AN ABSTRACT OF THE THESIS OF

Milton Lee Dean (Name) for the M.S. (Degree) in Botany (Major)

Date thesis is presented August 14, 1959

Title A Taxonomic and Ecologic Study of the Vascular Plants of a Section of the Owyhee River Canyon in Oregon

Abstract approved Signature redacted for privacy. (Major professor)

A taxonomic and ecologic study was made of the vascular plants of a section of the Owyhee River Canyon of Malheur County, Oregon. The particular study area is known as Three Forks, and is located at the junction of the North Fork of the Owyhee River, East Fork of the Owyhee River, and Little Owyhee River.

The Three Forks canyon is a relatively broad portion of a river canyon which cuts through the high plateau country of southeastern Oregon. The plateau has been built up of sedimentary material from the Tertiary period, and then covered by layers of lava poured out in Pliocene times or later. The three streams flowing into Three Forks arise from various points in southwestern Idaho, northern Nevada, and southeastern Oregon.

The first white inhabitants of Three Forks arrived in 1863, although Indians had probably occupied the area for centuries previously. Since that time, farming has been the primary occupation of many settlers. The closest ranch today is about six miles from Three Forks. Little evidence of grazing can be seen. No fires have been recorded for the area.

The climate of Three Forks is one of hot dry summers and cold winters. Most of the approximately 13 inches of precipitation falls in the winter and spring. The years of 1956 and 1957 had above average moisture conditions.

Collections were made periodically throughout the growing season of 1957 and part of 1958. An attempt was made to collect specimens of every species of vascular plant. When collections were made, ecological notes were taken. These notes were correlated into a description of vegetation, with an attempt to define plant associations. Three horizontal belts of vegetation were distinguished, encompassing 13 plant associations.

The main body of the thesis deals with the taxonomic treatment, and consists of keys constructed to classes, families, genera, and species, with descriptions of genera and species. The study area yielded a total of 211 species, classified into 148 genera and 45 families. Of special interest was the discovery of a new, undescribed species of Artemisia.

A TAXONOMIC AND ECOLOGIC STUDY OF THE VASCULAR PLANTS OF A SECTION OF THE OWYHEE RIVER CANYON IN OREGON

by

MILTON LEE DEAN

A THESIS

submitted to

OREGON STATE COLLEGE

in partial fulfillment of
the requirements for the
degree of

MASTER OF SCIENCE

June 1960

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Date thesis is presented August 14, 1959

Typed by Gwen Finkbeiner

ACKNOWLEDGEMENTS

The writer wishes to express sincere appreciation to several people who have contributed to the completion of this thesis. Special acknowledgment is due the late Dr. Albert N. Steward, major professor and advisor, who was most helpful and generous with his time and suggestions. Thanks go to Dr. Frank H. Smith for assuming advisory duties following the untimely death of Dr. Steward.

Several men gave valuable assistance with identification of species in particularly difficult genera; Dr. Arthur Cronquist, Aster and Artemisia; Dr. David Keck, Mimulus; Dr. I. M. Johnston, Hackelia; Dr. Marion Ownbey, Astragalus; and Dr. S. Conrade Head, Penstemon.

Finally, appreciation and thanks go to my wife, Shirley, for her encouragement during this project.

TABLE OF CONTENTS

ILLUSTRATIONS

A TAXONOMIC AND ECOLOGIC STUDY OF THE VASCULAR PLANTS OF A SECTION OF THE OWYHEE RIVER CANYON IN OREGON

INTRODUCTION

Although a fine treatment of the vascular flora of Oregon has been in print for 18 years (10, p. 1-866), it is felt that some of the more remote areas of the state are incompletely known. One such area is the Owyhee River Canyon of Malheur County, southeastern Oregon. That portion of the Owyhee Canyon which comprises this study is known as Three Forks, and is located at the junction of the North Fork of the Owyhee River, East Fork of the Owyhee River, and Little Owyhee Rivers. These streams converge to form the main Owyhee River.

The area is accessible to passenger cars only by an unimproved (dirt) road from the town of Jordan Valley, Oregon, 35 miles to the north. The Idaho state line is seven miles to the east, and the Nevada state line is about 40 miles to the south.

The primary purpose of the study was to cover the area thoroughly and obtain as complete a plant list as possible. Collecting trips were made, weather permitting, every third or fourth week throughout the growing season

of 1957 and the first half of 1958. The main body of the thesis consists of keys to and descriptions of the plants collected. Wherever collections were made, ecological notes were taken, and these later correlated in an effort to define and describe the plant communities. Nearly all of the study and collecting was done in the Three Forks canyon and on the plateau surrounding the canyon. Some sampling was also done in the adjoining canyons.

PHYSICAL DESCRIPTION AND GEOLOGY

The study area is part of the great plateau region which is characteristic of most of southeastern Oregon. This plateau generally varies from 4000 to 5000 feet above sea level. The elevation at Jordan Valley is 4400 feet with a gradual rise to the rim above Three Forks at 4800 feet. This breaks away sharply some 900 feet to the river.

All of the various river forks flow through an alternating succession of sheer, rock-walled gorges, and broader, open-sloped canyons. The sheer rock portions are formed of resistant igneous rock, while the open slopes are composed of a softer, sedimentary material. The canyon rims are made of a dark, very hard basalt rock, and are called the rimrock.

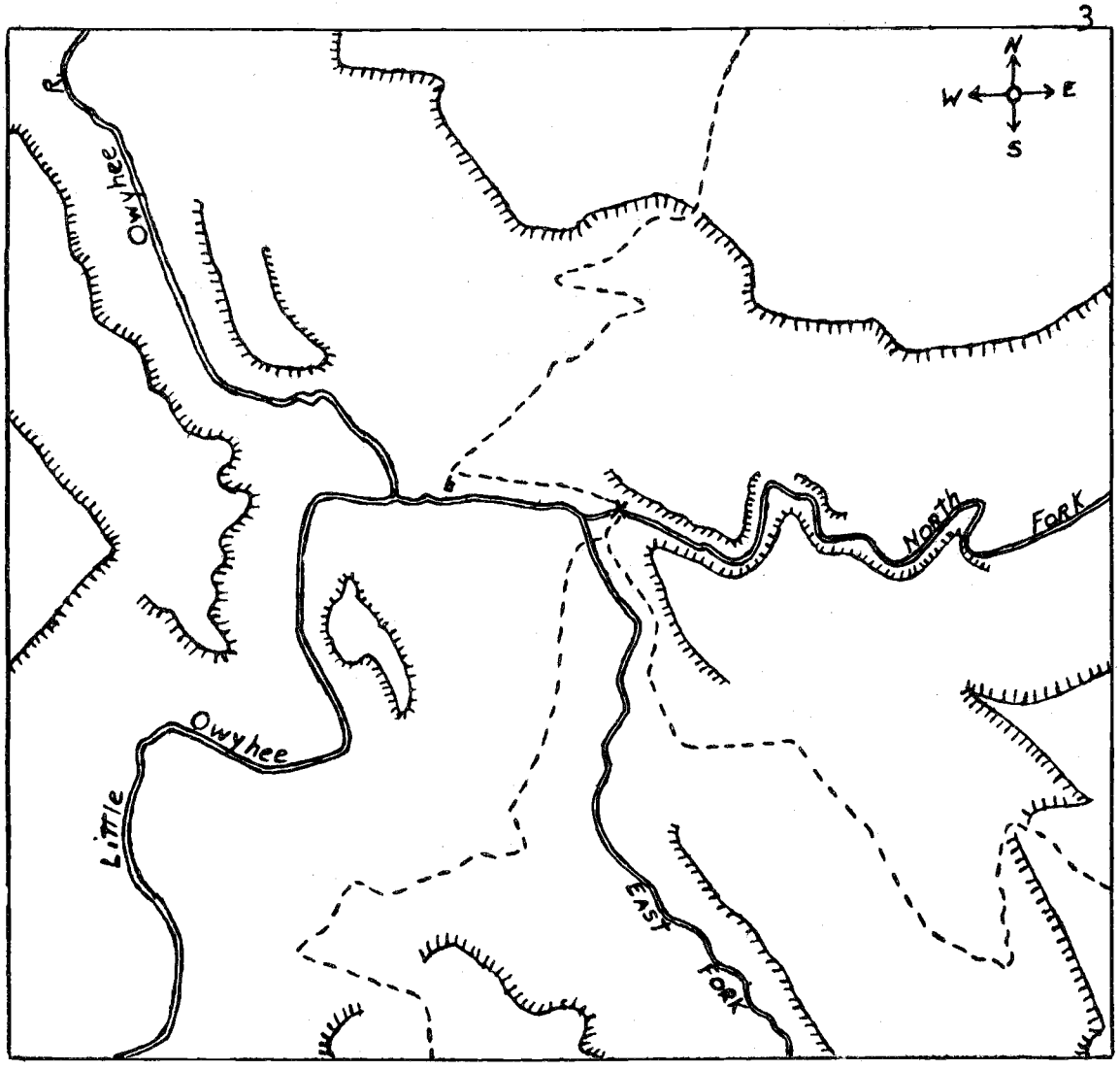


Figure 1. The Study Area of Three Forks, Oregon.

Legend: 1 inch = .5 mile

Rimrock

Road

Bridge

Cabin

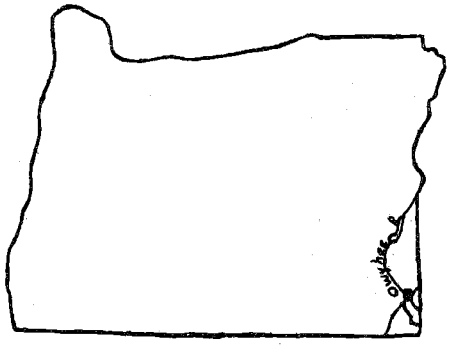
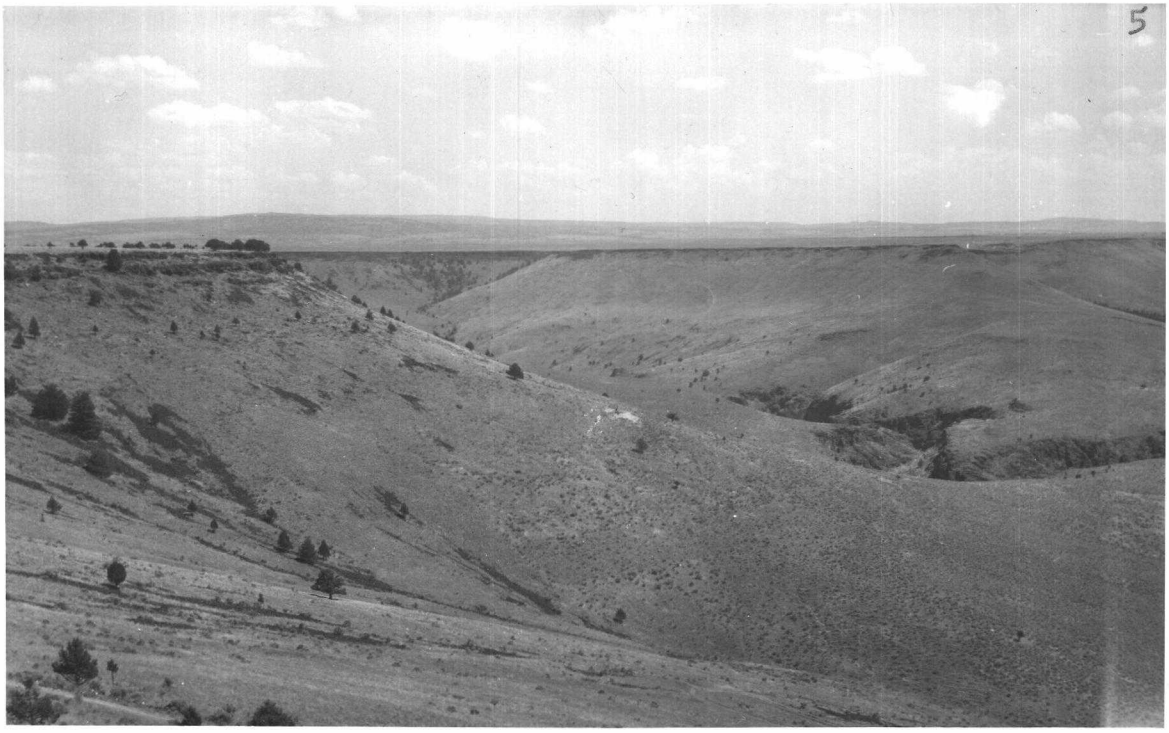


Plate 1

The south-facing slope of the Three Forks canyon. Note the narrow gorge at the canyon bottom to the right (part of North Fork canyon), flaring slopes and upper rimrock. The road can be seen in the lower left corner.

Plate 2

The North Fork canyon, typical of the various canyons leading into the Three Forks canyon.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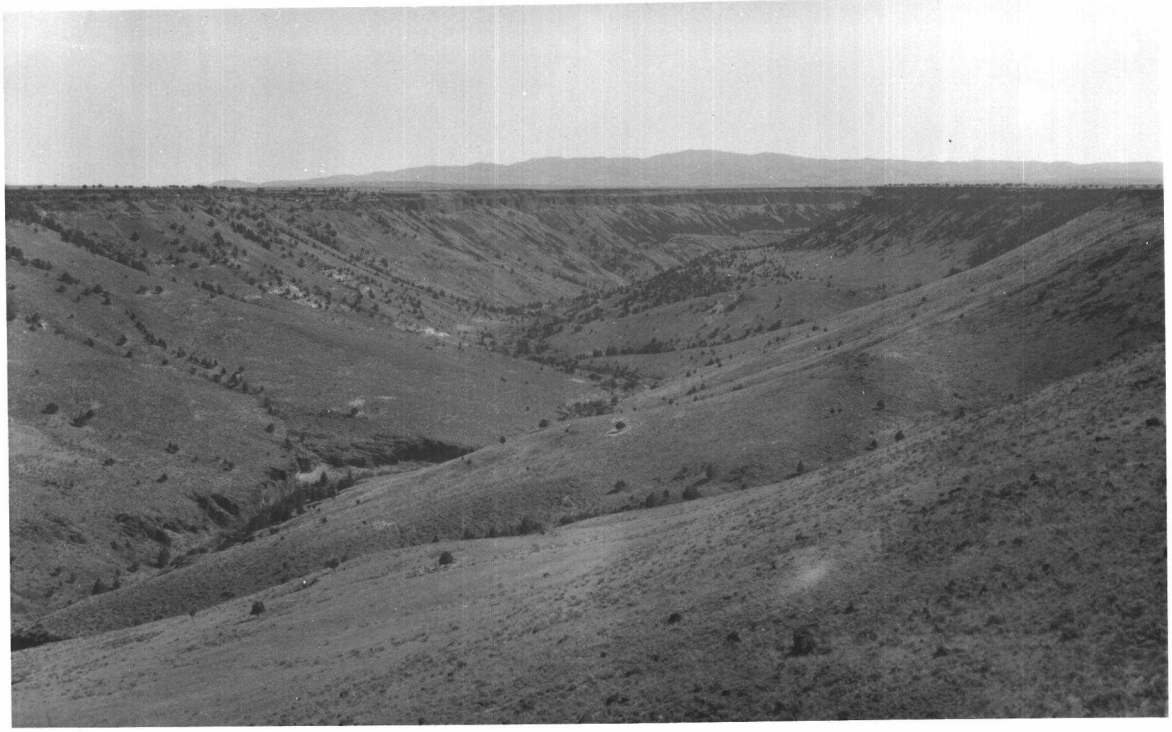


It is thought that much of the sedimentary rock was laid down under large lakes in early Tertiary times. Then in the Pliocene Age, much volcanism occurred, pouring out layers and layers of lava from fractures in the earth's surface. This lava, or "Columbia River basalt," is one of the main components of the high plateau country of central and eastern Oregon. Within the canyons, the rimrocks are the most obvious evidence of the old lava flows.

The Three Forks canyon proper is one of the broad, open portions of the Owyhee Canyon. It lies in an east-west direction and is roughly a square, being approximately one and one-half miles in length, and in width. As here defined, Three Forks includes a portion of each of the contributing stream canyons. The entire study area (Fig. 1) is three miles square.

The North Fork arises in the South Mountain area of southwestern Idaho and comes into Three Forks from the east. About one-half mile past its entrance into Three Forks, the North Fork is joined by the East Fork. This stream has its beginnings far to the east in the Independence Mountains of northcentral Nevada. It flows across the southwestern corner of Idaho and enters Three Forks

from the southeast. The Little Owyhee originates in extreme northern Nevada and southern Oregon and flows slightly to the northeast to reach Three Forks. About seven miles south of Three Forks, the Little Owyhee is joined by the South Fork. This fork arises in the Tuscarora Mountains of northcentral Nevada (west of Independence Mtns.), and also flows across the southwestern corner of Idaho into Oregon.

With such widespread origins, and the variety of habitats through which they flow, the streams, with their potential for carrying seed, have undoubtedly had considerable effect on the flora of the Three Forks area.

HISTORY

Most of the historical information was obtained from long-time residents of the area. Especially helpful were Mr. and Mrs. Ernest Fenwick of the Circle Bar Ranch, six miles east of Three Forks. The remainder of the data was taken from a book by Jacob Gregg about the early history of Malheur County (7, p. 20-37).

The known history of Three Forks dates back to about 1863 when a fort was established there. When gold was discovered to the east in Idaho, a road was built from the mines to the town of Winnemuca, Nevada. The road

went through Three Forks. However, Indian raids on the travelers became so frequent that a fort was built, with soldiers assigned to protect the road. Indian wars ceased in 1868 and it is likely that the fort was abandoned soon thereafter.

The Indians of this country were the fierce Bannocks and Piutes, and the peaceful Snakes. These tribes probably lived there for centuries before the white man arrived. Some evidence still remains of baskets, pottery and other items in diggings in a cave along the river. Writing can also be seen on the walls of some caves.

Apparently mining was not successful in the Three Forks area, for no one ever stayed long for that purpose. The first actual settlers were for agricultural purposes, and they began moving in about 1870.

Horse raising was the first livestock business, soon followed by sheep raising. Now these are largely replaced by the cattle industry. Large ranches are widely scattered throughout the area, but none closer to Three Forks than the Circle Bar. Because of the distance from ranches, or perhaps because of careful ranching practice, the plateau country surrounding Three Forks shows little effect of grazing. Even within the canyon there is a fine stand of grass. However, every winter cattle are brought into

the canyon to be fed. A cabin is standing near the river and is used during the winter months. The great number of introduced plants along the river is indicative of this intrusion of civilization. Perhaps the wheeled vehicles which travel over the road are an even greater contributor to the weed population.

Mr. Fenwick could not recall having ever seen a fire in the area, and I could see no evidence of any. As far as investigation could determine, no one has made extensive botanical collections in this area.

CLIMATE

No weather records have been kept for the Three Forks area, the closest records being for the towns of Rome and Danner. Rome is about thirty miles northwest, or downriver from Three Forks, at 3370 feet elevation. Danner is nineteen miles east of Rome and 1000 feet higher. The 27-year records for Danner show a 10.9 inch annual precipitation. Only four years have been recorded for Rome, with the average close to 7.5 inches per year. Perhaps a more accurate indicator of rainfall is the three-year record of Fairylawn, Idaho, some 11 miles east of Three Forks, and at the same elevation as the Three Forks plateau. The average rainfall at Fairylawn has been near

14.5 inches annually, but Fairylawn is closer to the South Mountains.

Thus I would classify Three Forks as semi-arid with an annual rainfall of nearly 13 inches on the plateau, and slightly less in the canyon. This precipitation is rather evenly distributed from the autumn through the spring months, with December and May having the highest average. The summers are hot and quite dry. Much of the winter precipitation is in the form of snow. According to Mr. Fenwick, the snow rarely gets very deep or stays on long in the canyon. However, in the winter of 1950, frequent and heavy snows covered the canyon, and hundreds of deer congregated and nearly starved to death.

The two years preceding this study had well over average moisture conditions, especially in the spring. This factor very likely influenced the germination of many annual seeds and was responsible for the fine growth of native grasses.

The entire plateau country is usually one of hot summers and cold winters. Judging Three Forks from Danner statistics, the high for 1957 was 97° F. on July 5. The low was 24 degrees below 0° F. on Jan. 27. The mean annual temperature is 46.7° F., with the July mean at 69.1° F. and the January mean at 25.4° F. In 1957, there

were 94 days between freezing temperatures. However, this is slightly more than average, indicating a rather short growing season.

DESCRIPTION OF VEGETATION

The flat plateau country surrounding the Three Forks area is characterized by a more or less uniform vegetation. Big sagebrush, Artemisia tridentata is the dominant species in a shrub land that stretches for miles on all sides of the canyons. Closely associated with this dominant are two large bunchgrasses, Agropyron spicatum and Festuca idahoensis, with the former more abundant. Just as widespread, but smaller and less dominant are the bunchgrasses, Poa secunda and Sitanion hystrix. These species are not separated into any distinct associations, but together with many annual and perennial herbs, form one extensive association. On the basis of the species mentioned above, except Sitanion hystrix, Daubenmire (5, p. 55-79) in his study of the Inland Empire, distinguished three zones. His associations seem to be merged here and all are included in one.

This vegetational cover of the plateau is undoubtedly a climatic climax, or one due to the prevailing climate. It is possible that Artemisia tridentata was not as abundant before livestock grazing began, but this is not known. The soil is a rather uniform light loam, light in color

and fairly deep. For the most part it is not gravelly, but has a few large rocks, and along dry washes is very rocky.

The following species characterize the Plateau:

Agoseris glauca
Agropyron spicatum
Allium acuminatum
Artemisia tridentata
Astragalus lentigenosus
Calochortus macrocarpum
Delphinium andersoni
Epilobium paniculatum
Erigeron bloomeri
Festuca idahoensis
Fritillaria pudica
Lomatium montanum
Lupinus saxosus
Plectritis macrocera var. *grayii*
Poa secunda
Sitanion hystrix
Trifolium macrocephalum

Within the canyons, however, several definite zones or horizontal belts can be distinguished. They will subsequently be referred to as belts. There are three main belts in two divisions of the canyon. The river and riverbank is the most obvious belt and constitutes one division. The second division is the remainder of the canyon, or canyon slopes, and includes the other two belts, the Sagebrush Belt and the Grass Belt.

The river belt has by far the greatest number and density of plant species. Of this number, many are not native, having been introduced by grazing activities, and

are common weeds. However, because of long establishment, some are now a characteristic part of the flora. Especially is this true of Bromus tectorum. This annual grass is found throughout the study area and in many places forms a solid cover between the perennial dominants. A good number of other introduced species are also found on the canyon slopes.

Because of the profusion of plants along the river, they have been put into five seasonal categories according to peak flowering time. These categories are: 1. Spring (April to May 15); 2. Early summer (May 16 to June 30); 3. Mid-summer (July); Late summer (August); 5. Early autumn (September). These categories are also used for the canyon slope belts where possible. However, very few plants except the sagebrush flower after mid-summer on the slopes. In fact, most have flowered and set seed by mid-summer, whereas those along the river flower throughout the season, but predominantly in mid-summer or later. This feature is undoubtedly an adaptation developed in direct ratio to available soil moisture (5, p. 67).

THE RIVER BELT

In some places the sheer rock walls dip down into the river. Mostly though, there is a bank varying up to 100 yards in width. It is this portion of the canyon which constitutes the River Belt. This belt is always distinct and in sharp contrast with the dryer canyon slope. The soil is not uniform, but the slight differences play a part in characterizing the associations.

Within the River Belt, four plant associations can be seen. They are as follows:

Sedge/Rush Association

Salix/Ribes/Rosa Association

Elymus Association

Artemisia/Chrysothamnus Association

Sedge/Rush Association

As summer progresses and the river level falls, sloughs or marshes are cut off all along the river (Plate 3). These sloughs, or even the slower parts of the river, support a characteristic flora unlike the adjacent river bank. The soil is mostly a thick, black mud or "muck", though occasionally slightly sandy.

The following species characterize this association:

Spring

Equisetum arvense

Mid-summer

Cyperus aristatus	Marsilea vestita
Eleocharis palustris	Plantago major
Glyceria grandis	Scirpus americanus
Juncus ensifolius	Scirpus heterochaetus
Juncus saximontanus	

Late summer

Alisma plantago-aquatica	Sagittaria cuneata
Potamogeton epihydrous	Sparganium simplex

Salix/Ribes/Rosa Association

All along the river is a very dense and complex association which might be called a streambank thicket (Plate 4). The soil is a uniform light sand to sandy loam, and is nearly always under flood water in the spring. Salix lutea is the most abundant shrub, with Ribes aureum, Salix argophylla, and Rosa woodsii following in that order. Of less abundance, but characteristic of this association are the small trees, Cornus stolonifera subsp. stolonifera, Alnus tenuifolia, Crataegus columbiana, and the creeping vine, Clematis ligusticifolia.

No attempt will be made to further break down this association. The numerous annual and perennial species are lumped into one category with the above mentioned dominants. It is felt that the shrubby dominants

Plate 3

Sedge/Rush Association found along the river's edge, or in sloughs cut off from the river, as seen here.

Plate 4

Salix/Ribes/Rosa Association, or riverbank thicket. Note the sharp contrast with the sagebrush behind.

represent both an edaphic and climatic climax. However, because of grazing effects and numerous introduced species, the herbaceous vegetation is definitely in a changing or seral state.

The following species characterize this association:

Spring

Alnus tenuifolia
Chorispora tenella
Ribes aureum
Salix argophylla
Salix lutea

Early summer

Amsinckia micrantha
Capsella bursa-pastoris
Cornus stolonifera subsp. *stolonifera*
Crataegus columbiana
Heracleum lanatum
Mimulus guttatus
Plagiobothrys hispidulus
Poa ampla
Poa pratensis
Potentilla millegrana
Ranunculus cymbalaria var. *saximontanus*
Scrophularia lanceolata
Trifolium repens
Veronica anagallis-aquatica

Mid-summer

Agrostis exarata
Alopecurus aequalis
Boisduvalia stricta
Bromus marginatus
Carex athrostachya
Mentha arvensis var. *glabrata*
Poa palustris
Rorippa sinuata
Senecio serra

Lactuca pulchella

Urtica holosericea

Veronica americana

Late summer

Artemisia dracunculus

Aster eatonii

Aster occidentalis var. intermedius

Cirsuim vulgare

Polygonum lapathifolium

Solidago missouriensis var. fasciculata

Verbascum thapsus

Early autumn

Conyza canadensis var. glabrata

Elymus Association

Throughout the River Belt are areas of various size dominated by the giant wild rye, Elymus condensatus. These areas are always between the Salix/Ribes/Rosa Association and the canyon slopes (Plate 5). The soil is a sandy loam, but is much finer and deeper than that of the Salix/Ribes/Rosa Association. It is only seldom flooded in the Spring.

The tall, tufted, dominant grass grows in rather dense stands, and despite the many introduced plants along the river, relatively few are present in this association. Especially typical is a large triangle of land approximately one hundred yards long and one hundred yards wide

bounded by the river on two sides. During the winter, when cattle are in the canyon and the river is high, this land is actually an island, and is at least partially protected from grazing. On the "island" is an almost pure stand of Elymus condensatus. Thus it is felt that this plant is the natural climax dominant of much of the River Belt.

The following species characterize this association:

Spring

Carex douglasii

Early Summer

Elymus condensatus

Rumex crispus

Vicia americana

Mid-summer

Achillea millefolium

Agastache urticifolia

Bromus japonicus

Elymus glaucus

Potentilla flabelliformis

Sidalcea oregana

Artemisia/Chrysothamnus Association

As was implied in the previous discussion, the receding of the river leaves dry river beds or flood plains (Plate 6). These areas also support a characteristic flora. Some plants are restricted to this habitat, while others, although occasionally scattered in other

Plate 5

Elymus Association in the foreground. Where present, it is between the riverbank thicket and dry canyon slopes.

Plate 6

Artemisia/*Chrysothamnus* Association of the dry river floodplain. This is always flooded in the spring.

associations, attain their greatest abundance here. Such is the case with the two dominants, Chrysothamnus nauseosus and Artemisia ludoviciana.

The soil is quite gravelly and sandy with very little loam. The entire habitat might be classed as a transition area between the Sedge/Rush and Salix/Ribes/Rosa Associations.

The following species characterize this association:

Mid-summer

Apocynum suksdorfii
Chenopodium botrys
Echinochloa crusgalli var. mitis
Glycyrrhiza lepidota
Gnaphalium palustre
Mimulus pilosus
Monardella odoratissima
Navarretia intertexta
Nicotiana attenuata
Oenothera hookeri
Oenothera tanacetifolia
Polypogon monspeliensis
Xanthium strumarium

Late summer

Artemisia ludoviciana
Brickelia oblongifolia var. linifolia
Chrysothamnus nauseosus

THE CANYON SLOPES

Sharply contrasting with the River Belt is the Canyon Slopes division of the canyon, on which can be seen two rather intergrading belts. The lower belt is the Sagebrush

Belt and the upper belt is the Grass Belt. There is no sharp distinction between the belts, nor is there a definite width. In general, the lower belt is wider, extending a little more than half way up the slopes. However, the many variations are primarily due to differences in exposure and available moisture, and perhaps soil.

The soil texture changes very little from bottom to top of the canyon. In general, it is a dry, deep loam, but quite gravelly, and becomes shallower towards the top. In the Grass Belt there are many large basalt rocks throughout with occasional rock slides.

THE SAGEBRUSH BELT

Big sagebrush, Artemisia tridentata, is dominant throughout this belt, but forms several associations with other plants. On the south-facing slope of the main study area, this belt occupies more than half of the slope. This is also true of the southeast-facing slope of the North Fork canyon. On the opposite sides of the canyons mentioned, the situation is reversed, with this belt extending less than half way up the slope.

Within this belt, three associations may be found. Of these, the first two are very limited in area, the third being much more common.

Artemisia/Prunus Association

Just above the Elymus Association, on the south and west sides of the River, is a discontinuous stand of small chokecherry trees, Prunus demissa var. melanocarpa. Also scattered with the trees is Elymus condensatus and snowberry, Symphoricarpos rotundifolius. The protection provided by the steep slopes directly behind this association has allowed an environment enabling these more mesic plants to grow. However, their rather dwarf condition indicates the severity of their struggle in this environment. Chrysothamnus nauseosus is also an infrequent member of this association.

Festuca/Chrysothamnus Association

In the narrow gorge near the bottom of the North Fork canyon, steep slopes on the south side below the lower rimrock are dominated by these genera. In places, Festuca idahoensis forms an almost solid cover, with the shrub, Chrysothamnus viscidiflorus, common throughout. The slopes are shaded during much of the day and this is the only place that Festuca was found below the top of the canyon. Elymus condensatus is again present along with a few junipers, Juniperus occidentalis.

This combination is obviously a topographic climax, or one due to slope exposure. Conditions are even mesic enough to allow a good moss cover to grow over much of the soil. The presence of Chrysothamnus in this and the preceding association indicates a preference for situations more mesic than the dry, open slopes, where it is only occasionally found.

Artemisia/Sarcobatus Association

The remainder of the Sagebrush Belt is covered by this association (Plate 7). The two dominant shrubs, big sagebrush, Artemisia tridentata, and greasewood, Sarcobatus vermiculatus, form a rather dense stand. On the whole, Sarcobatus is not as abundant as Artemisia, and decreases more markedly towards the upper edge of the association. However, in one large patch near the river the soil is whitened with salt deposits, and Sarcobatus completely dominates, to the exclusion of Artemisia.

It is in this association that Bromus tectorum is most abundant, but many native plants are also present.

The following species characterize this association:

Spring

Delphinium andersonii
Descurainia pinnata var. filipes
Lomatium macrocarpum
Lomatium montanum
Microsteris humilis

Layia glandulosa

Ranunculus glaberrimus

Early summer

Bromus tectorum

Castelleja chromosa

Chaenactis douglasii var. *achillaefolia*

Clarkia pulchella

Erigeron aphanactis

Eriogonum ovalifolium

Lupinus brevicaulis

Oenothera allyssoides

Orobanche fasciculata

Penstemon speciosus

Mid-summer

Aster canescens

Lygodesmia spinosa

Mentzelia laevicaulis

Salvia carnosa

Sarcobatus vermiculatus

Sphaeralcea munroana

Tetradymia glabrata

Early autumn

Artemisia tridentata

THE GRASS BELT

Two bunchgrasses, *Agropyron spicatum* and *Poa secunda* are the dominant species in this belt. *Poa* is the lesser dominant, both in size and in abundance, and is also earlier. By the time the larger *Agropyron* is in full bloom, *Poa* has ripened and nearly faded.

This belt occupies the upper and usually the smaller part of the canyon slopes. However, on the northwest-facing slope of the North Fork canyon, it nearly covers

the entire slope. Sagebrush is much more scattered there than on the opposite slope. This belt also appears to hold to the steepest part of the canyon slopes. The large rocks increase in number from the lower edge of the belt up to the solid rimrock, limiting the soil accumulation.

Within this belt, four associations will be described, with each association having the dominant grasses represented.

Agropyron/Poa Association

In the greatest part of the Grass Belt, the two dominants are exclusive of any other association (Plate 8). This condition is especially true of the lower part of the belt, although in many places it extends up to the rimrock. The remarkable density and vigor of the grasses is evidence of their climax status, probably a climatic climax.

The following species characterize this association:

Spring

Amsinckia intermedia
Astragalus lentigenosus
Crepis modocensis
Cryptantha propria
Plagiobothrys tenellus
Poa secunda

Early summer

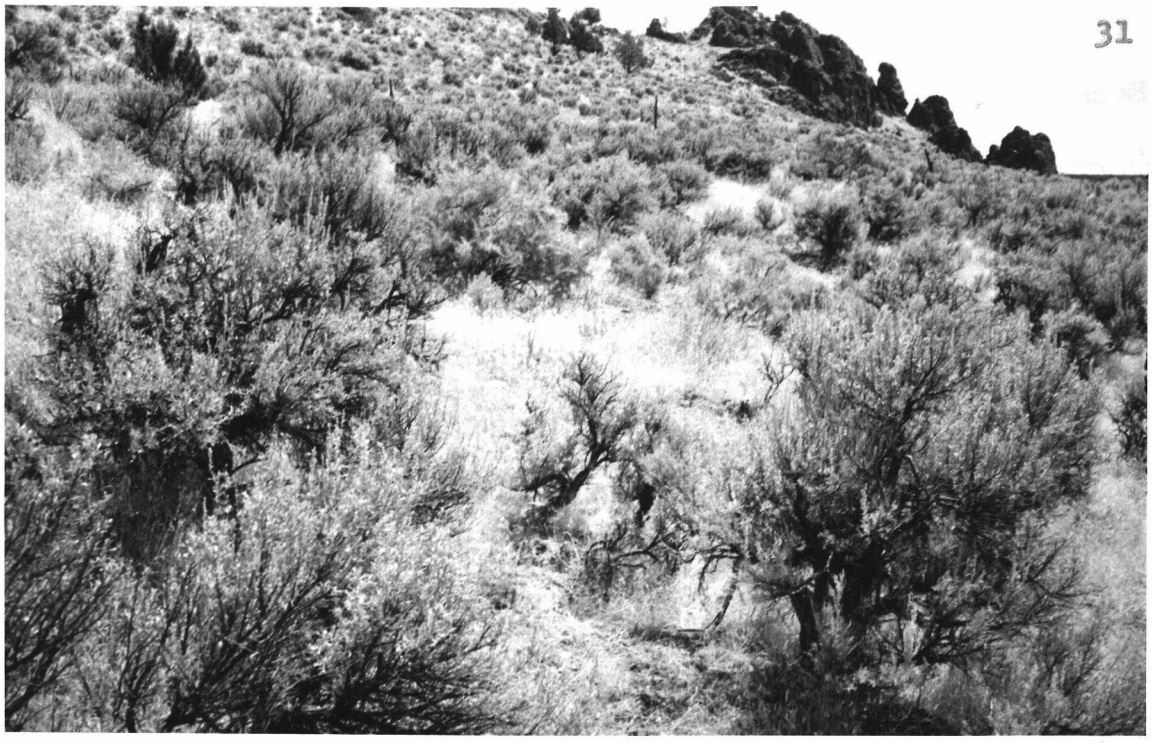
Agropyron spicatum
Allium acuminatum
Cirsium undulatum
Crepis occidentalis subsp. *occidentalis*

Plate 7

Artemisia/*Sarcobatus* Association of the dry canyon slopes. Note abundance of cheat grass, *Bromus tectorum*, typical of much of the area.

Plate 8

Agropyron/*Poa* Association which covers much of the upper slopes. The large bunchgrass, *Agropyron spicatum*, is a much more predominant member of the association than the smaller *Poa secunda*.



Astragalus curvicarpus var. curvicarpus
Astragalus obscurus
Calochortus nuttallii
Erigeron bloomeri
Phacelia linearis
Senecio canus

Juniperus/Festuca Association

All along the various upper rimrocks, wherever a large bend or curve in the topography occurs, a stand of Junipers, Juniperus occidentalis, will usually be found on the more shaded side (Plate 9). Mostly they are confined to the upper slopes, but in places a row of trees follows a gully down to the bottom of the canyon.

Beneath the trees near the rimrock, Festuca idahoensis forms a dense stand (Plate 10). At no other place in the Grass Belt does this grass attain any degree of frequency. The rimrock undoubtedly provides a degree of shelter and may also allow snow to drift deeper in the winter. Thus the Juniperus/Festuca Association indicates a slightly more mesic condition than the surrounding Grass Belt, and is perhaps a topographic climax.

The following species characterize this association:
Spring

Agoseris glauca var. parviflora
Lithophragma parviflora

Plate 9

Juniperus/Festuca Association. Found scattered along the rimrock, usually where the canyon slope topography bends or curves forming a large niche.

Plate 10

Juniperus/Festuca Association. One of the few places where Festuca idahoensis occurs in the canyon is under the Juniper trees.

Early summer

Crepis acuminata	Festuca idahoensis
Cryptantha watsonii	Juniperus occidentalis
Erigeron pumilus	Penstemon deustus
subsp. intermedius	Scutellaria antirrhinoides

Grayia/Sarcobatus Association

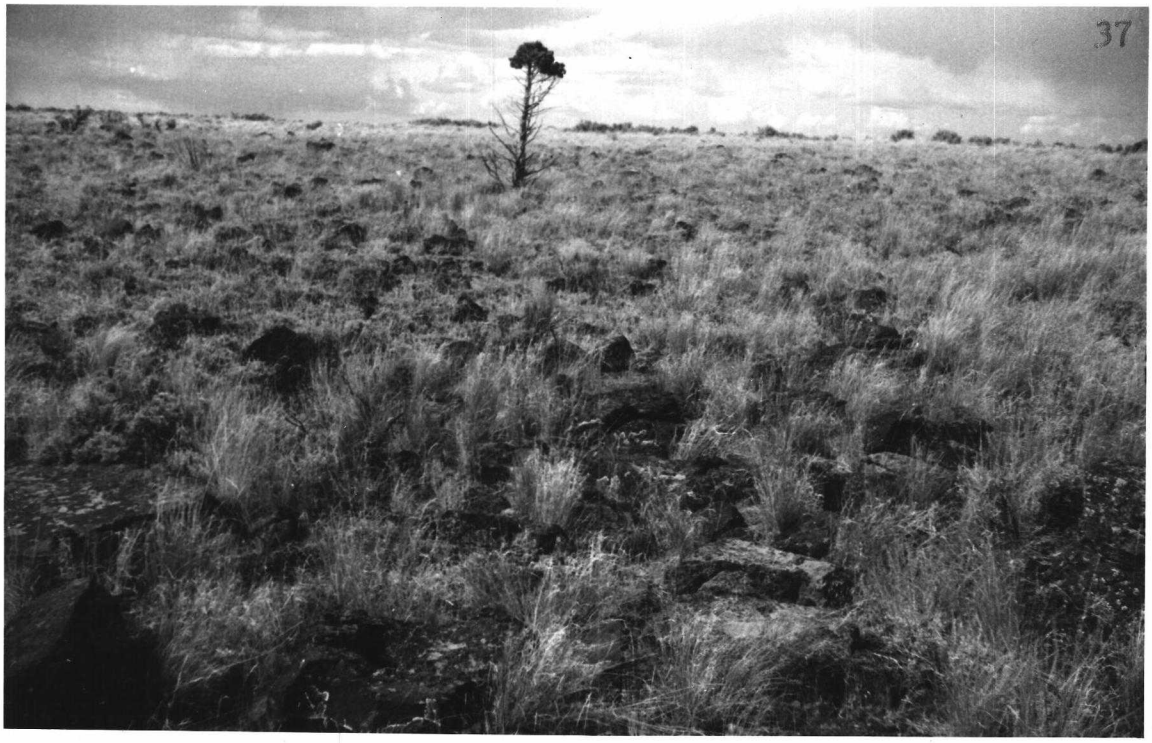
On the exposed southeast-facing slope of the North Fork Canyon, a dense stand of the dominant genera is found just beneath the rimrock. No junipers are present here. There is also an occasional patch of Grayia in the Three Forks Canyon. The large stand is approximately two hundred yards long and fifty yards wide. Both Grayia and Sarcobatus are halophytes that tolerate alkaline soils. Their association indicates an edaphic climax. However, there are a few Artemisia tridentata plants in the association, indicating a not-too-heavy concentration of salts. No additional collections were made in this association.

Artemisia/Sitanion Association

This association, although not within the canyon slopes, is a part of the Grass Belt. Between the rim of the canyons and the large sagebrush of the plateau is a zone completely free of the large sagebrush, Artemisia tridentata (Plate 11). This border is uniformly about

Plate 11

Artemisia/Sitanion Association or scabland. The low sagebrush, Artemisia arbuscula and bunchgrass, Sitanion hystrix are found almost exclusively here. Note line of large sagebrush, Artemisia tridentata, in the background.


37

one hundred yards wide. It is dominated by a low, matted Sagebrush, Artemisia arbuscula. In addition to the scattered Agropyron-Poa present, the low bunchgrass, Sitanion hystrix, attains its best development here.

This zone might also be called a scab-land, for the soil is quite thin and extremely rocky. It lies right on top of the rimrock where the effects of wind and water erosion have made the soil building process very slow. The wind also reduces available moisture by blowing off the winter snows.

Despite the severe environment, the association supports a number of herbs, mostly low perennials.

The following species characterize this association:

Spring

Arabis puberula
Astragalus obscurus
Astragalus purshii
Balsamorhiza hookeri
Bromus commutatus
Eriogonum caespitosum
Phlox diffusa var. scleranthifolia
Phlox longifolia
Viola beckwithii

Early summer

Aster scopulorum
Eriogonum proliferum
Eriogonum sphaerocephalum
Eriophyllum lanatum
Penstemon cinereus
Sitanion hystrix

Early autumn

Artemisia arbuscula

Other Associations:

Hackelia/Ivesia Association

Wherever large rock outcrops occur, shade and shelter are provided. Several of these outcrops occur on the canyon slopes in both belts. A comparison of these outcrops reveals the striking similarity of their plant associations. Although the shrubby currant, *Ribes cereum*, is the only consistent representative of the bare, exposed part of the outcrops, a large number of species characterize the sheltered part.

In the various cracks and niches, there is almost continual shade. Also, moisture is retained longer than in surrounding locations. The soil is usually quite thin and gravelly, with a covering of lichens and mosses. The choice of the dominants is somewhat arbitrary, but is based on their being more widespread.

The following species characterize this association:

Artemisia sp.
Cystopteris fragilis
Galium aparine
var. *echinospermum*
Lithophragma bulbiferum
Mimulus floribundus
var. *membranaceous*
Montia perfoliata

Hackelia cusickii
Heuchera rubescens
Ivesia baileyi
Phacelia rattani
Ribes niveum
Stephanomeria tenuifolia

Roadside Association

Although many of the species listed here are dispersed in the various associations, they are most abundant along the road. The road winds down the north side of the canyon, runs along the river from west to east one-half mile before crossing the North Fork on a bridge. Then the road forks, both forks going up the south slope of the Canyon. One goes toward the South Fork and the other goes toward the North Fork.

The following species characterize this association:

Spring

Lepidium perfoliatum
Thlaspi arvense

Mid-summer

Eriogonum vimineum
Helianthus annuus
Lactuca scariola
Polygonum aviculare
Salsola kali var. *tenuifolia*

Late-summer

Atriplex rosea
Iva axillaris

TAXONOMIC TREATMENT

The majority of the study work consisted of identifying and classifying the plants collected. Keys were then constructed to classes, families, genera and species. Descriptions were made for each genus and its included species.

A total of 211 species were determined for the study area. These were included in 148 genera, 45 families and four classes. The keys are artificial and are necessarily limited in scope because of the small size of the study area.

Especially helpful in identification were the state floras of Oregon (10, p. 1-866) and Idaho (6, p. 1-828). In addition, a few other floras and several monographs were used. None of the latter are included in the bibliography.

Of particular taxonomic interest was the discovery of an undescribed species of Artemisia. Because this discovery was verified by Dr. Arthur Cronquist, a specialist in the family Compositae, he was given the opportunity of naming and describing the plant.

KEYS TO CLASSES AND FAMILIES

Plants not producing seeds; asexual spores produced in sporangia; gametophyte generation of inconspicuous thalloid sexual plants.

Leaves scale-like, whorled at the nodes; spores borne in a terminal cone; stems jointed . . . . . Class II. EQUISETINEAE

Leaves large, circinate; spores borne on the leaf surface; stems not jointed . . . . . Class I. FILICINEAE

Plants producing seeds; without asexual spores; gametophyte generation enclosed, not thalloid.

Seeds borne on scales which form a cone; plants woody, without true flowers . . Class III. GYMNOSPERMAE

Seeds borne within a closed cavity or ovary; plants with true flowers . . . . Class IV. ANGIOSPERMAE

Class I FILICINEAE

Leaves sessile, pinnate, bearing spores in sporangia on the under side . . . . . 1. POLYPODIACEAE

Leaves long-stalked, clover-like with four segments; spores borne in a basal sporocarp . . . . . 2. MARSILEACEAE

Class II EQUISETINEAE

One family . . . . . 3. EQUISETACEAE

Class III GYMNOSPERMAE

One family . . . . . 4. CUPRESSACEAE

Class IV ANGIOSPERMAE

Flower parts mostly in three or sixes; leaves parallel-veined; vascular bundles scattered in the stem . . . . . Subclass I MONOCOTYLEDONEAE

Flower parts mostly in fours or fives; leaves mostly netted-veined; vascular bundles concentrically arranged . . . . . Subclass II DICOTYLEDONEAE

Subclass I MONOCOTYLEDONEAE

1a. Perianth parts inconspicuous or lacking.

Plants aquatic; calyx of four distinct sepals . . . . . 6. NAJADACEAE

Plants terrestrial, though often in damp places; calyx lacking.

Flowers in globose heads, without subtending bracts; perianth of 3-6 parts . . . . . 5. SPARGANIACEAE

Flowers in spikelets, subtended by chaffy bracts; perianth reduced to bristles or wanting.

Flowers usually with two subtending bracts; leaves two-ranked; stems usually round and hollow . . 8. GRAMINEAE

Flowers usually with one subtending bract; leaves three-ranked; stems usually solid and triangular. 9. CYPERACEAE

1b. Perianth parts present and well developed.

Pistils numerous; fruits achenes . . . . . 7. ALISMACEAE

Pistils one per flower; fruit a capsule.

Perianth scale-like and rather inconspicuous, not brightly colored . . . . . 10. JUNCACEAE

Perianth conspicuous, at least the inner whorl petaloid and brightly colored . . . . . 11. LILIACEAE

Subclass II DICOTYLEDONEAE

2a. Petals absent; species monoecious or dioecious or flowers perfect.

Flowers in catkins; seeds with a tuft of hairs (coma) . . . . . 12. SALICACEAE

Flowers not in catkins; seeds without a coma.

Shrubs or vines

Climbing or twining vine; flowers white and showy . . . . . 19. RANUNCULACEAE

Rather stiff spiny shrubs; flowers inconspicuous . . . . . 15. CHENOPODIACEAE

Herbs.

Ovary three-celled; fruit a capsule; small annuals.

Flowers unisexual, both sexes borne together in an involucre . . 25. EUPHORBIACEAE

Flowers perfect, without an involucre . . . . . 17. AIZOACEAE

Ovary one-celled; fruit an achene or utricle.

Leaves with stipules.

Stipules free; leaves opposite; plants with stinging hairs.13. URTICACEAE

Stipules sheathing; leaves alternate; plants without stinging hairs . . . . . 14. POLYGONACEAE

Leaves without stipules.

Flowers colorful and conspicuous, subtended by an involucre of partly united bracts (Eriogonum). . 14. POLYGONACEAE

Flowers greenish and inconspicuous; bracts, if present, free.

Bracts scarious; flowers in dense spikes . . . . . 16. AMARANTHACEAE

Bracts, if present, fleshy; flowers solitary or in glomerules . . . . . 15. CHENOPODIACEAE

2b. Petals present; flowers perfect (ours).

3a. Petals free from each other.

4a. Stamens numerous (more than ten).

Filaments united, forming a tube around the pistil . . 26. MALVACEAE

Filaments free, not forming a tube.

Stamens borne on the receptacle; stipules lacking . . . . . 19. RANUNCULACEAE

Stamens borne on a floral tube or hypanthium; stipules present . . . . . 23. ROSACEAE

4b. Stamens ten or fewer.

5a. Calyx free from ovary; ovary superior.

Stamens opposite the petals; placenta basal; sepals two . . . . . 18. PORTULACACEAE

Stamens alternate with petals or twice as many as petals; placenta parietal.

Flowers irregular, parts in fives.

Stamens five . . 27. VIOLACEAE

Stamens ten . . 26. LEGUMINOSAE

Flowers regular, parts mostly in fours; stamens six, four long and two short . . . . . 20. CRUCIFERAE

5b. Calyx fused to ovary; ovary wholly or partly inferior.

Ovary partly inferior . . 21. SAXIFRAGACEAE

Ovary wholly inferior.

Stamens and petals borne on the hypanthium.

Fruit a berry; shrubs . . . . . 22. RIBESACEAE

Fruit a capsule; herbs . . . . . 28. ONAGRACEAE

Stamens and petals borne on the ovary; calyx minute.

Flowers in compound umbels; flower parts in fives . . 29. UMBELLIFERAE

Flowers in cymes; flower parts in fours . . . . . 30. CORNACEAE

3b. Petals wholly or partly united.

6a. Ovary superior.

Pistil simple; stamens 10, borne on the receptacle; fruit a legume . . . . . 26. LEGUMINOSAE

Pistil compound; stamens less than 10, borne on the corolla; fruit not a legume.

7a. Fruit a capsule.

Corolla irregular.

Plants parasitic, without green color; leaves scale-like . . . . 40. OROBANCHACEAE

Plants not parasitic, with green color; leaves well developed . . . 39. SCROPHULARIACEAE

Corolla regular.

Corolla scarious; capsule splitting transversely (circumscissile) . . . . . 41. PLANTAGINACEAE

Corolla petaloid, not scarious; capsule not circumscissile.

Ovary 2-chambered.

Corolla circular (rotate) and flattened; stamens exserted . . . . . 39. SCROPHULARIACEAE

Corolla long-tubular; stamens included . . . . . 38. SOLANACEAE

Ovary 1-or 3-chambered.

Style 2-cleft; inflorescence usually scorpioid . . 35. HYDROPHYLLACEAE

Style 3-cleft; inflorescence not scorpioid . . . . . 34. POLEMONIACEAE

7b. Fruit not a capsule.

Ovary deeply 4-lobed, separating into one-seeded nutlets at maturity.

Leaves opposite; stems 4-angled; flowers mostly irregular . 37. LABIATAE

Leaves alternate or basal; stems cylindric; flowers regular . . 36. BORAGINACEAE

Ovary of two carpels separate to the tip, becoming a pair of many-seeded follicles; plants with milky juice . . . . . 33. APOCYNACEAE

6b. Ovary inferior.

Ovary with two functional chambers.

Leaves whorled; fruit splitting into two spiny sections or mericarps . . . . . 42. RUBIACEAE

Leaves opposite; fruit a smooth white berry . . . . . 43. CAPRIFOLIACEAE

Ovary with one functional chamber.

Stamens separate; flowers not in an involucrate head . . . . . 44. VALERIANACEAE

Stamens fused to form a tube; flowers in an involucrate head . 45. COMPOSITAE

CLASS I. FILICINEAE

1. POLYPODIACEAE - FERN FAMILY

1. Cystopteris Bernh. (Brittle Fern)

Fragile ferns of sheltered to open places; fronds erect and in small clusters; sori covered by hood-like indusium which is attached below and to one side, this turned back and lost with age.

1. C. fragilis (L.) Bernh. Growing on north slope of the North Fork Canyon, with grass in rather rocky soil.

2. MARSILEACEAE - PEPPERWORT FAMILY

1. Marsilea L. (Clover Fern)

Small aquatic plants with clover-like leaf blades on long petioles; sporocarps basal, sessile or short-stipitate, very hairy when young.

1. M. vestita Hook. and Grev. Plants with long rhizomes, growing along the edge of the river and floating in the water.

CLASS II. EQUISETINEAE

3. EQUISETACEAE - HORSETAIL FAMILY

1. Equisetum L. (Horsetail)

Plants with rhizomes and a jointed hollow stem;

leaves scale-like, whorled, united into a sheath at the node; spores with elaters, borne in a terminal cone.

1. E. arvense L. Aerial stems annual, the fertile ones unbranched and non-green, the sterile ones branched and green; fertile stems up to 3 dm. high, the sterile ones slightly taller. Found in sloughs along the river.

CLASS III. GYMNOSPERMAE

4. CUPRESSACEAE - CYPRESS FAMILY

1. Juniperus L. (Juniper)

Small trees of semi-arid slopes; leaves scale-like and awl-shaped, imbricated, in whorls of three; cones berry-like, round, purplish.

1. J. occidentalis Nutt. (Western Juniper). Our trees small, up to 8 m. high; along rimrock of canyon, extending down along gullies; leaves very resinous and sticky.

CLASS IV. ANGIOSPERMAE

SUBCLASS I. MONOCOTYLEDONEAE

5. SPARGANIACEAE - BUR-REED FAMILY

1. Sparganium L. (Bur-Reed)

Marsh plants with deep rootstock and long, linear, two-ranked leaves; flowers in globose heads, the staminate heads extended above the pistillate; fruit beaked.

1. S. simplex Huds. Common in marshy area along the river, up to five dm. high.

6. NAJADACEAE - PONDWEED FAMILY

1. Potamogeton L. (Pondweed)

Perennial aquatic herbs with floating and submerged leaves, these alternate; flowers in spikes, greenish, four-parted.

1. P. epihydrous Raf. (Nuttall's Pondweed). Floating leaves petioled, the submerged sessile, ribbon-like. Found abundantly in a stagnant pond, which had been cut off from river.

7. ALISMACEAE - WATER PLANTAIN FAMILY

Leaves arrow-shaped; receptacle rounded . . . . . 2. Sagittaria

Leaves not arrow-shaped; receptacle flat . . . . . 1. Alisma

1. Alisma L. (Water Plantain)

Leaves all basal, long-petioled; stamens six; achenes distinct, arranged in a ring on a low receptacle. Plants of wet places.

1. A. plantago-aquatica L. Plant from a rootstock, up to four dm. tall. Found in marshy area with Sparganium.

2. Sagittaria L. (Arrowhead)

Leaves arrow-shaped, all basal; stamens numerous; achenes numerous, crowded on a rounded receptacle.

1. S. cuneata Sheldon. Flowers white and showy. Collected in a stagnant pond with Potamogeton.

8. GRAMINEAE - GRASS FAMILY

1a. Spikelets with one terminal, perfect floret and a sterile floret below; articulation below the spikelets; spikelets dorsally compressed. (PANICEAE)

Spikelets awned, in a narrow dense panicle . . . . . 5. Echinochloa

Spikelets awnless, in a very diffuse panicle . . . . . 11. Panicum

1b. Spikelets with one to many perfect florets, the sterile florets, if any, above; articulation usually above the glumes; spikelets laterally compressed.

2a. Spikelets sessile on opposite sides of a jointed rachis, forming a terminal spike. (HORDEAE)

Spikelets solitary at each node of the rachis . . . . . 1. Agropyron

Spikelets two or more at each node of the rachis.

Rachis readily disarticulating; glumes two-cleft, with long divergent awns . . . . . 14. Sitanion

Rachis continuous; glumes entire, with short straight awns . 6. Elymus

2b. Spikelets pedicellate in open or condensed panicles.

3a. Spikelets one-flowered. (AGROSTIDEAE)

Articulation below the glumes; panicle dense, spike-like.

Glumes long-awned, not united . . . . . 13. Polypogon

Glumes awnless, united below . . . . . 3. Alopecurus

Articulation above the glumes; panicles not spike-like.

Lemma hardened, awned; callus bearded.

Awn short and straight, deciduous . . . . . 10. Oryzopsis

Awn long and twisted, persistent . . . . . 15. Stipa

Lemma not hardened, awnless; callus not bearded.

Palea wanting; glumes exceeding the lemma . . . . . 2. Agrostis

Palea present; lemma exceeding the glumes . . . . 9. Muhlenbergia

3b. Spikelets two-many-flowered; glumes shorter than the first floret. (FESTUCEAE)

Lemmas awnless.

Nerves of lemma prominent, parallel . . . . . 8. Glyceria

Nerves of lemma faint, converging towards the tip . . . . . 12. Poa

Lemmas awned.

Lemmas awned from the tip . . . . . 7. Festuca

Lemmas awned from a bifid apex . . . . . 4. Bromus

1. Agropyron Gaertn. (Wheatgrass)

Ours perennial with fibrous roots; spikelets large, several-flowered, solitary at the rachis joints; glumes nearly equal, stiff; lemmas 5-7-nerved.

Awn of lemma less than 4 mm. long or lacking; spikelets overlapping . . . . . 2. A. trachycaulum

Awn of lemma mostly 10 mm. long or more; spikelets not overlapping . . . . . 1. A. spicatum

1. A. spicatum (Pursh) Scribn. & Smith (Bluebunch Wheatgrass). Culms slender, in large bunches up to 9 dm. high; leaf blades 1-3 mm. wide; spikelet 4-7-flowered; awns bent. The most abundant native grass in the study area.

2. A. trachycaulum Malte. (Slender Wheatgrass). Culms few, in small tufts up to 7 dm. high; leaf blades 2-5 mm. wide; glumes 2-3 mm. broad, nearly as long as the spikelet; awns, if present, straight. Common in gravelly flood plain.

2. Agrostis L. (Bentgrass)

Ours perennial with slender culms; glumes nearly equal, enclosing the single floret; spikelets awnless.

1. A. exarata Trin. (Spike Redtop). Tall perennial up to 12 dm. high, from fibrous roots; panicle rather dense and narrow; leaf blades flat, 4-10 dm. wide; ligule prominent. Common in streambank thicket association.

3. Alopecurus L. (Foxtail)

Mostly perennials; spikelets laterally compressed, in soft, narrowly cylindric panicles; glumes equal; lemmas as long as the glumes, awned from below the middle.

1. A. aequalis Sobol. (Short-awned Foxtail). Slender perennial up to 6 dm. high; panicle 3-5 mm. wide; awns only slightly, if at all, exceeding the glumes. Common in rather sandy soil along the river.

4. Bromus L. (Bromegrass)

Annuals or perennials; spikelets large, often many-flowered; lemmas keeled or rounded, longer than the glumes, awned from a bifid apex; blades and sheaths usually hairy.

Perennials; lemmas compressed-keeled; blades 4-7 mm. wide . . . . . 3. B. marginatus

Annuals; lemmas rounded on the back; blades 2 mm. wide or less.

Teeth of lemma 2-5 mm. long; spikelets nodding . . . . . 4. B. tectorum

Teeth of lemma less than 2 mm. long; spikelets erect.

Margins of lemmas slightly inrolled; panicle branches stiffly erect to spreading . . . . . 1. B. commutatus

Margins of lemmas not inrolled; panicle branches flexuous, erect to drooping . . . . . 2. B. japonicus

1. B. commutatus Shrad. (Hairy Chess). An erect annual, 3-6 dm. high; culms often reddish; lemmas broad, lower half of margins inrolled; palea nearly as long as the lemma. Found abundantly in patches in the scabland zone along the canyon rim.

2. B. japonicus Thurb. A tall annual, up to 10 dm. high; panicle open; lemma margins papery; palea 1-2 mm. shorter than lemma. Found along the road near the top, but more commonly in Elymus association.

3. B. marginatus Nees. Stout perennial, up to 10 dm. high; blades and sheaths sparsely hairy to glabrous; awns 4-7 mm. long. Common in the Salix/Ribes/Rosa association.

4. B. tectorum L. (Cheatgrass). Slender annual, up to 6 dm. high; spikelets hairy; lemmas narrow; awns 1-2.5 cm. long. Abundant throughout the area, especially in Sagebrush Belt.

5. Echinochloa Beauv.

Low spreading annuals or perennials; spikelets bi-convex, nearly sessile; first glume about half the length of the spikelet; second glume and sterile lemma equal.

1. E. crusgalli (L.) Beauv. var. mitis (Pursh) Peterm. (Barnyard grass). Plants annual, decumbent; culms up to 6 dm. high in ours; blades flat, 4-8 mm. wide; awn of sterile lemma 3 mm. long or less. Common in sand along the river.

6. Elymus L. (Wild Rye)

Usually stout perennials; blades broad and flat; glumes equal; lemmas rounded, 5-nerved.

Lemmas long-awned; glumes lanceolate . 2. E. glaucus
Lemmas short-awned or awnless; glumes linear . . . . . .
. . . . . 1. E. condensatus

1. E. condensatus Presl. (Giant Wild Rye). Culms in large tufts, up to 2.5 m. high; spikes dense; blades stiffly erect, 5-20 mm. wide. Abundant in some areas near the river; infrequent in Sagebrush Belt.

2. E. glaucus Buckl. (Blue Wild Rye). Culms rather slender, up to 9 dm. tall; blades spreading, 8-16 mm. wide; awn of lemma straight, 1-2.5 cm. long. Common in Elymus association.

7. Festuca L. (Fescue)

Annuals or perennials; glumes and lemmas acute; lemmas rounded dorsally, 5-nerved.

1. F. idahoensis Elmer (Idaho fescue). A densely tufted perennial, up to 9 dm.; leaves numerous, blades strongly rolled inward (involute); spikelet 5-7-flowered; awns 2-5 mm. long. Mostly found in shaded places in the canyon; in Sagebrush and Grass Belts.

8. Glyceria R. Br. (Mannagrass)

Tall perennial marsh plants with creeping rhizomes; blades broad and flat; glumes usually scarious; lemmas rounded on the back, firm, strongly nerved.

1. G. grandis S. Wats. Culms stout, erect, up to 12 dm. high; panicle diffuse, nodding; glumes white; lemmas purplish, 7-nerved. Common in marshy areas along the river.

9. Muhlenbergia Schreb. (Muhly)

Annuals or perennials; panicles narrow or open; lemmas exceeding the glumes, mostly 3-nerved, usually awned from the tip.

1. M. richardsonis (Trin.) Rydb. (Mat Muhly). Low tufted perennial; culms much-branched and spreading, up to 3 dm. high; panicle narrow and dense; glumes equal; blades 1-2 mm. wide, short and recurved. Infrequent in sandy soil along the river.

10. Oryzopsis Michx. (Ricegrass)

Large tufted perennials; glumes equal; lemmas hard, rounded on the back, usually as long as the glumes.

1. O. hymenoides (R. & S.) Ricker (Indian Ricegrass). Culms up to 6 dm. high; panicle diffusely spreading; blades narrow, involute; glumes papery, nearly twice as long as the lemma; lemma densely long-hairy. Sparse, only one plant found in Sagebrush Belt.

11. Panicum L.

Annuals or perennials; glumes very unequal; second glume and sterile lemma equal; margins of fertile lemma inrolled and enclosing the palea.

1. P. capillare L. var. occidentale Rydb. (Witchgrass). Spreading annual, up to 5 dm. high; blades flat, 8-15 mm. wide, these and sheaths hairy; panicle very diffuse. Common in sandy loam of Salix/Ribes/Rosa association.

12. Poa L. (Bluegrass)

Ours all perennials; glumes keeled; lemmas scarious at the tip, never awned; blades with boat-shaped tips.

Spikelets compressed; lemmas keeled, webbed at the base.

Rhizomes present; spikelets 2-4 mm. wide . . . . 3. P. pratensis

Rhizomes wanting; spikelets less than 2 mm. wide . . . . 2. P. palustris

Spikelets not compressed; lemmas convex, not webbed.

Spikelet 8-10 mm. long; lemma glabrous . . . . 1. P. ampla

Spikelet 4-6 mm. long; lemma crisp-pubescent . . . . 4. P. secunda

1. P. ampla Merr. (Big Bluegrass). Culms up to 10 dm. high; panicle narrow, branches ascending; plant somewhat glaucous. Common in Salix/Ribes/Rosa association along the river.

2. P. palustris L. (Fowl Bluegrass). Culms slender, up to 12 dm. high; panicle branches spreading; spikelets small, 2-4-flowered; ligules prominent. Infrequent in Salix/Rosa/Ribes association.

3. P. pratensis L. (Kentucky Bluegrass). Culms up to 9 dm. high; lower panicle branches in whorls of 5,

spreading; lemma nerves prominent. Common in Salix/Rosa/Ribes association.

4. P. secunda Presl. (Sandberg Bluegrass). Culms densely tufted, up to 6 dm. high, mostly less; blades narrow, involute; panicle narrow, erect. Common to abundant in Grass Belt.

13. Polypogon Desf.

Low annuals with dense, spike-like panicles; glumes lobed, long-awned from between the lobes; lemma short-awned.

1. P. monspeliensis (L.) Desf. (Rabbitfoot Grass). Culms erect, tufted, up to 3 dm. high; blades flat, narrow; ligule prominent. Common in sand or gravel along the river.

14. Sitanion Raf. (Squirreltail)

Tufted perennials with dense bushy spikes; glumes narrow, long-awned; lemmas convex, long-awned.

1. S. hystrix (Nutt.) J. G. Smith (Bottle-brush Squirreltail). Culms up to 5 dm. high, mostly less; glumes bristle-like, entire or 2-cleft; common in the scabland zone of the Grass Belt.

15. Stipa L. (Needlegrass)

Large tufted perennials, with narrow rolled leaves; panicle usually narrow; lemmas hard, rounded on the back, long-awned.

1. S. comata Trin. & Rupr. (Needle-and-thread). Culms stout, up to 9 dm. high; glumes large, over 1 cm. long; panicle open; lemma glabrous above, hairy below. Sparce, with Oryzopsis on west-facing slope in Sagebrush Belt.

9. CYPERACEAE - SEDGE FAMILY

Small annuals; spikelets strongly flattened; flowers 2-ranked . . . . . 2. Cyperus

Perennials; spikelets not flattened; flowers spirally arranged around the axis.

Flowers unisexual; achene enclosed in a sac (perigynium) . . . . . 1. Carex

Flowers perfect; achene not enclosed in a sac.

Spikelets 1; style base much expanded, persistent as a tubercle on the achene . . . . . 3. Eleocharis

Spikelets several; style base not expanded . . . . . 4. Scirpus

1. Carex L. (Sedge)

Perennial herbs from rootstocks, with grass-like, 3-ranked leaves; inflorescence of 1-many spikes; species monoecious or dioecious; the achene enclosed in a sac or perigynium.

Species monoecious, pistillate flowers above; lowest bract surpassing the head . . . . 1. C. athrostachya

Species dioecious; lowest bract shorter than the head . . . . . 2. C. douglasii

1. C. athrostachya Olney. Heads terminal, erect; spikes 4-12; bracts much longer than the head; perigynium winged, bi-convex; culms up to 8 dm. high. Growing in wet sand along the river.

2. C. douglasii Boott. Culms low, up to 25 cm. high; heads of 5-12 spikes; blades flat, tapering to a long point, spreading. Found abundant in a small patch in Elymus Association.

2. Cyperus L. (Nut-grass)

Ours are small annuals scarcely over 5 cm. high; leaves grass-like, 3-ranked; inflorescence much surpassed by subtending leaf-like bracts.

1. C. aristata Rottb. Stigmas 3; achenes triangular; scales awned, these strongly spreading or recurved. Common in the sand near the water.

3. Eleocharis R. Br. (Spikerush)

Single-spiked annuals or perennials, without blades; leaves reduced to sheaths; perianth bristles present in ours; inflorescence bracts much reduced.

1. E. palustris (L.) R. & S. Perennial in small tufts, up to 8 dm. high; sheath reddish at base; style branches 2; achene bi-convex, bright yellow. Common along river's edge and in the water.

4. Scirpus L. (Bulrush, Tule)

Large perennials with rhizomes; leaves prominent or reduced; spikelets in umbels or heads; ours with lower involucral bract continuous with the culm; perianth bristles present.

Culms sharply 3-angled; leaf blades well developed . . . . . 1. S. americanus

Culms nearly cylindric; leaves reduced to sheaths . . . . . 2. S. heterochaetus

1. S. americanus Pers. Culms slender, up to 12 dm. high; spikelets 1-7, sessile, in a dense head; involucral bract much surpassing the head; styles 3; achene slightly 3-angled. Common in patches along the river or in the water.

2. S. heterochaetus Chase. Culms thick and fleshy, up to 1.5 m.; inflorescence much-branched; spikelets numerous, in compound umbels; styles 3; achene 3-angled. Common in marshy areas along the river.

10. JUNCACEAE - RUSH FAMILY

1. Juncus L. (Rush)

Ours perennials from rootstocks; leaves strongly flattened, 2-ranked, grass-like with incomplete septa; flowers in paniculate clusters.

Stamens 3; capsule slightly longer than the perianth . . . . . 1. J. ensifolius

Stamens 6; capsule slightly shorter than the perianth . . . . . 2. J. saximontanus

1. J. ensifolius Wiks. (Three-stamened Rush). Plants closely tufted, up to 3 dm. high; leaves spreading to erect, tapered to a point. Infrequent in the mud along the river.

2. J. saximontanus Nels. Plants loosely tufted, up to 5 dm. high; leaves nearly as long as the stem; styles slightly exserted. Growing along the river's edge with Eleocharis.

11. LILIACEAE - LILY FAMILY

Flowers in umbels; plants with onion odor . . . . . 1. Allium

Flowers not in umbels; plants without onion odor.

Perianth parts dissimilar, in two sets; style absent . . . . . 2. Calochortus

Perianth parts similar; style present.

Flowers solitary, nodding; stamens included . . . . . 3. Fritillaria

Flowers numerous, in a panicle; stamens exserted . . . . . 4. Zigadenus

1. Allium L. (Onion)

Plants from bulbs, with onion-like odor; leaves linear, basal, dying early; umbel subtended by 2 bracts in ours; capsule round.

1. A. acuminatum Hook. Bulb coat with a definite network pattern, the meshes nearly isodiametric; perianth bright rose-purple above, white below; plants 2-3 dm. high. Commonly scattered over much of the canyon.

2. Calochortus Pursh (Sego Lily)

Plants from coated corms; leaves few, linear, withering early; petals with a conspicuous gland at the base and a green stripe down the center; capsule narrow, 3-angled.

Petals without a purple spot; sepals longer than petals . . . . . 1. C. macrocarpum

Petals with a purple spot; sepals shorter than petals . . . . . 2. C. nuttallii var. bruneaunis

1. C. macrocarpum Dougl. Stem erect, up to 6 dm. high; petals lavender to nearly white, yellow at the base; gland depressed, moderately hairy. Infrequent on the plateau with big sagebrush.

2. C. nuttallii Torr. var. bruneaunis (Nels. & Macb.) Ownbey. Flowers 2-4; petals mostly white, yellow at the base, this edged with purple above; few hairs around gland. Found scattered throughout canyon, more common near the top.

3. Fritillaria L.

Perennial herbs from a scaly bulb; stems leafy; perianth parts distinct; stamens 6; capsule 6-angled.

1. F. pudica (Pursh) Spreng. (Yellow Bells). Stems up to 3 dm. high; leaves fleshy, linear to oblanceolate; flowers deep yellow. Scattered infrequently on the plateau.

4. Zigadenus Michx. (Death Camas)

Large perennials from a round, deep-seated bulb; leaves grass-like; perianth parts spreading, with a gland at the base; stamens 6; capsule 3-lobed.

1. Z. paniculatus (Nutt.) Wats. (Foothill Death Camas). Stems up to 7 dm. high; stem leaves sheathing; flowers small, yellowish-white; gland green. Collected both on the plateau scabland and near the river in Sagebrush Belt.

SUBCLASS II. DICOTYLEDONEAE

12. SALICACEAE - WILLOW FAMILY

1. Salix L. (Willow)

Dioecious shrubs or small trees, usually with narrow leaves and slender branches; stamens mostly 2; winter bud-scale one; seeds with long silky hairs.

Leaves and young twigs appressed-hairy; scales of staminate catkins yellow . . . . . 1. S. argophylla

Leaves and young twigs glabrous; scales of staminate catkins black . . . . . 2. S. lutea

1. S. argophylla Nutt. A shrub 2-3 m. high; leaves silvery when young, becoming grayish-green. Common in sandy soil along the river.

2. S. lutea Nutt. (Yellow willow). Shrub or small tree up to 7 m. high; bark light brown or tan; leaves green, lighter below, with rounded stipules. Abundant along the river.

13. BETULACEAE - BIRCH FAMILY

1. Alnus Hill (Alder)

Large monoecious shrubs or trees; pistillate catkins cone-like, scales becoming woody in fruit; flowers 2 per scale; staminate flowers 3-6 per bract.

1. A. tenuifolia Nutt. (River Alder). Shrub or small tree with sharply serrate, slightly lobed leaves; buds obtuse and resinous; cones on short stout peduncles. Sparse along the river in the North Fork canyon.

14. URTICACEAE - NETTLE FAMILY

1. Urtica L. (Nettle)

Large herbs, with opposite, stipuled leaves and stinging hairs; flowers green, in axillary spikes; staminate and pistillate flowers in separate spikes; calyx unequal in pistillate flowers, the 2 large sepals enclosing the ovary.

1. U. holosericea Nutt. Perennial, 1.5-2 m. high; leaves nearly glabrous above, hairy below; petioles and stem finely pubescent and bristly; stipules dark brown. Abundant along the river in Salix/Ribes/Rosa association.

15. POLYGONACEAE - BUCKWHEAT FAMILY

Flowers subtended by an involucre of partly united bracts; leaves without stipules; stamens 9 . . . . . 1. Eriogonum

Flowers without an involucre of partly united bracts; leaves with sheathing stipules; stamens 6-8.

Perianth parts 6, the inner whorl enlarging and enclosing the fruit, often forming a dorsal, grain-like callus . . . . . 3. Rumex

Perianth parts 5, not enlarging or enclosing fruit, without a dorsal callus . . . 2. Polygonum

1. Eriogonum Michx. (Buckwheat)

Annual or perennial herbs, some shrubby; leaves quite tomentose; perianth 6-parted, enclosing the achene; flowers sometimes stipe-like at the base; stamens 9.

Plants annual; flowers white with red lines . . . . . 5. E. vimineum

Plants perennial; flowers yellow.

Flowers with a basal stipe, pubescent; perianth parts nearly equal.

Peduncle without bracts; head solitary; matted plants . . . . . 1. E. caespitosum

Peduncle with a whorl of bracts subtending the solitary or usually umbellate heads; erect plants . . . . . 4. E. sphaerocephalum

Flowers without a basal stipe, glabrous; outer perianth parts much broader than inner.

Involucres all terminal, forming a large head over 2 cm. wide . . . . 2. E. ovalifolium

Involucres in umbellate clusters less than 1 cm. wide . . . . . 3. E. proliferum

1. E. caespitosum Nutt. A dense matted plant, woody at the base, with peduncles up to 12 cm. high. Common in the thin gravelly soil along the top of the canyon.

2. E. ovalifolium Nutt. Perennial with a dense woody caudex; many peduncles arising up to 3 dm. high. Scattered infrequently in dry loamy soil of the lower Sagebrush Belt.

3. E. proliferum T. & G. Woody caudex with a few branching peduncles up to 4 dm. Abundant along the rim-rock and in scabland.

4. E. sphaerocephalum Dougl. Woody caudex erect and branching, with several peduncles up to 10 cm. high. Found in one patch in the scabland zone.

5. E. vimineum Dougl. An erect branching annual up to 2 dm. high; flowers numerous along the branches. A common plant in sandy soil along the river and along the road.

2. Polygonum L. (Knotgrass)

Ours annual herbs with alternate leaves; stipules united into a sheath; flowers in ours terminal and axillary; plants glabrous.

Achene bi-concave; flowers in peduncled spikes . . . . .
. . . . . 2. P. lapathifolium
Achene 3-angled; flowers 1-5, sessile in the leaf axils .
. . . . . 1. P. aviculare

1. P. aviculare L. (Knotweed). A spreading prostrate weed, up to 8 dm. long; flowers greenish-white, borne the length of the stem in the leaf axils; stipules 2-lobed. Common in sandy soil and along the road.

2. P. lapathifolium L. An erect to spreading plant, up to 2 dm. high; flowers creamy-white; stipules entire. Found in moist sand along the East Fork.

3. Rumex L. (Dock)

Ours large perennials with alternate leaves; flowers greenish, whorled, in long paniculate clusters; stamens 6; achene 3-angled.

1. R. crispus L. (Curly-leaved Dock). Stems stout, up to 1.5 m. high; leaf margins curly or wrinkled; 1, 2, or all the inner perianth parts with prominent dorsal callus. Abundant plant along the river.

16. CHENOPODIACEAE - GOOSEFOOT FAMILY

Spiny shrubs.
Pistillate calyx present; pistillate flowers solitary, axillary . . . . . 5. Sarcobatus

Pistillate calyx lacking; flower enclosed in a pair of united bracts; pistillate flowers in terminal spikes . . . . . 3. Grayia

Herbs, ours all annual.

Flowers perfect; calyx enclosing the fruit.

Flowers in glomerules, bractless; leaves not spine-tipped . . . . . 2. Chenopodium

Flowers solitary in leaf axils, subtended by 3 spiny bracts; leaves spine-tipped . . . . . 4. Salsola

Flowers unisexual; pistillate calyx lacking; fruit enclosed by 2 bracts . . . . 1. Atriplex

1. Atriplex L. (Saltbush)

Usually mealy or scurfy plants; leaves alternate; flowers in glomerules; staminate calyx 4-5-parted; pistillate bracts enlarging in fruit and partly united.

1. A. rosea L. (Red Orache). Much-branched spreading weed up to 1 m. high. Abundant along and in the road by the river.

2. Chenopodium L. (Lamb's Quarter)

Often mealy herbs; flowers in axillary or panicled glomerules; stamens 5, exserted.

1. C. botrys L. (Jerusalem Oak). Plant erect, branching from the base, up to 3 dm. high; herbage quite

glandular; leaves pinnately lobed, red-veined. Common along the river in sand.

3. Grayia Hook. & Arn.

A spiny shrub with shredding bark; usually dioecious; staminate flowers in glomerules; fruiting bracts thin, white and rounded, winged.

1. G. spinosa (Hook.) Moq. (Hop Sage). Branching shrub up to 1.5 m. high; leaves pale green, turning reddish with age. Common beneath rimrock in North Fork Canyon, infrequent elsewhere.

4. Salsola L. (Russian Thistle)

A spreading or prostrate herb up to 4 dm. long; leaves linear, spiny; stems red-lined; flowers perfect; calyx membranaceous.

1. S. kali L. var. tenuifolia G.F.W. May. Much-branched weed, becoming rounded in outline. Common along the road.

5. Sarcobatus Nees (Greasewood)

Branching shrub with sessile, fleshy linear leaves; staminate flowers in a terminal spike with calyx wanting; pistillate calyx forming a horizontal wing in fruit.

1. S. vermiculatus (Hook.) Torr. Monoecious or dioecious species, up to 1.5 m. high. Common in most of the Sagebrush Belt.

17. AMARANTHACEAE - AMARANTH FAMILY

1. Amaranthus L. (Pigweed)

Annual herbs with alternate leaves; no stipules; flowers inconspicuous, in dense spikes, unisexual or perfect, subtended by 3 unequal bracts.

1. A. retroflexus L. Slightly hairy annual, erect with few branches, up to 4 dm. high; bracts spine-tipped; fruit black and shining. Common along the sandy shore of the river.

18. AIZOACEAE - CARPET-WEED FAMILY

1. Mollugo L. (Carpet-weed)

Low spreading annuals with whorled leaves; flowers inconspicuous, axillary, pedicelled; sepals 5; stamens 3; capsule exceeding sepals.

1. M. verticillata L. Glabrous prostrate annual, branching from the base, up to 10 cm. long; flowers greenish-white, about 2 mm. long. Infrequent along the sandy shore of the river.

19. PORTULACACEAE - PURSLANE FAMILY

1. Montia L.

Succulent annual or perennial herbs with mostly basal leaves; stem leaves opposite; flowers small, pinkish, with 2 sepals, 5 petals and 5 stamens.

1. M. perfoliata (Donn) How. (Miner's lettuce). Weak spreading annual, up to 12 cm. high; stem leaves 2, united to form a rounded disk below the raceme. Scattered in moist, shaded rock outcrops.

20. RANUNCULACEAE - BUTTERCUP FAMILY

Flowers unisexual; petals absent; a twining shrub . . . . . 1. Clematis

Flowers perfect; petals present; herbs.

Flowers irregular; calyx spurred, showy; petals inconspicuous . . . . . 2. Delphinium

Flowers regular; calyx green, not spurred; petals showy . . . . . 3. Ranunculus

1. Clematis L.

Dioecious climbing and twining shrubs, with opposite, pinnately compound leaves; sepals petal-like, white; stamens and pistils numerous; achenes with long feathery styles.

1. C. ligusticifolia Nutt. A large shrub growing in large masses, up to 3 m. high. Common to abundant along both sides of the river.

2. Delphinium L. (Larkspur)

Perennial herbs with palmately cleft or divided leaves; flowers blue to purple, irregular; sepals 5, the upper extended into a long spur; petals 4, much smaller

than sepals, upper pair spurred; stamens many; fruit usually 3 erect follicles.

1. D. andersonii Gray (Desert Larkspur). Stems hollow, up to 5 dm. high, from fibrous roots; racemes 5-15-flowered; lower flowers long-pedicelled. Usually in close association with a big sagebrush plant, in the canyon and on the plateau.

3. Ranunculus L. (Buttercup)

Ours perennial herbs with glabrous, mostly basal leaves; sepals and petals 5; stamens and pistils numerous; achenes flattened and beaked; flowers yellow.

Petals 5-10 mm. long; fruiting head 8-17 mm. wide . . . . . 2. R. glaberrimus

Petals 5 mm. long or less; fruiting head 3-6 mm. wide . . . . . 1. R. cymbalaria var. saximontanus

1. R. cymbalaria Pursh var. saximontanus Fern. Small stoloniferous plant up to 10 cm. high; leaves oval in outline, 4-5-toothed at apex. Growing in wet soil slong the river, infrequent.

2. R. glaberrimus Hook. Plant up to 15 cm. high, from rather fleshy roots; leaves 3-4-parted at apex, shorter than the scapes. Common in rocky loam near the river in Sagebrush Belt.

21. CRUCIFERAE - MUSTARD FAMILY

1a. Pods twice as long as wide or less, a silicle.

Locules one-seeded; stem leaves perfoliate . . . . . 7. Lepidium

Locules several-seeded; stem leaves sagittate-clasping.

Mature pod globose, with persistent style 1-2 mm. long . . . . . 3. Camelina

Mature pod flattened, not globose; style less than 1 mm. long or wanting.

Pod ovate, winged . . 11. Thlaspi

Pod wedge-shaped, wingless . . . . . 4. Capsella

1b. Pods more than twice as long as wide, a silique.

Leaves undivided or shallowly lobed; flowers purple to white.

Pods long-beaked, ascending; stem leaves petioled . . . . . 5. Chorispora

Pods beakless, strictly reflexed; stem leaves sessile . . . . . 1. Arabis

At least basal leaves deeply divided or pinnatifid; flowers yellow to white.

Anthers strongly twisted; pod short-stiped . . . . . 10. Thelypodium

Anthers not twisted; pod stipeless.

Plants glabrous or with few simple hairs.

Terminal leaf segment much larger than lateral ones; petals bright yellow . . . . . 2. Barbarea

Terminal leaf segment not much larger; petals pale yellow.

Erect annuals; pod more than 20 mm. long . . 9. Sisymbrium

Spreading perennial; pod less than 10 mm. long . . . . . 8. Rorippa

Plants stellate-pubescent . . . . . 6. Descurania

1. Arabis L. (Rock Cress)

Biennial or perennial herbs with mostly sessile leaves; flowers in racemes; pods long and linear, compressed parallel to the partition.

1. A. puberula Nutt. Stems slightly tufted from a caudex, up to 4 dm. high; leaves curled or twisted; plants densely puberulent. Common throughout the scabland zone.

2. Barbarea R. Br. (Winter Cress)

Biennials or perennials with angled stems and pinnatifid leaves; pods ascending, 4-angled.

1. B. vulgaris R. Br. Stem simple, erect, up to 5 dm. high; pods 1-3 cm. long; leaves fleshy, sagittate-clasping. Infrequent near the river in Salix/Ribes/Rosa association.

3. Camelina Crantz (False Flax)

Slender annuals with sagittate-clasping leaves; pods obovoid, slightly flattened parallel with the partition; flowers light yellow.

1. C. microcarpa Andrz. Stems erect, 2-9 dm. high; leaves mostly entire; inflorescence glabrous, finely pubescent below. Common near the river but also scattered in the Sagebrush Belt.

4. Capsella Medic (Shepherd's Purse)

Nearly glabrous annuals with mostly basal leaves; stem leaves sagittate-clasping; flowers very small, white; pods wedge-shaped.

1. C. bursa-pastoris (L.) Medic. Stems erect or decumbent at the base, up to 7 dm. high. Abundant near the river.

5. Chorispora DC.

Stout branching annuals with large dentate or shallowly lobed leaves; pods indehiscent, constricted between the seeds, long-beaked.

1. C. tenella DC. Stems erect, up to 8 dm. high; flowers few, purple; pods curving upward. Common to abundant near the river.

6. Descurainia Webb & Berth. (Tansy Mustard)

Erect, simple or branching annuals with finely dissected leaves; flowers small, pale yellow; pods curving upward on pedicels as long as the pods.

Pods club-shaped, less than 8 mm. long . . . . . 1. D. pinnata subsp. filipes

Pods narrowly linear, more than 8 mm. long . . . . . 2. D. sophia

1. D. pinnata (Walt.) Brit. subsp. filipes (Gray) Det. Stem slender, usually branched, up to 4 dm. high; seeds in 2 rows in the club-shaped pod. Frequent in the early spring in the Sagebrush Belt.

2. D. sophia (L.) Webb. Tall herb, up to 10 dm. high; leaves 2-3-pinnate. Common along the river in Salix/Ribes/Rosa association.

7. Lepidium L. (Pepper-grass)

Annuals or perennials with entire or pinnate leaves; flowers small; pods rounded, slightly notched at the apex, 2-seeded.

1. L. perfoliatum L. Simple or branching annual, 1-6 dm. high; basal leaves pinnatifid, the lower cauline dissected, the upper cauline perfoliate. Common through much of the area and along the road.

8. Rorippa Scop. (Water Cress)

Annuals or perennials with pinnate leaves; flowers small, yellow in ours; pods club-shaped, round in cross section (terete).

1. R. sinuata (Nutt.) A. S. Hitch. Plants perennial from creeping rootstocks; stems decumbent or spreading up to 4 dm. long; leaves deeply lobed; flowers yellow. Frequent in patches on sandy shore.

9. Sisymbrium L.

Annuals or perennials with mostly pinnatifid leaves; pubescence of simple hairs; pods linear, much elongated in ours.

1. S. altissimum L. (Jim Hill Mustard). Simple or usually branching annual, up to 8 dm. high; flowers light yellow. Common along the road, scattered elsewhere.

10. Thelypodium Endl.

Biennials or perennials; flowers white in ours; pods long, terete, with a short stipe; plants glabrous.

1. T. laciniatum (Hook.) Endl. Stems erect or spreading, up to 12 dm. high, branched above; stamens

exserted; anthers curled; pods spreading, twisted and constricted between seeds. Common in shaded rock outcrops.

11. Thlaspi L. (Penny Cress)

Glabrous annuals or perennials; flowers white in ours, small; pods flat, several-seeded.

1. T. arvense L. (Fan Weed). Branching annual, up to 7 dm. high, usually less; pods broadly winged, notched at the apex. Common to abundant along the road.

22. SAXIFRAGACEAE - SAXIFRAGE FAMILY

Stamens 5, long-exserted; carpels two 1. Heuchera
Stamens 10, included; carpels three . 2. Lithophragma

1. Heuchera L.

Perennial herbs from stout rootstocks; leaves mostly basal, lobed; flowers dull, in long panicles or racemes; ovary partly inferior.

1. H. rubescens Torr. Stems tufted, spreading, up to 5 dm. long; flowers pink or reddish, in a panicle; styles 2, exserted. Growing on the face of shaded rock walls, infrequent.

2. Lithophragma Nutt. (Fringe-cup)

Slender perennial herbs from tuberous or bulblet-bearing rootstocks; basal leaves palmately divided, the sections again lobed; petals white or pink, 3-5-cleft.

Leaf axils bearing bulblets; stems usually reddish . . .
. . . . . 1. L. bulbiferum
Leaf axils not bearing bulblets; stems green . . . . . .
. . . . . 2. L. parviflorum

1. L. bulbiferum Rydb. Stems simple, 1-3 dm. high; calyx bell-shaped; petals mostly pink. Infrequent in shaded rock outcrops.

2. L. parviflorum (Hook.) Nutt. Stems mostly simple, erect, 2-4 dm. high; calyx top-shaped, becoming club-shaped in fruit; petals mostly white. Common in rocky soil near the rimrock.

23. RIBESACEAE - GOOSEBERRY FAMILY

1. Ribes L. (Currant, Gooseberry)

Shrubs with alternate, palmately lobed leaves; stems spiny or not; ovary inferior; calyx tubular and showy; petals small, included in the calyx tube.

Plants with stout spines . . . . . 3. R. niveum
Plants without spines.
Flowers bright yellow; leaves not glandular . . . .
. . . . . 1. R. aureum
Flowers white; leaves quite glandular and sticky . .
. . . . . 2. R. cereum

1. R. aureum Pursh (Golden Currant). Erect shrub up to 3 m. high; leaves glabrous, 3-5-lobed; racemes 5-15-flowered; berries bright orange. Common along the river in Salix/Ribes/Rosa association.

2. R. cereum Dougl. (Squaw Currant). Dense, much-branched shrub, up to 1 m. high; leaves small, rounded, finely dentate; racemes 3-5-flowered; berries red. Frequent on exposed rimrock.

3. R. niveum Lindl. Stems up to 2.5 m. high, with stout spines; leaves deeply 3-5-lobed; calyx lobes much longer than the tube; flowers white; berries purplish-black. Infrequent in shade of large rock outcrops.

24. ROSACEAE - ROSE FAMILY

Ovary superior.

1 simple pistil; fruit a drupe; small tree . . . . . 5. Prunus

3-many simple pistils; fruit achenes or follicles.

Shrubs.

Leaves compound; stipules present . . . . . 6. Rosa

Leaves simple; stipules absent . . . . . 2. Holodiscus

Herbs.

Stamens 5; pistils 3-5; leaves pinnately compound . . . . . 3. Ivesia

Stamens and pistils 10 or more; leaves palmately compound . 4. Potentilla

Ovary inferior; fruit a pome . . . . 1. Crataegus

1. Crataegus L. (Hawthorn)

Large shrubs or small trees with stout spines; leaves simple, serrate; flowers few, white in ours; carpels stony in fruit.

1. C. columbiana Howell. Much-branched shrub, up to 3 m. high; leaves shallowly 3-5-lobed, tapering to the base; spines 2-3 cm. long; fruit red. Infrequent along the river bank.

2. Holodiscus (Koch) Maxim. (Ocean-spray)

Shrubs with shredding bark and simple alternate leaves; flowers small, white, in spreading panicles; pistils 5, long-hairy.

1. H. glabrescens (Greenm.) Hel. (Dwarf Ocean-spray). Stiff branching shrub up to 1.5 m.; leaves small, few-toothed, finely pubescent. Found scattered in rocky situations, both near the river and near the rimrock.

3. Ivesia Torr. et Gray

Perennial herbs from stout rootstocks; hypanthium saucer-shaped; flowers subtended by 5 bractlets; sepals, petals, and stamens 5.

1. I. baileyi S. Wats. Stems densely tufted, weak, up to 20 cm. high; flowers small, inconspicuous; petals white. Growing on steep, shaded rock walls, common.

4. Potentilla L. (Cinquefoil)

Annual, biennial, or perennial herbs, ours with compound leaves; bractlets, sepals, and petals 5; stamens 10 or more; simple pistils numerous; flowers yellow.

Flowers inconspicuous; petals shorter than sepals; inflorescence leafy . . . . . 2. P. millegrana

Flowers conspicuous; petals longer than sepals; inflorescence not leafy . . . . . 1. P. flabelliformis

1. P. flabelliformis Lehm. Stout perennial with stems up to 8 dm. high; leaves densely white-hairy beneath, light-hairy to glabrous above; leaflet segments linear, nearly distinct; flowers numerous. Frequent in Elymus association.

2. P. millegrana Engelm. ex. Lehm. Annual or biennial from a taproot; stems up to 8 dm. high; leaflets 3, serrate; stamens 10. Infrequent in willow thickets along the river.

5. Prunus L. (Cherry)

Shrubs or small trees with simple serrate leaves; flowers white; sepals and petals 5; calyx bell-shaped; fruit a drupe.

1. P. demissa (Nutt.) D. Dietr. var. melanocarpa Nels. (Western Chokecherry). Small tree up to 7 m. high; flowers in long racemes; leaves glabrous; fruit purplish-black. Frequent near the river in the lower Sagebrush Belt.

6. Rosa L.

Shrubs, usually with prickly stems; leaves pinnately compound; sepals and petals 5; stamens and pistils numerous; hypanthium enclosing the achenes, forming a hip.

1. R. woodsii Lindl. (Wild Rose). Stout prickly shrub up to 3 m. high; flowers few, pink, large and showy. Common to abundant along the river in Salix/Ribes/Rosa association.

25. LEGUMINOSAE - PEA FAMILY

Terminal leaflet modified into a tendril; stigmas subtended by a dense ring of hairs . 7. Vicia

Terminal leaflet not modified; stigmas not subtended by a ring of hairs.

Stamens all united; anthers in two sets . . . . . .

. . . . . 3. Lupinus

Stamens all but one united; anthers all alike.

Leaves mostly trifoliate, or if more than three leaflets, leaves palmately compound.

Flowers in dense heads; petiolules all equal . . . . . 6. Trifolium

Flowers in racemes; middle petiolule longest.

Pedicels ascending; pods coiled . . . . . 4. Medicago

Pedicels reflexed; pods straight . . . . . 5. Melilotus

Leaves pinnately compound with many leaflets.

Plants very glandular; pods prickly . . . . . 2. Glycyrrhiza

Plants not glandular; pods not prickly . . . . . 1. Astragalus

1. Astragalus L. (Milk Vetch, Locoweed)

Ours all perennial herbs from long taproots; leaves pinnately compound; flowers in racemes, often subtended by bracts; ours plants of dry slopes.

1a. Pods and leaves densely woolly-or silky-pubescent; plants stemless (acaulescent) to short-stemmed.

Plants acaulescent; leaflets obovate; flowers purple, 20-30 mm. long . . . . . 3. A. newberryi

Plants subcaulescent or caulescent; leaves elliptic; flowers yellowish to purple.

Flowers yellowish, 20-25 mm. long . . . . . 6. A. purshii var. purshii

Flowers purplish, less than 20 mm. long . . . . . 5. A. purshii var. ophiogenes

1b. Pods glabrous; leaves not densely pubescent; stems mostly well developed.

Leaflets linear or narrowly elliptic; pods straight and not inflated.

Pods long-stiped; flowers mostly 1 cm. or more long . . . . . 7. A. stenophyllus

Pods stipeless; flowers less than 1 cm. long . . . . . 4. A. obscurus

Leaflets mostly ovate or broader; pods curved, inflated or not inflated.

Pods strongly curved, stipitate, not inflated; plants densely puberulent, grayish . . . . . 1. A. curvicarpus var. curvicarpus

Pods slightly curved, stipeless, inflated; plants glabrous, green . 2. A. lentigenosus var. platyphyllidius

1. A. curvicarpus (A. Hall.) Macbr. var. curvicarpus. Erect to spreading herb, 3-5 dm. high; flowers cream to yellow with a sickeningly sweet smell. Common on open slopes in the Grass Belt.

2. A. lentigenosus Dougl. ex. Hook. var. platyphyllidius (Barneby) ined. Decumbent to spreading, tufted herb, 3-4 dm. high; flowers white, 10-17 mm. long. Frequent on open slopes of the Grass Belt.

3. A. newberryi Gray. Densely tufted spreading herb, 1-2 dm. high; flowers rose-lavender to purple. Infrequent on the dry slopes within the canyon.

4. A. obscurus S. Wats. Erect herb, tufted or more open, 1-3 dm. high; flowers small, white or yellowish. Common on open scabland or canyon slopes.

5. A. purshii Doug. ex. Hook. var. ophiogenes (Barneby) ined. Spreading to erect, several-stemmed herb, 10-15 cm. high; flowers purple or some green. Sparse on the open slopes of the canyon.

6. A. purshii Doug. ex. Hook. var. purshii. Densely tufted, subcaulescent herb, 6-10 cm. high; flowers cream to yellow with some purple-tipped. Frequent on the open scabland and canyon slopes.

7. A. stenophyllus T. & G. Erect many-stemmed herb, 3-6 dm. high; stems wiry, woody at the base; flowers whitish; pods pendulous. Sparse on the open slopes of the Grass Belt.

2. Glycyrrhiza L.

Viscid-glandular perennial herbs, with pinnately compound leaves; flowers in axillary spikes or racemes; calyx lobes subulate, the upper two shorter.

1. G. lepidota Nutt. (Wild Licorice). Plants erect to spreading, 4-6 dm. high; flowers whitish; fruit hooked-prickly. Frequent on the moist river floodplain.

3. Lupinus L. (Lupine)

Annual or perennial herbs with palmately compound leaves; flowers in a terminal raceme; calyx two-lipped.

Annuals; plants less than 1.5 dm. tall . . . . . .
. . . . . 1. L. brevicaulis
Perennials; plants over 1.5 dm. tall. 2. L. saxosus

1. L. brevicaulis S. Wats. Erect to spreading herb; stems less than 3 cm. high; flowers bluish-violet; pod 2-seeded. Common on the open slopes in the Sagebrush Belt.

2. L. saxosus Howell. Erect herb, 1.5-3 dm. high; leaflets 8-12, loosely villous; petals mostly purple, banner with yellow center; upper edge of keel ciliate toward tip. Common on the open plateau.

4. Medicago L.

Annual or perennial herbs with trifoliate leaves; flowers in dense axillary racemes (ours); stipules fused (adnate) to the petiole.

1. M. lupulina L. (Black Medic). Usually an annual with prostrate or spreading stems, up to 6 dm. long; racemes 10-30-flowered; flowers small with yellow petals. Infrequent in the riverbank thicket.

5. Melilotus Hill (Sweet Clover)

Biennial herbs (ours), with trifoliate leaves; flowers in long, open, axillary racemes; pedicels recurved; stipules free.

1. M. officinalis (L.) Lam. (Yellow Sweet Clover). Stems prostrate, 2-4 dm. long; flowers 4-6 mm. long with yellow petals. Found in old exposed roadbed.

6. Trifolium L. (Clover)

Ours perennial herbs with palmately compound leaves; flowers in axillary or terminal heads; stipules adnate to the petiole.

Leaves with 5-9 leaflets; flowers 2 cm. or more long . . . . . 1. T. macrocephalum

Leaves with 3 leaflets; flowers mostly less than 1 cm. long . . . . . 2. T. repens

1. T. macrocephalum (Pursh) Poir. (Large-headed Clover). Erect herb up to 2.5 dm. high; heads solitary, terminal; corolla pink to reddish; calyx long-villous. Frequent on the open plateau several miles north of Three Forks.

2. T. repens L. (White Clover). Erect herb up to 2 dm. high; heads few, axillary; corolla pink and white; plants glabrous. Frequent in the riverbank thicket.

7. Vicia L. (Vetch)

Ours perennial herbs or vines, with even-pinnate, tendril-bearing leaves; stipules free; flowers in axillary racemes; stamens diadelphous.

1. V. americana Muhl. Weak trailing stems, up to 9 dm. long; raceme 3-10-flowered; corolla bluish-lavender. Infrequent to sparse on open riverbank.

26. EUPHORBIACEAE - SPURGE FAMILY

1. Euphorbia L. (Spurge)

Herbs with milky juice, monoecious; unisexual flowers borne together in an involucre or cyathium; fruit globose, 3-lobed and 3-seeded.

1. E. serpyllifolia Pers. Low decumbent annual with inconspicuous flowers; leaves opposite, finely toothed, glabrous. Sparsely scattered in sand along the riverbank.

27. MALVACEAE - MALLOW FAMILY

Stigmas capitate, terminal; carpels several-ovuled . . . . . 2. Sphaeralcea

Stigmas linear, extending down the style; carpels one-ovuled . . . . . 1. Sidalcea

1. Sidalcea Gray

Ours perennial herbs with palmately veined leaves; flowers in long terminal racemes; stamens united around the style in two series; involucel none.

1. S. oregana (Nutt.) Gray. Erect to spreading herb, many-stemmed, up to 7 dm. high; lower leaves rounded, palmately 5-7-lobed; upper leaves deeply 3-5-parted; flowers showy, lavender to rose-purple. Infrequent on the open riverbank in Elymus Association.

2. Sphaeralcea St. Hil. (False Mallow)

Perennial herbs with dense stellate pubescence; leaves palmately veined; flowers in axillary racemes; stamens united aroung the style in one series; involucel of 3 deciduous bractlets.

1. S. munroana (Dougl.) Spach. Erect to spreading herb, 3-5 dm. high; leaves broadly ovate, 3-5-lobed; flowers bright pink to salmon. Common on the open slopes of the Sagebrush Belt.

28. VIOLACEAE - VIOLET FAMILY

1. Viola L. (Violet)

Usually low perennials with stipulate leaves; flowers irregular, solitary, nodding; petals 5, the lower one spurred; filaments broad and membranous with anthers borne on the inner surface.

1. V. beckwithii T. & G. (Sagebrush Violet). Low perennial up to 8 cm. high; leaves deeply lobed to finely dissected; upper pair of petals deep purple, the others much lighter with yellow at the base. Found infrequently in the open scabland of the plateau.

29. LOASACEAE - LOASA FAMILY

1. Mentzelia L. (Blazing Star)

Ours large perennials with harshly hispid or barbed pubescence; leaves alternate, pinnatifid; stem becoming white and shiny; stamens numerous, borne on the calyx; ovary inferior.

1. M. laevicaulis (Dougl.) T. & G. Stout erect herb, 1-1.5 m. high; flowers large and showy, in cymose clusters; petals 5, light yellow. Sparse on the open canyon slopes.

30. ONAGRACEAE - EVENING PRIMROSE FAMILY

Seeds with a tuft of hair at one end .3. Epilobium

Seeds without a tuft of hairs.

Anthers attached basally; flowers purple, reddish, or pinkish-white.

Flowers large, showy; petals deeply 3-lobed . . . . . 2. Clarkia

Flowers minute, inconspicuous; petals not 3-lobed.

Ovary 2-celled; sepals reflexed . . . . . 4. Gayophytum

Ovary 4-celled; sepals erect . . . . . 1. Boisduvalia

Anthers attached in the middle; flowers yellow to white . . . . . 5. Oenothera

1. Boisduvalia Spach

Annuals with leafy stems; leaves alternate and sessile; petals 2-lobed; stamens 8, those opposite the petals shorter.

1. B. stricta (Gray) Greene. Stiffly erect annual, 2-4 dm. high, branching from the base; herbage long-hairy throughout; flowers small, axillary, deep red. Frequent in the riverbank thicket.

2. Clarkia Pursh

Slender annuals with alternate leaves; buds nodding; flowers showy, in racemes; stamens 8, those opposite the petals small and sterile.

1. C. pulchella Pursh (Deer horn). Stems simple, 1-3 dm. high; petals distinct, deeply 3-lobed, lavender to violet. Common on the open slopes of the sagebrush belt.

3. Epilobium L. (Willow-herb)

Annual or perennial herbs with alternate or opposite leaves; petals usually lobed; stamens 8, 4 with shorter filaments.

1. E. paniculatum Nutt. (Annual Willow-herb). Erect much-branched annual, 2-6 dm. high; leaves linear, mostly alternate; flowers small, in an open panicle; petals white to pink. Common on the open scabland.

4. Gayophytum A. Juss.

Slender annuals; flowers very small, in the upper leaf axils; hypanthium not evident; calyx lobes reflexed; stigma capitate.

1. G. helleri Rydb. var. glabrum Munz. Erect branching herbs, 8-12 cm. high; flowers white, subsessile; seeds appressed-puberulent. Infrequent in the moist sand of the river floodplain.

5. Oenothera L. (Evening Primrose)

Annual, biennial, or perennial herbs; hypanthium prolonged beyond the ovary; calyx lobes reflexed; stamens 8, those opposite the petals shorter.

Plants without evident stems, prostrate; leaves strongly pinnatifid . . . . . 3. Oe. tanacetifolia

Plants with erect stems; leaves entire or only slightly toothed.

Large biennial or perennial; stigma of 4 linear lobes . . . . . 2. Oe. hookeri

Small annual; stigma capitate, not lobed . . . . . 1. Oe. alyssoides

1. Oe. alyssoides Hook. & Arn. Erect annual, 3-6 cm. high; cauline leaves numerous, linear-oblanceolate; flowers in the upper leaf axils; petals white; capsule twisted and contorted. Infrequent on the dry open slopes of the Sagebrush Belt.

2. Oe. hookeri Torr. & Gray. Large erect biennial; stems one to several from the base, 3-5 dm. high; flowers axillary, large and showy; petals yellow, becoming pink with age. Infrequent on the moist sandy floodplain.

3. Oe. tanacetifolia Torr. & Gray. Prostrate acaulescent perennial; flowers showy; petals yellow,

becoming red. Infrequent in the moist sand of the flood-plain.

31. UMBELLIFERAE - CARROT FAMILY

Fruit not dorsally flattened; involucels inconspicuous or absent . . . . . 2. Ligusticum

Fruit flattened dorsally; involucels of conspicuous bracts.

Plants stemless or nearly so; petals all equal . . . . . 3. Lomatium

Plants long-stemmed; outer petals larger than inner . . . . . 1. Heracleum

1. Heracleum L. (Cow Parsnip)

Large perennial herb with ternately compound leaves; herbage tomentose; involucre and incolucels of deciduous linear bracts; flowers white, in large compound umbels.

1. H. lanatum Michx. Plant erect, 1-2 m. high; stems very stout, ridged; leaves 1-4 dm. wide. Infrequent in the riverbank thicket.

2. Ligusticum L. (Lovage)

Mostly glabrous perennial herbs with 1 or 2 cauline leaves; leaves petiolate, compound; flowers white, in compound umbels.

1. L. grayi Coult. & Rose (Gray's Lovage). Erect slender perennial, 3 dm. high; leaves usually all basal

but one, deeply pinnatifid. Rare, only one found in the riverbank thicket.

3. Lomatium Raf. (Desert Parsley)

Short-stemmed or acaulescent perennials with tubers or fleshy taproots; leaves pinnately compound; involucres wanting in ours; flowers in compound umbels.

Plants from a long taproot; herbage pubescent . . . . 1. L. macrocarpum

Plants from a rounded tuber; herbage glabrous . . . . 2. L. montanum

1. L. macrocarpum (H. & A.) Coult. & Rose. Usually acaulescent spreading herb, 2-3 dm. high; scapes much exceeding the pale pinnatifid leaves; basal sheaths purple. Frequent in the Sagebrush Belt.

2. L. montanum Coult. & Rose. Acaulescent or short-caulescent, .5-2 dm. high; involucel bractlets not confluent; flowers yellow. Common on the slopes of the Sagebrush Belt.

32. CORNACEAE - DOGWOOD FAMILY

1. Cornus L. (Creek Dogwood)

Herbs, shrubs (ours), or trees with opposite leaves; flowers in a flat-topped cyme, 4-merous; ovary inferior; fruit a drupe.

1. C. sericea L. subsp. stolonifera (Michx.) Fosberg. Branching shrub, 2-3 m. high, with deep red bark; herbage glabrous or appressed pubescent; flowers small, white. Frequent in the riverbank thicket.

33. APOCYNACEAE - DOGBANE FAMILY

1. Apocynum L. (Dogbane)

Perennial herbs with milky sap and opposite leaves; flowers small, in cymes; corolla urn-shaped; carpels 2, surrounded at the base by a ring of nectaries (disk); fruit a pair of follicles.

1. A. suksdorfii Greene. Erect herb up to 2 m. high, with ascending leaves; glabrous throughout; corolla about twice as long as calyx. Sparse in rocky river floodplain.

34. POLEMONIACEAE - PHLOX FAMILY

Leaves pinnatifid; calyx lobes cleft and quite unequal . . . . . 2. Navarretia

Leaves entire; calyx lobes entire and equal.

Perennials; flowers large and showy . . . . . 3. Phlox

Annuals; flowers small and inconspicuous . . . . . 1. Microsteris

1. Microsteris Greene

Small branching annuals with all but upper leaves opposite; calyx tube expanding and splitting at maturity; stamens unequal, included.

1. M. humilis (Dougl.) Greene. Plants up to 10 cm. high, with small axillary flowers; corolla tube yellow, limb lavender to pink. Common in a variety of habitats, from sandy shore to open dry slopes.

2. Navarretia Ruiz & Pav.

Low diffuse annuals with spiny, simple or compound leaves; inflorescence a capitate cluster subtended by leaf-like bracts.

1. N. intertexta (Benth.) Hook. Small white-flowered annuals up to 8 cm. high; inflorescence densely pubescent; stamens slightly exserted. Frequent in sand along the river.

3. Phlox L.

Perennials, often shrubby at the base; leaves opposite, entire; calyx lobes united by intercostal membranes; corolla salverform.

Plant erect; leaves 2-3 cm. long; internodes long . . . . . 2. P. longifolia

Plants matted; leaves less than 1 cm. long, crowded . . . . . 1. P. diffusa var. scleranthifolia

1. P. diffusa Benth. var. scleranthifolia (Rydb.) Wherry. Low many-branched plant, 3-6 cm. high; leaves very narrow and stiff; intercostal membrane of calyx nearly flat. Common on the plateau scabland.

2. P. longifolia Nutt. Spreading few-stemmed plant, 5-15 cm. high; flowers few, pink to lavender; intercostal membrane of calyx strongly keeled (carinate). Common on the plateau scabland.

35. HYDROPHYLLACEAE - WATERLEAF FAMILY

1. Phacelia Juss. (Scorpion Weed)

Inflorescence more or less scorpioid; style 2-cleft; sepals nearly distinct; plants usually harshly pubescent.

Perennials; leaves mostly basal . . 1. P. leucophylla
Annuals; leaves mostly cauline.

Leaves linear, entire; stamens exserted . . . . . .
. . . . . 2. P. linearis

Leaves ovate, toothed; stamens included . . . . . .
. . . . . 3. P. rattani

1. P. leucophylla Torr. Plants several-stemmed from woody base, 2-4 dm. high; leaves long-petioled, mostly basal, entire; flowers light lavender to white. Infrequent member of Artemisia/Prunus association on lower canyon slopes.

2. P. linearis (Pursh) Holz. Erect, simple to few-stemmed annual, up to 3 dm. high; leaves linear to lanceolate, ascending; flowers blue to white. Common with grasses on upper canyon slopes.

3. P. rattani Gray. Decumbent branching stems, 15-25 cm. high; pubescence stiff-bristly; leaves large, ovate, dark green; flowers light lavender. Frequent at base of shaded rock cliff near river.

36. BORAGINACEAE - BORAGE FAMILY

Nutlets with hooked prickles . . . . 3. Hackelia

Nutlets smooth or roughened, but not prickly.

Flowers bright yellow or orange 1. Amsinckia

Flowers white.

Inner angle of nutlets grooved, groove forked below . . . . . 2. Cryptantha

Inner angle of nutlets keeled, not grooved . . . . . 4. Plagiobothrys

1. Amsinckia Lehm. (Fiddleneck)

Roughly hispid annuals with yellow flowers; inflorescence a long scorpioid spike; nutlets 1-4, bony and roughened in ours, attached below the middle to the pyramidal receptacle.

Corolla 5 mm. long or less; leaves broadly linear to oblong . . . . . 1. A. micrantha

Corolla 6-10 mm. long; leaves narrowly linear . . . . . .
. . . . . 2. A. intermedia

1. A. micrantha Suksd. Stems simple or few-branched, weak and often decumbent, 4-7 dm. long; spikes up to 2 dm. long. Abundant in sandy soil near the river.

2. A. intermedia F. & W. Stem simple, erect, up to 3 dm. high; leaves clustered at the base as well as cauline. Infrequently scattered on open canyon slopes.

2. Cryptantha Lehm.

Annual or perennial herbs with linear to spatulate, pustulate leaves; corolla white with 5 appendages in the throat.

Perennial; corolla limb 6-10 mm. broad; nutlets roughened
. . . . . 1. C. propria
Annual; corolla limb 1 mm. broad; nutlets smooth . . . .
. . . . . 2. C. watsoni

1. C. propria (N. & M.) Payson. Densely caespitose perennial, from a woody branched caudex, 1-2 dm. high; leaves spatulate, densely clustered at the base, greenish-gray with fine appressed pubescence. Sparsely scattered just beneath rimrock on south facing slope.

2. C. watsoni (Gray) Greene. Slender branching annual, with linear pustulate leaves, 15-20 cm. high;

minute flowers in scorpioid racemes. Abundant in patches beneath Juniper trees near upper rimrock.

3. Hackelia Opiz. (Stickseed)

Ours are perennial herbs with bluish flowers; corolla throat prominently crested; pedicels recurved in fruit; nutlet bristles with recurved barbs at the tip (glochidiate).

1. H. cusickii (Piper) Brand (Stickseed). Stems densely to loosely tufted, erect to spreading, 3-5 dm. high; leaves broadly ovate, basal ones long-petioled, cauline sessile. Common in moist, shaded, rock outcrops.

4. Plagiobothrys Fisch. & Mey.

(Popcorn Flower)

Ours annual herbs, with roughly hispid herbage and linear to lanceolate leaves; corolla minute, white; calyx lobes connivent in fruit.

Leaves mainly in a basal tuft; nutlets cruciform . . . . . 2. P. tenellus

Leaves not in a basal tuft, numerous above; nutlets ovate . . . . . 1. P. hispidulus

1. P. hispidulus (Greene) Jtn. Stems weak and spreading, branching, 2-3 dm. high; leaves linear, 1-4 cm. long, at least the lower opposite. Frequent in sandy loam along the river.

2. P. tenellus (Nutt.) Gray. Erect, simple to few-branched annual, 10-15 cm. high; leaves all alternate, lanceolate, less than 1 cm. long. Common on dry, open canyon slopes.

37. LABIATAE - MINT FAMILY

Plants shrubby or woody at the base; inflorescence in terminal clusters subtended by broad bracts.

Calyx regular; functional stamens 4 . . . . . 3. Monardella

Calyx 2-lipped; functional stamens 2 . . . . . 4. Salvia

Plants perennial herbs; inflorescence variable, not as above.

Calyx 2-lipped, the lips entire; flowers solitary . . . . . 5. Scutellaria

Calyx nearly regular, 5-toothed; flowers in clusters.

Corolla nearly regular; flowers in axillary clusters . . . . . 2. Mentha

Corolla 2-lipped; flowers in terminal, spikelike or interrupted clusters . 1. Agastache

1. Agastache Clayton (Giant Hyssop)

Large perennial herbs, with petioled, broadly ovate, toothed leaves; upper corolla lip 2-lobed, lower lip 3-lobed; stamens exserted and crossed, upper pair longer.

1. A. urticifolia (Kuntze) Rydb. Erect to spreading herb, 6-8 dm. high; herbage glabrous throughout; flowers white; plants mildly fragrant. Common in sandy loam soil of riverbank thicket.

2. Mentha L. (Mint)

Strongly fragrant perennial herbs; leaves short-petioled, toothed; calyx and corolla nearly regular.

1. M. arvensis L. var. glabrata (Benth.) Fern. (Field Mint). Plants from creeping rootstocks; flowers light lavender to white; stems erect or weak and trailing, 3-6 dm. high. Common in sandy soil along the river.

3. Monardella Benth. (False Horse Mint)

Many-stemmed perennial from a woody base; flowers in capitate clusters subtended by membranous, usually colored bracts; corolla 2-lipped.

1. M. odoratissima Benth. Stems rather densely clustered, 3-4 dm. high; leaves entire, short-petioled; bracts purple-tinged and hairy; corolla light purple. Abundant in gravelly river floodplain.

4. Salvia L. (Sage)

Strongly aromatic shrubs (ours), with entire, obovate, petioled leaves; upper calyx lip 3-lobed or entire, lower lip 2-lobed; upper corolla lip 2-lobed, lower lip 3-lobed.

1. S. carnosa Dougl. (Grayball Sage). Clustered shrub about 6 dm. high; flowers in dense capitate clusters, subtended by purple-tinged bracts; corolla purple. Infrequently scattered on open dry slopes with big Sagebrush.

5. Scutellaria L. (Skullcap)

Perennial herbs with solitary axillary flowers; upper lip of calyx with a prominent crest; corolla 2-lipped, upper lip arched and entire, lower lip 3-lobed.

1. S. antirrhinoides Benth. Stems simple, erect, 1.5-2.5 dm. high; corolla bright bluish-purple, tube nearly straight, gradually dilated to the throat. Common in very rocky soil just beneath rimrock.

38. SOLANACEAE - NIGHTSHADE FAMILY

1. Nicotiana L. (Tobacco)

Viscid-pubescent annual herbs with alternate leaves; calyx lobes unequal; corolla white, salverform, with a long narrow tube; fruit a capsule.

1. N. attenuata Torr. (Wild Tobacco). Plant erect, branching from the base, 4-6 dm. high; basal leaves large and long-petioled, becoming smaller upwards; flowers in panicles. Frequent in the sand near the river.

39. SCROPHULARIACEAE - FIGWORT FAMILY

Corolla circular and flattened, nearly regular; stamens 2 or 5.

Stamens 5; leaves alternate; capsule round . . . . . 6. Verbascum

Stamens 2; leaves opposite; capsule flattened . . . . . 7. Veronica

Corolla tubular and elongate, quite irregular; functional stamens 4.

Leaves alternate; bracts large, brightly colored . . . . . 1. Castilleja

Leaves opposite; bracts small, greenish.

A sterile fifth stamen present, sometimes rudimentary.

Annuals; sterile stamen minute . . . . . 2. Collinsia

Perennials; sterile stamen enlarged and conspicuous.

Leaves sharply toothed; tip of sterile stamen broadly flattened . . . . . 5. Scrophularia

Leaves entire or few toothed; tip of sterile stamen not flattened, often bearded . . . 4. Penstemon

No sterile fifth stamen present; flowers bright yellow . . . . . 3. Mimulus

1. Castilleja Mutis (Indian Paintbrush)

Perennial herbs with woody roots; leaves alternate, cleft or divided; flowers in a dense terminal spike or raceme; upper corolla lip (galea) much longer than lower; calyx brightly colored.

1. C. chromosa A. Nels. Stems clustered at the base, erect or spreading 3-5 dm. high; flowers red or crimson. Frequent, scattered widely on open, dry canyon slopes.

2. Collinsia Nutt. (Blue-eyed Mary)

Small annuals; leaves opposite and entire; flowers 1-few in leaf axils; corolla tube swollen (gibbous) above and bent down, distinctly 2-lipped.

1. C. parviflora Dougl. Stems slender, simple or branching, 15-20 cm. high; lower lip of corolla dark purple, upper lip lighter; middle lobe of lower lip cup-shaped and enclosing the 4 stamens. Common on open slopes and along roadsides.

3. Mimulus L. (Monkey Flower)

Herbs with opposite leaves; flowers axillary, 1-few in ours; calyx usually ribbed, 5-toothed; corolla yellow, 2-lipped; stamens 4.

Calyx not longitudinally ribbed, lobes as long or longer than tube; two stamens shortened . 3. M. pilosus

Calyx longitudinally ribbed, lobes less than half as long as tube; stamens equal.

Perennials; calyx unequal, the upper lobe longer . . . . . 2. M. guttatus

Annuals; calyx lobes nearly equal.

Leaves linear to oblanceolate, entire; plants reddish . . . . . 4. M. suksdorfii

Leaves ovate, slightly toothed; plants not reddish . . . . . 1. M. floribundus var. membranaceous

1. M. floribundus Dougl. ex. Lindl. var. membranaceous (Nels.) Grant. Stems very slender and weak, decumbent, 8-20 cm. long; herbage viscid, sparsely pubescent; leaves petioled, very thin and membranous; calyx not inflated in fruit. Abundant in small patches, in wet shaded crevices of the lower rimrock near the river. Primarily a Rocky Mountain variety, apparently rare in Oregon.

2. M. guttatus DC. Usually perennial from rootstocks or stolons, 3-4 dm. high; stems erect or spreading, branching; calyx inflated in fruit; yellow corolla dotted with red and pubescent within. Frequent in shaded moist sand along the river.

3. M. pilosus (Benth.) S. Wats. Branching erect annual, 5-20 cm. high; herbage densely pilose-pubescent;

corolla yellow, slightly 2-lipped, lower lip with 2 dark spots. Common to abundant in moist sand along the river.

4. M. suksdorfii Gray. Very small annual, 3-6 cm. high, branching from the base; herbage slightly viscid, reddish. Infrequent on open plateau scabland.

4. Penstemon Mitch. (Beard-tongue)

Perennial herbs or subshrubs; leaves opposite; flowers showy, in racemes; corolla tubular, inflated; limb bilabiate, the upper lip 2-lobed, the lower lip 3-lobed.

Calyx lobes scarious-margined and minutely dentate; flowers mostly 3 cm. or more long . . 3. P. speciosus

Calyx lobes not as above, entire; flowers less than 2.5 cm. long.

Leaves linear; flowers blue-lipped with reddish-purple tube . . . . . 1. P. cinereus

Leaves lanceolate or broader; flowers white . . . . . 2. P. deustus subsp. heterander

1. P. cinereus Piper (Ashy Penstemon). Stems erect, several from a slightly woody base, 3-4 dm. high; herbage ashy-gray; inflorescence narrow, few-flowered. Common on the open scabland of the plateau.

2. P. deustus Dougl. ex. Lindl. subsp. heterander (Torr. & Gray) Penn. & Keck. Stems erect or ascending, several from a woody base, 1-3 dm. high; herbage green, glabrous; leaves entire or few-toothed; flowers in clusters in the upper leaf axils. Common on the open rocky slopes of the upper Grass Belt.

3. P. speciosus Dougl. ex. Lindl. Stout stems stiffly erect, few from a woody rootstock, 5-7 dm. high; herbage glabrous; flowers bright blue to lavender, in clusters in the upper leaf axils. Infrequent on the open slopes of the Sagebrush Belt.

5. Scrophularia L. (Figwort)

Large perennial herbs with opposite, coarsely dentate leaves; flowers greenish, in a long narrow panicle; corolla tube slightly inflated, upper lip 3-lobed, twice as long as entire lower lip.

1. A. lanceolate Pursh. Stem erect, 1-2 m. high; herbage glabrous; greenish flowers with reddish tinge. Sparse in shaded area of riverbank thicket.

6. Verbascum L. (Mullein)

Large biennial herbs with alternate leaves; flowers in terminal racemes or spikes; corolla rotate, nearly regular.

1. V. thapsus L. Stem stiffly erect, 1-2 m. high; herbage densely woolly; flowers yellow, in a dense elongated spike. Sparse along the river.

7. Veronica L. (Speedwell)

Ours perennial herbs with opposite leaves; flowers in axillary racemes; corolla rotate, 4-lobed; capsule compressed, usually notched at apex.

Leaves short-petioled; racemes loosely flowered . . . . . 1. V. americana

Leaves sessile, clasping; racemes closely flowered . . . . . 2. V. anagallis-aquatica

1. V. americana Schwein. Decumbent trailing herbs, 1-3 dm. long; flowers small, purple; herbage glabrous. Infrequent in moist soil of riverbank.

2. V. anagallis-aquatica L. Spreading or decumbent herb, 2 dm. long; flowers small, bluish-purple; herbage glabrous. Sparse in moist soil of riverbank.

40. OROBANCHACEAE - BROOM-RAPE FAMILY

1. Orobanche L. (Broom-rape)

Herbs without green foliage, parasitic on roots of other plants; leaves reduced to scales; corolla 2-lipped, upper lip 2-lobed in ours, lower lip 3-lobed; stamens 4.

1. O. fasciculata Nutt. Stems deep red, erect, 15-20 cm. high; flowers dull bronze with reddish tinge, long-pedicelled, in a close raceme. Sparsely scattered on dry open slopes of lower canyon, apparently parasitic on roots of Artemisia tridentata.

41. PLANTAGINACEAE - PLANTAIN FAMILY

1. Plantago L. (Plantain)

Ours perennial herbs with basal leaves and erect scape; flowers regular, in a dense terminal spike; calyx and corolla 4-parted; stamens 4; capsule splitting transversely.

1. P. major L. Erect scapes, 2-3 dm. high; leaves large, broadly ovate, long-petioled; flowers greenish, inconspicuous. Common in wet marshy areas along the river.

42. RUBIACEAE - MADDER FAMILY

1. Galium L. (Bedstraw, Cleavers)

Ours slender annual herbs with whorled leaves; flowers very small, few in axillary cymes; calyx wanting or nearly so; stems and leaves with stiff retrorse hairs; fruit separating into two, 1-seeded mericarps.

1. G. aparine L. var. echinospermum (Wallr.) Farwell. Prostrate to spreading herb, 1-9 dm. long; corolla rotate,

white; fruit prickly. Common in the riverbank thicket and also in shaded rock outcrops.

43. CAPRIFOLIACEAE - HONEYSUCKLE FAMILY

1. Symphoricarpus Juss. (Snowberry)

Spreading shrubs with opposite leaves; flowers regular, solitary or few in the leaf axils; corolla bell-shaped; ovary inferior; fruit white, berry-like, usually 2-seeded.

1. S. rotundifolius Gray. Dense bushy shrub, 6-8 dm. high; leaves simple, elliptic, 10-15 mm. long; corolla pink, 5-7 mm. long. Sparse on the canyon slope just above the floodplain.

44. VALERIANACEAE - VALERIAN FAMILY

1. Plectritis DC.

Slender annuals with opposite entire leaves; flowers small, in heads or interrupted spike-like clusters; corolla limb 5-lobed, tube spurred at the base; calyx limb wanting; ovary 1-celled.

1. P. macrocera T. & G. var. **grayii** (Suksd.) Dyal (Desert Plectritis). Erect weak stems, 1-3 dm. high; corolla white, usually bilabiate; fruit a winged achene, the wings being open empty chambers with inrolled margins. Common on the open canyon slopes.

45. COMPOSITAE - COMPOSITE FAMILY

1a. Flowers all ligulate and perfect; juice of plants milky.

Flowers white or pink; leaves mostly reduced.

Branches very spiny; pappus bristles not plumose . . . . . 23. Lygodesmia

Branches not spiny; pappus bristles plumose . . . . . 26. Stephanomeria

Flowers yellow or purple; leaves well developed.

Leaves all basal; head solitary on an erect scape.

Achene spinulose, long-beaked; leaves sharply lobed . . . 27. Taraxacum

Achene smooth, beakless; leaves entire . . . . . 2. Agoseris

Leaves not all basal; heads more numerous.

Pappus bristles plumose; leaves grass-like . . . . . 29. Tragopogon

Pappus bristles not plumose; leaves not grass-like.

Involucral bracts in several overlapping series; achenes flattened . . . . . 21. Lactuca

Involucral bracts in 1 or 2 series; achenes cylindric . . . . . 14. Crepis

1b. Flowers not as above; ligulate (ray) flowers, if present, around the margin; juice of plants watery.

2a. Heads with ray flowers (radiate).

3a. Ray flowers yellow or orange.

4a. Pappus of chaffy scales, or wanting.

Pappus wanting; leaves nearly all basal . . . . . 7. Balsamorhiza

Pappus of chaffy scales; obvious stem leaves present.

Receptacle naked; plants densely soft-woolly . . . . . 16. Eriophyllum

Receptacle with chaffy bracts clasping the achenes; plants not soft-woolly.

Perennial; leaves glabrous, entire . . . . . 30. Wyethia

Annual; leaves harshly scabrous, serrate . . . . . 19. Helianthus

4b. Pappus of capillary bristles.

Shrubs; flowers solitary on the individual branches . . . . . 18. Haplopappus

Herbs; flowers few to numerous.

Leaves opposite; flowers few . . . . . 4. Arnica

Leaves alternate or basal; flowers numerous.

Involucral bracts equal, uniseriate . . . . . 24. Senecio

Involucral bracts unequal, in 2-3 overlapping series . . . . . 25. Solidago

3b. Ray flowers white to pink, blue, or purple.

Pappus of thin scales, flattened bristles, or none; receptacle chaffy.

Leaves finely dissected; pappus wanting . . . . . 1. Achillea

Leaves not as above, mostly entire; pappus present.

Lower leaves few-toothed, the lowest forming a rosette . . . 22. Layia

Leaves all entire, no basal rosette present . . . . . 6. Blepharipappus

Pappus of capillary bristles; receptacle naked.

Annuals; ray flowers inconspicuous, scarcely 1 mm. longer than the disk flowers . . . . . 13. Conyza

Perennials; ray flowers conspicuous, longer than 1 mm.

Involucral bracts subequal, usually broadest at the base, not green above and papery below; tip acuminate; our plants spreading-hairy . . . . . 15. Erigeron

Involucral bracts imbricate, usually broader above than at the base, usually green above and papery below; tip acute to obtuse; our plants glabrous to densely puberulent . . . . . 6. Aster

2b. Heads without ray flowers (discoid).

5a. Pappus of capillary bristles.

Receptacle bristly; stem, leaves, and involucre spiny . . . . . 12. Cirsium

Receptacle naked; plants not spiny.

Flowers yellow.

Perennial herbs; involucres spreading-hairy . . 15. Erigeron

Shrubs; involucres variable, not as above.

Involucral bracts 4, equal, white-woolly . . . . 28. Tetradymia

Involucral bracts many, in 3-4 series, imbricated, glabrous and glandular . . . . . 11. Chrysothamnus

Flowers white to pink, or brownish.

Plants large; foliage green, puberulent . . . . . 9. Brickellia

Plants low; foliage grayish to white-woolly.

Matted perennials; dioecious . . . . . 3. Antennaria

Branching annuals; perfect flowers present . . . . 17. Gnaphalium

5b. Pappus of scales or none.

Involucral bracts of pistillate heads with hooked bristles; leaves up to 15 cm. wide . . . . . 31. Xanthium

Involucres without hooked bristles; leaves much narrower.

Pappus of well developed scales . . . . . 10. Chaenactis

Pappus none.

Heads solitary in the leaf axils; pedicels recurved . . . . . 20. Iva

Heads more numerous, or if solitary, pedicels erect . . . 5. Artemisia

1. Achillea L. (Yarrow)

Perennial herbs with alternate, finely dissected leaves; flowers small, numerous in corymbiform clusters; involucral bracts imbricate, with brown hyaline margins.

1. A. millefolium L. Stems erect, 6 dm. high; herbage finely pubescent; ray flowers white. Common on the open riverbank.

2. Agoseris Raf. (False Dandelion)

Ours perennial herbs from a thick taproot; heads solitary; involucral bracts subequal, in 2 series; pappus of capillary bristles.

1. A. glauca (Pursh) D. Dietr. var. parviflora (Nutt.) Rydb. Leaves all basal, glabrous, linear; scape 2-3 dm. high; flowers yellow; achene essentially beakless. Common on the open slopes of the upper Grass Belt.

3. Antennaria Gaertn. (Everlasting, Pussytoes)

Ours low matted perennial with entire, white-wooly leaves; dioecious; involucral bracts scarious, imbricate, brownish.

1. A. dimorpha (Nutt.) T. & G. Stems 2-6 cm. high, from a branching woody base. Common, forming large mats on the open canyon slopes.

4. Arnica L.

Perennials from rhizomes; leaves simple, opposite; heads few; flowers yellow; involucral bracts in 1 or 2 series, subequal.

Leaves lanceolate or narrower, in 5-8 pairs . . . . . .
. . . . . 1. A. longifolia
Leaves ovate or broader, narrowing upwards, in 4 pairs or less . . . . . 2. A. mollis

1. A. longifolia D.C. Eat. Stems erect, 5-7 dm. high, glandular-pubescent; some leaves with occasionally toothed margins. Infrequent in moist soil of riverbank thicket in the North Fork.

2. A. mollis Hook. Stems erect or ascending, 3-4 dm. high; herbage glandular, sparingly pubescent; leaf margins mostly entire. Sparse in the riverbank thicket.

5. Artemisia L. (Sagebrush, Wormwood)

Perennial herbs or shrubs with alternate leaves; nearly all strongly aromatic; heads small, discoid; involucre of few irregularly imbricated bracts; achenes 2-ribbed, usually glabrous.

Flowers all perfect; shrubs.

Plants dwarf, less than 4 dm. tall; inflorescence less than 1 cm. wide . . . . . 1. A. arbuscula

Plants large, well over 4 dm. tall; inflorescence 1-5 cm. wide . . . . . 5. A. tridentata

Marginal flowers pistillate; perennial herbs.

Plants densely matted-hairy or tomentose . . . . . 3. A. ludoviciana

Plants glabrous.

Leaves entire to 3-lobed; inflorescence broad, much-branched . . . . . 2. A. dracunculus

Leaves 3-7 lobed, the lobes toothed; inflorescence narrow, few-branched . . . . . 4. A. sp.

1. A. arbuscula Nutt. (Dwarf Sagebrush). Low shrub with few branches, 1-4 dm. high; leaves mostly 3-lobed or-toothed. Abundant on the scabland of the plateau.

2. A. dracunculus L. (Wormwood). Large herb, branching from the base, stems 1-1.5 m. high; leaves numerous, linear; disk flowers sterile. Common member of the river-bank thicket.

3. A. ludoviciana Nutt. (Wormwood). Erect herb with many basal stems, 3-5 dm. high; leaves mostly entire to 3-lobed, green above, lighter below. Abundant in the gravelly river floodplain.

4. A. sp. Many-stemmed perennial, the stems woody at the base, decumbent to ascending, 3-5 dm. high; inflorescence a relatively few-flowered panicle; herbage bright

green, glabrous; flowers light yellow; plant aromatic.

Verified by Dr. Arthur Cronquist of New York Botanical Gardens, as a completely new and undescribed species. Specimens have been turned over to him for study and eventually to name and describe. The plant was found exclusively in shaded situations of large rock outcrops. Here it was growing on ledges and small niches, always in the shade, where the soil was usually moist. In this habitat, the plant is common, but as far as search and investigation could determine, only one such rocky outcrop contains the plant. This is the south wall of the North Fork canyon, just as it enters the Three Forks canyon. This is a steep wall, in places rising out of the river, but only up to 75 feet high. The plant was found for a few hundred yards along this wall, in the various crevices and niches.

5. A. tridentata Nutt. (Big Sagebrush). Large diffusely branching shrub, 1-1.5 m. high; twigs and leaves gray tomentose, the older bark shredding; leaves shallowly 3-toothed; heads numerous, sessile. Abundant on the open canyon slopes and plateau.

6. Aster L. (Aster)

Ours all perennials with alternate leaves; flowers showy, usually blooming in late summer or fall.

Heads solitary on the individual stems; pappus distinctly double, the outer series short . 4. A. scopulorum

Heads more numerous; pappus in one series.

Plants fibrous-rooted, glabrous; leaves entire.

Flowers reddish-pink to white; heads 50-100 per plant . . . . . 2. A. eatoni

Flowers purple; heads mostly less than 50 per plant . . . . . 3. A. occidentalis var. intermedius

Plants tap-rooted, densely puberulent; leaves toothed . . . . . 1. A. canescens

1. A. canescens Pursh. Erect herb, several stems from the base, 3-5 dm. high; leaves oblanceolate to linear, toothed; flowers purple. Frequent on the open canyon slopes.

2. A. eatoni (Gray) Howell. Erect to lax stem, 1-2 m. high; leaves sessile, entire, lanceolate. Infrequent in the riverbank thicket.

3. A. occidentalis (Nutt.) T. & G. var. intermedius Gray. Erect herb, 3-4 dm. high; herbage glabrous; flowers purple. Common in the riverbank thicket.

4. A. scopulorum Gray. Erect tufted herb from a thick taproot; stems leafy below, naked above, 1-3 dm. high; leaves stiffly ascending, scabrous; flowers purple. Common on the open scabland.

7. Balsamorhiza Hook. ex. Nutt.

(Balsamroot)

Perennial herbs with mostly basal leaves and a large woody taproot; heads large, usually solitary; receptacle with chaffy bracts which enclose the achenes; pappus wanting.

1. B. hookeri Nutt. Scapes erect, 1-3 dm. high; leaves spreading, pinnately divided, 1-4 dm. long; flowers yellow. Common on the open scabland.

8. Blepharipappus Hook.

Annuals with alternate linear leaves; heads few; ray flowers 3-6, white; receptacle chaffy; pappus of fringed scales.

1. B. scaber Hook. Erect branching annual, 1-2.5 dm. high; leaves twisted and distorted; involucral bracts in 2 equal series. Common on the open scabland.

9. Brickellia Ell.

Ours densely tufted perennial herbs, with alternate entire leaves; heads discoid; flowers all perfect; involucral bracts striate, imbricate in several series.

1. B. oblongifolia Nutt. var. linifolia (D.C. Eat.) Rob. Stems erect, 4-6 dm. high; leaves glandular, resin-dotted; heads large, mostly solitary and terminating the branches. Common in the gravelly river floodplain.

10. Chaenactis DC. (Dusty Maiden)

Ours biennial or perennial herbs with alternate, pinnately divided leaves; heads discoid; involucral bracts in 2 or 3 unequal series; pappus of several scales.

1. C. douglasii (Hook.) H. & A. Erect herb with 1-several stems, 2-4 dm. high; stems and leaves tomentose; heads terminating branches; flowers pink to white; pappus scales 9 or 10. Common on the dry open slopes of the Sagebrush Belt.

11. Chrysothamnus Nutt. (Rabbitbrush)

Branching shrubs with alternate linear leaves; heads discoid, numerous, in terminal corymbiform clusters; involucral bracts imbricate, in more or less vertical ranks; flowers yellow.

Twigs with felt-or scale-like pubescence; involucral bracts distinctly vertically aligned . . . . . 1. C. nauseosus var. petrophilus

Twigs glabrous or puberulent; involucral bracts indistinctly vertically aligned . . . . 2. C. viscidiflorus

1. C. nauseosus (Pall.) Britt. var. petrophilus Cronq. (Gray Rabbitbrush). Erect or spreading shrub, 7-9 dm. high; leaves less than 2 mm. wide; involucre glandular; achenes glabrous. Frequent throughout on the open canyon slopes.

2. A. viscidiflorus (Hook.) Nutt. (Sticky Rabbit-brush). Erect shrub up to 6 dm. high; leaves 2-4 mm. wide, glandular; involucre glandular. Common in association with Festuca near the lower North Fork canyon in more sheltered areas.

12. Cirsium Mill. (Thistle)

Ours large spiny biennials with alternate toothed leaves; heads discoid, terminating branches; involucral bracts in many imbricate series, nearly all spine-tipped; pappus bristles plumose.

Stems winged by decurrent or continuous leaf bases; leaves short-hispid above . . . . . 2. C. vulgare
Stems wingless; leaves densely soft-woolly above . . . . . 1. C. undulatum

1. C. undulatum (Nutt.) Spreng. Erect herb, 1-2 m. high; stem and leaves gray tomentose; outer involucral bracts with a thickened dorsal ridge; flowers white to pink. Common on the open slopes of the Grass Belt.

2. C. vulgare (Savi) Airy-Shaw (Bull-thistle). Erect herb, 1-2 m. high; under side of leaves gray tomentose; flowers purple. Common in the riverbank thicket.

13. Conyza Less.

Annual herb, with numerous small heads in an open panicle; similar to Erigeron, but the outer, pistillate flowers of each head very numerous; involucre 3-4 mm. high.

1. C. canadensis (L.) Cronq. var. glabrata (Gray) Cronq. Erect branching herb, 4-6 dm. high; flowers white; leaves mostly linear and entire. Common in the riverbank thicket.

14. Crepis L. (Hawksbeard)

Ours perennial herbs from taproots; leaves mostly basal, pinnatifid, the cauline reduced; involucral bracts in 1 series, with few small outer bracts; flowers all ligulate and perfect, yellow.

Plants without setae; heads 30-100, each 5-10-flowered . . . . . 1. C. acuminata

Plants setose; heads less than 30, each 10-40-flowered.

Setae present on involucre and lower stem, not gland-tipped . . . . . 2. C. modocensis subsp. modocensis

Setae on involucre only, these gland-tipped . . . . . 3. C. occidentalis subsp. occidentalis

1. C. acuminata Nutt. Tall erect herb, 6-8 dm. high; herbage sparingly tomentose; involucre nearly glabrous,

about 1 cm. high, the bracts 5-7. Common in the rimrock shelter of the upper Grass Belt.

2. C. modocensis Greene subsp. modocensis. Erect herb, 2 dm. high; herbage quite tomentose. Sparse on the open canyon slopes.

3. C. occidentalis Nutt. subsp. occidentalis. Erect herb, 2-4 dm. high; herbage quite tomentose; several stems from a caudex. Common in the rimrock shelter of the upper Grass Belt.

15. Erigeron L. (Daisy)

Ours perennial herbs from a woody taproot or caudex; heads discoid or radiate; flowers usually blooming in the spring or early summer.

Heads without ray flowers; flowers yellow.

Leaves mostly basal, appressed-pubescent; heads solitary . . . . . 2. E. bloomeri

Stem leaves abundant, spreading-pubescent; heads several . . . . . 1. E. aphanactis

Heads with ray flowers; flowers white to lavender.

Leaves mostly basal, dissected; flowers white . . . . . 3. E. compositus

Leaves cauline, entire; flowers lavender . . . . . 4. E. pumilus subsp. intermedius

1. E. aphanactis (Gray) Greene. Stems tufted, erect, 1-2 dm. high; few heads per stem; involucre 4-5 mm. high; flowers yellow. Common on the open slopes of the upper Grass Belt.

2. E. bloomeri Gray. Stems few, erect, 1-3 dm. high; 1 head per stem; involucre quite tomentose or hirsute, 5-8 mm. high; flowers yellow. Common on the open slopes of the upper Grass Belt.

3. E. compositus Pursh. Dense spreading herb, 1-2 dm. high; leaves glandular, palmately dissected; heads solitary; involucre 6-9 mm. high; flowers white. Infrequent, growing in very little soil on large exposed rock.

4. E. pumilus Nutt. subsp. intermedius Cronq. Densely tufted herb, 2-3 dm. high; heads few per stem; involucre 4-6 mm. high; flowers lavender. Common on open scabland of plateau.

16. Eriophyllum Lag. (Woolly Sunflower)

Perennial herbs with alternate leaves; heads solitary and terminal; involucral bracts in 1 or 2 series, permanently erect; pappus of small scales; flowers yellow.

1. E. lanatum (Pursh) Forbes. Stems usually tufted, erect, from a taproot, 1.5-3 dm. high; herbage densely woolly; leaves usually few-toothed or-lobed. Frequent on the open canyon slopes.

17. Gnaphalium L. (Everlasting)

Annual (ours), or perennial woolly herbs with alternate entire leaves; heads clustered, discoid, inconspicuous; involucral bracts imbricate, scarious at the tip.

1. G. palustre Nutt. Low branching annuals, 2-6 cm. high; stems leafy; involucre 2-3 mm. high, the upper half of bracts scarious; flowers white. Common in the sandy river floodplain.

18. Haplopappus Cass.

Perennial herbs or shrubs (ours), with alternate leaves; heads usually few, few-flowered in ours; involucral scales imbricate; pappus of capillary bristles.

1. H. nanus (Nutt.) Eat. Small, gnarled branching shrub, 6-8 dm. high; leaves small, linear, resinous; heads solitary, terminal; flowers yellow, rays 1-3 mm. long. Sparse on the open canyon slopes.

19. Helianthus L. (Sunflower)

Annual (ours), or perennial herbs with alternate leaves, or sometimes the lower opposite; heads large, few per stem; involucral bracts leaf-like, imbricate; pappus usually of 2 awns.

1. H. annuus L. Erect herb, 1-2 m. high; herbage scabrous, glandular; ray flowers large and showy, yellow; disk flowers purplish-brown. Common along the roadside.

20. Iva L. (Poverty Weed)

Ours perennial herbs with opposite or alternate, entire leaves; heads discoid; receptacle chaffy; pistillate flowers marginal, without corollas.

1. I. axillaris Pursh. Erect branching herb, 3-5 dm. high; stems very leafy; involucre 2-4 mm. high, the 4-5 bracts united below. Common along the roadside.

21. Lactuca L. (Lettuce)

Annual, biennial, or perennial herbs with alternate leaves; heads paniculate; flowers all ligulate and perfect; achenes beaked, dilated at apex.

Perennials; flowers bright blue or purplish . . . . . 1. L. pulchella

Annuals; flowers yellow . . . . . 2. L. scariola

1. L. pulchella (Pursh) DC. Erect perennial, 5-8 dm. high; leaves entire to pinnately lobed, 5-15 cm. long; herbage glabrous; involucre 10-15 mm. high. Common in the riverbank thicket.

2. L. scariola L. Erect annual, 6 dm. high; leaves sagittate-clasping, spiny on the margins and lower midrib; herbage glabrous; involucre 5-10 mm. high.

22. Layia H. & A.

Annuals with alternate leaves; heads large, terminating the branches; involucral bracts equal in 2 series,

the inner series thin-margined and enclosing the achenes; pappus of flattened bristles.

1. L. glandulosa (Hook.) H. & A. Stem erect, 3-12 cm. high; herbage spreading-hairy; ray flowers white, 3-lobed; pappus present on disk achenes, wanting on ray achenes. Infrequent on the open canyon slopes.

23. Lygodesmia D. Don (Skeleton-weed)

Perennials with few linear leaves and many spiny branches; heads solitary, terminal; principal involucral bracts 4-8, outer ones reduced.

1. L. spinosa Nutt. Several stems from a woody base, 2-5 dm. high with tufts of brownish wool at the base; heads 3-5-flowered; flowers pink to rose-purple. Frequent on the open slopes in Sagebrush Belt.

24. Senecio L. (Groundsel)

Annual or perennial (ours) herbs with alternate or basal leaves; heads often in corymbiform clusters; involucral bracts essentially equal, uniseriate; flowers yellow.

Leaves mostly basal, reduced upwards; plants densely white-hairy . . . . . 1. S. canus

Leaves little reduced upwards; plants glabrous . . . . . 2. S. serra

1. S. canus Hook. One to several stems from taproot, 2-3 dm. high; leaves long-petioled, ovate, entire; involucre 6-8 mm. high. Frequent on the open upper canyon slopes.

2. S. serra Hook. Large erect herb, 1-1.5 m. high; leaves lanceolate to ovate, entire to serrate; heads numerous; involucre 5-7 mm. high. Common in the riverbank thicket.

25. Solidago L. (Goldenrod)

Perennial herbs with alternate leaves; heads numerous, small, racemose or paniculate; flowers yellow; involucral bracts imbricate.

1. S. missouriensis Nutt. var. fasciculata Holz. Several leafy stems from a rhizome, 7-9 dm. high; leaves narrow, entire, glabrous, with fascicles of reduced leaves in their axils; involucre 2-4 mm. high; rays 2-3 mm. long. Common in the riverbank thicket.

26. Stephanomeria Nutt. (Rush-pink)

Annual or perennial (ours) herbs with alternate leaves; heads axillary or terminal; principle involucral bracts 5-8, equal, uniseriate; the outer bracts much reduced; pappus bristles plumose.

1. S. tenuifolia (Torr.) Hall. Spreading much-branched herb, 3-4 dm. high; leaves linear, entire;

plants glabrous; flowers all ligulate and perfect, cream to pink. Frequent in usually shaded, rocky outcrops.

27. Taraxacum L. (Dandelion)

Perennial herbs with basal pinnatifid leaves; heads solitary; involucral bracts equal in 2 series, the inner series erect, the outer one usually reflexed.

1. T. officinale Weber. Leaves numerous, spreading, glabrous except along the midrib; scape erect, 2-3 dm. high; flowers yellow; achene spiny, beak twice as long as body. Infrequent in riverbank thicket.

28. Tetradymia DC. (Horsebrush)

Rough much-branched shrubs; leaves in fascicles, linear and entire; heads discoid, numerous in terminal corymbiform clusters; flowers yellow.

1. T. glabrata Gray. Bushy shrub, 1-1.5 m. high; leaves glabrous and glandular, 5 mm. long or less; twigs and involucre densely tomentose; flowers 4; achenes silky villous. Frequent on the open slopes with sagebrush.

29. Tragopogon L. (Goat's beard)

Ours biennial herbs with alternate grass-like leaves; heads few, large; involucre of 1 row of equal bracts; achenes spinulose, long-beaked, with 1 row of plumose bristles.

1. T. dubius Scop. Tufted herb, 7-9 dm. high; leaves linear and entire, clasping; herbage glabrous; flowers yellow. Sparse along the roadside.

30. Wyethia Nutt. (Mule's ears)

Perennial herbs from a large taproot; leaves alternate or basal; heads few, large; involucral bracts leaf-like, in several series; receptacle bracts clasping the achenes.

1. W. amplexicaulis Nutt. Erect to spreading, aromatic herb, 2-4 dm. high; leaves large, mostly basal, glabrous and resinous, denticulate; flowers yellow. Infrequent in moist soil of a rocky wash.

31. Xanthium L. (Cocklebur)

Large coarse annuals with alternate leaves; heads unisexual, the staminate above, many-flowered; pistillate below, 2-flowered, the involucre forming a 2-chambered bur covered with prickles.

1. X. strumarium L. var. canadense (Mill.) T. & G. Erect or ascending, branching herb, 6-8 dm. high; leaves irregularly toothed, scabrous; heads in short axillary clusters. Abundant in sandy soil of the river floodplain.

SUMMARY

A taxonomic and ecologic study was made of the vascular plants of a section of the Owyhee River Canyon of Malheur County, Oregon. The particular study area is known as Three Forks, and is located at the junction of the North Fork of the Owyhee River, East Fork of the Owyhee River, and the Little Owyhee River.

The Three Forks canyon is a relatively broad portion of a river canyon which cuts through the high plateau country of southeastern Oregon. The three streams flowing into Three Forks arise from various points in southwestern Idaho, northern Nevada, and southeastern Oregon.

Settlers have occupied the area since 1863, with farming as their primary occupation. The closest ranch today is about six miles from Three Forks. No fires have been recorded for the area.

The climate of Three Forks is one of hot dry summers and cold winters. Most of the approximately 13 inches of precipitation falls in the winter and spring. The years of 1956 and 1957 had above average moisture conditions.

Ecologically, the area has two sharp divisions, the river and its banks, and the canyon slopes. The canyon slopes reveal two rather intergrading belts, the lower

Sagebrush Belt and the upper Grass Belt. These two belts, plus the River Belt, form three horizontal belts of vegetation in which 13 plant associations were distinguished.

Four associations were described for the River Belt. The Sedge/Rush Association is the most mesic, usually found in the water. The Salix/Ribes/Rosa Association forms a usually dense growth along the river banks. The Elymus Association is a rather homogeneous stand between the river banks and the canyon slopes. Characteristic of the dry flood plains left by receding water is the Artemisia/Chrysothamnus Association.

Three associations were described for the Sagebrush Belt. The Artemisia/Prunus Association occupies a small area just above the River Belt on the south and west sides of the river. The Festuca/Chrysothamnus Association is restricted to a north exposure below the lower rimrock. The majority of the Sagebrush Belt is open exposed slope and is covered by the Artemisia/Sarcobatus Association.

Four associations were described for the Grass Belt, which occupies the upper and steeper part of the canyon slopes. The Agropyron/Poa Association forms a dense stand over most of the Grass Belt. The dominant grasses are also represented in the following three associations. The Juniperus/Festuca Association represents a more mesic condition provided by gullies or niches in the topography

near the upper rimrock. The Grayia/Sarcobatus Association is present in a small area of southeast-facing slope just beneath the upper rimrock. It probably indicates a more alkaline soil. The Artemisia/Sitanion Association is characteristic of the rocky, shallow-soiled scabland areas of the plateau which immediately surround the canyon.

In addition, two associations were found in both belts of the canyon slopes. The Hackelia/Ivesia Association is represented in the moist, shaded niches of several large rock outcrops. Along the road, a typical assemblage of plants, mostly weeds, formed a Roadside Association.

The study area yielded a total of 211 species, classified into 148 genera and 45 families. The taxonomic treatment consists of keys constructed to classes, families, genera and species, with descriptions of genera and species. Of special interest was the discovery of a new, undescribed species of Artemisia.

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