRAXINUS 200
- ③ Flowers with petals present.
- ④ Petals separate.
- ⑤ Ovary inferior.
6. Leaves alternate, petals and sepals 5.
7. Hypanthium longer than the sepals, narrow and tubular, brightly colored . . . . . RIBES 114
7. Hypanthium not longer than the sepals, cup-shaped, green.
8. Leaves pinnately compound, flowers small, born in broad, many-flowered, compound cymes . . . . . SORBUS ✓ 117

8. Leaves simple, flowers born in racemes or small cymes.
9. Twigs armed with long spines, cells in ovary equalling the number of styles . . . . . CRATAEGUS ✓ 129
9. Twigs not armed, cells of ovary twice as many as the number of styles.
10. Styles 3-5, rarely 2, ovary 3-5-carpellate . . . . . AMELANCHIER ✓ 120
10. Styles 2, ovary 2-carpellate . . . . . PERAPHYLLUM 134
6. Leaves opposite, petals and sepals 4, or rarely 5 . . . . . CORNUS 197
- ⑤. Ovary superior.
6. Flowers decidedly irregular, fruit a legume.
7. Leaves simple, orbicular, twigs unarmed, uppermost petal internal in bud, enveloped by the lateral ones . . . . . CERCIS ✓ 168
7. Leaves pinnately compound, twigs armed with spines, uppermost petal external in bud . . . . . ROBINIA ✓ 171
- ⑥. Flowers regular or nearly so.
7. Leaves pinnately twice compound, fruit a legume, branches armed with spines.
8. Stamens numerous, spines curved . . . . . ACACIA 158
8. Stamens 10 or fewer, spines straight . . . . . PROSOPIS 161
7. Leaves simple or once compound, fruit not a legume.
8. Leaves scale-like, less than 2 mm. long . . . . . TAMARIX 194
8. Leaves not scale-like, at least 5 mm. long, mostly much longer.
- ⑨. Flowers showy, perigynous, hypanthium well-developed, stamens many.
10. Carpel solitary, fruit a drupe, leaves entire or finely serrate . . . . . PRUNUS ✓ 152
- ⑩. Carpels more than one, or if one fruit an achene, leaves lobed or dentate.
- ⑪. Style greatly elongated in fruit, pistils several, leaves with lateral lobes . . . . . COWANIA ✓ 141

- 11. Style beak-like, stout, pistil solitary or rarely 2-3, leaves terminally dentate . . . PURSHIA 137
- 9. Flowers inconspicuous, hypogynous, stamens not more than 10.
  - 10. Leaves and branches opposite, fruit a samara . . . . . ACER 180
  - 10. Leaves alternate, fruit a drupe.
    - 11. Styles 3, leaves compound or if simple palmately veined . . . RHUS 174
    - 11. Styles 1, leaves simple, pinnate . RHAMNUS 190
- 4. Petals united.
  - 5. Flowers irregular, ovary superior, fruit a capsule, leaves simple . . . CHILOPSIS 206
  - 5. Flowers regular, ovary inferior, fruit a berry, leaves compound . . . . SAMBUCUS 209

Description of the Genus and Key  
to the Species of Pinus

Trees usually with straight, unbranched, cylindrical trunks (except for pinyon pines), branches whorled. Buds covered by overlapping scales with papery or fringed margins. Leaves persistent, needle-like, born in fascicles or bundles of 1-5, base enclosed by sheath; usually several lines of stomata on each surface of the needle. Trees monoecious; male cone with spirally arranged sessile pollen sacs, yellow to scarlet; female cones with numerous spirally arranged, 2-ovuled scales, each subtended by a small bract. Cones usually pendant, woody, umbo thickened or armed with a prickle. Seeds 2 per scale, wing small, papery or absent.

The cones usually mature in August to October of the second year. Good seed crops occur at irregular intervals every 2-5 years. The seeds are a favorite food of rodents such as mice, squirrels and of birds. Although these animals help in dispersal of the seed, great quantities are consumed and in poor years few are left to germinate.

Although all the pines in Utah are used for fence posts and fuel, the pinyon pines are the choicest of fireplace wood. The pinyon pines are also famous for their edible nuts. Only two Utah species, *P. Ponderosa* and *P. contorta* are used for lumber. All the pines are important in watershed management.

Key to the species of Pinus.

- 1. Leaves cylindric, born singly. . . . . P. monophylla
- 1. Leaves flattened or concave, born in fascicles of 2-5.
  - 2. Leaves born in fascicles of 5.
    - 3. Leaves usually tightly recurved towards the apex, branches and leaves with a foxtail appearance, branches often drooping, cones with prickles  
 . . . . . P. aristata
    - 3. Leaves usually straight, divergent, branches often ascending, cone without prickles  
 . . . . . P. flexilis
  - 2. Leaves born in fascicles of 2-3.
    - 3. Leaves born in fascicles of 3 but occasionally 2, 12-25 cm. long . . . . . P. ponderosa
    - 3. Leaves born in fascicles of 2 or occasionally 1, less than 9 cm. long.
      - 4. Leaves deeply concave on inner surface, stiff, sharp, straight to slightly curved, less than 4 cm. long, occasionally single, bundle sheath deciduous . . . . . P. edulis
      - 4. Leaves flexible, blunt, often twisted, 5-9 cm. long, never single, bundle sheath persistent  
 . . . . . P. contorta

*Pinus monophylla* Torr. & Frem. Singleleaf pinyon

*P. cembroides* var. *monophylla* (Torr. & Frem.) Voss, *Caryopitys monophylla* (Torr. & Frem.) Rydb.

Small tree up to 12-15 m. tall; trunk up to .3 m. in diameter, short, stocky, often bent and gnarled, occasionally divided near the ground; crown broad, flat or somewhat rounded; branches heavy, stout, bent and twisted. Twigs dull gray, smooth. Bark on trunks 2.5 cm. thick, dark reddish-brown, furrowed, ridges covered by small scales. Wood 35-37 lbs. per cubic ft., dry weight; rather soft, very brittle, narrow-ringed; sapwood thick, white; heartwood pale yellow-brown. Leaves usually persistent from 3-12 years, born singly, stiff, cylindrical, curved, 3.5-5.5 cm. long, sharp-pointed, yellow-green to gray-green. Female cones short-stalked, born in clusters; mature cones short-oblong, 3.5-6.5 cm. long, brown; scales concave, knobbed at apex, only middle scales bearing seeds. Seeds oval, 2 cm. long, thin-shelled, dark chocolate-brown with dull yellowish areas; wings rudimentary, 6.5-12 mm. long, attached to scale; kernel sweet and oily, edible.

Reproduction:

The seeds are dispersed by animals, gravity and cloudbursts. Germination occurs best when the seeds are in loose exposed soil.

The seedling has 7-10 cotyledons. These are soon succeeded by the primary leaves. Adult foliage is not produced until 6-7 years later. This is an exceedingly slow growing tree and reaches maturity in 100-250 years. (Sudworth 1917.)

Distribution:

Pinus monophylla extends from Southern Idaho through Utah and Nevada to California. In Utah it is found principally in the Great Basin.

Ecology:

This pinyon pine forms vast open forests on arid mountain slopes and mesas from 2,000 to 7,000 ft. Although it often forms pure stands, it is commonly associated with juniper and mountain mahogany, oak and other xeric trees and shrubs. It is intolerant of shade as an adult, but the seedlings thrive in conditions of partial shading. (Harrington 1954, Sudworth 1917.)

Representative specimens:

(BRU) Boxelder Co., Raft River Mtns., Cottam 2953, June 6, 1923; Juab Co., Mammoth, Diehl; Kane Co., Paria, Harrison 12055, May 11, 1953; Tooele Co., Topliff, Harrison 7227, Apr. 15, 1934; Washington Co., Zion NP, Erdman 44, May 11, 1960; Washington Co., Gunlock, Erdman 77, May 11, 1960.

*Pinus edulis* Engelm.

Pinyon pine

*P. cembroides* var. *edulis* (Engelm.) Voss, *P. monophylla* var. *tenuis* Tidestr., *Caryopitys edulis* (Engelm.) Small.

Small tree to 12 m.; trunks .3-.6 m. in diameter under best conditions, short, straight or crooked and gnarled, moderately tapering; crown rounded but flat-topped, open; branches few, large, crooked. Twigs gray, smooth except for numerous leaf scars and lenticels. Bark 1-3 cm. thick, reddish-brown, shallowly and irregularly furrowed, ridges broken into small scales. Wood 40 lbs. per cubic ft. dry weight, heaviest of all Rocky Mtn. pines; hard and brittle, very resinous; sapwood thin, white; heartwood light brown. Leaves persistent 3-9 years, born in fascicles of 2, or occasionally 1, stout, incurved, 2-4 cm.

long, sharp-pointed, margins entire, inner surface concave, outer surface convex; yellow-green, inner faces whitened with lines of stomata, outer surface with three rows of stomata. Female cones short-stalked, born at the ends of twigs; ovoid to globose, 2.5-5 cm. long, yellowish-brown. Seeds oval, 1-2 cm. long, shell thin, dull red-brown on one side, yellowish and mottled on the other; wings 3-4 mm. long, remain attached to the scales; kernel sweet and oily, edible.

#### Reproduction:

The seeds germinate best when washed into debris and soils and partially buried. Few if any germinate on the surface of the ground. (Harlow & Harrar 1958, Sudworth 1917.) The seedlings have 8-10 large spreading cotyledons. These wither rapidly and are replaced by primary needles. (Bates 1925.) The optimum temperature for seedling growth is 70° F. Hotter temperatures weaken the seedling and survival then depends on whether the radicle will be long enough to obtain water before the food reserves are gone. (Kintigh 1949.)

Pinus edulis grows very slowly and reaches maturity in 250-350 years. According to the tree ring studies of Dr. Schulman (1948) the known maximum age of this species is 860 years.

#### Distribution:

This pinyon pine is common from Utah and Arizona to Oklahoma, Texas, and Mexico. It is abundant in the Colorado Drainage of Utah.

#### Ecology:

Pinus edulis is abundant on the foothills and higher valleys between 4,500-9,000 ft. The species grows in dry, shallow, gravelly soils and is very drought resistant. It can withstand great extremes in temperature and climate, and is well adapted to its rugged environment. Although this pine forms some pure

stands, it grows most often with Juniperus utahensis and J. scopulorum, and together they form the vast pigmy forests of the Southwest. These communities are open, the trees widely spaced with little understory except sagebrush and other smaller plants in the openings. (Sudworth 1917, Woodin 1954, Merkle 1952, Wright 1953, Phillips 1909.)

Pinyon pine is more resistant to disease than many conifers. The heaviest damage is done by insect larvae and caterpillars in the cones. (Little 1943, Phillips 1909.)

**Economic importance:**

The rosin this tree produces is of very excellent quality.

**Representative specimens:**

(BRU) Beaver Co., Tushar Mtns., Erdman 116, May 13, 1960; Grand Co., Arches NM, Erdman 179, July 26, 1960; Grand Co., La Sal Mtns., Erdman 196, July 27, 1960; Millard Co., Pavant Range, Erdman 127, May 13, 1960; San Juan Co., Abajo Mtns., Erdman 267, July 29, 1960; Sevier Co., Monroe Co., Erdman 8, May 9, 1960.

**Pinus aristata Engelm.**

**Bristlecone pine**

Usually a tree up to 15 m. tall, but occasionally a shrub at high elevations; trunk up to .5-1 m. in diameter, short, stocky. often malformed; crown pyramidal when young, later bushy, wide, and dense; branches long, pendant except near top. Twigs stout, light orange-colored, glabrous or puberulent at first, later dark gray, black or brown and glabrous. Bark on branches and young trunks thin, gray-white; bark on old trunks 1-3 cm. thick, red-brown, shallowly fissured, ridges flat, covered by small scales. Wood 35 lbs. per cubic ft. dry weight; moderately soft, weak, brittle, narrow-ringed; sapwood thin, white; heartwood pale brownish-red. Buds oblong to ovoid, 8 mm. long, brown. Leaves persistent for 14-17 years, born in fascicles of 5. The leaves are recurved towards the apex of the twig and completely cover the twig, thus resembling a foxtail, leaves stout, curved, 2.5-4 cm. long, deep green, lustrous, lower surface marked by numerous rows of stomata, usually showing conspicuous exudations of resin; sheath deciduous. Female cones dark purple in July; mature cones short-stalked, cylindrical to ovoid or oblong, 5-9 cm. long, violet to reddish-brown, resinous, open at maturity; umbo dorsal bearing a long recurved prickle. Seeds nearly oval, compressed, 6.5 mm. long, light brown, often mottled with black; wing terminal 8 mm. long, 6.5 mm. wide,



broadest above the middle.

Reproduction:

Germination of the <sup>b</sup>ristlecone pine seeds averages about 66% if the seeds are in moist loose mineral soil. (Vines 1960, Billings & Thompson 1957.) Seedlings have 8-10 slim green cotyledons which are usually over 2.5 cm. long. These are dull bluish-green. The primary needles appear early and form a strong cluster by the end of the year. (Bates 1925.) These seedlings are very hardy and much more tolerant of shade than mature trees.

Pinus aristata grows very slowly and reaches maturity in 200-250 years. It is exceptionally long lived, particularly in the White Mountains of California and Nevada. Here there are many trees over 1000 years. Ring counts show that one of these bristlecone pines is over 4,600 years old and therefore the oldest living thing on earth. (Schulman 1958.) The longevity of these trees in Utah appears to be much more restricted.

Distribution:

Pinus aristata has a spotty distribution from Colorado and New Mexico to California and Nevada. There are only a few sites in Utah where it is common. These are Bryce Canyon, Cedar Breaks and surrounding area, the Wah Wah Mountains, and the Fish Lake Plateau. One specimen has been collected in Carbon Co.

Ecology:

Bristlecone pine is usually found on high rocky ridges near timberline. Although it is found from 8,000 to 11,000 feet, it is most common and prominent at the higher elevations. This pine grows in a variety of soils and is well adapted to growing in loose rock with very scanty soil. It is very drought

resistant and therefore able to withstand the great winter desiccation which occurs at high elevations. (Billing & Thompson 1957, Vines 1960.)

Bristlecone pine often dominates the subalpine flora but rarely occurs in pure groves. It is commonly associated with alpine fir, Engelmann spruce, and limber pine. There is little or no underbrush. At lower elevations Pinus aristata is very scattered and always mixed with other conifers such as Douglas fir, ponderosa pine, white fir, blue spruce. (Whitfield 1933, Billings & Thompson 1957.)

#### Economic importance:

The wood is unimportant. The tree adapts readily to cultivation. (Vines 1960, Harlow & Harrar 1958.)

#### Representative specimens:

(UT) Carbon Co., Price Canyon, S. Flowers, Jan. 12, 1935; (BRU) Garfield Co., Escalante Mtns., Erdman 35, May 10, 1960; Garfield Co., Bryce Canyon, Burkey 133, June 6, 1946; Iron Co., Cedar Breaks, Harrison 9864, Aug. 24, 1940; (UT) Millard Co., Wah Wah Range, A.P. Plummer, May 16, 1940.

#### *Pinus flexilis* James

#### Limber pine

Usually a tree to 15-20 m., but occasionally shrubby at high elevations; trunk usually not more than .5-1.5 m. in diameter, sharply tapered; crown large, often extending to the ground, broad, round-topped, open; branches numerous, large, plume-like, drooping or ascending, often very long. Twigs stout and tough, orange-green to brown or gray, covered by soft white hairs, later silvery-white or light gray, glabrous, smooth. Bark on trunks dark brown to black, deeply fissured, broad flat ridges covered by small scales. Wood moderately light, 27 lbs. per cubic ft. dry weight, soft, weak, moderately brittle, close-grained, very narrow-ringed; sapwood narrow, white; heartwood lemon-colored, reddish when exposed. Buds broadly ovoid, 8-12 mm. long, pointed. Leaves 5 in a fascicle, clustered near branch ends, stout and rigid, 4-7.5 cm. long, margins with minute teeth, dark green, stomata in 1-4 rows on each side; sheaths deciduous. Female cones clustered, at first reddish-purple, mature cones open, sub-terminal, short-stalked, horizontal or declined,

cylindrical to oval, 7-25 cm. long, brown; scales narrow, reflexed, apex square, spines absent, inner portion pale red. Seeds large, flattened, 8-12 mm. long; shell thick, light brown to dark red-brown or mottled with black; wing rudimentary.

#### Reproduction:

Germination of limber pine seeds is low, usually from 20-40% and is best on mineral soil. The seedlings usually have 10 cotyledons which are often more than 2.5 cm. long. (Bates 1925.)

This is a slow growing tree which reaches maturity in 200-300 years. A tree near Sun Valley, Idaho was found to be 1,650 years old. (Schulman 1958.) The maximum size is 26 m. tall by 2 m. in diameter. (Preston 1940.)

#### Distribution:

Pinus flexilis occurs from Texas to California and Mexico and north to British Columbia and Alberta. It grows throughout most of the mountainous regions of Utah but as yet has not been collected in many of the western desert ranges or in the La Sal Mountains.

#### Ecology:

Although limber pine is found on mountain slopes at elevations of 4,500-11,000 ft., it is most characteristically a tree of the high windswept ridges and the timberline zone. This pine grows on a wide variety of soils, from the poorly developed soil of rock crevices to heavy moist clays. It seems to prefer drier, gravelly loams with little humus. (Harlow & Harrar 1950, Sudworth 1917.)

This is a rather xeric mountain pine and grows best on warm dry cliffs with southwest exposures. Its low moisture requirements allow it to grow at timberline and withstand extreme

winter desiccation. (Cox 1933.)

When limber pine grows at lower elevations, it rarely occurs in pure stands, and most often is associated with conifers such as Douglas fir, blue spruce, white fir, and ponderosa pine. However, this is most commonly a tree of the timberline zone, and here it occurs in pure stands and also with Engelmann spruce, alpine fir and bristlecone pine. (Whitfield 1933, Ellison 1954, Sudworth 1917.)

On the Wasatch Plateau and probably in other similar areas, this plant is one of the first species to invade xeric rocky areas. However, it is usually found on cliffs in crevices and ledges and not on talus slopes. As long as such conditions are maintained, it might be considered as a climax species, but as the rock is broken down and the soil accumulates, other conifer species replace it because of their greater tolerance of shade. (Ellison 1954.)

Fire, blister rust and bark beetles are the major enemies of limber pine. (Preston 1940, Clapper & Miller 1949.)

Economic importance:

The wood is relatively unimportant. This pine is occasionally cultivated. (Vines 1960, Preston 1940.)

Representative specimens:

(BRU) Garfield Co., Henry Mtns., Harrison 7487, May 19, 1934  
Garfield Co., Escalante Mtns., Erdman 31, May 10, 1960; (UT)  
Grand Co., East Tavaputs Plateau, Vickery 1804, July 13-15,  
1956; (BRU) Juab Co., Deep Creek Mtns., Cottam 3185, June 19,  
1928; Summit Co., Uinta Mtns., Erdman 300, Aug. 25, 1960; Utah  
Co., Rock Canyon, near Provo, Harston 6180, May 12, 1933.

*Pinus ponderosa* Dougl.

Ponderosa pine

*P. brachyptera* Engelm., *P. ponderosa* var. *scopulorum* Engelm., *P. scopulorum* (Engelm.) Lemm.

Large trees to 60 m. tall; trunks up to 2-3 m. in diameter, usually clear of limbs for the major portion of its length; crown bushy; branches stout, thick, somewhat declined but upcurved terminally. Twigs stout, orange to dark gray or black. Bark up to 5-10 cm. thick, dark brown or black and deeply furrowed for the first 100-125 years; older trunks orange-brown, divided into large flat plates divided by conspicuous narrow black grooves. Wood 30 lbs. per cubic ft. dry weight, moderately soft and weak; sapwood up to 15 cm. thick, white or yellowish; heartwood light reddish-brown. Buds ovoid to oblong, 1 cm. long, covered with resin. Leaves persistent 2-3 years, born in fascicles of 3, occasionally 2; stout, 12-25 cm. long, yellow-green, stomata on 3 faces; sheaths 6-20 mm. long, persistent. Male cones clustered or paired. Female cones solitary or clustered, horizontal or slightly declined, sessile or stalked, obovoid to ellipsoid, 6-15 cm. long, light red-brown; scales narrow, apex thickened, diamond-shaped, umbo with deciduous prickle. Seeds ovoid 6.5 mm. long, base round, apex flattened; seed coat mottled brown to purple; seed wing 2-3 cm. long, apex narrow, oblique.

#### Reproduction:

Reproduction in ponderosa pine is a serious problem. It is rare that a good seed year and weather satisfactory for germination occur at the same time. Maguire (1956) postulated that if the monthly average temperatures of April and May were normal, and that if there were no severe frosts during the late spring of the second season, there would be good cone crops in two years. Apparently temperatures must be above normal to stimulate differentiation of cone primordia.

Germination must take place within the year and is dependent on satisfactory moisture and temperatures. (Maguire 1956, Pearson 1912.)

The tree grows very slowly and rarely reaches 40 m. in height and 24 cm. in diameter in this area. The older trees range from 250 to 350 years. (Woolsey 1911, Pearson 1912, 1931.)

**Distribution:**

Ponderosa pine is found abundantly in all the western states. Its distribution in Utah is restricted to the eastern portion of the state. It does not occur in the western desert ranges and in the Wasatch Mountains north of the Provo area.

**Ecology:**

This tree grows on moderate mountain slopes and plateaus from 7000-9500 ft. It tolerates a wide variety of soils but does best in rich deep ones. Most often ponderosa pine is found on moist to dry gravelly loam, but it also grows well in limestone, volcanic and gravelly soils. It avoids heavy clays. Most striking perhaps is this species' ability to grow in soils derived from hydrothermally altered rock. Such a stand occurs near Marysvale in Sevier-Piute counties. These soils are extremely acid with a pH of 3.3 and high Ca, Al, Fe, and sulfate and very low phosphate and nitrogen. Nearly all other species from the surrounding area are unable to tolerate these extreme conditions. (Salisbury 1954.)

Precipitation plays a major role in determining the distribution of this pine. There is no large stand where rainfall is less than 20 in. in the right altitudinal zone, but 12-13 in. is sufficient for survival. (Woolsey 1911.)

When ponderosa pine occurs in pure stands there is relatively little underbrush and the forest is like an open park. The floor is covered by grass, needles, and small scattered shrubs. However, the aspect is quite different in mixed stands. Here there is usually a much more prominent understory. At the lower reaches ponderosa pine grows with pinyon

and juniper. Higher up it is associated with Douglas fir, lodgepole pine, white fir, and blue spruce, oak and aspen. Although ponderosa pine is more tolerant than aspen and tends to replace it, it itself succumbs to succession by other more shade tolerant and moisture loving conifers. (Woolsey 1911.)

There are numerous enemies of this pine, such as fire, lightning, and rodents, but the effects of various insects and fungi are often equally severe. The dwarf mistletoe, Razoumofskya nobriata or Arceuthobium vaginatum f. cryptopodum is the most serious menace. In some areas 60% of the trees have been attacked. This infection causes an initial stimulus in growth and later swelling, witches'-brooms, clogging of sapwood by excess resin and eventual death. (Korstian & Long 1922, Hanksworth & Lusher 1956.)

Economic importance:

Pinus ponderosa is one of the most important trees of the United States. Its total stand is the greatest of any pine in North America and it is second in volume only to Douglas fir. About 15% of the 185 billion board feet is in the Southwest. In annual cut it is second only to Douglas fir and southern yellow pine. It is used for both rough construction and finished work. It resembles white pine and produces soft high grade lumber. (U.S.D.S. 1954.)

Not only is ponderosa pine important in lumber markets but also as an ornamental.

Remarks:

This species is variable and has been divided into varieties and species. That complex occurring east of the

Continental Divide and in the Central Plateau of western Colorado, Utah and eastern Nevada has been distinguished as P. ponderosa var. scopulorum or as P. scopulorum and P. brachyptera. However, the present majority opinion seems to be that it is only one species with two possible varieties. (Little 1953, Vines 1960.)

Representative specimens:

(BRU) Beaver Co., Tushar Mtns., Erdman 86, May 12, 1960; Daggett Co., Uinta Mtns., Harrison 7879, June 19, 1934; Garfield Co., Escalante Mtns., Erdman 29, May 9, 1960; San Juan Co., Abajo Mtns., Erdman 248, July 28, 1960; San Juan Co., Elk Ridge, Erdman 278, July 29, 1960; Sevier Co., Monroe Canyon, Erdman 9, May 9, 1960.

*Pinus contorta* Dougl.

Lodgepole pine

*P. murrayana* Grev. & Balf., *P. contorta* var. *latifolia* Engelm.,  
*P. contorta* var. *murrayana* (Grev. & Balf.) Engelm.

Medium size tree to 25-30 m., trunk up to .5-1 m. in diameter, long, slender, clear of branches for most of its length, tapering but little; crown small, narrow, open. Twigs rather stout, dark red-brown to black. Bark 6-12 mm. thick, orange-brown to gray; shallowly furrowed, covered by thin loose scales. Wood 25-36 lbs. per cubic ft. dry weight, hardness variable, often moderately soft, densely ringed; sapwood thin or thick, whitish; heartwood pale brown. Buds ovoid, slightly resinous. Leaves persistent 4-8 years, born in fascicles of 2, fairly stout, twisted, 2.5-7.5 cm. long, margins with minute teeth, dark green to yellow-green, 6-10 rows of stomata on all faces; sheath persistent. Female cones sessile, at maturity ovoid to subcylindric, asymmetrical at the base, 2-5 cm. long, often closed at maturity; scales tawny to dark brown, umbo dorsal, terminating in a long recurved deciduous prickle. Seeds ovoid, 4 mm. long, reddish-brown, often mottled with black; wings 1 cm. long.

Reproduction:

The determining factor in the size of the seed crops in any given year is the weather conditions at the time the young cones emerge two years earlier. Late spring snows and freezing temperatures damage or kill the young cones. In the



second season weather is not a factor. (Bates 1930.) The cones ripen in late August or September when many of the seeds are shed. However, a large number of cones remain closed, often for 10-20 years. Three factors determine the opening of the cones; limestone soils cause a retarding of cone development; late maturation causes an unusually large flow of sap and pitch into the cones which hinders opening; and third, the degree of insolation determines whether the cones dry quickly and thereby open readily, or whether drying is slow, thus retarding opening. (Bates 1917.)

Large numbers of cones with viable seeds accumulate on the trees over the years until a fire sweeps the stand. Fire has three beneficial results for lodgepole pine, even though it destroys the tree. First, the great heat opens the cones and releases the seeds, which usually are not harmed. Second, the birds and rodents which consume such vast quantities of seeds are driven away. Third, the herbs which compete with the seedlings are destroyed and the mineral soil is exposed. (Clements 1910.)

Germination is usually not impaired by the charring of the seeds and occurs rapidly on mineral soil when there are wide fluctuations of the temperature. The percentage of germination is usually high, often above 90%. (Crossley 1955, Bates 1930.)

The seedlings have 3-6 cotyledons of unequal size. If competition is strong with the herbaceous plants, growth will be strongly retarded. (Bates 1925.) Lodgepole pine grows slowly, but still faster than most conifer species with which

it associates. Because of fire few trees survive to any great age or size. The oldest stand known is 450 years old. The largest tree known is 45 m. tall and 1 m. in diameter. (Harlow & Harrar 1958, Sargent 1933, Mason 1915.)

Distribution:

This species is widespread from Alaska to California and Colorado. It is restricted to the Uinta Mts. and the Northern Wasatch Mts.

Ecology:

Pinus contorta has a great altitudinal range from sea level to 11,500 feet. It therefore encounters a wide variety of habitats, many of which (like coastal situations) do not occur in Utah and surrounding area. These will be excluded from this discussion.

In northern Utah Pinus contorta is a typical tree of the high mountain slopes and plateaus from 7,000-10,000 ft. It grows in many soils but does best in moist, well-drained soils which are sandy or loamy and of silicious origin. Some believe that soils with limestone origin hinder the development of the tree. (Mason 1915, Sudworth 1917, Bates 1917.)

Although this pine grows in regions with an average rainfall of at least 18-21 inches, soil moisture, not precipitation, is the determining factor of its lower limits. The upper limits on the other hand are set by length of growing season and coldness of temperatures. (Mason 1915.)

Lodgepole pine at lower elevations grows in mixed forests of Douglas fir, ponderosa pine, white fir, and blue spruce; while at higher elevations it is associated with Engel-

mann spruce and alpine fir. Most commonly, however, Pinus contorta grows in dense, pure stands of trees of the same age. These are the results of reproduction after a fire. However, this species cannot reproduce in its own shade, and therefore such forests are gradually being replaced by other species. (Sudworth 1917, Harlow & Harlow & Harrar 1958.)

Economic importance:

The wood of lodgepole pine is moderately valuable and is logged in some areas. It is used as construction lumber, telephone poles, and railroad ties. It is also used as an ornamental. (Preston 1940.)

Remarks:

This is a dimorphic species because of the differing ecological situations it grows in. The coastal type has often been separated as the true P. contorta and the inland mountain region form as P. murrayana. However, there are no reliable differences in cones and needles and at present most botanists consider this complex to be one species. (Sudworth 1917, Harlow & Harrar 1958, Little 1953.)

Representative specimens:

(BRU) Cache Co., S. of Laketown, Bear River Mtns., Harrison 7981, June 22, 1934; Duchesne Co., Uinta Mtns., Harrison 7744, June 16, 1934; Summit Co., Uinta Mtns., Erdman 305, Aug. 25, 1960.

Description of the Genus and Keys  
to the Species of *Picea*

Trees with straight, tapering trunks, crown usually pyramidal or conical, branches in whorls. Leaves persistent 7-10 years, bases of leaves woody, prominent, remaining after the leaves fall, leaves shed upon drying, spirally arranged; needle-like, stiff, sharp, 4-angled. Male cone 2-2.5 cm. long, scales spirally arranged each bearing 2 pollen sacs. Female cones pendant, terminal, born on upper part of the tree, scales numerous, thin, unarmed, persistent, much longer than the bracts. Seeds 2 under each scale.

The cones mature in one season. Good crops are born periodically, usually every 2-5 years.

Key to the species of *Picea*.

1. Young twigs and leaf bases strongly pubescent under a hand lens; cones commonly about 5 cm. long or less, scales rather round . . . . . *P. engelmanni*
1. Young twigs and leaf bases glabrous or very slightly pubescent; cones commonly about 8 cm. long, scales truncate . . . . . *P. pungens*

*Picea engelmanni* (Parry) Engelm.

Engelmann spruce

*P. columbiana* Lemm., *P. engelmanni* var. *glabra* Goodman. *Abies engelmanni* Parry.

Tree form up to 36 m. tall and 1 m. in diameter; trunk often clear for some distance; branches numerous, short; shrub form at high elevations, trunk short, small, bent, crown irregular, wind-trimmed, dense. Twigs slender, yellow-brown to gray, rather densely pubescent under a hand lens, often with resin blisters on older twigs. Bark thin, light reddish-brown to gray, separating into large loose, thin scales. Wood light, 21½ lbs. per cubic foot dry weight; soft, weak, close-grained; sapwood thick, hard to distinguish from yellowish or brown heartwood. Buds ovoid to conical, 3-6 mm. long, obtuse, pale chestnut-brown. Leaves often curved toward twig apex; somewhat flexible, 2-3 cm. long, apex acute or blunt, dull steel-blue to dark blue-green, covered at first by glaucous bloom, 3-5 rows of stomata on each face. Male cones long-stalked, dark purple. Female cones sessile to short-stalked, ovoid to oblong, 2.5-6.5 cm. long, brown and shiny; scales rhombic-oblong, margins and apex somewhat erose. Seeds compressed, 3 mm. long, obtuse, nearly black, wing broad, 1 cm. long, oblique.

### Reproduction:

The seeds are predominately dispersed by the wind and are often carried 2000 ft. up mountain slopes to the high subalpine regions. (Bates 1923, Lowdermilk 1925.)

Germination is variable but often excellent with as high as 97% of the seeds germinating if on moist mineral soil. These seeds also often germinate on the decaying logs and stumps and grow satisfactorily. (Oosting & Reed 1952, Lowdermilk 1925, Harlow & Harrar 1958.)

The tiny seedlings have 4-7 cotyledons. Although they are very shade tolerant, the seedlings are weak and frail and succumb easily to strong competition by herbaceous plants. (Bates 1925.)

Growth rates are determined by the season's length and the environment. Generally Engelmann spruce grows slowly and reaches maximum ages of 500-600 years. The maximum size is 49.5 m. by 1.8 m. (Vines 1960, Preston 1940, Hodson 1910, Oosting & Reed 1952.)

### Distribution:

This is a widespread spruce of the mountainous west. Its distribution in Utah is spotty and uncertain. It is known to form extensive forests in the Uinta, Deep Creek, La Sal, and Abajos Mountains, and the East Tavaputs Plateau. It is also apparently widespread in the Wasatch Mountains although it is poorly collected.

### Ecology:

Picea engelmanni is not restricted to the high subalpine region for it often extends down north facing slopes and

ridges to mingle with lower species. Generally it is found from 9000-11,000 ft. This species demands soils with a high water holding capacity and therefore the soil structure is often more important than composition although it does grow best on soils of limestone origin. (Oosting & Reed 1952, Hodson 1910, Preston 1940, Bates 1923.)

Engelmann spruce is a tree of the cool moist high mountain climates. It is hardy and withstands great extremes in temperature. Rarely, however, do the temperatures rise above 90°. There are often severe frosts every month except July and August. Precipitation is variable but usually about 30 in. a year. (Hodson 1910.)

In the southern portion of the Rocky Mountains this species forms vast pure stands at high elevations but it is also commonly mixed with alpine fir, bristlecone pine, and limber pine. At lower elevations Engelmann spruce grows very commonly with lodgepole pine which it usually replaces if fire is controlled, and less commonly with Douglas fir, and aspen. (Harlow & Harrar 1958, Hodson 1910.)

This is probably the most shade tolerant tree of the central Rocky Mountains except perhaps alpine fir. Where moisture is sufficient it will eventually dominate and crowd out most other conifer species. (Bates 1923, Oosting & Reed 1952.)

The Engelmann spruce beetle is the greatest menace to the vast stands of this species. But there are numerous other insects and fungi like the spruce bud worm, brown butt rots, and trunk rots which attack, damage, and kill these

trees. (Hodson 1910, Bates 1923.)

Economic importance:

For reasons of inaccessibility, Engelmann spruce is little used as a lumber source in many areas. However, where there are stands of sufficient size which are accessible there is considerable cutting. The wood is used for telephone poles, railroad ties, mine props, light construction and some furniture. The tree is a good ornamental because its pleasant pyramidal form and dense foliage. It also plays an important role in erosion and flood control on the headwaters of many drainages. (Vines 1960, Preston 1940.)

Representative specimens:

(BRU) Duchesne Co., Uinta Mtns., Harrison 10093, July 30, 1940; Grand Co., La Sal Mtns., Erdman 218, July 28, 1960; (UT) Grand Co., East Ravaputs Plateau, Vickery 1802, July 13-15, 1956; Juab Co., Deep Creek Mtns., Cottam 8223, June 17, 1940; (BRU) San Juan Co., Abajo Mtns., Erdman 252, July 28, 1960; Summit Co., Uinta Mtns., Erdman 319, Aug. 25, 1960.

*Picea pungens* Engelm.

Blue spruce

*P. parryana* Sarg., *Abies menziesii parryana* Andre.

Tree to 25-30 m. or more; trunk often up to 1 m. in diameter, crown dense, regular when young, old trees thinner, and ragged; branches stout, rigid, spreading. Twigs stout, rigid, gray to cinnamon-red, glaucous. Bark pale gray and smooth on young trees; later gray to reddish-brown, deeply divided into broad ridges with small scales. Wood light, 23 lbs. per cubic ft. dry weight, soft and weak, close-grained; sapwood pale, hardly distinguishable from the pale brown heartwood. Winter buds stout, 6.5-8.5 mm. long, obtuse to acute, keeled, pale brown. Leaves incurved, 1-3.5 cm. long, apex spiny-acuminate; color varying from dull blue-green to silver-blue. Male cones reddish-yellow. Female cones short-stalked or sessile, oblong-cylindric, 7-8 cm. long, reddish-green when immature, later chestnut-brown and lustrous; scales oval to rhombic. Seeds compressed, 3 mm. long, dark chestnut-brown, wing 6-12 mm. long.

### Reproduction:

The optimum age of this species for seed bearing is from 50-150 years. Germination of the seeds is excellent, often above 90% if the seeds are on mineral soil, especially rich moist clays. The seedlings cannot compete with dense herbaceous cover and often, therefore, only a few survive. This is a slow growing tree and reaches ages from 400-600 years. (Harlow & Harrar 1958, Preston 1940, Vines 1960.)

### Distribution:

Picea pungens is a distinctive tree of New Mexico, Arizona, Utah, Idaho, Wyoming and Colorado. This species has been very poorly collected in Utah and the known distribution is therefore spotty. It is known to occur in the Uinta, Deep Creek, and the central Wasatch Mountains, and the Tushar and Escalante Mountains of the Plateau region of southern Utah.

### Ecology:

This spruce prefers moist sites and grows along streams or on cooler hillsides from 6500-11,000 ft. Blue spruce is never abundant and although it does occur in pure stands of limited extent it is often found growing with other conifer species such as Douglas fir, ponderosa pine, alpine fir, white fir, and Engelmann spruce and stream side broad leaf trees. Spruce budworm is the greatest enemy of the species. (Preston 1940, Harlow & Harrar 1958.)

### Economic importance:

There is little demand for the wood of blue spruce, but it is one of the most popular ornamental conifers in the United States. Numerous varieties have been developed through the



many years of cultivation. (Vines 1960, Dallimore & Jackson 1948, Peattie 1953.)

Representative specimens:

(BRU) Beaver Co., Tushar Mtns., Erdman 88, May 12, 1960;  
Duchesne Co., Uinta Mtns., Harrison 7729, June 16, 1934;  
Garfield Co., Escalante Mtns., Erdman 29, May 9, 1960;  
(UT) Garfield Co., Bryce Canyon, Buchanan 133, June 17, 1957;  
Utah Co., Mt. Timpanogos, Garrett 5705.

Description of *Pseudotsuga**Pseudotsuga menziesii* (Mirb.) Franco

Douglas fir

*P. taxifolia* (Lamb.) Britton, *P. douglasii* (Lindl.) Carr., *P. mucronata* (Raf.) Sudw., *P. vancouverensis* Flous, *P. glauca* Mayr, (Synonymy adapted from Little 1953. The taxonomy of this species has been rather confused and only pertinent synonyms are included here.)

Tree to 45 m. tall in the Rocky Mountain region; trunk up to 1-1.5 m. in diameter; crown narrow, compact, somewhat pyramidal; branches usually in whorls, slender, down-sweeping. Twigs slender, orange to reddish-brown, pubescent and lustrous; later dark gray-brown, glabrous and dull. Younger bark thin, gray-brown or reddish, smooth except for resin blisters; bark on older trunks up to 2 m. thick, reddish-brown, deeply and irregularly furrowed, oblong plates covered by small scales. Wood characters variable, about 32 lbs. per cubic ft. dry weight, soft to moderately hard, rather strong, grain variable; sapwood thin, whitish to yellowish or reddish-white; heartwood yellowish to red. Terminal bud fusiform 1 cm. long, much larger than lateral buds, acute, gray to reddish-brown, lustrous; lateral buds in leaf axils. Leaves persistent 5-12 years, born spirally and spreading at nearly right angles, petiolate, linear, flattened, 2-3 cm. long, apex acute, rounded or obtuse; dark blue-green to yellow-green, lustrous, grooved above, lower side marked by rows of stomata on each side of midrib. Male cones scattered, axillary, solitary, oblong-cylindric; bracts slender, elongate, reddish; pollen sacs numerous, globose. Female cones terminal on branches of previous years growth, solitary, pendant, oblong-ovoid, 5-11 cm. long, bright red with greenish margins when young; scales spirally arranged on axis, thin, rigid, longer than broad, rounded; bracts much exserted, 3-lobed, 5-6.5 mm. wide, reddish-brown, white-spotted beneath, lustrous; seed coat in two layers, outer coat thick, inner one thin and membranous; seed wing oblong, oblique, and rounded.

## Reproduction:

Cones mature in one season and are ripe by August to September. The seeds are dispersed by the wind. Germination takes place best on mineral soil. The seedlings have reddish stems with 6 cotyledons which are flat and widespreading. Growth rates are variable, dependent on shading, soils, climate and etc. (Frothingham 1909, Bates 1925.)

Trees can bear fertile cones at nine years and maximum cone bearing period is 50-150 years of age. The oldest Douglas firs approach 1000 years in age but few trees in this area are more than 400 years old. Likewise the largest trees are also on the coast where some reach 105-114 m. tall and 4.5-5.1 m. in diameter. (Peattie 1953, Harrow & Harrar 1958, Frothingham 1909.)

Distribution:

Pseudotsuga menziesii is very widespread throughout the western temperate region of North America. It is common in Utah but has not been collected in the Pine Valley Mountains or in most of the ranges in the western desert of the state.

Ecology:

Douglas fir grows in a great variety of habitats from sea level to 11,000 ft. This discussion will be limited to situations typical of the Rocky Mountain region. Although Douglas fir prefers moist deep porous soils of northern exposure, it tolerates a variety of soils, except those which are heavy clays or predominately sandy. (Preston 1940, Frothingham 1909, Bates 1917.)

This is a drought resistant conifer, but it grows poorly where precipitation is below 15 inches a year. This is the major factor in the lower limits of Douglas fir. Seasonal temperatures vary considerable but this species has adapted itself very well to such changes. (Frothingham 1909.)

Pseudotsuga menziesii often forms pure stands but in this area it is more commonly mixed with the various conifers from Engelmann spruce and alpine fir at higher elevations to

ponderosa pine and white fir at the lower elevations. Although Douglas fir seedlings can't survive in dense shade, the species is more tolerant than all associated species in this region except white fir, alpine fir, and Engelmann spruce. (Harlow & Harrar 1958, Frothingham 1909, Peattie 1953.)

The greatest enemy of Douglas fir is fire. The bark on the coastal trees is very thick and fire resistant but it is much thinner in this area and, therefore, more susceptible to injury. The crowns are highly inflammable but are usually high above the ground. Crown fires do occur, however, and are terribly devastating. (Frothingham 1909.)

Economic importance:

Douglas fir is the greatest industrial tree in the United States. Its stand is the largest in volume and area. About 60% of the standing timber in the West is this species. It is first in annual cut and the wood is used for almost anything. Plywood, pulp and lumber for heavy construction are three important uses, but it is also used in furniture, cabinet trim, and almost anything that is wood in the home. Douglas fir has tremendous value as a watershed control species. The tree is also widely used as an ornamental. (Vines 1960, Peattie 1953.)

Remarks:

The most common scientific name used for this species is *Pseudotsuga taxifolia*. This has now been replaced by the earlier name *P. menziesii*. Because of the wide range, ecological habitats and different forms, this species has been divided into various species, sub-species and varieties.

However, the coastal form is distinct enough from the inner mountain form that two varieties are now rather widely accepted. P. menziesii var. menziesii for the coastal form and P. menziesii var. glauca for the inland type. The later variety is the one present in Utah and distinguished by the glaucous leaves, smaller cones and more exserted bracts. (Vines 1960, Little 1953.)

Representative specimens:

(BRU) Beaver Co., Tushar Mtns., Erdman 90, May 12, 1960; Garfield Co., Escalante Mtns., Erdman 36, May 10, 1960; Grand Co., La Sal Mtns., Erdman 198, July 27, 1960; San Juan Co., Abajo Mtns., Erdman 247, July 28, 1960; Summit Co., Uinta Mtns., Erdman 315, Aug. 25, 1960; Wasatch Co., Provo Canyon, Harrison 10852, Dec. 2, 1944.

Description of the Genus and Keys  
to the Species of *Abies*

Tree with straight, gradually tapering trunk, crown symmetrical, pyramidal or spire-like, dense; branches whorled, horizontal, slender. Young bark thin, smooth; resin blisters numerous, prominent older bark thick, furrowed. Wood weak, brittle, coarse-grained. Leaves persistent 7-10 years, spirally arranged, sessile, leaf scar circular, smooth, single, needle-like, flat and blunt, grooved above. Male cones axillary, single numerous on lower sides of the lower branches. Female cones born erect on upper side of the topmost branches, scales numerous, imbricated, shorter than bracts, thin, fan-shaped, 2-ovuled, deciduous at maturity; central spike-like axis persistent for many years. Seeds with a large thin wing and conspicuous resin vesicles.

The cones mature in one season. Utah species usually produce good seed crops every two-five years. Germination is rarely higher than 40%. The seedlings have 5-7 cotyledons.

Key to the species of *Abies*.

1. Twigs glabrous at one year old, cones grayish-green, bracts of cone scales with short triangular tip, resin ducts of leaves near the lower epidermis . . . *A. concolor*
1. Twigs pubescent when one year old, cones dark brownish-purple, bracts of cone scales with a long, awl-shaped tip, resin ducts of leaves central . . . . . *A. lasiocarpa*

*Abies concolor* (Gord. & Glend.) Hoopes

White fir

*A. lowiana* (Gord.) A. Murr., *A. grandis* var. *lowiana* (Gord.) Hoopes, *A. concolor* var. *lowiana* (Gord.) Lemm., *Picea concolor* Gord. & Glend. *P. lowiana* Gord.

Tree to 60 m., trunk up to 1.5 m. in diameter, bole clear for 1/2-2/3 of its length when in crowded stands; crown of older trees often rounded or irregular; branches in whorls of 4 or 5 which form flat masses of foliage, branches prune poorly. Twigs stout, yellow-green to gray-brown; glabrous and lustrous, young bark gray, older bark up to 18 cm. thick, very hard and massive, gray to reddish-brown, deeply furrowed, ridges broad, broken into irregularly shaped plate-like scales. Wood 22½ lbs. per cubic ft. dry weight; sapwood not distinct, heartwood pale yellow to white. Buds sub-globose 3-6.5 mm. long, yellow-brown, puberulent to glabrous, resinous. Leaves crowded but somewhat 2-ranked, spreading but tending to be erect, especially on outermost branches leaves join twigs at right angles, 2-7.5 cm. long,

1.5-3 mm. wide, apex notched to rounded or acute, silver-blue to blue-green, somewhat glaucous, stomata on all surfaces. Male cones oval to oblong, dark red or rose colored; pollen sacs yellow or red, topped by short knob-like projections. Female cones oblong, oval or cylindrical, 7.5-12.5 cm. long, apex rounded or obtuse, green to yellow or purple, puberulose; scales broader than long, apex rounded; bracts emarginate or truncate with spikelike top. Seeds 8.5-12 mm. long, yellow-brown; wing rose-colored, lustrous.

#### Reproduction:

Seedlings develop rapidly under the canopy of old trees. These are not frost resistant and therefore need cover. Growth is fairly rapid and the tree begins bearing cones about the age of 40. After 100 it begins to decline although it will often live to be 350 years. In the Rocky Mountains Abies concolor does not approach the large dimensions common to the west coast trees. Although most white firs in Utah rarely exceed 30 m. high and .9 m. in diameter, occasionally it has been known to reach 1.8 m. in diameter in the Wasatch. (Harlow & Harrar 1958, Preston 1940; Johnson & Brundage 1934.)

#### Distribution.

Abies concolor is more wide spread than any other western fir. It is common in Utah in most of the montane regions except in the Uinta Basin.

#### Ecology:

Abies concolor grows usually on north mountain slopes from 6000-11,000 ft. It does best on well-drained gravelly or sandy loam and has lower moisture requirements than most western firs.

Rarely does white fir occur in pure stands. It usually grows in mixed forests of ponderosa pine, Douglas fir, alpine fir, Engelmann spruce, blue spruce, and aspen. Although shade

does tend to suppress its growth, the tree will recover when light is provided. (Preston 1940, Meinecke 1916.)

This species is often severely damaged by mistletoe, heart rot and wind shake. (Meinecke 1916.)

Economic importance:

Abies concolor is a common tree in cultivation. Many beautiful varieties have now been developed through years of cultivation. While this is its greatest use, the wood is occasionally utilized for pulp, boxes, and packing cases. (Vines 1960.)

Representative specimens:

(BRU) Beaver Co., Tushar Mtns., Erdman 91, May 12, 1960; Grand Co., La Sal Mtns., Erdman 214, July 27, 1960; Millard Co., Canyon Mtns., Erdman 129, May 13, 1960; San Juan Co., Abajo Mtns., Erdman 249, July 28, 1960; Summit Co., Uinta Mtns., Erdman 308, Aug. 25, 1960; Utah Co., Wasatch Mountains, Erdman 150, June 25, 1960.

*Abies lasiocarpa* (Hook.) Nutt.

Usually a tree to 45 m., trunk up to 1-1.5 m. in diameter, crown often extending to the ground; branches short, stout, crowded; shrub at higher elevations, irregular in habit. Twigs stout, reddish and pubescent at first, later orange-brown to gray or white and glabrous. Young bark gray to white, often marked by horizontal resin vesicles; older bark up to 4 cm. thick, gray to reddish-brown, fissures revealing red inner bark, scales thick. Wood light, 21½ lbs. per cubic ft. dry weight; sapwood whitish, heartwood pale brown to whitish. Buds subglobose, 3-6.5 mm. long, scales imbricate, orange-brown. Leaves crowded, nearly erect or leaning toward twig apex by twist at base, 2.5-4.5 cm. long, apex notched to acute, deep blue-green, numerous rows of stomata on each surface. Male cones oval or cylindrical, dark blue or violet. Female cones oval, cylindrical to oblong, 6-10 cm. long, dark brown to purple; scales 6-20 mm. wide and long, reddish-brown to purple; bracts lacinate cut, tips black. Seeds 6.5 mm. long, seed coat in 2 layers, outer one leathery, inner one membranous; wing dark and lustrous.



### Reproduction:

Although the seeds have transient viability, they are less rigid in their requirements of seedbeds than other species. They flourish on both deep duff and mineral soil. Moisture content is the controlling factor. (Oosting & Reed 1952, Hodson 1910, Cox 1911.)

Although the seedlings usually grow slowly at first, this is because of suppression. When the shade is removed or the tree grows above it, the growth rate is intensified and the tree overcomes the suppression. It begins to bear cones when about 20 years old. At higher elevation asexual reproduction by the layering of the lower branches is common. (Harlow & Harrar 1958, Lowdermilk 1925.)

### Distribution:

Abies lasiocarpa is widespread throughout the West in high montane regions. In Utah it grows on most of the higher mountain ranges and the central plateau region. It is possible that the higher ranges in the western desert support this species and that sampling has not been extensive enough for records to be available.

### Ecology:

Alpine fir is characteristic of the timberline zone. Although it does occur at lower elevations on cool mountain slopes, the most extensive stands are near the species' upper altitudinal limits. Generally it is found from 8,000-11,000 ft. elevation. Soil moisture is very important and alpine fir can even encroach on swampy land if the soil is not too heavy. However, it grows best on deep loose soils. (Preston

1940, Harlow & Harrar 1958.)

This species has developed great hardiness in a climate that is severe. The growing season is short and heavy frosts occur every month but July and August. Temperatures rarely reach 90° in the summer and plunge to below zero during the winter. The snow and the winds often affect the habit of the tree.

Abies lasiocarpa grows occasionally in pure stands but most commonly in association with Picea engelmanni, Pinus flexilis, and P. aristata. On the high plateaus of central Utah alpine fir and Engelmann spruce form an important community. Here they occupy an early stage of succession. These conifers invade the talus slopes and the P. flexilis stands of the warmer exposures. After a soil mantle has been developed, shrubs and later herbaceous plants move in and crowd out the conifers. At lower elevations alpine fir grows with ponderosa pine, lodgepole pine, Douglas fir, and aspen. (Preston 1940, Ellison 1954.)

Economic importance:

Because of inaccessibility this tree is rarely used as a lumber source. However, it is important as an ornamental. Alpine fir also plays an important role in watershed protection of the higher headwaters of mountain streams. (Vines 1960.)

Representative specimens:

(BRU) Garfield Co., Henry Mtns., Stanton 5180, July 13, 1930; Grand Co., La Sal Mtns., Erdman 216, July 28, 1960; Piute Co., Tushar Mtns., Erdman 24, May 9, 1960; Summit Co., Uinta Mtns., Erdman 307, Aug. 25, 1960; Utah Co., Mt. Timpanogos, Harrison 10595, July 15, 1944; Washington Co., Pine Valley Mtns. D. Hall, May 13, 1936.

Description of the Genus and Keys  
to the Species of *Juniperus*

Small tree, trunk often divided near the ground into a few large branches, twigs at first covered completely by leaves, later round, smooth or scaly, reddish-brown to gray. Wood weak, close-grained, fragrant. Buds small, naked except as covered by leaves. Leaves persistent, scale-like, sessile, born in 4 or 6 rows, opposite or in three's, rhombic-ovate, 2-3 mm. long; juvenile leaves awl-shaped, sharp-pointed, longer than mature leaves. Trees monoecious or dioecious. Cones born terminally on short axillary twigs. Male cones small, solitary, yellow. Female cone of 3-8 scales, berry-like, indehiscent, 1-2 seeds in each mature cone; seeds ovoid, apex acute, wingless, hilum prominent.

Two years are required to develop mature female cones. Good seed crops are produced every 2-5 years. Few seeds germinate because of rodent and bird consumption and the rigorous environment in which the plant grows. (Sudworth 1915, Phillips & Mulford 1912.)

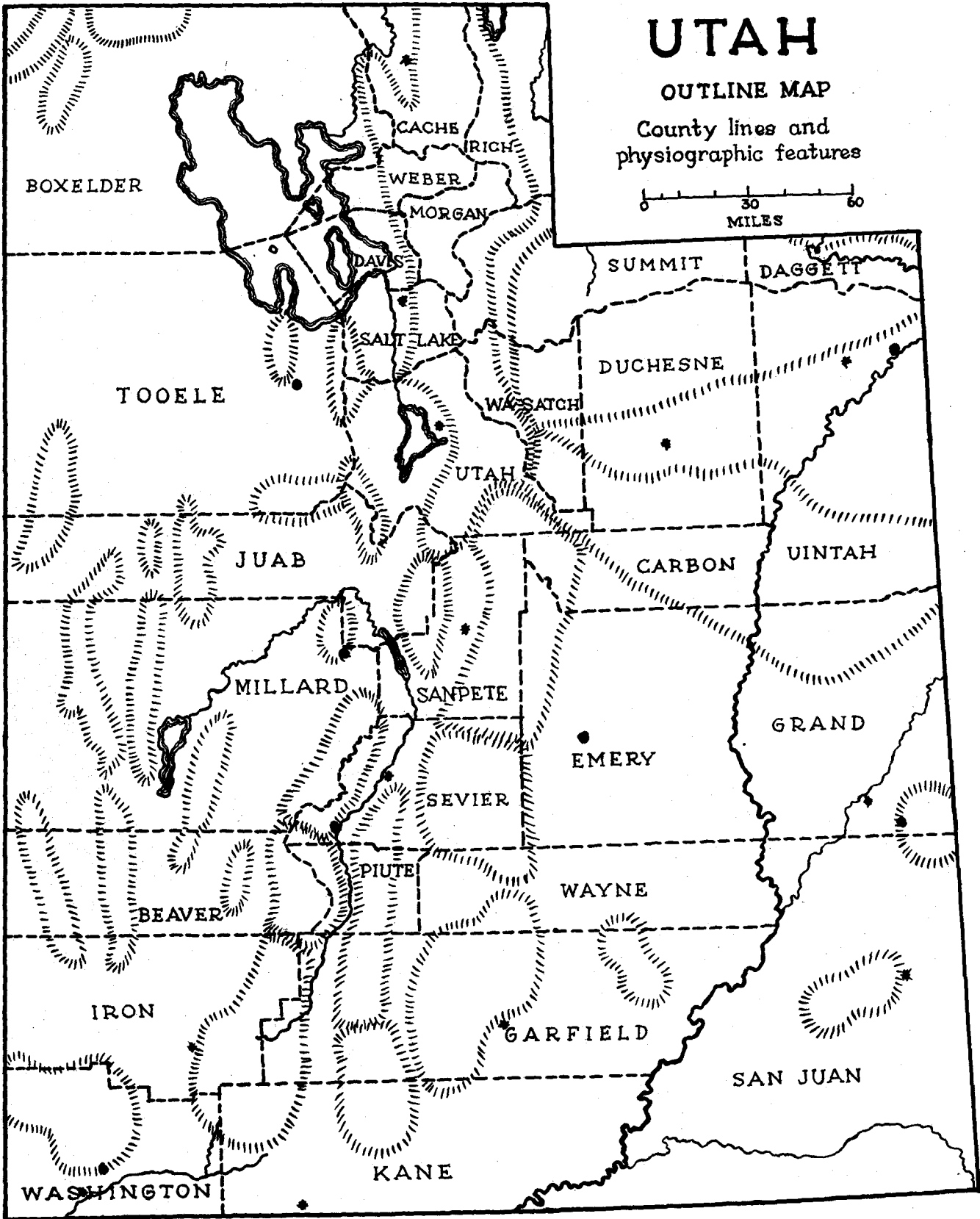
Key to the species of *Juniperus*.

1. Leaves entire (under a hand lens), paired, leafy twigs very slender, often drooping, flattened, seeds usually  
2 . . . . . *J. scopulorum*
1. Leaves minutely denticulate, paired or in whorls of 3, leafy twigs stout, spreading.
  2. Leaves without dark glandular dot or pit on the dorsal surface, tips acute to obtuse, closely appressed to the twig, fruit 7-18 mm. in diameter, trunk usually dividing above the ground level  
. . . . . *J. osteosperma*
  2. Leaves with dark glandular dot or pit on the dorsal surface, tips acute to acuminate, often spreading, fruit 4-7 mm. in diameter, trunk usually dividing beneath the ground level  
. . . . . *J. monosperma*

*Juniperus monosperma* (Engelm) Sarg.

One-seed Juniper

Shrub or small tree to 15 m., trunk up to 1 m. in diameter, often very short and divided into a few large stout branches near the ground level. Bark gray, ridges rather flattened and irregular, separating into elongate, loose shreddy scales. Sapwood yellowish or white, heartwood light reddish-brown. Leaves with acute or acuminate apex, margins minutely denticulate, dorsal leaf surface with glandular pit or dot. Tree usually dioecious but occasionally monoecious.



*Juniperus monosperma* (Engelm.) Sarg.



plant grows very slowly and many reach extremely old ages. (Sudworth 1915, Phillips & Mulford 1912.)

Distribution:

Juniperus osteosperma is abundant from New Mexico to California, Idaho and Wyoming. It is probably one of the most common trees of Utah and it is found almost everywhere except the northwestern corner of the state.

Ecology:

Utah juniper is the characteristic tree of the lower mountain slopes from 5000-7000 ft. It grows well in dry, rocky, gravelly, or sandy soils in areas with precipitation between 12-20 inches. Utah juniper forms pure stands of considerable size, particularly in regions of recent invasion. It is also very commonly associated with the pinyon pines with which it forms the pigmy forests of the desert ranges and plateaus. At higher elevations Utah juniper grows with gambel oak, ponderosa pine and other such species. (Sudworth 1915, Phillips & Mulford 1912, Harlow & Harrar 1958, Woodbury 1947.)

In the last century overgrazing in much of Utah has been severe. This has resulted in the depletion of the natural climax vegetation and opened great areas once dominated by sagebrush and grass to invasion by this tree. Serious range problems have resulted. (Herman 1953.)

Economic importance:

This tree is rarely cultivated and only occasionally used for fuel. It is used widely for fence posts which is excellent for this purpose in spite of the smallness of the

trunk.

Representative specimens:

(BRU) Beaver Co., Tushar Mtns., Erdman 125, May 13, 1960; Grand Co., Arches NM, Erdman 188, July 26, 1960; Millard Co., Pavant Range, Erdman 128, May 13, 1960; San Juan Co., Abajo Mtns., Erdman 268, July 29, 1960; Sevier Co., Monroe Canyon, Erdman 6, May 9, 1960; Washington Co., Zion NP, Erdman 53, May 11, 1960.

*Juniperus scopulorum* Sarg.

Rocky Mountain juniper

*J. virginiana* var. *montana* Vasey, *J. virginiana* var. *scopulorum* Lemm., *J. scopulorum* var. *columnaris* Fassett.

Shrub or tree to 15 m. high; trunk up to 1 m. in diameter, short; crown pyramidal when young, later more irregular and narrowly rounded to flat-topped; branches large, ends of branches and twigs drooping. Twigs slender, 4-angled. Bark thin, reddish-brown to gray; fissures shallow, flat ridges form loose network, often shreddy and fibrous. Wood light, soft, durable, resistant; sapwood thick or thin, nearly white; heartwood dull red to brown, often streaked with yellow. Leaves with margins entire, apex acute or acuminate, light to dark green, sometimes glaucous, glandular pit on dorsal side. Pistillate cones globose, 6-8.5 mm. in diameter, bright blue to nearly black, covered by whitish bloom; scales thick and fleshy, inner pulp resinous and sweet. Seeds 6 mm. long, grooved and angled, outer coat thick, bony; inner coat thin, membranous; endosperm fleshy.

Reproduction:

The seeds germinate best in moist soil pockets in crevices, washes, and river bottoms. (Sudworth 1915.)

Distribution:

*Juniperus scopulorum* is the most widespread juniper in the West. Although in Utah it is generally restricted to the eastern portion, it is found in the West Desert on the Wah Wah Mountains.

Ecology:

This juniper is common on mountain slopes and especially on rocks, crags and dry exposed ridges from 5000-9000 ft. ele-

vation. Although this tree is well adapted to such environments by its great drought resistance, it grows best in moist canyon bottoms. (Sudworth 1915, Preston 1940.)

Juniperus scopulorum occurs in both pure and mixed stands. It is commonly associated with Pinus edulis but it also grows with other conifers such as ponderosa pine, Douglas fir, blue spruce and with broadleaf species such as gambel oak, mountain mahogany, and narrowleaf cottonwood.

Juniperus scopulorum tolerates dense shade in its youth. Even though it becomes increasingly intolerant in age, it still does well in moderately shady, moist sites. (Preston 1940, Sudworth 1915.)

Economic importance:

The wood can be substituted for eastern red cedar, Juniperus virginiana, and used in chests, closets, pots, poles, pencils, novelties, and fuel. The tree is used widely as an ornamental. (Preston 1940, Vines 1960.)

Remarks:

Juniperus scopulorum is closely related to Juniperus virginiana of the Eastern states. Some authors consider it as a variety of the latter but it is treated as a separate species in this work.

Representative specimens:

(BRU) Beaver Co., Tushar Mtns., Erdman 92, May 12, 1960; Garfield Co., Escalante Mtns., Erdman 32, May 10, 1960; Millard Co., Canyon Mtns., Erdman 138, May 13, 1960; Summit Co., Uinta Mtns., Erdman 309, Aug. 25, 1960; (UT) Tooele Co., Wendover, Cottam 7085, May 3, 1937; (BRU) Utah Co., Hobble Creek, Wasatch Mtns., Thorneck, Apr. 27, 1932.



## Description of Yucca

*Yucca brevifolia* Engelm.

Joshua tree

*Y. draconis* L. var. *arborescens* Torr., *Y. arborescens* (Torr.) Cov., *Y. brevifolia* var. *jaegeriana* McKelvey, *Y. brevifolia* var. *wolfei* M.E. Jones, *Clistoyucca brevifolia* (Engelm.) Rydb. (Synonomy adapted from Little 1953.)

Small tree to 9 m. tall, rarely exceeding 4 m. in Utah; trunk short and stout, 1-4.5 m. long, up to 1 m. in diameter; crown very broad and open; branching grotesquely, forking at intervals of .5-1 m.; branches few, armlike, bearing clusters of leaves at the ends. Younger branches and stems covered with stiff dead leaves hanging downward; older trunks dark brown, corky, rough, deeply furrowed or cracked into small squarish plates; interior of stem light weight, soft, spongy, pliable, light brown to white. Leaves persistent, simple, stiff, narrow, flattened, 10-20 cm. long or occasionally to .3 m. long, 6-25 mm. wide; margins yellowish, bearing many minute, sharp teeth; apex a short sharp spine; blue-green, smooth or slightly roughened, parallel veination, keeled below. Flowers born on stalks .1-.5 m. long, at the ends of branches in March to May; panicles much-branched, bearing many-flowered clusters nearly to the base; flowers regular, large and showy, 4-6.5 cm. long, complete, perfect; perianth segments 6, greenish-white, thick, fleshy; stamens 6, 1-2 cm. long, filaments stout, greatly enlarged just below the anthers; pistil superior, 3-carpellate, stigmas 3, obscurely 2-lobed. Fruit a fleshy indehiscent capsule with thick walls and numerous seeds in 2 rows in each of 3 cells; capsule 5-10 cm. long, 3.8-5 cm. broad; slightly 3-angled; green and fleshy, becoming brown and dry at maturity. Seeds with thin black coat.

## Reproduction:

The flowers of the Joshua tree are dependent for pollination on a species of the pronuba moth which pollinate the flowers and also lay their eggs in the ovary. Although the larvae destroy many seeds, some intact seeds are left. (Jepson 1923.)

The Joshua tree is very slow-growing and does not form annual rings. Therefore, its age is difficult to determine but it is estimated to be among the oldest living plants of the desert, often reaching an age of two or three hundred

years and perhaps a few reaching a thousand years. (Little 1950.)

Distribution:

This yucca is widespread in the Mohave Desert of southeast California, Arizona, Nevada, and Utah. In Utah it is restricted to the Beaver Dam Wash in the extreme southwest corner of the state.

Ecology:

This is a characteristic tree of the desert plains and lower mountain slopes from 2000-3500 ft. elevation and occasionally higher. The Joshua tree is exceptionally hardy and grows in sites with very little moisture. It is the most prominent plant of the Mohave desert and forms so called "forests" of widely scattered individuals. (Benson & Darrow 1954, Little 1950.)

Economic importance:

The Joshua tree is occasionally used for novelties, surgeons' splints and boxes. However, because of its limited range and slow growth, destruction of this plant is strongly discouraged. Indians roasted the fruit for food. (Little 1950.)

Remarks:

The plant as it occurs in Utah has sometimes been considered a variety because of its dwarf form and its isolation in the Virgin River drainage. (Little 1950, Kearny & Peebles 1951.)

Representative Specimens:

(BRU) Washington Co., Beaver Dam Wash, Welsh 1474, April 8, 1961.

Description of the Genus and Key  
to the species of Populus

Trees variable in habit, trunks one to several, straight or leaning; crown small and compact to large and open, branching alternate, twigs marked by persistent leaf scars. Wood soft, weak, brittle, straight-grained, diffuse-porous. Terminal bud present, scales imbricate. Leaves alternate, simple, deciduous; stipules present, early deciduous. Trees dioecious, both male and female flowers born in drooping catkins; flowers minute, regular, without petals or sepals, solitary, inserted on broad cup-shaped disk, subtended by scale; ovary single, 1-celled, sessile, style short. Fruit a capsule, seeds numerous, small, tufted with long silky hairs.

Trees of this genus have the ability to sprout readily from roots and stumps. Often this is an important form of reproduction. The trees are fast growing but short lived.

Remarks:

It is now becoming increasingly evident that plants, long considered as the species P. acuminata, are hybrids between P. angustifolia and other broadleaf species such as P. Sargentii east of the Rocky Mountains, and P. fremontii in Utah. This common hybrid differs from P. angustifolia in having slightly broader, coarsely serrate leaves with longer petioles. These features, however, are highly variable and at times it is difficult to separate the hybrid from P. angustifolia. (Bennion 1960.)

Key to the species of Populus.

1. Leaves lanceolate, petioles terete, branches upright . . . . . P. angustifolia
1. Leaves ovate to deltoid, often as broad or broader than long, petioles flattened, branches spreading.
  2. Leaves broadly deltoid, margins usually coarsely crenate, not conspicuously paler beneath. . P. fremontii
  2. Leaves broadly ovate to suborbicular, margins finely crenulate or serrulate, usually conspicuously paler beneath . . . . . P. tremuloides

*Populus angustifolia* James

Narrowleaf cottonwood

*P. fortissima* A. Nels. & Macbr.

Medium sized tree, 12-21 m. tall; single trunk .3-.6 m. in diameter, usually straight; crown narrow, somewhat pyramidal; branches slender, ascending to erect. Twigs slender, terete, yellow-green or orange the first season, pale yellow or gray in the second season; glabrous; lenticels pale; leaf

is widespread in mountainous areas but it has not been collected in the range of the west desert.

Ecology:

Narrowleaf cottonwood is a water-loving tree and is restricted to sites with a constant water supply such as stream sides, river bottoms, washes, and moist flats. It is present in mountain canyons from 4,000 ft., or lower, to 8,000 ft. The tree is found in either pure groves or in mixed river-bottom forests with maples, willows, alders, birch and various conifer species. P. angustifolia is quite intolerant of shade and gives way to such trees as conifers eventually. (Sudworth 1934, Preston 1940.)

Economic importance:

Narrowleaf cottonwood is occasionally used in the western states as a shade tree but its tendency to break during storms limits its usefulness. The wood is used for fuel, fence posts and converter timber. The bark is eaten by beaver and the saplings are browsed by deer and cattle. Indians used the twigs for baskets, and the excretions of the leaf aphids for sugar. (Vines 1960.)

Representative specimens:

(BRU) Beaver Co., Tushar Mtns., Erdman 106, May 13, 1960; Grand Co., La Sal Mtns., Erdman 204, July 27, 1960; Millard Co., Pavant Range, Erdman 122, May 13, 1960; Sevier Co., Monroe Creek, Erdman 4, May 9, 1960; Uinta Co., Dinosaur NM, Welsh 67, April 30, 1955; Utah Co., Provo, Cottam 363, Aug. 8, 1925.

*Populus fremontii* S. Wats.

Fremont cottonwood

*P. macdougalii* Rose, *P. arizonica* Sarg., *P. fremontii* var. *pubescens* Sarg.; *P. fremontii* var. *thornberii* Sarg., *P. fremontii* var. *toumeyii* Sarg., *P. fremontii* var. *macrodisca* Sarg., *P. fremontii* var. *arizonica* (Sarg.) Jeps., *P. fremontii* var. *macdougalii* (Rose) Jeps., *P. wislizenii* (S. Wats.) Sarg., *P. fremontii* var. *wislizenii* S. Wats. (Synonymy adapted from Little 1953.)

Tree up to 30 m. tall; trunk .3-1.8 cm. in diameter, often branching near the base, rarely straight, often curved or leaning; crown widely rounded, open; branches stout, and somewhat curved downward. Twigs round, stout, green or light yellow, becoming light yellow-gray in the 2nd year; glabrous, rarely pubescent; leaf scars 3-lobed. Bark thin, smooth, light gray-brown, later becoming 4-5 cm. thick, reddish-brown with deep irregular grooves dividing broad ridges covered with small appressed scales. Wood 29½ lbs. per cubic ft. dry weight, considerably heavier than other cottonwoods; heartwood light brown to whitish. Buds prominent, ovoid, acute; terminal buds large, with light green lustrous scales, often resinous. Leaves thick and firm, deltoid to reniform 5-6.5 cm. long and 5-7.5 cm. wide; margins coarsely crenate with teeth few to many, incurved; apex acute to short acuminate; base truncate, cordate or abruptly cuneate; bright green, lustrous and glabrous on both upper and lower surfaces; midrib thin, yellow, with 4-5 pairs of slender lateral veins. Petioles 3.5-7.5 cm. long, flattened, yellowish, glabrous. Staminate catkins densely flowered, 3.5-7.5 cm. long, 6.5 mm. thick, peduncles glabrous; disk thickened; stamens numerous, 40-60, exerted at anthesis; anthers large and dark red. Pistillate catkins sparsely flowered, 10-12.5 cm. long before the fruit ripens; peduncles stout, glabrous; pedicels variable in length; flower scales thin, dilated, cut into filiform lobes at the apex; disk minute to 5 mm. in diameter; ovary ovoid to oblong, glabrous; stigmas 3 or rarely 4, broad and irregularly crenate. Fruit divided into 2-4 thick-walled valves; ovoid to nearly globose, 8-12 mm. long, acute or obtuse, slightly pitted. Seeds ovoid, acute, up to 3 mm. long, light brown.

#### Reproduction:

*P. fremontii* produces seeds in great numbers but these are viable for only a few days (Billings 1945.) However, in spite of this limitation, the seedlings of this species are widespread and vigorous in open sunny areas if there is sufficient moisture. (Little 1950.)

**Distribution:**

This species is wide-spread in the Southwest and is found in Colorado, Utah, New Mexico, Arizona, Nevada, California and Mexico. Though the tree is most abundant in the southern portion of Utah, it extends northward into the central and northeastern counties.

**Ecology:**

These are water loving trees and are therefore found exclusively along rivers, streams, washes and other sites where water is plentiful and constant. It is generally restricted to sites below 6,000 ft. in Utah. Fremont poplar grows in a variety of moist soils from sandy loam to gravel. (Sudworth 1934.) This species is found in pure groves and in mixed river bottom forests with other species of cottonwoods, willows, alders, birch and similar plants. The tree is very intolerant of shade at all times in its life cycle and reproduction is difficult within the river bottom groves. Occasionally it is attacked by mistletoe.

**Economic importance:**

Fremont poplar is used widely in the Southwest as a shade tree because of its pleasant form, easy propagation and rapid growth. Its wood is used for fuel and fence posts. Indians ate the green capsules and made baskets out of the twigs. Deer and cattle sometimes browse the younger saplings. (Vines 1960.)

**Remarks:**

According to Sargent (1933) Populus fremontii extends only into extreme southwestern Utah. However, broadleaf

specimens closely resembling those from Washington County have been collected from areas far north and east of that county. Such plants have been called P. wislizenii (Preston 1940.) However, he restricts this species to southeastern Utah and does not include those more northern plants. Harrington (1954) in his treatment of the broadleaf trees of western Colorado, considered them all as P. wislizenii. Graham (1937) called the broadleaf poplars of the Uinta Basin P. sargentii but this species reaches its western limits in the eastern foothills of the Rocky Mountains.

P. wislizenii is very closely related to P. fremontii. There is considerable question whether it is a separate species, or even distinct enough to be a variety of P. fremontii. The author could not find reliable characteristics to separate those specimens he had into these two groups. He, therefore, has grouped all native broadleaf poplars in Utah into one species, P. fremontii until more intensive taxonomic studies clarify the problem.

Representative specimens:

(BRU) Grand Co., road to Dead Horse Point, Erdman 185, July 25, 1960; Grand Co., Green River, Erdman 163, July 25, 1960; Kane Co., Kanab, Cottam 4319, June 13, 1929; Washington Co., Gunlock, Erdman 80, May 11, 1960; Zion NP, Erdman 49, May 11, 1960; Wayne Co., Henry Mtns., Harrison 11527, May 16, 1950.

*Populus tremuloides* Michx.

Quaking aspen

*P. cercidiphylla* Britton; *P. aurea* Tidestr., *P. tremuloides* var. *aurea* (Tidestr.) Daniels, *P. vancouveriana* Trel., *P. tremuloides* var. *vancouveriana* (Trel.) Sarg., *P. tremuloides* *cercidiphylla* (Britton) Sudw., *P. tremuloides* var. *intermedia* Victorin, *P. tremuloides* var. *magnifica* Victorin, *P. tremuloides* var. *rhomboidea* Victorin.

Trees usually up to 6-12 m. tall, occasionally to 30 m.; trunks up to .5-1 m. in diameter, bole long, slender, clear; crown small, loose, narrowly rounded; branches often very contorted. Twigs slender, round, red-brown to gray; lustrous and glabrous; lenticels scattered, oblong, orange to yellow. Bark thin, white, occasionally greenish or yellow; generally smooth except for black branch scars, leaf scars, and wounds; old trunks dark and furrowed near the base. Wood light, 25 lbs. per cubic ft. dry weight; smooth-textured; sapwood nearly white, heartwood light brown. Buds both terminal and lateral, conical, 6.5 mm. long, apex acute, red-brown, shiny, resinous or glabrous; covered by 6-7 visible scales. Leaves appearing in May or June, rather variable, thin and firm, ovate to semi-orbicular, 2.5-10 cm. long and wide; margins regularly crenate to serrate, teeth incurved, glandular; apex short-pointed or acuminate; base truncate or rounded; upper surface yellow-green to bluish-green, rather lustrous and glabrous; dull yellow-green and glabrous below; midrib conspicuous, whitish, veins uniting near margins, veinlets reticulate. Petioles 2.5-7.5 cm. long, slender, flattened. Staminate catkins 4-6.5 cm. long, 6-12 mm. in diameter; disk oblique, entire; scales divided, 3-5, triangular-lanceolate, acute to acuminate; stamens 6-12, filaments short. Pistillate catkins 10 cm. long at maturity; disk crenate; ovary conic, style thickened, stigmas 2, erect, red, lobed. Fruit born spirally on stalks; capsules narrowly conical, 6.5 mm. long, thin-walled, light green to brown; seeds obovoid, .7 mm. long, light brown.

#### Reproduction:

In Utah quaking aspen rarely reproduces sexually. The pistillate trees rarely flower while the staminate trees only occasionally flower. Large areas of the state often go many years without aspen flowering at all. Thus very little seed is produced. Such seed is viable for only a few weeks unless it is stored at temperatures below 5° C. Germination takes place readily if the proper moist conditions are provided. But this is rarely the situation in Utah for the month of June when the seeds would normally be shed is one of the driest months. Often there is insufficient moisture to induce germination but enough to greatly decrease the viability of the seeds. If the seed crop is good and the moisture sufficient,



a great number of seedlings are produced. Few if any of these, however, survive. (Moss 1938.) It has now been established that the development and survival of aspen seedlings depend on the surface layer of the soil being maintained in a moist but not flooded condition. This is necessitated by the rather unique structure of the seedling. While the hypocotyl and cotyledons develop rapidly, the radicle grows very slowly and cannot obtain sufficient water for the growing plant. The absorption function, usually performed by the new root, is taken over by a brush of long delicate hairs which grow out at the junction of the hypocotyl and the root. The distal ends adhere to soil particles in the surface soil layer and act as root hairs. This is very effective if surface water is present in the right amount. However, because of the present climatic conditions in Utah, this mechanism is more of a handicap than an advantage. If the soil surface is disturbed either by flooding, or by drying, the hairs are torn, injured, broken or dried. This deprives the seedling of sufficient water and often fatally injures it. Thus, few aspen trees in Utah are produced from seed. (Moss 1938.)

Because of the lack of sexual reproduction of aspen in Utah, root suckering is the principal method of propagation. The vast interconnected root systems lie a few feet under the soil and at intervals produce sprouts which eventually become independent of the old roots and develop their own. The expansion of such aspen clones is very slow. It is inconceivable that this has always been the case for the clones are scattered widely and separated by physical barriers such as rock out-

crops, swamps, and rivers. It is probable that earlier in Utah, perhaps at the close of the Pleistocene, conditions were right for the propagation of aspen by seed. (Baker 1925.)

#### Distribution:

Populus tremuloides is a world wide species of the northern temperate region. It is common throughout Utah in the mountains.

#### Ecology:

Aspen is usually found in mountain regions along creeks, on mountainsides, and on flats in Utah at elevations from 6000 to 10,500 ft. It is found on practically every variety of soil found in the climate to which it is suited. The most influential factor is the rockiness of soil. This often causes stunting and limits lateral spread of roots and reproduction. (Baker 1925, Sudworth 1934.)

Although aspen requires considerable moisture, it is more drought resistant than western yellow pine, Engelmann spruce, and alpine fir. The advantage aspen has in occupying such drier sites, however, is not so much a matter of actual water requirements as it is a matter of clonal growth and reproduction. The critical moisture requirement of conifers is during germination but aspen in Utah usually have no corresponding stage. (Baker 1925, Sudworth 1934.)

Because of the clonal growth of aspen, they are usually found in pure stands, often of even age because of fires. Shrubby species such as oregon grape, mountain lover and snow-berry are found in the understory. Sagebrush and oak often

ring the stands. Maples, chokecherries, and service berries are found with aspen less commonly. (Baker 1925.)

Populus tremuloides is very intolerant and cannot reproduce in its own shade. It yields to conifers such as Douglas fir, white fir, blue spruce, and others. Few, if any, stands of aspen in Utah are climax stands unless maintained as such by fire or moisture conditions. (Baker 1925.)

Aspen is susceptible to many kinds of fungal and insect attacks. The wood is not resistant and the fungus enters easily through numerous scars from fires, deer damage, and wind breakage. Beavers destroy many trees near streams and stock can overgraze the sprouts and kill off reproduction. (Meinecke 1929, Baker 1925.)

#### Economic importance:

The uses of aspen are quite limited. It has been used as a source of pulp in some eastern states and as a source of excelsior, and match sticks. In Utah such uses are restricted by other factors such as availability of trees and water. The tree has been used for fence posts, and mine posts but because it rots too easily when in contact with the ground it is less commonly used now. Aspen would be a fine ornamental if it could be grown from seed and the public made interested in it. It is also an important browse plant for sheep, cattle, and deer.

#### Representative specimens:

(BRU) Beaver Co., Tushar Mtns., Erdman 96, May 12, 1960; Grand Co., La Sal Mtns., Erdman 215, July 28, 1960; Millard Co., Canyon Mtns., Erdman 133, May 13, 1960; San Juan Co., Abajo Mtns., Erdman 239, July 28, 1960; Summit Co., Uinta Mtns., Erdman 296, Aug. 25, 1960; Utah Co., Mt. Timpanogos, McKnight 11356, April 25, 1948.

Description of the Genus and Key  
to the Species of Salix

Shrubs or trees, growing singly or in clumps. Twigs tough, marked by elevated leaf scars, lenticels numerous, small, pale. Wood light, soft, weak, usually brittle, sapwood whitish, heartwood pale brown or reddish-brown. Terminal bud absent, lateral buds covered by one or two cap-like scales. Leaves alternate, simple, deciduous; stipules small and early deciduous except on vigorous shoots. Trees dioecious. Flowers born in cylindrical catkins; individual flowers regular, minute, without petals or sepals, born on gland-like disk, subtended by pubescent bract; stamens inserted on base of bract, ovary single, 1-celled, 2-valved, style short, stigmas 2. Fruit a capsule, seeds many, small, brown, tufted with long silky hairs.

Key to the tree-like species of Salix.

1. Margins of leaves entire or obscurely serrulate.
  2. Capsules silky-pubescent, leaves rounded to acute at the apex.
    3. Leaves broadly obovate, upper surface glabrous . . . . . S. scouleriana
    3. Leaves elliptic, oval, oblanceolate or narrowly obovate, upper surface persistently pubescent . . . . . S. bebbiana
  2. Capsules glabrous, leaves lanceolate to oblanceolate, apex long acuminate . . . . . S. laevigata
1. Margins of leaves serrate or at least finely so.
  2. Leaves broadly obovate . . . . . S. scouleriana
  2. Leaves narrower than broadly obovate.
    3. Lower leaf surface green, slightly paler than upper surface, not distinctly glaucous . . . . . S. Gooddingii
    3. Lower leaf surface decidedly paler than the upper surface, usually glaucous.
      4. Petioles slender, leaves usually not more than 3 times longer than wide, not shiny above . . . . . S. amygdaloides
      4. Petioles stout, leaves commonly at least 4 times as long as wide, shiny above.
        5. Margins of leaf blades and apex of petiole bearing conspicuous yellowish glands, upper surface very shiny. . . S. lasiandra
        5. Margins not glandular, upper leaf surface only moderately shiny . . . . S. laevigata

### Distribution:

This is a wide-spread species occurring from Alaska to New Mexico. It occurs throughout most of the mountain areas of Utah except for the central plateau region from Utah County to Washington County. This apparent absence may be due to a lack of collection.

### Ecology:

Usually Salix scouleriana is found in moist areas of conifer and aspen forests from 6,500 ft. to 11,000 ft. It grows best in well-drained soils. At times it will survive on drier, hotter slopes but here it is somewhat deformed and dwarfed. This willow is shade tolerant and grows among the conifers and aspen or in thickets along the edges of creeks, springs and etc. The tree is also one of the first to invade burned areas and thus is important in erosion control. (Little 1950, Sudworth 1934, Harrington 1954.)

### Economic importance:

This is an important browse plant for sheep and cattle where it is common but usually it is rare and scattered. The tree makes a beautiful ornamental because of its symmetrical shape and varied foliage. (Little 1950, Sudworth 1934.)

### Representative specimens:

(UT) Cache Co., Logan Canyon, Preece 452, Aug. 13, 1948;  
 (BRU) Duchesne Co., Uinta Mtns., Harrison 7690, June 15, 1934;  
 Boxelder Co., Raft River Mtns., Cottam 2949, June 5, 1928;  
 Garfield Co., Henry Mtns., Stanton 88, June 24, 1930; Grand  
 Co., La Sal Mtns., Erdman 211, July 27, 1960; Utah Co., Mt.  
 Timpanogos, Weight 288, Aug. 8, 1927.

glandular-warty, minutely hairy. Slightly drooping catkins, 5-10 cm. long, born at ends of short, small-leaved twigs. Staminate catkins with small thin scales, toothed at apex, minutely hairy; stamens 5-6, filaments separate, hairy at base. Pistillate catkins with similar scales. Fruit a long-stalked capsule, elongate, conical, 6.5 mm. long, hairless.

Distribution:

This willow has a restricted range from southern California and Mexico to Arizona, Utah, and Nevada. It is distinctly a southern species, in Utah being prevalent along the Virgin and Santa Clara Rivers of Washington County and along the Colorado River as far north as Grand County. Two specimens however, have been collected far north of these sites in the Uinta Basin and at the mouth of the Bear River.

Ecology:

Salix laevigata is an uncommon willow that grows along fast-moving streams in mountain, foothill, and desert regions from 1800 to 5000 ft. It prefers sandy or gravelly soil. The tree occurs singly or in small clumps in the oak woodland, pinyon juniper forest and desert areas. (Little 1950, Peattie 1953, Sudworth 1934.)

Representative specimens:

(UTC) Boxelder Co., Bear River Refuge, May 1, 1938; (UT) Duchesne Co., E. of Tabiona, Cottam 1457, Aug. 25, 1956; Garfield Co., Colorado River, Lindsay 81, July 8, 1958; (BRU) Grand Co., Moab, Cottam 2118, June 7, 1927; San Juan Co., Natural Bridges NM, Cottam 2449, June 28, 1927; Washington Co., Veyo, Cottam 3370, June 21, 1928.

glabrous; veins prominent, yellowish. Petiole slender, round, 6-20 cm. long, twisted, glandless; stipules early deciduous, reniform, as much as 12 mm. wide. Flowers born on ends of short lateral branches. Staminate catkins slender, 2.5-5 cm. long, hairy, scales deciduous, ovate, apex rounded, yellow-green, hairy; stamens 5-9, distinct, filaments hairy at base, anthers yellow. Pistillate catkins 3.5-7.5 long, scales oblong to obovate, early deciduous; ovary oblong-conic, glabrous; stigmas nearly sessile. Fruit born on elongate pedicel, lanceolate to conic, 4-6 mm. long, light yellow to orange-yellow, glabrous.

#### Reproduction:

The seedlings of the peach-leaf willow are not numerous and occur only along moist open borders of streams, springs, lakes and other such areas in sand gravel or silt. It grows rapidly the first 25-30 years and is short lived. (Sudworth 1934.)

#### Distribution:

This willow is widespread throughout the United States. The distribution in Utah is uncertain because of the lack of collections. At present it is known to occur in the northeastern portion of the state.

#### Ecology:

Salix amygdaloides is a water-loving tree and therefore restricted to the borders of perpetual and intermittent streams from 3000-7000 ft. in this area. (Sudworth 1934, Little 1950.)

#### Economic importance:

The wood is used for fuel and posts while the tree is a good ornamental. (Sudworth 1934, Vines 1960.)

#### Representative specimens:

(UT) Davis Co., Farmington Canyon, Toomey 56, Aug. 8, 1950;  
 (BRU) Grand Co., Green River, Erdman 166, July 25, 1960;  
 (UT) Rich Co., Bear Lake, Flowers 1668, Aug. 14, 1933; Salt Lake Co., Parley's Canyon, Vickery 2498, Aug. 30, 1959;  
 (BRU) Utah Co., Provo, Weight 38, June 30, 1927.

*Salix lasiandra* Benth.

Pacific willow

*S. lancifolia* Anders., *S. lasiandra* var. *lyallii* Sarg., *Salix lyallii* (Sarg.) Heller, *S. lasiandra* var. *abramsi* Ball, *S. lasiandra* var. *macrophylla* (Anders.) Little.

Shrub or tree, rarely to 9 m. in this area; trunk up to .3-.6 m. in diameter; crown open, narrow, asymmetrical; branches straight, ascending. Twigs rather stout, purple or reddish-brown in early spring, later bright yellow or yellow-green; hairy when young, occasionally glaucous; later glabrous. Bark up to 1 cm. thick, dark brown or reddish, fissures shallow, ridges flat, scaly. Wood 28-30 lbs. per cubic ft. dry weight. Buds ovate, 6.5 mm. long, acute, brown and lustrous. Leaves thick, somewhat leathery, lanceolate to oblanceolate, 5-13 cm. long, 1-4 cm. wide; margins serrate with glandular teeth; apex acuminate, base acute to rounded; upper surface dark green and lustrous, lower surface slightly paler, glaucous. Petioles 6-17 mm. long, yellowish, smooth; black glands at base of leaf blade; stipules less than 1.5 mm. long, acute, glandular-dentate. Flowers born in terminal catkins with the leaves. Staminate catkins 2-6.5 cm. long, 9.5-12 mm. wide; scales obovate to lanceolate, entire to dentate; stamens 5-9, filaments hairy near base. Pistillate catkins 3-10 cm. long, 9.5-20 cm. wide; scales obovate to ovate, dentate near the apex, sparsely hairy; ovary long-stalked, apex acuminate, sometimes glandular; style thick. Fruit born on pedicel 1-2 mm. long, capsule lanceolate, 4-6 mm. long, light brown.

#### Distribution:

*Salix lasiandra* grows from New Mexico to Alaska. However, very few specimens have been collected in Utah. These were found in the Deep Creek, the Wasatch, and the Uinta Mountains and the Wasatch Plateau.

#### Ecology:

The Pacific willow commonly grows along mountain streams, lakes and other moist sites from 5000-8500 ft. It does best in moist sandy or gravelly soils. (Sudworth 1934, Little 1950.)

#### Economic importance:

The wood is used for fuel and charcoal. (Sudworth 1934.)

#### Representative specimens:

(UTC) Daggett Co., Uinta Mtns., June 10, 1932; Juab Co., Deep Creek Mtns.



ond year. Grafting is difficult. (Vines 1960.)

Distribution:

Ostrya knowltonii is a rare species restricted to scattered localities in western Texas, New Mexico, Arizona, and Utah. The only collections in Utah are from the Colorado drainage.

Ecology:

The Knowlton hophornbeam is usually found in moist canyons from 4200 to 7000 ft. in the pinyon-juniper forests or the oak woodland. (Little 1950, Preston 1940.)

Representative specimens:

(BRU) Grand Co., Moab, Cottam 2145, June 8, 1927; (UTC) San Juan Co., Rainbow Bridge, June 1, 1960.

Description of *Betula**Betula occidentalis* Hook

Water birch

*B. fontinalis* Sarg., *B. Utahensis* Britton, *B. papyrifera* var. *occidentalis* (Hook.) Sarg., *B. fontinalis* var. *inopina* (Jeps.) Jeps., (modified synonymy from Little 1953.)

Large shrub or small tree to 9 m. tall; trunks up to .3 m. in diameter, usually several forming a clump; crown broad and open; branches alternate, numerous, slender, and ascending or sometimes drooping. Twigs light green, sometimes puberulous, shiny, resinous-glandular; later dark reddish-brown, glabrous; lenticels light brown, horizontal. Bark 6.5 mm. thick, dark bronze or reddish-brown, lustrous and smooth; lenticels on old trunks 15-20 cm. long and 6.5 mm. wide. Wood light, soft, strong; sapwood thick, light colored; heartwood light brown. Winter buds ovoid, 6.5 mm. long, acute; scales ovoid, acute, brown. Leaves alternate, simple, deciduous, thin and firm, broadly ovate to orbicular, 2.5-5 cm. long, 2-4 cm. wide; margins sharply single or double serrate, occasionally lobed; apex acute to acuminate; base rounded or abruptly cuneate; dark green above, pale yellow-green and glandular-dotted below; veins 3-5 pairs, glandular, veinlets reticulate. Petiole 8.5-12 mm. long, stout, flattened above, green to yellow or reddish, glandular dotted. Stipules broadly ovate, margins ciliate, apex acute or rounded, bright green at first, later pale and dry. Flowers born in many-flowered catkins, regular, apetalous, monoecious. Staminate catkins born singly or in groups of two or three, 1-2 cm. long in winter, 5-6.5 cm. long in the spring; chestnut-brown; scales ovate, acute, brown; stamens 4, adnate to the 4-parted calyx. Pistillate catkins small, solitary, appearing at the ends of spur-like branches, 2 cm. long, slender, green, short-peduncled; scales acute at the apex, greenish; ovary superior, styles 2, bright red, stigmas terminal, bright red. Fruit a nutlet, born in strobiles which are 2.5-3 cm. long, erect or pendant and born on glandular peduncles 6.5-20 mm. long; scales 3-lobed with the center lobe the longest; nutlet ovoid, compressed, downy toward apex, wing wider than seed body.

## Distribution:

*Betula occidentalis* is generally widespread in the western states from New Mexico to California and Washington. It is found throughout all of Utah in its suitable habitats.

## Ecology:

This is a water-loving plant and found only in moist situations such as bottomlands, streamsides, and riverbanks in the mountains and foothills from 5000 to 8000 ft. It often

forms dense thickets but also grows in clumps in association with other riverside species. (Little 1950.)

Economic importance:

Betula occidentalis plays an important role in erosion and flood control particularly on the headwaters of mountain streams. Its wood is used for fuel and posts and the foliage is browsed by sheep, cattle, and deer. As yet this beautiful tree is used but little as an ornamental although it is very suitable.

Representative specimens:

(BRU) Beaver Co., Tushar Mtns., Erdman 87, May 12, 1960; Grand Co., Moab, Erdman 186, July 27, 1960; Sevier Co., Monroe Creek, Erdman 2, May 9, 1960; Summit Co., Uinta Mtns., Erdman 291, Aug. 25, 1960; San Juan Co., La Sal Mtns., Erdman 227, July 28, 1960; Utah Co., Mt. Timpanogos, Erdman 328, Aug. 1959.

Description of *Alnus**Alnus tenuifolia* Nutt.

Thinleaf alder

Large shrub or small tree to 9 m. tall; trunks to 20 cm. in diameter, leaning or straight, usually several forming clumps; crown narrowly rounded; branches alternate, slender, spreading and slightly pendulous. Twigs slender, brown and pubescent at first, later light brown to reddish-brown or gray, glabrous; lenticels few, large, scattered, horizontal, yellow to orange. Bark thin, reddish-brown or gray and rather smooth on branches and younger stems; older trunks silver gray or occasionally dark brown, broken on surface by closely appressed small scales. Heartwood light brown. Winter buds 6.5-8.5 mm. long, blunt-pointed, bright red and puberulous, enveloped by a pair of stipular scales. Leaves alternate, simple, deciduous, thin and firm, broadly elliptical to ovate or oblong, 5-10 cm. long, 3.8-6.5 cm. wide; margins doubly serrate and sometimes lobed; apex obtuse, acute or short-acuminate; base rounded to cordate or cuneate; upper surface dark green, and yellow-green below; young leaves densely hairy, later glabrous to occasionally pubescent; veins prominent, impressed above, midribs stout, orange. Petioles 1-2.5 cm. long, stout, orange-yellow. Stipules caducous, ovate to lanceolate, 6.5-8.5 mm. long, thin and pubescent. Flowers opening in spring before the leaves, born in many-flowered catkins; regular, apetalous, imperfect, and monoecious. Staminate catkins either sessile or born on stout peduncles up to 1 cm. long; 3 or 4 born together in a raceme; catkins 2 cm. long and purplish, later becoming 5 cm. long and 6.5 mm. thick; bractlets 4-5 under each short-stalked shield-like scale; 2-3 flowers per scale; sepals 3-5, separate; stamens 4, longer than sepals. Pistillate catkins ovoid-oblong, 1 cm. long, erect, dark brown; scales imbricate, acute; ovary 2-celled. Fruit a nutlet born in a strobile; strobiles 3-9 on peduncles 3-8.5 cm. long remaining on the tree until the next season, ovoid-oblong 8.5-12 mm. long, scales thickened, woody, 3-lobed; nutlet solitary, small, oval to oblong, flattened and encircled by a small thin membranous wings.

## Reproduction:

The catkins begin development in the summer and while yet closed hang naked on the branches through the winter. They open in the spring and seed is shed later in the summer or fall. The strobiles are persistent and may hang on the tree long after the seed is shed. (Coulter & Nelson 1909.)

This alder propagates profusely by underground rhizomes and suckers as well as by seed. (U.S.F.S. 1940.)

**Distribution:**

Alnus tenuifolia is the most widely distributed of western alders. It is found all over the western states, in Mexico, Canada, and Alaska. Records of this species in Utah are scattered. Graham (1937) collected it at various sites along the southern slopes of the Uinta Mts., and it has been collected rather often in the Wasatch from Provo to Logan. This species has also been collected in the Fish Lake Plateau, Raft River, Abajo, and La Sal Mountains.

**Ecology:**

The thinleaf alder is usually restricted to moist situations such as streamsides, river bottoms and moist flats. The soil is usually rich in organic matter. The altitudinal distribution varies with the latitude. In Utah it is about 5000 to 8000 ft. This tree often forms thickets or grows singly in conifer forests. Though it is tolerant of shade in youth, it becomes increasingly intolerant in age and therefore grows best in open, sunny glades. (Preston 1940; Billings 1945, Little 1950.)

**Economic importance:**

This tree is valuable as erosion control on the headwaters of mountain streams. It has some importance as a forage plant and is the best of the alders for sheep. (Billings 1945, U.S.F.S. 1940, Dayton 1931.) This species is also reported to contribute to soil development by the fixation of nitrogen in its root nodules. (U.S.F.S. 1940.)

**Representative specimens:**

(UT) Boxelder Co., Raft River Mtns., Preece 775, July 29, 1947; Salt Lake Co., Wasatch Mtns., Vickery 1509, Oct. 9, 1957; (BRU) Summit Co., Uinta Mtns., Erdman 290, Aug. 25, 1960; Uinta Co., Uinta Mtns., Murphy 6, June 1943; Utah Co., Provo River, Cottam 361, Aug. 8, 1925; (UT) Weber Co., Weber Canyon, Call 95, July 26, 1940.

Description of the Genus and Key  
to the Species of *Quercus*

In Utah trees or shrubs, branching alternate, twigs slender or stout, angled, lenticels pale, leaf scars semicircular. Buds clustered at end of twig, scales chestnut-brown, imbricate, in 5 ranks, hairy or tomentose. Wood heavy, hard, brittle. Leaves alternate, simple, deciduous or persistent. Trees monoecious. Flowers regular, minute, apetalous, calyx 4-7 lobed. Staminate flowers in clustered catkins, stamens 6, rarely 2-12, exserted. Pistillate catkins solitary or in 2-many-flowered spikes, flowers with 3 or occasionally 4-5-celled ovary, 1-2 ovules in each cell, ovary partly enclosed by an involucre. Fruit an acorn, 1-seeded by abortion, maturing in one season.

Numerous oaks have been described as occurring in Utah. Some of these, however, are either part of the *Q. gambelii* complex, or hybrids. Several other oaks have been erroneously reported in literature as occurring in Utah. These are *Q. chrysolepis* and its synonym *Q. wilcoxii*, *Q. dunnii* and its synonym *Q. palmeri*. (Tucker & Haskell 1960.)

Key to the species of *Quercus*.

1. Leaves often deeply lobed, sinuses often extending 1/3 or more the distance to the midrib, not spinose-dentate, lower surfaces glabrous to tomentose, leaves deciduous in the fall . . . . . *Q. gambelii*
1. Leaves not deeply lobed and often spinose-dentate, lower surfaces with stellate hairs, leaves deciduous in winter-spring.
  2. Leaves shallowly lobed, mucronate tips often obscure, somewhat stellate-pubescent on lower surface, usually more than 3 cm. long . . . . . *Q. X pauciloba*
  2. Leaves coarsely spinous-toothed, thickened, lower surface densely stellate pubescent, usually less than 4 cm. long . . . . . *Q. turbinella*

*Quercus turbinella* Greene

Shrub live oak

*Q. dumosa* var. *turbinella* (Greene) Jeps., *Q. subturbinella* Trel. (synonymy adapted from Little 1953.)

Shrub or small tree to 5 m. tall; trunk usually short; crown open, wide and spreading. Twigs rather rigid. Bark dark brown or gray, fissured and scaly. Sapwood tan or yellowish, heartwood brown. Buds ovoid 1-2 mm. long. Leaves evergreen, thick, stiff and leathery, elliptic to ovate or oblong 1-4 cm. long, 5-20 mm. wide; margins coarsely spinous-toothed, flattened or slightly revolute and thickened, rarely

manzanita, mountain mahogany, squaw bush, and etc. It is also found in the pinyon-juniper forests and the lower ponderosa pine belt. (U.S.F.S. 1940.)

**Economic importance:**

Like most trees it is used as fuel and fence posts, but its greatest value is as browse. It is particularly valuable in the winter or in times of drought. (U.S.F.S. 1940.)

**Representative specimens:**

(UT) Iron Co., Kanarraville, Drobnick 14758, Sept. 5, 1957; Kane Co., Orderville, Cottam 14641, Sept. 8, 1956; Washington Co., Pine Valley Mtns., Cottam 14435, July 15, 1956; (BRU) Zion NP, Woodbury 1925; Gunlock, Erdman 78, May 11, 1960.

*Quercus gambelii* Nutt.

Gambel oak

*Q. eastwoodiae* Rydb., *Q. gunnisonii* (Torr. & Gray) Rydb., *Q. leptophylla* Rydb., *Q. nitescens* Rydb., *Q. novomexicana* (A. DC.) Rydb., *Q. submollis* Rydb., *Q. utahensis* (A. DC.) Garrett, *Q. confusa* Woot & Standl., *Q. utahensis* var. *submollis* (Rydb.) Sarg., *Q. utahensis* var. *mollis* Sarg., *Q. novomexicana* var. *andrewsii* Trel., *Q. gambelii* subsp. *vreelandii* (Rydb.) A. Camus, *Q. novomexicana* var. *nitescens* (Rydb.) A. Camus, *Q. pauciloba* Rydb. sub-sp. *confusa* (Woot. & Standl.) A. Camus, *Q. utahensis* subsp. *submollis* (Rydb.) A. Camus.

Shrub or small tree up to 15 m. tall; trunk up to .5 m. in diameter, and occasionally to 1 m.; crown narrowly rounded; branches numerous. Twigs red-brown and pubescent at first, later becoming orange-brown, glabrous. Bark thin to thick, gray-brown, deeply fissured, scales small and appressed. Wood 52½ lbs. per cubic ft. dry weight; close-grained. Buds 3-6.5 mm. long. Leaves highly variable in size, shape, number of lobes, degree of lobing, and hairyness; deciduous, thick and firm; generally oblong to obovate, oval or elliptic, 5-18 cm. long, 3.5-9 cm. wide; margins 5-9-lobed, middle lobes often the longest, lobes shallow or extending almost to the midrib, terminal lobe rounded or occasionally 3-parted, lobes mostly oblong and entire; base of leaf cuneate or truncate; upper surface dark green, shiny, nearly glabrous; lower surface paler, soft-pubescent to sometimes tomentose, glaucous or glabrous; veins conspicuous. Petioles slender or stout, 6-25 mm. long, pubescent or glaucous. Flowers open in May at the same time as the young leaves. Staminate catkins loosely flowered 2.5-6.5 cm. long; calyx scarious.



(Christensen 1949, 1950, 1955; Cottam et. al. 1959.)

#### Ecology:

This oak is found in numerous ecological habitats from streamsides and canyons to rocky hillsides and mountain slopes. Its altitudinal range is somewhat higher than many other southwestern oaks, extending from 4000 to 8000 ft. or higher. Gambel oak reaches its maximum development on sandy, gravelly loams in canyon bottoms and sheltered places. However, it is also very common on coarse, rocky soils of drier hillsides. (U.S.F.S. 1940.)

The climatic factor which determines the northern boundary of this species is the occasional minimum temperatures which exceed the tolerance limits of this species. Gambel oak also requires somewhat moister climates than most southwestern oaks and therefore grows at higher elevations. (Cottam et. al. 1951.)

Quercus gambelii forms great belts which extend for hundreds of miles along the foothill regions of the various mountain ranges in Utah. Often within these belts it forms dense clones and groves excluding most other woody species. However, it is also found associated with Prunus virginiana, Cercocarpus montanus, Amelanchier sp., Artemisia tridentata and occasionally with aspen, maple and other broadleaf species. Gambel oak is also a common understory plant in the ponderosa pine forest. (Peattie 1953, U.S.F.S. 1940, Dayton 1931.)

#### Economic importance:

Besides such uses as fuel and fence posts, this oak plays an important role as a forage plant. Although it is only fair

in palatability and even poisonous to cattle if grazed exclusively, its vast amount of available herbage makes this widespread species an important browse plant. (U.S.F.S. 1940, Clawson & Marsh 1919.)

Remarks:

Because of the high degree of variation, the taxonomy of this oak has been in confusion for many years. It has been considered as a closely related group of several species by various authors. (Rydberg 1922.) However, because of the intergradations between these so-called species and the difficulty involved in finding reliable characteristics to separate them, it has become increasingly evident that this is one vast highly variable complex including all of the deciduous oaks of the mountain brush zone in Utah as one species, Quercus gambelii (Christensen 1955, Cottam et. al. 1959, Vines 1960.)

Representative specimens:

(BRU) Beaver Co., Tushar Mtns., Erdman 105, May 13, 1960, Grand Co., La Sal Mtns., Erdman 197, July 27, 1960; San Juan Co., Abajo Mtns., Erdman 240, July 28, 1960; Sevier Co., Monroe Creek, Erdman 16, May 9, 1960; Summit Co., Uinta Mtns., Erdman 292, Aug. 25, 1960; Utah Co., Provo, Erdman 146, June 25, 1960.

*Quercus X pauciloba* Rydb.

Wavy-leaf oak

*Q. undulata* Torr., *Q. fendleri* Liebm., *Q. venustula* Greene,  
*Q. obtusifolia* (A. DC.) Rydb., *Q. rydbergiana* Cockerell,  
*Q. media* Woot. & Standl., *Q. subobtusifolia* A. Camus.

Shrub or rarely a small tree to 4 m. tall, bark gray and rough. Twigs sparingly stellate-pubescent when young. Leaves highly variable, generally persistent until spring, firm, oblong to ovate-oblong, 3-12 cm. long, margins lobed to sinuate dentate, teeth mucronate but sometimes obscurely so, apex acute, base cuneate, surfaces blue-green or light green, glabrate or stellate-pubescent below. Acorn with hemispheric

cup, 7-10 mm. in diameter, acorn 10-15 mm. long.

This oak hybrid is part of the vast complex commonly called Q. undulata. This complex has presented such variation that its taxonomy has long been in question. (Tucker 1961b.) Recent studies indicate that in all probability, Q. undulata is actually a large hybrid swarm between Q. gambelii and perhaps six other oaks of the Southwest. (Tucker 1961a.) The Utah plants seem to be predominantly the introgressed hybrids between Q. gambelii and Q. turbinella. This latter oak is common in Washington and Kane Counties and southward into Arizona.

Q. X pauciloba is widespread in southern Utah. It is also interesting to note that similar hybrids are found associated with Q. gambelii all along the western limits of this species in Utah far north of the present range of Q. turbinella. It is therefore postulated by Cottam and others (1959) that Q. turbinella once extended far north of its present range during the Altithermal period 4000-7000 years ago and hybridized with Q. gambelii. Subsequent colder temperatures have killed out Q. turbinella but the relictual hybrids remain. (Cottam 1959.)

Another oak, Q. havardii also apparently hybridizes with Q. gambelii to form another portion of the Q. undulata complex in southeastern Utah. However, no populations have been discovered which can be readily identified as Q. havardii.

nutlet; fruit 6.5-9.5 mm. in diameter, tipped with remnants of the style; color variable, orange-red or brownish to purplish; skin thick and firm; flesh thin and sweet.

Distribution:

Celtis reticulata is widely distributed in the Western United States except in the cooler, moister coast regions. The distribution of this species in Utah is in question because of the taxonomic problems and because of the spotty collections. It is common in the Salt Lake Valley, Utah Valley, drainage areas of the Colorado and the Green Rivers, and in Washington County.

Ecology:

The hackberry is a tree of the washes, canyon, and foothills growing at elevations of 2500 ft. to 6000 ft. Although the plant grows in dry soils, it is often restricted to areas with a constant water supply. This hackberry is commonly found with Quercus gambelii and other species of the lower mountain brush zone. (Benson & Darlow 1954, Preston 1940.)

Celtis reticulata is subject to severe attacks of the mite Eriophyes which causes the branches or twigs to develop witches brooms. This infection is almost universal. Mistletoe infections are common in the branches, powdery mildew affects the leaves and the gall fly stings them and causes thick bumps on a high proportion of the leaves. (Peattie 1953.)

Economic importance:

This tree has little economic importance. It is used occasionally for fence posts and the fruit is edible. The palatability of this plant as browse is reduced by the various infections. The berries are a favorite food of many

birds.

Taxonomic problems:

Harrington (1954) in describing the genus in Colorado, described Celtis occidentalis as a rather variable complex composed of what has been called C. crassifolia, C. reticulata, C. douglasii, and C. rugulosa. He could not separate the Colorado material into these species because of the numerous intergradations involved. The taxonomy of this genus in Utah is also very confused. The leaves and fruits are rather variable and different authors disagree on many characters in their treatments of the species. The herbarium collections are inadequate for determining either the classification or the distribution. Although most of the specimens are identified as either C. reticulata or C. douglasii, the author could distinguish no reliable characteristics to separate what specimens he had. Therefore, all Utah hackberries are being considered as belonging to one species, C. reticulata until further taxonomic studies are carried out.

Representative specimens:

(BRU) Grand Co., Arches NM, Erdman 179, July 26, 1960; Kane Co., Colorado River, Harrison 12108, May 14, 1935; (UT) Tooele Co., Stansbury Island, Cottam 9187, July 7, 1942; (BRU) Utah Co., Provo, Erdman 143, June 25, 1960; Washington Co., Gunlock, Erdman 79, May 11, 1960; Zion NP, Erdman 46, May 11, 1960.

## Description of Ribes

*Ribes aureum* Pursh

Golden currant

*Chrysobotrys aurea* (Pursh) Rydb.

Usually a shrub 1-3 m. tall but occasionally a small tree; branches alternate, erect or ascending. Twigs puberulous at first, later glabrous, without spines or bristles. Bark gray to brown or reddish. Leaves alternate, simple, deciduous, firm and leathery, reniform to orbicular or obovate, 2-5 cm. wide; margins 3-5-lobed, lobes deeply separated, rounded, and entire or somewhat toothed; base cordate to cuneate; upper surface light green and glossy, lower surface puberulous at first, later glabrous; palmate venation, 3-5 principle veins, rather inconspicuous. Petioles 1-4 cm. long, glabrous. Flowers in March-June, terminal on short lateral branches, racemes leafy, 2-5-flowered, 2.5-4 cm. long; flowers regular, complete, perfect, showy, fragrant; receptacle forming a tube, 6-20 mm. long, slender, yellow; sepals 5, erect or spreading, oval, bright yellow; petals 5, reduced in size, 2-3 mm. long, born on calyx throat, margins erose, yellow or tipped with red; stamens 5, alternate; ovary inferior, 1-celled, glabrous. Fruit a several-seeded berry maturing in July-Sept., breaking from pedicel; globose, 6.5-8.5 mm. in diameter, color variable, black to red or yellow, glabrous; flesh sweet and juicy; style persistent, withered.

## Reproduction:

Usually the seeds have an embryo dormancy period and if grown in cultivation, stratification of the seeds for two months is necessary. Propagation by cuttings is also possible. (Vines 1960.)

## Distribution:

*Ribes aureum* is widely distributed throughout the western states and is common in most of the mountain regions of Utah. However, there are certain areas where it would seem likely to occur but as yet has not been collected there.

These areas include the western Uintas and the central plateau region between Beaver and Utah Counties.

**Ecology:**

The golden currant is usually found in moist canyons, along streams, or on mountain slopes from 4000 to 10,000 ft. It occurs as an understory plant of the pinyon, ponderosa pine and spruce fir forests. (Harrington 1954, Vines 1960.)

**Economic importance:**

This species has average palatability as browse. It is also used extensively as an ornamental because it adapts well to cultivation and is very showy.

**Representative specimens:**

(BRU) Beaver Co., Tushar Mtns., Erdman 93, May 12, 1960; Boxelder Co., Raft River Mtns., Cottam 3003, June 7, 1928; Grand Co., La Sal Mtns., Harrison 12480, Aug. 18, 1954; Tooele Co., Ibapah, Cottam 3147, June 15, 1928; Utah Co., Provo River, Cottam 366, Aug. 7, 1925; Washington Co., Pine Valley Mtns., Olsen, May 8, 1928.

**Ecology:**

Sorbus scopulina is usually found either along streams or on rocky mountain slopes from 6000-10,000 ft. It is usually growing in sandy or gravelly soils. This species extends from the mountain brush and ponderosa pine belts into the spruce fir forests. It is predominantly an understory plant. (Preston 1940, Dayton 1931.)

**Economic importance:**

This handsome tree is occasionally used as an ornamental but it does not adapt well to valley sites. It is also used as a browse plant in late summer.

**Representative specimens:**

(BRU) Salt Lake Co., Little Cottonwood Canyon, Cottam 3563, July 2, 1928; San Juan Co., Abajo Mtns., Erdman 244, July 28, 1960; Utah Co., Mt. Timpanogos, Erdman 321, Aug. 1959; Washington Co., Pine Valley Mtns., D. Hall, May 13, 1936; (UT) Weber Co., Ben Lomond, Call 43, June 28, 1940.



Description of the Genus and Key  
to the Species of Amelanchier

Large shrubs or small trees to 7 m. tall, usually several, often forming clump; branching alternate. Twigs slender, often pubescent when young, later becoming somewhat glabrous. Bark thin, up to 3 mm. thick, smooth. Wood heavy, hard, strong, close-grained, diffuse-porous, sapwood whitish, heartwood light brown. Leaves highly variable, alternate, simple, deciduous; stipules deciduous, linear, pubescent. Flowers born in racemes, flowers regular, complete, showy, fragrant; hypanthium campanulate, sepals 5, petals 5, white, ovary 1, inferior, 2-5-carpellate, each carpel with 2 ovules separated by a false partition. Fruit a pome.

Key to the species of Amelanchier.

1. Leaves puberulent or finely tomentose at least below, rarely glabrous, somewhat subcoriaceous, styles usually 3-4, rarely 5, stamens 10-15, fruit often dry before maturity. . . . . A. utahensis
1. Leaves predominantly glabrous, often from the first, styles usually 5, occasionally 4, stamens 20, fruit usually juicy and edible.
  2. Top of ovary glabrous, leaves glabrous from the first. Plants shrubs, rarely if ever trees.
    3. Sepals more or less pubescent, petals 1.5-2 cm. long . . . . . A. cusickii
    3. Sepals, hypanthium, and pedicels glabrous, petals shorter than 1.2 cm. long . . . . . A. pumila
  2. Top of ovary tomentose, twigs and leaves pubescent at first, usually becoming glabrous. Plants often trees. . . . . A. alnifolia

Two of the four Amelanchiers which grow in Utah reach tree size. However, because these two, A. utahensis and A. alnifolia are also commonly shrubs, the other two shrubby Amelanchiers will be briefly discussed to point out the differences.

*Amelanchier cusickii* Fern.

## Cusick's serviceberry

A shrub up to 3 m. in height. Twigs brown, glabrous. Leaves rarely compound on young, vigorous shoots, 3-5 leaflets, whole leaf up to 9 cm. long; leaves usually simple, elliptic to ovate, 3-5 cm. long, margins serrate, often only above the middle. Racemes few-flowered, glabrous; sepals acuminate, glabrous within, petals oblanceolate, 1.5-2 cm. long; ovary glabrous at apex, styles usually 5, occasionally 4.

This *Amelanchier* is common in Oregon and Washington east of the Cascades. It also extends into Idaho and into northern Utah. It inhabits drier mountain slopes.

*Amelanchier pumila* Nutt.

## Serviceberry

*A. polycarpa* Greene, *A. alnifolia pumila* (Nutt.) A. Nels.,  
*A. glabra* Greene.

Shrub up to 3 m. in height. Twigs and buds glabrous. Leaves thick, oval to suborbicular, 1-5 cm. long, margins coarsely serrate to the middle or somewhat below, apex obtuse, base rounded to subcordate, leaves glabrous from the first, upper surface deep green, lower surface paler. Pedicels and sepals glabrous, sepals about 3 mm. long; petals 8-12 mm. long, top of ovary glabrous, styles usually 5, occasionally 4. Fruit dark purple and glaucous, 8-9 mm. in diameter.

This shrubby serviceberry occurs from Oregon and California to Montana and Colorado. In Utah it is found in the northern part of the state. It has also been collected in the La Sal Mountains and in Zion National Park. It grows on mesas and mountain slopes from 5000-8000 ft.

*Amelanchier utahensis* Koehne

## Utah serviceberry

*A. alnifolia* var. *utahensis* (Koehne) M.E. Jones., *A. prunifolia* Greene, *A. venulosa* Greene, *A. bakeri* Greene, *A. crenata* Greene, *A. rubescens* Greene, *A. elliptica* A. Nels., *A. oreophila* A. Nels., *A. mormonica* Schneid., *A. jonesiana* Schneid., *A. goldmanii* Woot & Standl., *A. australis* Standl., *A. covillei* Standl., *A. plurinervis* Koehne, *A. purpusii* Koehne, *A. nitens* Tidestrom, *A. alnifolia* var. *covillei* (Standl.) Jeps., *A. alnifolia* var. *venulosa* (Greene) Jeps., *A. alnifolia* var. *nitens* (Tidestrom) Munz, *A. utahensis* subsp. *covillei* (Standl.) Clokey, *A. utahensis* subsp. *oreophila* (A. Nels.) Clokey, *A. alnifolia* var. *oreophila* (A. Nels.) R. J. Davis.

## Ecology:

Amelanchier utahensis is found in somewhat more xeric conditions than A. alnifolia. This species grows in gullies, washes, canyons and also on foothills and rocky slopes from 4000-9000 ft. This serviceberry grows most commonly in loose dry sandy or gravelly soils. It is associated with various species of the pinyon-juniper, ponderosa pine, and mountain brush zones. (Little 1950, U.S.F.S., Dayton 1931.)

## Economic importance:

This species is excellent browse for sheep, cattle and deer, particularly in the spring. The berries are edible and were ground into flour by the Indians. This plant is highly suitable as an ornamental because of its flowers and fruit. (Vines 1960, U.S.F.S. 1940.)

## Remarks:

Amelanchier utahensis is an extremely variable species. Jones in a recent monograph (1946) listed 24 different names that had been applied to this species. One problem is that the leaves of plants grown in the shade approach A. alnifolia and some of these plants can only be distinguished on the basis of flower characteristics. Though the fruits are often described as yellow or orange, this is an abnormality usually caused by a fungus.

## Representative specimens:

(BRU) Boxelder Co., Raft River Mtns., Cottam 2975, June 5, 1928; Garfield Co., Henry Mtns., Stanton 349, July 12, 1930; Grand Co., La Sal Mtns., Erdman 205, July 27, 1960; San Juan Co., Elk Ridge, Erdman 255, July 29, 1960; Tooele Co., Stansbury Island, Harrison 333, July 12, 1939; Utah Co., Provo, Wasatch Mtns., Erdman 148, June 25, 1960.

## Distribution:

This species is widespread in Western United States and in Utah it is distributed throughout the state except in the ranges of the Great Basin.

## Ecology:

Amelanchier alnifolia has the ability to grow in a wide range of habitats. It is found on dry rocky slopes in full sunlight and along streams. It is common in the shady conifer forests and in the more open aspen groves. Thus the soil and climatic tolerances of this species are very broad throughout its altitudinal range of 5000-9000 ft. This tree is most commonly associated with manzanita, maple, gambel oak, and chokecherry. (Preston 1940, U.S.F.S. 1940.)

## Economic importance:

This is a valuable browse plant for cattle, sheep, and deer because of its high palatability, widespread distribution and availability. (U.S.F.S. 1940.)

## Remarks:

According to Jones in a recent monograph (1946) much of the confusion concerning Amelanchier alnifolia and A. florida, and A. cusickii results from the lack of a type specimen of A. alnifolia. However, it is now fairly well established that A. florida is restricted to the west coast and does not extend east of the Cascade divide. All specimens reported as this species from Utah and other inland states are probably either A. cusickii if the flowers are large, and A. alnifolia if they are small. Both of these occur in the same areas but apparent-

ly do not hybridize. A. cusickii occurs in northern Utah but does not reach tree size.

Apparently A. alnifolia hybridizes occasionally with Sorbus scopulina. Whether such hybrids occur in Utah has not yet been determined yet. (Jones 1946.)

Representative specimens:

(BRU) Iron Co., Cedar Canyon, Cottam 3978, May 31, 1929; Millard Co., Canyon Mtns., Erdman 140, May 13, 1960; San Juan Co., Abajo Mtns., Erdman 245, July 28, 1960; Sevier Co., Monroe Creek, Erdman 1, May 9, 1960; Summit Co., Uinta Mtns., Erdman 295, Aug. 25, 1960; Utah Co., Mt. Timpanogos, Erdman 320, Aug. 1959.

Description of the Genus and Key  
to the Species of *Crataegus*

Shrubs or small trees up to 6 m. in height, usually in clumps; crown generally rounded, branching alternate. Twigs round, rigid, somewhat zigzag, lenticels oblong, leaf scars small, spines stiff, sharp. Wood heavy, hard, tough, close-grained, diffuse-porous, sapwood thick, light-colored, heartwood red-brown. Buds small, globose, scaly, brown, lustrous. Leaves alternate, simple, deciduous, margins irregularly serrate, occasionally shallow-lobed; stipules present. Flowers regular, complete, showy, born in terminal corymbs; receptacle tubular, sepals 5, petals 5, inserted on edge of receptacle, white, stamens 10-20 or 5 by abortion, ovary inferior, 2-5-celled, 2 ovules in each cell. Fruit a pome, flesh dry and mealy.

In Utah the hawthorns are generally water-loving plants and are found along river bottoms and other damp areas in the mountains from 5000-8000 ft. Sometimes the trees extend out of the forest into range and sagebrush lands along streams. (Little 1950, Peattie 1953, Preston 1940.)

These trees are suitable for use as ornamentals. The fruit is excellent bird food.

Key to the species of *Crataegus*.

1. Seeds 5, pedicels of fruit usually glabrous, leaves elliptic to lanceolate, base narrowly cuneate, spines few, seldom over 3 cm. long . . . . . *C. rivularis*
1. Seeds 2-4, pedicel of fruit usually villose, leaves ovate to nearly orbicular, base broadly cuneate to truncate, spines numerous, often over 3 cm. long . . . . . *C. succulenta*

*Crataegus rivularis* Nutt.

Trunks up to .3 m. in diameter; branches spreading, erect, and ascending. Twigs reddish-brown, glabrous and lustrous; spines few, 6-32 mm. long. Bark reddish-brown, scaly. Leaves thin, lanceolate to elliptic, 3.5-5 cm. long, about 2 cm. wide; margins finely serrate, teeth glandular; apex acute or abruptly acuminate; base gradually narrowed from the middle to cuneate; leaves reddish and hairy at first; upper surface later dull green, smooth and glabrous; lower surface paler and yellow-green; midrib slender, yellow; primary veins 3-4 pairs, obscure. Petioles slender, 1-2 cm. long, wing-margined above, reddish hairy at first, glabrous later. Flowers opening in May, born in compact, glabrous corymbs; pedicels long, slender; flowers 1 cm. in diameter; receptacle obconic, slightly hairy at first, later glabrous; sepals slender, entire, reddish, glabrous externally, hairy within; petals rounded, anthers whitish to pink, rose

or purple; ovary 5-celled, with tufts of long pale hairs at apex, styles 5. Fruit ripening in Sept. born in drooping corymbs; pome short-oblong, ends rounded, 6.5-12 mm. in diameter, dark red but turning black at maturity, usually white-dotted, lustrous; flesh occasionally sweet and somewhat succulent; seeds 3-5 bony seeds, 1 cm. long, apex narrowly rounded, dorsally ridged; ventral cavities broad, shallow.

Distribution:

This hawthorn extends westward from northwest Texas to Arizona and north to Idaho and Wyoming. The distribution of this species in Utah is uncertain although it seems to be restricted to the northern and central parts of the state. It has also been recorded from the La Sal Mountains.

Representative specimens:

(UT) Cache Co., Paradise, Garrett 8427, Sept 19, 1941; Duchesne Co., Uinta Mtns., Cottam 14575, Aug. 25, 1956; Salt Lake Co., Big Cottonwood Canyon, Blake 52, June 5, 1932; (BRU) San Juan Co., La Sal Mtns., Cottam 2288, June 16, 1927; Utah Co., Provo River, Cottam 371, Aug. 7, 1923; (UT) Weber Co., Ogden, Call 6, May 10, 1940.

*Crataegus succulenta* Schrad.

Fleshy hawthorn

*C. macracantha* Lodd., *C. coccinea* L. var. *macracantha* (Lodd.) Dudley, *C. illinoensis* Ashe, *C. neo-fluvialis* Ashe, *C. per-tomentosa* Ashe, *C. colorado* Ashe, *C. occidentalis* Britton, *C. gemmosa* Sarg., *C. crux* Ashe, *C. vegeta* Sarg., *C. gaultii* Sarg., *C. dumicola* Sarg., *C. fertilis* Sarg., *C. micracantha* Sarg., *C. coloradensis* A. Nels., *C. virilis* Sarg., *C. coloradoides* Ramaley, *C. victorinii* Sarg., *C. succulenta* var. *macracantha* (Lodd.) Eggl., *C. succulenta* var. *rhombifolia* (Sarg.) Eggl., *C. glandulosa* Moench var. *michiganensis* (Ashe) Farwell, *C. glandulosa* var. *minor* (Loud.) Farwell, *C. glandulosa* var. *neofluvialis* (Ashe) Farwell, *C. succulenta* var. *membranacea* (Sarg.) Palmer, *C. succulenta* var. *neofluvialis* (Ashe) Palmer, *C. succulenta* var. *michiganensis* (Ashe) Palmer, *C. leucantha* Laughlin.

Trunk short, up to 12-15 cm. in diameter; crown broad, irregular; branches ascending. Twigs dark orange-brown, lustrous, becoming dull gray-brown in second season, ultimately ashy-gray; spine 4-6.5 cm. long, stout, slightly curved, bright chestnut-brown. Leaves oval to round or elliptic, 5-6.5 cm. long, 2.5-4 cm. wide; margins sharply serrate,

teeth not glandular; apex rounded to acute; base gradually narrowed from the middle; upper surface dark green, glossy, glabrate; lower surface pale yellow-green, more or less villose-pubescent at least near the veins; midrib stout, yellow; secondary veins, 4-7 pairs, extending obliquely to the tip of the lobes and deeply impressed on the upper surface. Petioles 5-12 cm. as long as blade, stout, slightly winged above, often red after midsummer. Flowers born in broad villose corymbs; pedicels long, slender, hairy; flowers 1.5-2 cm. in diameter; hypanthium narrowly obconic, villous or glabrous; sepals broad, acute, glandular with bright red glands, villose; anthers small, rose-colored; ovary 2-3 carpellate with ring of pale hairs at apex, styles 2-3. Fruit maturing in Sept.-Oct.; pedicels, slender, elongate; fruit globose, 1-2 cm. in diameter, bright scarlet, with large pale dots; flesh thick, juicy, sweet, yellow; seeds 2-3, 8.5 mm. long, 6.5 mm. broad, prominently ridged on back, ventral cavities wide and deep.

**Distribution:**

This hawthorn is found from Eastern Canada and New England westward to Colorado and Arizona. In Utah it has been collected only along the Provo River as it cuts through the Wasatch Mountains.

**Representative specimens:**

(UT) Utah Co., Provo Canyon, Garrett 8439, May 20, 1942;  
Wasatch Co., Provo Canyon, Altenison 8417, Sept. 10, 1941.



in sandy soils. This is a very characteristic tree of the pinyon-juniper, and yellow pine forests. (Dayton 1931, Harrington 1954.)

**Economic importance:**

Browse use of this species is limited. It is probably grazed only where there is a scarcity of other suitable browse. (Dayton 1931.) Squaw apple is also used occasionally as a cultivated plant. (Vines 1960.) The fruit is sometimes used for jellies and jams.

**Reproduction:**

Although the squaw apple does not fruit regularly, it produces abundant crops when it does so. (Vines 1960.)

**Representative specimens:**

(BRU) Grand Co., La Sal Mtns., Harrison 12430, Aug. 16, 1954; Kane Co., Orderville, Cottam 4263, June 12, 1929; (UT) San Juan Co., Abajo Mtns., Cottam 12193, May 1950; (BRU) Sanpete Co., Manti, June 27, 1896; Washington Co., Pintura, Cottam 3467, June 25, 1928.

## Distribution:

Purshia tridentata is one of the most widespread shrubs of the west. It extends from New Mexico westward to California and northward to Montana and British Columbia. It is common in Utah except in the western desert ranges.

## Ecology:

Purshia tridentata is found on arid plains, foothills and mountain slopes from 4000 to 8000 ft. in Utah. This species usually prefers well-drained sandy, gravelly or rocky soils on open south exposures. P. tridentata is exceptionally drought resistant and it thrives under rigorous conditions. Bitterbrush is a common plant of the pinyon-juniper forests, oak-brush and aspen belts. It is often associated with such plants as sagebrush, mountain mahogany, oak, serviceberry, pinyon pine, and etc. (U.S.F.S. 1940, Cline 1959.)

## Economic importance:

Purshia tridentata is one of the most important browse plants, if not the most important single species on the western range. The foliage and young twigs are highly palatable to cattle and sheep and grazing is heavy in the late fall, winter and spring. It is also an important plant on the deer winter range. Although this is a lovely shrub, it is rarely used as an ornamental.

## Remarks:

Purshia tridentata and the closely related Cowania stansburiana apparently hybridize and back cross where they intermingle. This results in discordant variation which is very common in both species throughout Utah and elsewhere.

P. glandulosa of southern California and Nevada is a stabilized hybrid resulting from such introgression of C. stansburiana characters into P. tridentata. (Thomas 1957.)

Representative specimens:

(BRU) Emery Co., San Raphael River, Harrison 8070, May 8, 1936; Garfield Co., Escalante Mtns., Erdman 40, May 10, 1960; Kane Co., Kanab, Castle 156, July 16, 1953; San Juan Co., Elk Ridge, Erdman 258, July 29, 1960; Uinta Co., Dinosaur NM, Welsh 492, June 2, 1956; Utah Co., Wasatch Mtns., Mason, July 9, 1935.

## Distribution:

Cowania stansburiana is found from New Mexico west to California and north to Colorado, Utah and Nevada. It is widespread in most of Utah. However, it is not found north of Ogden or in the Uinta Basin.

## Ecology:

The cliffrose is often a common plant of dry rocky foothills and mesas between 4000 and 8000 ft. It seems to be a very characteristic plant of soils with limestone origin although it is also found on soils of igneous origin. This species is found in the upper reaches of the desert up through the pinyon-juniper forests and often into the oak brush of ponderosa pine forest. It is most commonly associated with mountain mahogany, serviceberry, sagebrush, and other moderately xerophytic trees and shrubs. (Preston 1940, Kearny & Peebles 1951, Benson & Darrow 1953, U.S.F.S. 1940, Cline 1959.)

## Economic importance:

This is a very important browse plant in Utah, particularly in the winter ranges of deer, cattle and sheep. It is occasionally used as an ornamental. (Kearny & Peebles 1951, U.S. F.S. 1940.)

## Remarks:

See the discussion of Purshia tridentata.

## Representative specimens:

(BRU) Boxelder Co., Lucine, Cottam 3075, June 12, 1928; Millard Co., Pavant Range, Erdman 119, May 13, 1960; San Juan Co., Dead Horse Point, Erdman 173, July 26, 1960; Tooele Co., Stansbury Island, Harrison 338, July 12, 1939; Utah Co., Springville, Johnson 73, May 25, 1931; Washington Co., Virgin, Erdman 65, May 11, 1960.

Description of the Genus and Key  
to the Species of *Cercocarpus*

Shrubs or trees, branching alternate. Twigs with persistent leaf scars, numerous small lateral branches. Wood very heavy, hard, brittle, dark colored. Leaves simple, born alternately or in fascicles, prominently veined below. Flowers solitary or in small fascicles, regular, apetalous, perfect; hypanthium slaverform, sepals 5, small, yellowish; stamens 15 to many, inserted on hypanthium in 2-3 rows, pistil 1, superior, sessile, 1-ovuled, style terminal. Fruit a villose achene, enclosed in sheath-like hypanthium, persistent style elongate, exserted, plumose.

According to unpublished studies of Dr. Howard Stutz of Brigham Young University, the three species of this genus apparently hybridize with each other and plants with intermediate conditions are common.

Key to the species of *Cercocarpus*.

1. Leaves thick and leathery, linear to elliptic or lanceolate, margins entire, revolute; flowers sessile or nearly so.
  2. Leaves predominantly linear, strongly revolute, little under surface exposed, styles on mature fruits 2-4 cm. long . . . . . *C. intricatus*
  2. Leaves narrowly elliptical to lanceolate, margins moderately revolute, much of the under surface exposed, styles on mature fruits 4-7 cm. long . . . . . *C. ledifolius*
1. Leaves moderately thick but not leathery, obovate to oblanceolate, margins toothed, not revolute, flowers on definite short pedicels . . . . . *C. montanus*

*Cercocarpus ledifolius* Nutt.

Curlleaf mountain mahogany

Large shrub or small tree 7 m. tall, rarely to 12 m. tall; trunks one to several, up to .5 m. in diameter, short, stout, often crooked; crown compact, round; branches ascending to widespreading, crooked. Twigs stout, round, rigid, red-brown, pubescent at first, becoming dark brown to silver-gray and glabrous, often covered with a glaucous bloom; leaf scars elevated, crowded. Bark thin, to 2.5 cm. thick on older trunks; red-brown or gray; deep broad furrows, ridges broken on surface into thin, small persistent scales 2.5 cm. wide. Wood 67 lbs. per cubic ft. dry weight; close-grained, diffuse-porous; sapwood thin, yellow, heartwood red to dark brown. Buds minute, scales persistent. Leaves persistent for two years, thick and firm, aromatic; narrow-elliptical to oblong or

**Distribution:**

Cercocarpus montanus extends from New Mexico west to California and north to Colorado, Utah, and Nevada. It is found in all parts of Utah except in the ranges of the western desert.

**Ecology:**

Mountain mahogany grows in a variety of habitats from the stream beds and canyon bottoms to dry slopes and flats and rocky ridges. This shrubby tree has an altitudinal range from 4000 to 9500 ft. and therefore is present in various plant zones such as the pinyon-juniper forest, the mountain brush, and spruce fir. It is most commonly associated with gambel oak, serviceberry, bitterbrush, manzanita, ceanothus, sagebrush, and other such shrubby species. Mountain mahogany often dominates the mountain brush communities forming "mountain mahogany" type of chaparral. (U.S.F.S. 1940.)

**Economic importance:**

Cercocarpus montanus is a very palatable plant for deer, cattle, and sheep and its abundance makes it a very important winter range plant. (U.S.F.S. 1940.)

**Representative specimens:**

(BRU) Duchesne Co., Uinta Mtns., Harrison 7696, June 15, 1934; Garfield Co., Bryce Canyon, Harrison 12322, May 18, 1954; Grand Co., La Sal Mtns., Erdman 206, July 27, 1960; San Juan Co., Dead Horse Point, Erdman 175, July 26, 1960; Elk Mtns, Erdman 257, July 29, 1960; Utah Co., Wasatch Mtns., Larsen 7126, May 27, 1933.

Description of the Genus and Key  
to the Species of Prunus

Shrubs or small trees, wood hard, close-grained, diffuse-porous. Twigs round, marked by lenticels and elevated leaf scars. Terminal buds usually present, scales imbricate. Leaves alternate, simple, deciduous, stipules early deciduous, free from petiole. Flowers regular, complete or rarely imperfect; flowers perigynous with a cup-like hypanthium, sepals 5, petals 5, inserted on hypanthium disk, white, stamens 10-20, ovary superior, 1-carpellate, style terminal; fruit a drupe.

Key to the species of Prunus.

1. Leaves born in fascicles, sessile or nearly so, linear-spatulate, less than 2 cm. long, entire or sparingly serrate, drupe pubescent, exocarp rather dry, splitting on one side . . . . . P. fasciculata
1. Leaves alternate, petiolate, oval to oblong, longer than 5 cm., margins sharply serrate, drupe glabrous, fleshy . . . . . P. virginiana

*Prunus fasciculata* (Torr.) Gray

Desert almond

*Emplectocladus fasciculatus* Torr., *Amygdalus fasciculata* Gray, *Lycium spenceriae* MacBr.

Usually a shrub, rarely a small tree to 3 m.; crown dense, rounded; branches very numerous, spreading, spinescent. Twigs short, stiff, brown to gray, puberulent and semi-lustrous when young, later dull and glabrous. Leaves often clustered on short branches, oblanceolate to linear-spatulate, 6-20 mm. long, 3-6.5 mm. wide; margins entire or occasionally with a few teeth; apex obtuse to acute; base tapering to a very short petiole or sessile; both surfaces gray-green, finely pubescent. Flowers appearing March-May, solitary or in groups of 2-5 in leaf axils; sessile or short-pedicelated; flowers 6-9 mm. across; hypanthium yellow; sepals short acuminate; petals oblanceolate to obovate, 2-3 mm. long, spreading; stamens exerted, filaments slender, distinct. Drupe maturing in April-May, subglobose or ovoid, about 1.5 cm. long, acute or obtuse-pointed, flattened, densely light brown, hairy, flesh thin, dry; stone solitary, bony, flattened, narrowly-winged on ventral side, smooth.

Reproduction:

Although this species is usually dioecious, monoecious plants are occasionally found.

*Prunus virginiana* L.

## Chokecherry

*P. nana* Du. Roi, *P. demissa* (Nutt.) D Dietr., *P. virginiana* var. *demissa* (Nutt.) Torr., *P. melanocarpa* (A. Nels.) Rydb., *P. demissa* var. *melanocarpa* A. Nels., *P. valida* (Woot & Standl.) Rydb., *P. virginiana* var. *melanocarpa* (A. Nels.) Sarg., *Padus virginiana* (L.) Mill., *P. nana* (Du Roi) Borkh., *P. melanocarpa* (A. Nels.) Shafer, *P. valida* Woot & Standl., *P. virginiana* var. *melanocarpa* (A. Nels.) Moldenke, *Cerasus demissa* Nutt., *Cerasus demissa* var. *melanocarpa* A. Nels.

Large shrub or small tree to 8 m.; trunk one or several, up to 20 cm. in diameter, slender, often crooked; crown spreading; branches small, erect or horizontal. Twigs slender, red-brown to orange-brown, lustrous; lenticels pale. Bark 3 mm. thick, dark gray to brown or black, smooth, later fissured and scaly; inner bark disagreeably scented. Wood heavy, 36 lbs. per cubic ft. dry weight, moderately strong, brittle; sapwood thick, white; heartwood light brown. Terminal buds 3-7 mm. long, acute or obtuse, pale chestnut-brown. Leaves variable, thick or thin, strong odor when crushed; oval to oblong, 5-10 cm. long, 1-5 cm. wide; margins sharply serrate; apex acute or abruptly acuminate; base rounded or cordate; upper surface dark green, shiny; lower surface light green, glabrous except sometimes pubescent on veins. Petioles slender, 1-2.5 cm. long, 2 glands at apex. Flowers appearing in April-June, born in racemes 7-15 cm. long, racemes dense, many-flowered, cylindric, erect or nodding; pedicels slender, glabrous; flower 6-9 mm. in diameter; sepals short, apex obtuse, margins glandular-laciniate; petals round, short-clawed; filaments of stamens glabrous; style thick, short, stigma orbicular. Drupe ripening in July to Sept.; globose 6-12 mm. in diameter, dark red or nearly black, lustrous; skin thin, flesh dark, juicy, astringent, barely edible; stone large, oblong-ovoid, one surface edged, the other acute.

## Reproduction:

*Prunus virginiana* produces good crops of chokecherries almost every year. Seedlings are numerous and rather aggressive. This species also commonly propagates by producing suckers on the roots. (Vines 1960, Preston 1940.)

## Distribution:

This is a very widespread species, found throughout temperate North America. It is found in nearly all the mountainous regions of Utah.



**Ecology:**

Although Prunus virginiana is often found in moist situations, such as streamsides and seeps, it also grows in dry open areas on hillsides and even in cliffs and rocks from 4500 to 8000 ft. It is often very abundant, growing in large clumps or with other streamside trees. (Little 1950, U.S.F.S. 1940, Preston 1940.)

The tree is subject to the "black knot of cherries", caused by Flowrightia morbosa. These infections are often large and conspicuous. It is suspected of being a host to certain viruses that infect cultivated fruit trees.

**Economic importance:**

This species has moderate browse value but under some conditions is poisonous. The plant yields hydrocyanic acid which is fatal if consumed in sufficient amount. The young leaves in the spring are most dangerous and by August the tree is moderately safe. (U.S.F.S. 1940.) The pit of the fruit is also dangerous.

The fruit is widely used in jellies and preserves. The tree itself is sometimes used as an ornamental. Its beautiful flower clusters and lovely foliage make it highly attractive.

**Representative specimens:**

(BRU) Grand Co., La Sal Mtns., Erdman 208, July 27, 1960; Piute Co., Tushar Mtns., Erdman 26, May 9, 1960; Millard Co., Canyon Mtns., Erdman 132, May 13, 1960; San Juan Co., Abajo Mtns., Erdman 246, July 28, 1960; Summit Co., Uinta Mtns., Erdman 297, Aug. 25, 1960; Utah Co., Wasatch Mtns., Erdman 152, June 25, 1960.

## Description of Acacia

Acacia greggii A. Gray

Catclaw acacia

Senegalia greggii (A. Gray) Britton &amp; Rose

Large shrub or small tree to 9 m.; trunk to 30 cm. in diameter, crown irregular, large; branches numerous, spreading. Twigs slightly angular, pale brown to reddish, pubescent, prickle interstipular, curved, 6-7 mm. long. Bark 3 mm. thick, gray, furrowed, scaly. Wood 53 lbs. per cubic ft. dry weight, hard, strong, close-grained; sapwood yellow, heartwood reddish-brown. Leaves persistent into late winter, alternate, bipinnately compound, 2-8 cm. long, 2-3 pairs of primary divisions, each with 4-6 pairs of oblong leaflets, each about 6 mm. long, margins entire, apex round to truncate, base contracted into small petiole; surfaces pubescent, 2-3-veined. Flowers in dense cylindrical spikes, 4-5 cm. long, 1 cm. in diameter, dense, oblong, fragrant, peduncle about one-half the length of the spike, often a number of spikes clustered near the ends of the twigs; flowers nearly regular, complete, small; sepals united, lobes 5, minute, upper surface puberulose; stamens numerous, 6-7 mm. long exserted, filaments pale yellow; ovary long-stalked, hairy. Fruit a legume, straight, curved, or twisted, linear oblong, 5-14 cm. long, 1-2 cm. wide, constricted between the seeds; apex acute or rounded, sometimes mucronulate, base narrowed into stalk, margins thickened, valves thin and membranous, light brown to reddish. Seeds almost orbicular but compressed slightly, 6-9 mm. long, dark brown, shiny.

## Reproduction:

The tree bears flowers for a very long period from April into October. The seeds have about 60% germination. (Vines 1960.)

## Distribution:

Acacia greggii is a species of Mexico and the Southwest. Its northern limits are in Washington County, Utah. Here it occurs in the Beaver Dam Wash. One grove of about 40 trees is reported near Terry's Ranch.

## Ecology:

This is a tree of desert washes, mesas, and plains from sea level to 5000 ft. elevation. It grows in very dry gravelly

soil and has great drought resistance. Often the tree forms impenetrable thickets. (Vines 1960, Benson & Darrow 1953, Little 1950.)

**Economic importance:**

This tree is widely disliked because of its sharp spines which inflict painful wounds. The wood is used for fuel and novelties. The foliage is grazed when better forage is lacking. The flowers are a source of honey and the legumes are used as food by the Indians. (Vines 1960, Little 1950.)

**Representative Specimen:**

(BRU) Washington Co., Beaver Dam Wash, Welsh 1480, April 8, 1961.

Description of the Genus and Key  
to the Species of *Prosopis*

Shrubs or small trees, crown open and broad. Twigs slightly zigzag, spines born in pairs at the nodes, straight, stout, sharp. Wood hard, about 48 lbs. per cubic ft. dry weight, close-grained. Leaves alternate, deciduous, pinnately compound, 1-2 pairs of primary pinnae each with numerous leaflets, which are narrow, and entire with an acute apex. Flowers nearly regular, complete, small, greenish-yellow to whitish, somewhat fragrant; sepals united, 5-lobed; petals 5, slightly united, pubescent within; stamens 10, separate, exserted; pistil pubescent. Fruit an indehiscent legume.

Mesquites bloom intermittently from April to early autumn. Cattle are the most important agents of dispersal of the seeds. These animals eat the pods readily and the highly resistant seeds pass through the digestive tract unharmed. (Little 1950, U.S.F.S. 1940.)

These are drought resistant trees due to their very remarkable root systems. The tap roots often probe downward for 15 m. and strong lateral roots extend outward in a great circle from the center. (Preston 1940, Peattie 1953, Little 1950.)

The wood of the mesquites is very hard and durable and it is used extensively for fence posts. There is no better wood for fuel in the desert. The pods are very sweet and excellent food for livestock. They are a favorite food of the Indians of the Southwest. The flowers are a source of honey. The root system is very effective in binding the soil. (Vines 1960, Peattie 1953.)

Key to the species of *Prosopis*.

1. Fruits linear, curved, twisted or straight but not coiled, often constricted between the seeds, longer than 4 cm., leaflets commonly more than 9 pairs, spines yellowish . . . . . *P. juliflora*
1. Fruits tightly and spirally coiled, 2-4 cm. long, leaflets 5-9 pairs, spines white . . . . . *P. pubescens*

**Ecology:**

This tree usually is found on the plains, low ranges, and desert regions from sea level to 5500 ft. It grows in large, pure, open stands but it is occasionally a member of the lower mountain brush communities. This is an extremely vigorous and aggressive tree, when the natural vegetation has been disturbed. (Preston 1940, Peattie 1953, U.S.F.S. 1940.)

**Economic importance:**

In spite of the great usefulness of this species, it is creating a very serious problem by overrunning more valuable range land. The seeds are spread over great distances by cattle as they are moved from range to market. Much of this land has been overgrazed and therefore susceptible to invasion by the mesquite. At least 37 million acres of range land in Texas alone have been taken over by mesquite in recent years and it has rapidly moved into vast areas of Louisiana, Arkansas, and Kansas where it was once rare or absent. This problem is not unique to the United States however, but this is occurring in many other areas wherever it has become established. (Peattie 1953, U.S.F.S. 1940, Little 1950.)

The eradication of mesquite is a very real problem. It sprouts easily from stumps and roots. Until recently it was almost impossible to get rid of the plant in large scale efforts. The application of sodium arsenic to the freshly cut stumps seems to be efficient and fairly economical. (Peattie 1953.)

**Remarks:**

The variety common in southern Utah, P. juliflora var.

**Distribution:**

Prosopis pubescens grows from West Texas to California, Nevada, and Colorado. In Utah it is restricted to the drainages of the Virgin and Santa Clara Rivers of Washington County in the extreme southwest corner of the state.

**Ecology:**

This tree is generally found on alluvial fans, along streams, washes, and foothills from sea level to 5500 ft. Prosopis pubescens is hardier than Prosopis juliflora and can withstand greater drought and alkalinity although it is not as aggressive nor abundant. (Little 1950, Benson & Darrow 1954, Preston 1940, Peattie 1953.)

**Representative specimens:**

(BRU) Washington Co., St. George, Galway, Oct. 19, 1935; Santa Clara, Cottam 3396, June 21, 1928.

It extends only into the southern portion of Utah along the Virgin, Santa Clara, and Colorado Rivers.

Ecology:

Cercis occidentalis grows in either moist soils along streams or on the dry rocky slopes of desert ranges from 500-6000 ft. It is found both in desert regions and as an occasional member of the oak brush communities. (Little 1950, Benson & Darrow 1954, Preston 1940.)

Economic importance:

This beautiful plant is a common ornamental. (Vines 1960.)

Representative specimens:

(UT) Garfield Co., Colorado River, Lindsay 27, July 6, 1958;  
San Juan Co., Colorado River, Lindsay 147, July 25, 1958;  
(BRU) Washington Co., Santa Clara, Cottam 4716; Washington  
Co., Pintura, Cottam 4662, April 22, 1930.

Description of *Robinia**Robinia neomexicana* A. Gray

Newmexican locust

*R. neo-mexicana* var. *luxurians* Dieck; *R. luxurians* Schneid.  
*R. subvelutina* Rydb., *R. neomexicana* var. *subvelutina* (Rydb.)  
 Kearney & Peebles.

Shrub or small tree up to 7 m.; trunk up to 30 cm. in diameter. Twigs slender, mostly round or slightly winged, reddish-brown to gray, pubescent at first, later glabrous; lenticels small, scattered; prickles straight or curved, sharp, stout. Bark thin, light brown, furrowed, separating into small plates. Wood very heavy, hard, strong, close-grained, ring-porous; sapwood thin, light yellow, heartwood yellow, streaked with brown. Terminal bud absent, lateral buds minute, naked, depressed-globose, subpetiolate. Leaves alternate, deciduous, odd-pinnately compound, leaflets 13-21, elliptic-lanceolate, 1-e cm. long, margins entire, apex obtuse to rounded; both surfaces finely strigillose. Rachis stout and pubescent; stipules papery or becoming spines. Flowers born in large drooping racemes, 5-10 cm. long, all parts pubescent or glandular-hispid; flower papilionaceous, perfect, about 2.5 cm. long, calyx tube campanulate, 8-10 mm. long, lobes 5, triangular; petals 5, rose to whitish, standard large, rounded, and reflexed, wings nearly as long; stamens 10, diadelphous, overy superior, 1-celled, style elongate. Fruit a legume, compressed, 5-10 cm. long, 9-10 mm. wide, flat, thin, thickened on one edge, thin-valved, glandular-hispid. Seeds 3-8 per pod, oblong-oblique, 1-2 mm. long, thin-coated, dark brown.

## Reproduction:

Flowers appear in April and the tree continues to flower into August. The legumes are mature in September or October and seeds are dispersed from then until December. (Vines 1960.)

## Distribution:

This southwestern species occurs in extreme southern Utah from Santa Clara to Kanab.

## Ecology:

*Robinia neomexicana* is a desert plant generally restricted to moist soils along streams and washes or mountain slopes from 4000-8500 ft. (Preston 1940.)



**Economic importance:**

The wood is used for fence posts. The tree is valuable in erosion control and also as an ornamental. (Vines 1960.)

**Representative specimens:**

(UT) Kane Co., Kanab, Greenhalgh, May 21, 1947; Washington Co., Gunlock, Plummer 7325, May 14, 1939.

Description of the Genus and Key  
to the Species of Rhus

Trees or shrubs with rounded crowns. Leaves alternate, deciduous, usually compound. Flowers regular, usually perfect, small, greenish-yellow to whitish, born in dense, many-flowered spikes or panicles; sepals 5, petals 5, stamens 5, ovary superior, 1-celled, surrounded by cup-like disk. Fruit a drupe, born in dense clusters, persistent, subglobose 4-7 mm. in diameter.

Key to the species of Rhus.

1. Leaves pinnately compound with 11-21 leaflets,  
panicle terminal . . . . . R. glabra
1. Leaves usually 3-foliolate or simple, inflorescence axillary.
  2. Leaves 3-foliolate . . . . . R. trilobata
  2. Leaves usually simple but occasionally  
3-foliolate . . . . . R. utahensis

Rhus utahensis Gooding

This species is so similar to R. trilobata that it is possibly only a variety. It is generally smaller and shrubby with ovate to round simple leaves. It is found in more xeric habitats and is common on lower arid mountain slopes throughout much of Utah.

Rhus trilobata Nutt.

Skunkbush or squawbush

R. aromatica Ait. var. flabelliformis Shinnars.

Usually a shrub but occasionally a small tree to 4 m., trunks numerous, slender; branches numerous, slender, spreading, crooked. Twigs slender, gray to reddish-brown, puberulent at first, later glabrous. Leaves alternate, firm, strongly pungent when crushed, trifoliolate, 2-5 cm. long; leaflets cuneate, obovate, oval or spatulate; terminal leaflet cuneate, larger than the others, 3-lobed with smaller lobes or crenate-toothed, 2 cm. long, apex obtuse or rounded, base cuneate; lateral leaflets smaller, obovate to oval, 1 cm. long, also 3-lobed but much less so; upper surfaces dark green and glabrous, lower surfaces paler and pubescent. Petioles 6-9 mm. long, reddish, pubescent. Flowers born in axillary spikes, pedicels 2-3 mm. long; flowers occasionally imperfect due to abortion of the stamens; sepals triangular-lanceolate to oblong, 1-2 mm. long, apex obtuse to rounded, margins ciliate, glabrous; petal obovate, 2-3 mm. long, obtuse, glabrous above, hairy below; stamens 1-2 mm. long, anthers oval, pistil short, stigma short. Drupe orange-red, covered by glandular, sticky hairs; seed lenticular, about 5 mm. long.

The seeds are dispersed by birds and mammals. (Vines 1960.)

Distribution:

Although this tree grows throughout much of the United States and southern Canada, its distribution in Utah seems to be rather restricted. It is abundant in certain localities in the Wasatch Mountains and it also occurs in Zion National Park and along the Colorado river near the mouth of the San Juan river.

Ecology:

Rhus glabra usually grows in rich moist soil although it is also found on shallow rocky hillsides from 4500-7000 ft. It usually forms dense thickets but also grows scattered in the oakbrush. (Harrington 1954, Zion-Bryce Natural History Assoc. 1937.)

Economic importance:

This tree has great value as an ornamental because of its form, large beautiful leaves which turn to striking reds and oranges in the fall, and the bright clusters of berries. It had medicinal value for the Indians who used it for astringents, to stop bleeding, and for renal disorders. Occasionally it is planted for erosion control. Numerous birds and mammals feed on its leaves and berries. (Vines 1960, Rehder 1927.)

Representative specimens:

(BRU) Kane Co., Colorado River, Harrison 12122, May 14, 1953;  
(UT) Salt Lake Co., Big Cottonwood Canyon, Vickery 676, July 7, 1956; (BRU) Utah Co., Provo, Erdman 155, June 25, 1960;  
Washington Co., Zion NP, Cottam 3455, June 25, 1928.

Description of the Genus and Key  
to the Species of *Acer*

Trees or large shrubs, branches opposite, twigs round, marked by ring-like bud scale scars, leaf scars U or V-shaped with 3-5 bundle scars. Leaves opposite, simple or compound, deciduous, stipules absent. Flowers regular, occasionally apetalous, perfect or imperfect, sepals usually 5, petals 5, ovary 2-celled, 2-lobed, compressed, styles 2, 2 ovules per cell. Fruit a double samara united at the base, wings large, thin, obovate; seeds solitary by abortion, ovoid, compressed.

Key to the species of *Acer*.

1. Leaves all pinnately compound with 3-9 leaflets,  
trees dioecious . . . . . *A. negundo*
2. Leaves always simple, thick and leathery, often  
pubescent beneath, lobes few, large, coarse,  
teeth blunt, flowers apetalous . . . . . *A. grandidentatum*
2. Leaves occasionally 3-foliolate, thin, lobes  
small, numerous, acute, glabrous, flowers with  
petals . . . . . *A. glabrum*

*Acer grandidentatum* Nutt.

Bigtooth maple

*A. barbatum* Michx. var. *grandidentatum* (Nutt.) Sarg., *A. brachyterum* Woot. & Standl.

Shrub or small tree to 16 m., trunk up to 30 cm. or rarely more; crown open, rounded; branches stout, erect. Twigs slender, bright red to brown, later gray; lenticels numerous, small, pale; leaf scars narrow, almost encircling the twig, conspicuous long hairs in their axils. Bark thin gray to dark brown, narrow furrows separating the flat ridges which are broken into plate-like scales. Wood heavy, hard, strong, close-grained; sapwood thick, white; heartwood light brown. Buds 1-2 mm. long, acute; scales ovate to obovate, reddish-brown, puberulous. Leaves simple, leathery, 5-13 cm. long; 3-5-lobed, divided by shallow sinuses, margins sinuate-dentate or entire, lobes acute to obtuse; base cordate or truncate; upper surface dark green, glabrous and lustrous; lower surface pale and glaucescent, usually pubescent; palmate venation. Petioles stout, 3-5 cm. long. Trees polygamous. Flowers born in axillary corymbs, few flowered; short-stalked, hairy; flowers apetalous, 3-7 mm. across; calyx tube campanulate, 6-7 mm. long, sepals broad, round, pale-hairy; stamens 6-8, elongate in staminate flowers; ovary glabrous. Samara with wings usually spreading, 2-3 cm. long, rose-colored in summer, green at maturity, glabrous or somewhat pubescent. Seed 6-7 mm. long, bright reddish-brown, smooth.

like, obtuse; stamens 7-8, absent or rudimentary in pistillate flowers, filaments unequal and glabrous; pistil obtusely lobed, glabrous, absent or rudimentary in staminate flowers; style divided into 2 stigmatic lobes. Fruit born in a cluster; wings parallel or spreading to 90 degrees, 1-4 cm. long, tan or reddish; seed 6-7 mm. long, chestnut-brown.

#### Reproduction:

The flowers appear in May to July and the fruits are mature by August or September. (Vines 1960.)

#### Distribution:

Acer glabrum is found from New Mexico to California, British Columbia, and Alberta. It has been collected in every major mountain range in Utah except the western desert ranges. It probably occurs in some of these areas also.

#### Ecology:

This species grows along streams and on cool, moist mountain slopes from 7000 ft. (or lower) to 9000 ft. Acer glabrum usually thrives in well-drained sandy soils and it is common on soils of limestone origin. (U.S.F.S. 1940, Dayton 1931.)

Although this maple is sometimes found in moister portions of the pinyon-juniper zone, it is most characteristic of the mountain brush-ponderosa pine, and spruce-fir zones.

It can be readily recognized by the bright red infections on the green leaves which are caused by a fungus or blight. This infection is almost universal in this area. (U.S.F.S. 1940, Little 1950.)

#### Economic importance:

In some areas Acer glabrum is used as a browse plant but in Utah it is of little value as such. The tree is some-

times used in erosion control and as an ornamental. (U.S.F.S. 1940, Vines 1960.)

Remarks:

This species is rather variable and has been divided into several varieties on the basis of leaves, and coloration of fruit. The form with trifoliate leaves is the most unusual. (Vines 1960.)

Representative specimens:

(BRU) Beaver Co., Tushar Mtns., Erdman 111, May 13, 1960; (UT) Boxelder Co., Raft River Mtns., McMillan 1504, June 18, 1948; (BRU) Grand Co., La Sal Mtns., Erdman 201, July 27, 1960; Juab Co., Deep Creek Mtns., Cottam 3230, June 18, 1928; San Juan Co., Abajo Mtns., Erdman 236, July 28, 1960; Utah Co., Mt. Timpanogos, Erdman 322, Aug. 1959.

*Acer negundo* L.

Boxelder

*A. frazinifolium* Nutt., *A. californicum* (Torr. & Gray) D. Dietr., *A. interius* Britton, *A. kingii* Britton, *A. nuttallii* (Nieuwl.) Lyon, *Negundo aceroides* Moench, *N. californicum* Torr & Gray, *N. negundo* (L.) Karst., *N. interius* (Britton) Rydb., *N. kingii* (Britton) Rydb., *N. nuttallii* (Nieuwl.) Rydb., *N. texanum* (Pax) Rydb., *N. fraxinifolium* (Nutt.) Farwell, *Rulac negundo* (L.) Hitchc., *R. texana* (Pax) Small, *R. nuttallii* Nieuwl.

Tree to 22 m. tall, trunk up to 1.8 m. in diameter, bole irregular, often dividing near the ground into several stout, widespreading branches; crown bushy, broad, rounded; branches numerous, spreading. Twigs stout to slender, green to purplish-green, lustrous or covered with glaucous bloom; lenticels common. Bark thin, light brown, divided into narrowly rounded anastomosing ridges by shallow fissures. Wood light, 27 lbs. per cubic ft. dry weight, soft, weak, close-grained; sapwood thick, heartwood white to yellow-brown, often streaked. Terminal buds ovoid, scales bluish-white, tomentose; lateral buds short-stalked, appressed. Leaves compound, 10-35 cm. long, odd pinnate, 3-9 leaflets, usually 5-7; leaflets ovate-elliptic, to ovate-lanceolate, 7-10 cm. long, 3-7.5 cm. wide, margins irregularly serrate or lobed; apex acute to acuminate, base cuneate, rounded, or cordate, sometimes asymmetrical; upper surface light yellow-green, glabrous to slightly pubescent; lower surface pale green, pubescent along the veins; leaflets short-stalked. Petioles long, slender, glabrous to puberulose. Flowers apetalous. Staminate flowers born in

fascicles, 2.5-5 cm. long, flowers slender-stalked; calyx campanulate, hairy; stamens 4-6, exserted; filaments slender, hairy; anthers linear. Pistillate flowers born in narrow drooping racemes; ovary hairy; style separating into 2 elongate stigmatic lobes. Samara born in drooping racemes 15-20 cm. long; samara 2.5-5 cm. long, greenish, somewhat pubescent; wings divergent to about 90°, reticulate. Seeds 1 cm. long, reddish-brown, smooth.

#### Reproduction:

The flowers appear in March to May and the fruits ripen between August and October. (Vines 1960.) Seed production is excellent and good crops occur almost every year. However, the viability of the seeds is low and germination often not higher than 33%. (Harlow & Harrar 1958, Preston 1940.)

Acer negundo is a very rapidly growing tree but it is also rather short lived. It develops new buds and leaves as long as the growing season continues. Staminate trees have a greater tendency to do this and therefore are more prone to early frost injury and dieback. Thus they tend to be more irregular in habit than the pistillate tree. (Harrow & Harrar 1958, Plowman 1915.)

#### Distribution:

This tree is found throughout the United States except in the West Coast States. It is common in Utah but collections are relatively few and there are large gaps in the record.

#### Ecology:

Acer negundo is found chiefly along streams or in moist mountain areas between 4000 and 8000 ft. Although it grows best in deep moist soils, it can tolerate much poorer soil conditions. This is a hardy tree which can withstand climatic extremes. It is a common member of the river bottom

forests, growing with narrowleaf and Fremont poplars, willows, and maples. It also grows in the oak woodland where there is sufficient moisture. (Harlow & Harrar 1958, Preston 1940, Little 1950, Dayton 1931.)

**Economic importance:**

The wood is used sometimes to make cheap furniture. Its sap can be a source of sugar but it is inferior to sugar maple. Although it occurs widely as a cultivated tree, the boxelder is rather trashy because of its sprouting habit, and its great susceptibility to insects, fungi, and mechanical damage from storms. (Vines 1960, Harrow & Harrar 1958.)

**Representative specimens:**

(BRU) Beaver Co., Tushar Mtns., Erdman 104, May 13, 1960; Grand Co., La Sal Mtns., Erdman 226, July 28, 1960; San Juan Co., Elk Ridge, Erdman 253, July 29, 1960; Utah Co., Provo, Erdman 336, July 1959; Washington Co., Shivwits Indian Reservation, Erdman 82, May 11, 1960; Zion NP, Erdman 47, May 11, 1960.



Description of the Genus and Key  
to the Species of *Rhamnus*

Shrubs or small trees. Leaves alternate, simple, deciduous. Flowers regular, perfect or unisexual, axillary in small fascicles or solitary, greenish; hypanthium lined by a disk; sepals 4-5, petals 4-5 or wanting, small; stamens 4-5, inserted on the edge of hypanthium disk, ovary superior, 2-4 celled; fruit a berry-like drupe with 2-4 nutlets.

Key to the species of *Rhamnus*:

1. Flowers perfect, often with petals, winter buds  
not scaly, hairy . . . . . *R. betulaeifolia*  
1. Flowers imperfect, petals lacking, winter buds  
scaly . . . . . *R. alnifolia*

*Rhamnus alnifolia* L. Her.

Alder-leaf buckthorn

Low shrub, to 80 cm. tall or rarely to 2 m.. Branches forking slightly, upright, gray. Leaves oval, serrate, nearly straight-veined. Trees polygamodioecious. Flowers apetalous; berry-like drupes 3-seeded, seeds flat, scarcely grooved on the back.

This species has just recently been found in one mountain canyon in the Wasatch Mountains. It also occurs in California, Wyoming and eastward to the New England States. Usually the plant is a low shrub up to 80 cm. high but here in Utah it was growing in a large clump about 2 m. high.

Representative specimen:

(BRU) Salt Lake Co., Big Cottonwood Canyon, Wasatch Mtns., Cottam 16021, Aug. 23, 1959.

*Rhamnus betulaeifolia* Greene

Birch-leaf buckthorn

*R. purshiana* DC. var. *betulaeifolia* (Greene) Cory, *R. betulaeifolia* var. *obovata* Kearney & Peebles.

Shrub or small tree to 6 m. tall; trunk up to 15 cm. in diameter, often branching near the ground; crown rounded. Twigs green to reddish, pubescent at first, later glabrous and darker. Bark gray to dark brown. Leaves thin, elliptic to oblong or obovate, 5-15 cm. long, margins serrate to rarely entire, apex acute to rounded; base rounded or cuneate; upper surface bright green, glabrous and lustrous; lower surface pale, pubescent or glabrate; veins prominent, pinnate, in 10-11 pairs. Petioles slender, 5-10 mm. long, pubescent.

## Remarks:

According to Kearny and Peebles (1951), this species of *Rhamnus* is restricted to Arizona and the variety *R. betulae-folia* var. *obovata* which has thicker, more prominent veins and obovate leaves is found in southern Utah.

## Representative specimens:

(BRU) Garfield Co., Escalante, Beck, Aug. 4, 1939; Grand Co., Moab, Erdman 189, July 27, 1960; Kane Co., Colorado River, Harrison 12107, May 14, 1953; San Juan Co., Bluff, Cottam 2541, July 2, 1927; (UT) Washington Co., N of St. George, Cottam 8815, June 18, 1941.

Description of the Genus and Key  
to the Species of Tamarix

Introduced shrubs or small trees to 6-9 m.; trunk small, twisted; crown narrowly rounded or loosely pyramidal; branches slender, upright, spreading, somewhat contorted. Twigs very slender, drooping, graceful, reddish to gray, glabrous. Bark reddish-brown, smooth, becoming furrowed and ridged. Wood close-grained, light colored. Leaves alternate, deciduous, scale-like, imbricate, crowded, deltoid to lanceolate, up to 3 mm. long; margins entire, apex acute to acuminate; blue-green to gray-green, glabrous. Flowers born in racemes which are grouped into panicles of varying length; flowers regular, complete, minute, pink or white; sepals 5, ovate, 1-2 mm. long; petals 5, oblong, 1-2 mm. long, stamens 5, filaments 1-2 mm. long, anthers 2-celled, mucronate; ovary 1-2 mm. long, set on disk, styles 3, clavate. Fruit a capsule, 2-3 mm. long, dehiscent into 3 parts; seeds many, minute, bearing tufts of hair at apex.

The flowers are born throughout the summer on the current wood. Large quantities of seeds are produced and the seedlings are widespread in the proper habitat. The plants are also easily propagated by cuttings. (Vines 1960, Little 1950.)

There is considerable confusion as to which species of tamarisk are present in Utah and surrounding states. It is probable that most of the trees are either T. gallica or T. pentandra or both. These are very closely related species, distinguished primarily on flower structure. In T. gallica the filaments are broadened toward the base and confluent with the angles of the disk. The petals are usually deciduous from the fruit. In T. pentandra the filaments are not broadened toward the base and are inserted between the angles of the disk. The petals remain on the fruit. Many specimens in the herbaria of Utah are vegetative and, therefore, impossible to differentiate. Those specimens with flowers which the author examined closely seemed to be T. pentandra. Because of the difficulty in separating these species the genus is treated as a whole.

Distribution:

Tamarisk was introduced from Europe and it is now widely naturalized throughout the southern United States. Its distribution in Utah seems to be restricted to the eastern and southern portions of the state except for its presence in Utah Valley and Salt Lake Valley. Tamarisk has not been reported from the west desert nor in the plateau country be-

tween Utah and Washington Counties.

**Ecology:**

This is a water-loving tree and grows near streams and lakes from sea level to 5000 ft. It is moderately drought resistant and can grow in dry washes and gullies. The tamarisk tolerates salty and alkaline soils and is known in some areas as "salt cedar." It commonly grows with willows or forms dense pure thickets. (Benson & Darrow 1954, Little 1950.)

**Economic importance:**

Tamarisk is an excellent plant for erosion control but it also is an undesirable plant in some areas because of the great amount of water lost through transpiration. It is extremely difficult to eradicate. The tree is a popular ornamental. (Vines 1960.)

**Representative specimens:**

(UT) Emery Co., San Rafael Swell, Garrett 5937, July 21, 1931; (BRU) Grand Co., Green River, Erdman 165, July 25, 1960; Kane Co., Colorado River, Harrison 12120, May 14, 1953; Uinta Co., Dinosaur National Monument, Welsh 310, July 2, 1955; Utah Co., Utah Lake, Harrison 8392, June 24, 1938; (UT) Washington Co., Santa Clara, Cottam 8765, June 17, 1941.

## Ecology:

Cornus stolonifera grows along streams and in other moist habitats. It is somewhat tolerant of alkaline soils. (Vines 1960.) This species is normally associated with riverside trees and shrubs such as birch, alder, willows, and poplars. It also grows on cooler hillsides with chokecherry, serviceberry, and gambel oak. (Woodbury 1933, Little 1950, Dayton 1931.)

## Economic importance:

This beautiful plant has been cultivated since 1656 and many varieties have been derived. It is fair in palatability for cattle, sheep, and deer. (Vines 1960, Dayton 1931.)

## Representative specimens:

(BRU) Beaver Co., Tushar Mtns., Erdman 101, May 13, 1960; Boxelder Co., Raft River Mtns., Cottam 3060, June 10, 1928; Duchesne Co., Uinta Mtns., Harrison 7615, June 13, 1934; Grand Co., La Sal Mtns., Erdman 217, July 28, 1960; Sevier Co., Monroe Creek, Erdman 3, May 9, 1960; Utah Co., Mt. Timpanogos, Erdman 327, Aug. 1959.

apex rounded or acute; base cuneate or cordate; upper surface dark green with short white hairs at first, later glabrous. Petiole 1-5 cm. long, grooved, pubescent at first, glabrous later. Flowers born in short pubescent axillary panicles; bracts 1 cm. long; flowers perfect or imperfect by abortion, monoecious, often both types of flowers found in the same panicles; sepals 4, minute; stamens often aborted, filaments slender, as long as style, anthers linear to oblong, yellow-orange; style united, with terminal 2-lobed stigma. Samara 1-2 cm. long, 9 mm. wide, thin, flattened; wing extending to the base of the seed cavity, rounded or emarginate at apex; seed solitary, compressed.

#### Distribution:

The single-leaf ash is found from New Mexico to California and Mexico, Nevada and Colorado. It is widespread in the southern and south-eastern portion of Utah, generally following the major rivers and streams.

#### Ecology:

Fraxinus anomala grows on dry hillsides, ravines and often along rivers, and streams from 2000-6000 ft. It is sometimes found in desert washes and in the upper reaches of the desert and into the pinyon-juniper forests or the chaparral. (Woodbury 1933, Benson & Darrow 1954, Preston 1940.)

#### Economic importance:

The forage value of this plant varies from very poor to good for cattle and sheep. It is occasionally cultivated as an ornamental. (Vines 1960.)

(BRU) Garfield Co., Henry Mtns., Harrison 11725, May 15, 1951; Grand Co., Moab, Erdman 193, July 27, 1960; Grand Co., Dead Horse Point, Erdman 172, July 26, 1960; Iron Co., Cedar Canyon, Cottam 3940, May 31, 1929; Uinta Co., Dinosaur National Monument, Welsh 251, May 21, 1955; Washington Co., Zion National Park, Erdman 41, May 11, 1960.

*Fraxinus velutina* Torr.

Velvet ash

*F. pistaciaefolia* Torr., *F. coriacea* S. Wats., *F. attenuata* Jones, *F. toumeyi* Britten, *F. oregona* var. *glabra* Lingelsh., *F. glabra* Thornber, *F. standleyi* Rehd.

Small tree, occasionally to 15 m. tall; trunk up to 50 cm. in diameter; crown rounded; branches spreading. Twigs gray, densely tomentose at first, later glabrous; leaf scars large, obcordate. Bark up to 15 mm. thick, gray to reddish-brown, divided by deep fissures into broad flat broken ridges; scales thin, small. Wood fairly heavy, soft, weak, heartwood light brown, sapwood lighter. Terminal buds 3 mm. long, acute; scales 6 or more, ovate to linear, 6-12 mm. long, tomentose. Leaves highly variable in number of leaflets, size and harness, thick, 10-13 cm. long, 3-9 leaflets; each leaflet elliptic to ovate, 2.5-4 cm. long, 2-2.5 cm. wide; margins finely crenate-serrate above the middle to almost entire; apex acute, base narrowed, rounded or cuneate; upper surface pale green, pubescent or tomentose when young, later glabrous; lower surface paler, tomentose; veins reticulate. Petioles up to 4 mm. long; terminal petiolules up to 4 mm. long; terminal petiolules up to 1 cm. long; rachis slender, grooved; petiole grooved, densely villose. Trees dioecious. Flowers born in elongate, pubescent panicles; hypanthium densely pubescent; stamens short, anther oblong and apiculate; stigma lobes subsessile. Samara 2 cm. long, 4 mm. wide; wing terminal, rounded, apex rounded to acute or emarginate; seed terete, 1 cm. long.

#### Reproduction:

The flowers usually appear from March to May with the new leaves. The fruit is mature in September. (Vines 1960.)

#### Distribution:

This ash occurs throughout the southwest from Texas and Mexico to California, Nevada, and Utah. It is restricted in Utah to the extreme southwest corner of the state, Washington County.

#### Ecology:

*Fraxinus velutina* grows in mountain canyons, along streams and washes in or near the desert from 2000-6000 Ft. It is restricted to those areas with a permanent underground

water supply. This tree has greater tolerance for alkaline soils than many other associated species. (Woodbury 1933, Benson & Darrow 1954, Sargent 1933, Preston 1940.)

Economic importance:

This tree is widely cultivated as a shade tree in Arizona and California. (Little 1950.)

Representative specimens:

(BRU) Washington Co., Veyo, Cottam 3374, June 21, 1928;  
Zion National Park, Harrison 10257, May 10, 1941.



**Reproduction:**

The flowers usually appear in May or June but the tree also blooms after rains during the rest of the summer. Viability of the seeds is often lower than 50%. The plant grows rapidly but is short-lived. (Vines 1960, Little 1950, Preston 1940.)

**Distribution:**

This species is native to the region between Texas and northern Mexico to California. It extends into the southwestern corner of Utah along the Virgin and Santa Clara Rivers and the Beaver Dam Wash.

**Ecology:**

Chilopsis linearis is a tree of the desert washes and ravines. It also can be found along rivers, seeps and moist areas on lower mountain slopes, and mesas, from 1500-5000 ft. The tree is drought resistant and grows in dry sandy or gravelly soils which are well drained. Occasionally it forms dense thickets along desert streams. (Little 1950, Benson & Darrow 1954, Dayton 1931, Preston 1940.)

**Economic importance:**

The desert willow is a popular ornamental because of its graceful shape and its beautiful, sweet-scented flowers. It is also used in erosion control and for fuel and fence posts. The foliage is unpalatable to livestock and eaten only in emergencies. (Vines 1960, Little 1950.)

**Representative specimens:**

(BRU) Washington Co., St. George, Cottam 4020, June 1, 1949; Beaver Dam Wash, Erdman 72, May 11, 1960; Gunlock, Erdman 76, May 11, 1960.

### Reproduction:

The blueberry elder bears flowers most of the spring and summer. The fruits ripen in August or September and are eaten in great numbers by birds. The plant grows rapidly and is short-lived. Sprouting from the older stumps is common.

(Vines 1960, Preston 1940.)

### Distribution:

This is a widespread species of Western North America. It is present in most of the mountainous areas of Utah but has not been collected from smaller ranges like the Henry, La Sal, and Abajo Mountains of southeastern Utah and several ranges of the western desert.

### Ecology:

Sambucus glauca grows along streams, in canyons, on moist hillsides and mountain slopes from 5500-9000 ft. It does best in moist, porous soils. This tree is rather intolerant of shade and although it grows in the ponderosa pine, Douglas fir, and aspen forests, it is found chiefly in the open glades and along streams. (Little 1950, Preston 1940, Peattie 1953.)

### Economic importance:

The browse value of this species varies with the season. In the spring it is worthless for cattle and sheep but as the season progresses the palatability increases until the fall when it is very palatable. Deer and perhaps elk feed on it also. The berries are edible and used for jellies and pies. (U.S.D.S. 1940, Dayton 1931.)

## Representative specimens:

(BRU) Garfield Co., Bryce Canyon, Cottam 2776, July 12, 1927;  
(UT) Salt Lake Co., Emigration Canyon, Vickery 2514, Aug. 30,  
1951; (BRU) Sevier Co., Fish Lake N. F., Markham, Aug. 1938;  
(UT) Tooele Co., Stansbury Island, Cottam 9174, July 7, 1942;  
Uinta Co., East Tavaputs Plateau, Vickery 1641, July 13-15,  
1956; (BRU) Utah Co., Mt. Timpanogos, Cottam 1266, July 28,  
1927.

## CONCLUSION

Large portions of Utah are arid or semi-arid and largely incapable of supporting extensive tree communities. This is especially true of the valleys and the low plateaus. Certain plants, however, such as mesquite, singleleaf ash, and the joshua tree are adapted to these xeric conditions and are well established in the arid parts of southern and eastern Utah.

In striking contrast to the sparse tree flora of the desert proper, the desert washes and streamsides support a rich tree flora. Here one finds the typical desert species such as Fremont poplar, velvet ash, and Goodding willow which are restricted to desert water courses. In addition there are often other woody plants such as hawthorn, birch and squawbush which follow the streams down from the mountains and extend well out into the valleys.

The lower mountain slopes and desert ranges support the vast pigmy forests of pinyon and juniper. This is probably the largest tree community in the state. The pinyon-juniper forests of Utah are among the most extensive to be found anywhere.

In southern Utah ponderosa pine forests form a large belt between the pinyon-juniper forests and the spruce-fir forests. These stands of ponderosa pine are particularly well developed on some of the high southern plateaus.

In other parts of the state, this belt of ponderosa pine is replaced by mountain brush which forms a transition zone. In contrast to the conifer forests of the state which are

dominated by only a few species, the mountain brush communities present a much more varied composition. Hackberry, bitterbrush, cliffrose, sumac and squawbush are common on the drier slopes, and boxelder, maple, dogwood, and alder are common streamside species. The larger part of the tree flora is made up of oak, maples, mountain mahoganies, chokecherry, and serviceberries.

At higher elevations the mountain brush species are prominent as understory trees and shrubs of the spruce-fir forests. Of the deciduous trees, only aspen forms large stands, and these are eventually invaded and replaced by the conifers.

Douglas fir and white fir are the dominant species in the lower portion of the spruce-fir forests. Blue spruce is common but usually restricted to moist sites. At higher elevations Engelmann spruce, and subalpine fir form extensive forests. Lodgepole pine forms similar large stands in the Uinta Mountains. Although these pure stands of lodgepole pine are often replaced by spruce and fir, the tree tends to persist as an important part of the high altitude forest.

Because of the great differences in elevations, geography and climate in Utah, the state supports a very diversified tree flora. The spruce-fir forests represent a southern extension of the great north-temperate conifer forest. Together with the more southern pinyon and ponderosa pine forests, these conifers cover a large portion of Utah and are the most important tree species in terms of size of plants, numbers of individuals, and area covered. However, they represent

but 5 genera and 13 species of a total of 33 genera and 63 species.

In contrast to the conifers, the broadleaf trees are usually much smaller in size, fewer in number, and cover a much smaller area. They reach their greatest development along the streams and on the lower mountain slopes. Many of these trees are shrubby and reach tree size only under favorable conditions. Approximately 50 broadleaf plants can be considered as trees in Utah and these represent 15 families and 28 genera. Many of these are rare or restricted to certain sections of Utah, such as Washington County. Others, like cottonwoods, maples, oaks, and aspen are a common part of the landscape throughout most of the state.

Utah's forests play several important roles in the economy of the state. One important contribution is the protection of the valuable watersheds. Another important asset is the large amount of merchantable timber, especially in the ponderosa pine forests of southern Utah and the spruce-fir forests of the Uintas. These forests supply a considerable amount of softwood lumber. Many of Utah's trees are used as browse by livestock and game animals. Bitterbrush, cliffrose and mountain mahogany are notable forage plants. Trees such as blue spruce, ponderosa pine, lodgepole pine, junipers, poplars, boxelder, redbud, and golden currant are popular ornamentals. However, there are still many species like birch, aspen, and cliffrose which have fine potential but have been rarely cultivated. Another major asset of the forest lands is their recreational value which is becoming increasingly important in forest management.

## LIST OF REFERENCES

- Baker, F. S. 1925. Aspen in the Central Rocky Mountain Region. U. S. Dept. Agr. Bull. 1291.
- Bates, C. G. 1917. The biology of lodgepole pine as revealed by the behavior of its seed. Jour. of Forestry 15, pp. 410-416.
- \_\_\_\_\_ 1923. Physiological requirements of Rocky Mountain trees. Jour. Agr. Res. 44, pp. 94-164.
- \_\_\_\_\_ 1924. Forest Types in the Central Rocky Mountains as affected by Climate and Soil. U. S. Dept. Agr. Bull. 1233.
- \_\_\_\_\_ 1925. Key to the identification of some coniferous seedlings. Jour. of Forestry 23: 278-281.
- \_\_\_\_\_ 1930. The Production, Extraction, and Germination of Lodgepole Pine Seed. U. S. Dept. Agr. Tech. Bull. 191.
- Bennion, G. C. 1960. Hybridization of Populus Fremontii and Populus angustifolia in Perry Canyon, Boxelder Co., Utah. Thesis (M.S.) Univ. of Utah.
- Benson, L. & R. A. Darrow 1954. The Trees and Shrubs of the Southwestern Deserts. University of Arizona, Tucson.
- Billings, W. D. 1945. Nevada Trees. Agr. Extension Service Bull. 94. University of Nevada, Reno.
- Billings, W. D. & J. H. Thompson 1957. Composition of a stand of old bristlecone pines in the White Mountains of California. Ecol. 38: 158-160.
- Brush, W. D. 1947. Single-leaf pinyon pine. American Forests 53: 170-171.
- Burke, M. H. 1934. Plant Distribution Studies in the Wellsville Range, Utah. Thesis (M.S.) Utah State Univ.
- Christensen, E. M. 1949. The Ecology and Geographic Distribution of Oakbrush (Quercus gambelii) in Utah. Thesis (M.S.) Univ. of Utah.
- \_\_\_\_\_ 1950. Distributional observations of oakbrush (Quercus gambelii Nutt.) in Utah. Utah Acad. Sci., Arts, and Letters. Proc. 27: 22-25.

1955. Ecological notes on the mountain brush in Utah. Utah Acad. Sci., Arts, and Letters. Proc. 32: 107-111.
- Clapper, R. B. & J. R. Miller 1949. Breeding and selecting pest resistant trees. Year Book of Agr. 1949, (Trees) pp. 465-471.
- Clawson, A. B. & H. Marsh 1919. Oak-leaf Poisoning of Domestic Animals. U. S. Dept. Agr. Bull. 707.
- Clements, F. E. 1910. The Life History of the Lodgepole Burn Forests. U. S. Dept. Agr. Forest Service Bull. 79.
- Cline, M. 1960. A Comparison of the Root Systems of Bitterbrush and Cliffrose. Thesis (M.S.) Brigham Young Univ.
- Cottam, W. P. et. al. 1959. Some clues to the Great Basin postpluvial climates provided by oak distributions. Ecology 40: 361-377.
- Coulter, J. M. & A. Nelson 1909. New Manual of Rocky Mountain Botany. American Book Co., New York.
- Cox, W. T. 1911. Reforestation on the National Forests. U. S. D. A. Forest Service Bull. 98.
- Cox, C. F. 1933. The vegetation of the Pikes Peak Region. Ecol. Monog. 3: 299-372.
- Crossley, D. L. 1955. Viability of seed of lodgepole pine after 20 years storage. Forest Chron. 31: 250-253.
- Dallimore, W. & A. B. Jackson 1948. Handbook of Conifers. Edward Arnold & Co., London.
- Dayton, W. A. 1931. Important Western Browse Plants. U. S. D. A. Misc. Pub. 101.
- Ellison, L. 1954. Subalpine vegetation of the Wasatch Plateau, Utah. Ecol. Monogr. 24: 89-184.
- Frothingham, E. H. 1909. Douglas Fir: A Study of the Pacific Coast and the Rocky Mountain forms. U. S. D. A. Forest Service Circular 150.
- Graham, E. H. 1937. Botanical studies in the Uinta Basin of Utah and Colorado. Annals of Carnegie Museum 26.
- Hanksworth, F. G. & A. A. Lusher 1956. Dwarf mistletoe survey and control on the Mescalero-Apache Res., New Mex. Jour. of Forestry 54: 384-390.
- Harlow, W. M. & E. S. Harrar. 1958. Textbook of Dendrology. McGraw Hill, New York.



- Harrington, H. D. 1954. Manual of the Plants of Colorado. Sage Books, Denver.
- Hermon, F. R. 1953. A growth record of Utah juniper in Arizona. Jour. of Forestry 51: 200-201.
- Hodson, E. R. & J. H. Foster 1910. Engelmann Spruce in the Rocky Mountains. U. S. D. A. Forest Serv. Circular 170.
- Jepson, W. L. 1923. Flowering Plants of California. Univ. of Calif., Berkeley.
- Johnson R. P. A. & M. R. Brundage 1934. Properties of White Fir and Their Relation to the Manufacture and Uses of the Wood. U. S. D. A. Tech. Bull. 408.
- Jones, G. N. 1946. American species of Amelanchier. III. Biol. Monogr. Vol. 20, No. 2.
- Kearny, T. H. & R. H. Peebles 1951. Arizona Flora. U. of Calif. Press. Berkeley & Los Angeles.
- Kintigh, R. G. 1949. Some effects of temperature on germination and development of pinyon pine. Jour. of Forestry. 47: 622-626.
- Korstian, C. F. & W. H. Long 1922. The Western Yellow Pine Mistletoe. U. S. D. A. Bull. 1112.
- Little, E. L. 1943. Common insects on pinyon (Pinus edulis). Jour. of N. Y. Entomological Soc. 51: 239-252.
- \_\_\_\_\_ 1950. Southwestern Trees, U. S. D. A. Forest Service Agr. Handbook #9.
- \_\_\_\_\_ 1953. Check List of Native and Naturalized Trees of the United States. U. S. D. A. Forest Service Agr. Handbook 41.
- Lowdermilk, W. C. 1925. Factors affecting reproduction of Engelmann spruce. Jour. of Agr. Res. 30: 995-1009.
- McMillan, C. 1948. A Taxonomic and Ecological Study of the Flora of the Deep Creek Mountains of Central Western Utah. Thesis (M.S.) Univ. of Utah.
- Maguire, W. 1956. Are ponderosa pine cone crops predictable? Jour. of Forestry. 54: 778-779.
- Marsh, C. D. 1929. Stock-poisoning Plants of the Range. U. S. D. A. Bull. 1245.
- Mason, D. T. 1915. The Life History of Lodgepole Pine in the Rocky Mountains. U. S. D. A. Bull. 154.

- Meager, 1950. Reproduction of ponderosa pine. Jour. of Forestry. 48: 188-191.
- Meinecke, E. P. 1916. Forest Pathology in Forest Regulation. U. S. D. A. Bull. 275.
- \_\_\_\_\_ 1929. Quaking Aspen--a Study in Applied Forest Pathology. U. S. D. A. Tech. Bull. 155.
- Merkle, J. 1954. An analysis of the spruce-fir community on the Kaibab Plateau, Arizona, Ecol. 35: 316-322.
- Miner, E. L. 1929. A Study of Utah Trees in Their Winter Condition. Thesis (M.A.) Univ. of Utah.
- Moss, E. H. 1938. Longevity of seed and establishment of seedlings in Populus. Bot. Gaz. 99: 529-542.
- Oosting, H. J. & J. F. Reed. 1952. Virgin spruce-fir forest in the Medicine Bow Mountains, Wyoming. Ecol. Monog. 22: 69-91.
- Pearson, G. A. 1912. Influence of Age and Condition of Tree on Seed Production in the Western Yellow Pine. U. S. D. A. Forest Service Circular 196.
- \_\_\_\_\_ 1914. Role of aspen in the reforestation of the mountain burns of Arizona and New Mexico. Plant World 17: 249-260.
- \_\_\_\_\_ 1931. Forest Types in the Southwest as Determined by Climate and Soil. U. S. D. A. Tech. Bull. 247.
- Peattie, D. C. 1953. Natural History of Western Trees. Houghton Mifflin Comp., Boston.
- Phillips, F. J. 1909. A study of pinyon pine. Bot. Gaz. 48: 216-223.
- Phillips, F. J. & W. Mulford 1912. Utah Juniper in Central Arizona. Forest Service Circular 197.
- Plowman, A. B. 1915. Is the boxelder a maple? A study of the comparative anatomy of Negundo. Bot. Gaz. 60: 169-192.
- Preece, S. J. 1950. Floristic and Ecological Features of the Raft River Mountains of Northwestern Utah. Thesis (M.S.) Univ. of Utah.
- Preston, R. J. 1940. Rocky Mountain Trees. Iowa State College Press, Ames.

- Rehder, A. 1927. Manual of Cultivated Trees and Shrubs. MacMillan Co., New York.
- Reimschiessel, E. F. 1951. A Study of Ornamental Deciduous Trees of Utah. Thesis (M.S.) Brigham Young Univ.
- Rydberg, P. A. 1922. Flora of the Rocky Mountains. Intelligencer Printing Co., Lancaster, Pa.
- Salisbury, F. 1954. Some chemical and biological investigations of materials derived from hydrothermally altered rock in Utah. Soil Science 78: 277-294.
- Sargent, C. S. 1933. Manual of the Trees of North America. Houghton Mifflin Co., Boston.
- Saul, W. E. 1955. A Descriptive Catalogue of the Trees and Larger Woody Shrubs of Utah Based on the Anatomy of the Wood. Thesis (Ph.D.) Univ. of Utah.
- Schulman, E. 1948. Dendrochronology in Northeastern Utah. Tree Ring Bull. 15: 2-14.
- \_\_\_\_\_ 1958. Bristlecone pine, oldest known living thing. National Geographic Mag. 113: 354.
- Smith, A. D. 1952. Digestibility of some native forages for mule deer. Jour. of Wildlife Management. 16: 309-312.
- Stanton, W. D. 1931. A Preliminary Study of the Flora of the Henry Mountains of Utah. Thesis (M.S.) Brigham Young Univ.
- Sudworth, G. B. 1915. The Cypress and Juniper Trees of the Rocky Mountain Region. U. S. D. A. Bull. 327.
- \_\_\_\_\_ 1916. Spruce and Balsam Firs of the Rocky Mountain Region. U. S. D. A. Bull. 327.
- \_\_\_\_\_ 1917. Pine Trees of the Rocky Mountain Region. U. S. D. A. Bull. 460.
- \_\_\_\_\_ 1918. Miscellaneous Conifers of the Rocky Mountain Region. U. S. D. A. Bull. 680.
- \_\_\_\_\_ 1934. Poplars, Principal Tree Willows and Walnuts of the Rocky Mountain Region. U. S. D. A. Tech. Bull. 420.
- Tidestrom, I. 1925. Flora of Utah and Nevada. Contrib. U. S. Nat. Herbarium 23.

- Thomas, L. K. 1957. Introggression in *Purshia tridentata* (Pursh) DC. and *Cowania stansburiana* Torr. Thesis (M.S.) Brigham Young Univ.
- Tucker, J. M. & Horace S. Haskell. 1960. *Quercus dunnii* and *Q. chrysolepis* in Arizona. *Brittonia* 12: 196.
- \_\_\_\_\_ 1961. Studies in the *Quercus undulata* complex I. A preliminary statement. *American Jour. of Botany.* 48: 202-208.
- Tucker, J. M. et. al. 1961. Studies in the *Quercus undulata* complex II. The contribution of *Quercus turbinella*. *American Jour. of Botany.* 48: 329-339.
- United States Forest Service. 1940. Range Plant Handbook.
- \_\_\_\_\_ 1954. Ponderosa Pine. (Useful Trees of the United States #6).
- Vines, R. A. 1960. Trees, Shrubs, and Woody Vines of the Southwest. U. of Texas Press, Austin.
- Weight, K. E. 1928. The Distribution, Taxonomy and Ecology of the Genus *Salix* of Utah Co., Utah. Thesis (M.S.) Brigham Young Univ.
- Whitfield, C. J. 1933. The vegetation of the Pikes Peak Region. *Ecol. Monog.* 3: 75-105.
- Woodbury, A. M. 1933. Biotic relationships of Zion Canyon. *Ecol. Monog.* 3: 147-245.
- \_\_\_\_\_ 1947. Distribution of pigmy conifers in Utah and Northeastern Arizona. *Ecol.* 28: 113-126.
- ✓ Woodbury, A. M. et. al. 1959. Ecological studies of the flora and fauna in Glen Canyon. U. of U. Dept. Anthropology--Anthropological Papers 36.
- ✓ Woodbury, A. M. et. al. 1959. Survey of vegetation in the Glen Canyon Reservoir Basin. U. of U. Dept. Anthropology--Anthropological Papers 44. <sup>D</sup>
- Woodin, H. E. & A. A. Lindsey. 1954. Juniper-pinyon of the Continental Divide as analyzed by the line-strip method. *Ecol.* 35: 473-489.
- Woolsey, T. S. 1911. Western Yellow Pine in Arizona and New Mexico. U. S. D. A. Forest Service Bull. 101.
- Zion-Bryce Natural History Association. 1937. Plants of Zion National Park. *Zion-Bryce Bulletin* 1.

CLASSIFICATION AND DISTRIBUTION  
OF THE NATIVE TREES OF UTAH

An Abstract  
of a Thesis Submitted to  
the Department of Botany  
Brigham Young University  
Provo, Utah

In Partial Fulfillment  
of the Requirements for the Degree  
Master of Science

by  
Kimball S. Erdman

June, 1961

## ABSTRACT

This study is an attempt to consolidate the information already known about the trees of Utah and to extend our knowledge of these trees. An intensive study was made of the available literature. The tree specimens of the herbaria of the Utah State University, University of Utah, Brigham Young University and the Regional Office of the Forest Service at Ogden were examined. These studies were supplemented with extensive field work in various parts of the state. From this information, keys and descriptions of the genera and species were written and distribution maps for each tree and illustrations of many of the trees made.

The great diversity of environments due to geography, physiography and climatic features of Utah has resulted in a rich flora which includes many species. The 62 tree species of Utah represent 16 families and 38 genera. The following is a check list of the trees of Utah arranged phylogenetically according to the families.

### Pinaceae:

*Pinus monophylla* Torr. & Frem.  
*Pinus edulis* Engelm.  
*Pinus aristata* Engelm.  
*Pinus flexilis* James  
*Pinus ponderosa* Dougl.  
*Pinus contorta* Dougl.

*Picea engelmanni* (Parry) Engelm.  
*Picea pungens* Engelm.

*Pseudotsuga menziesii* (Mird.) Franco

*Abies concolor* (Gord. & Glend.) Hoopes  
*Abies lasiocarpa* (Hook) Nutt.

*Juniperus monosperma* (Engelm.) Sarg.  
*Juniperus osteosperma* (Torr.) Little  
*Juniperus scopulorum* Sarg.

Liliaceae:

*Yucca brevifolia* Engelm.

Salicaceae:

*Populus angustifolia* James,  
*Populus fremontii* S. Wats.  
*Populus tremuloides* Michx.

*Salix scouleriana* Barratt  
*Salix bebbiana* Sarg.  
*Salix laevigata* Bebb.  
*Salix gooddingii* Ball  
*Salix amygdaloides* Anders.  
*Salix lasiandra* Benth.

Betulaceae:

*Ostrya knowltonii* Cov.  
*Betula occidentalis* Hook.  
*Alnus tenuifolia* Nutt.

Fagaceae:

*Quercus turbinella* Greene  
*Quercus gambelii* Nutt.  
*Quercus X pauciloba* Rydb.

Ulmaceae:

*Celtis reticulata* Torr.

Saxifragaceae:

*Ribes aureum* Pursh.

Rosaceae:

*Sorbus scopulina* Greene  
*Amelanchier cusickii* Fern.  
*Amelanchier pumila* Nutt.  
*Amelanchier utahensis* Koehne  
*Amelanchier alnifolia* Nutt.

*Crataegus rivularis* Nutt.  
*Crataegus succulenta* Schrad.

*Peraphyllum ramosissimum* Nutt.

*Purshia tridentata* (Pursh.) DC.

*Cowania stansburiana* Torr.

*Cercocarpus ledifolius* Nutt.  
*Cercocarpus intricatus* S. Wats.  
*Cercocarpus montanus* Raf.

*Prunus fasciculata* (Torr.) Gray  
*Prunus virginiana* L.

Leguminosae:

*Acacia greggii* A. Gray

*Prosopis juliflora* (Swartz) DC.  
*Prosopis pubescens* Benth.

*Cercis occidentalis* Torr.

*Robinia neomexicana* A. Gray

Anacardiaceae:

*Rhus trilobata* Nutt.  
*Rhus glabra* L.

Aceraceae:

*Acer grandidentatum* Nutt.  
*Acer glabrum* Torr.  
*Acer negundo* L.

Rhamnaceae:

*Rhamnus betulaeifolia* Greene.

Tamariacaceae:

*Tamarix gallica* L. (?)  
*Tamarix pentandra* Pallas.

Cornaceae:

*Cornus stolonifera* Michx.

Oleaceae:

*Fraxinus anomala* Torr.  
*Fraxinus velutina* Torr.



**Bignoniaceae:**

*Chilopsis linearis* (Cav.) Sweet

**Caprifoliaceae:**

*Sambucus caerulea* Raf.

Most of the trees of Utah grow in the various types of conifer forests such as the spruce-fir, ponderosa pine, and pinyon-juniper forests or the mountain brush. These communities are largely restricted to the mountainous areas of the state. Only a few species are adapted to the more arid lowlands and the best developed tree flora here is along the water courses.

The forest areas of Utah contribute heavily to the economy of the state through the protection of the watersheds, production of timber, and forage plants for livestock and game animals. The recreational value of the forested areas for hunting, fishing and picnicing is becoming increasingly important. The forests are also a source of many popular ornamental trees and shrubs.