A floristic survey of the Pryor Mountains, Montana
by Judith Colleen McCarthy

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Biological Sciences
Montana State University

Abstract:
The Pryor Mountains are located in southcentral Montana in Carbon and Big Horn counties. They occur at the interface of three floristic provinces: the Great Plains, the Rocky Mountains, and the Great Basin. It has been hypothesized that plant diversity is high in this area both because of this junction and the presence of xeric habitats which have accommodated invasion of species from more southern deserts. This floristic study was undertaken to describe the plant diversity and its relationship to the flora of the three adjoining regions. During the summer field seasons of 1994 and 1995, plants were systematically collected and a checklist of 981 taxa was developed for the 1,278 square kilometers study area. This flora was compared with 11 other floristic surveys from the western United States, which represented the three cited regions. The Pryor Mountain flora was found to be more diverse than comparative floras. While it has 948 species, the adjusted mean of the other floras is 716 species. The closest affinity of the Pryor Mountain flora was to the northwestern Black Hills, a Great Plains flora, with a 37% similarity, followed by floras from the Rocky Mountains and the Great Basin. Although the Great Basin region has the least numerical influence on this flora, a full 5% of the Pryor Mountain flora is composed of northern range extensions of southern desert species.

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APPROVAL

of a thesis submitted by

Judith Colleen McCarthy

This thesis has been read by each member of the graduate committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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Signature Judith C. McCarthy

Date April 18, 1996

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ABSTRACT

The Pryor Mountains are located in southcentral Montana in Carbon and Big Horn counties. They occur at the interface of three floristic provinces: the Great Plains, the Rocky Mountains, and the Great Basin. It has been hypothesized that plant diversity is high in this area both because of this junction and the presence of xeric habitats which have accommodated invasion of species from more southern deserts. This floristic study was undertaken to describe the plant diversity and its relationship to the flora of the three adjoining regions. During the summer field seasons of 1994 and 1995, plants were systematically collected and a checklist of 981 taxa was developed for the 1,278 square kilometers study area. This flora was compared with 11 other floristic surveys from the western United States, which represented the three cited regions. The Pryor Mountain flora was found to be more diverse than comparative floras. While it has 948 species, the adjusted mean of the other floras is 716 species. The closest affinity of the Pryor Mountain flora was to the northwestern Black Hills, a Great Plains flora, with a 37% similarity, followed by floras from the Rocky Mountains and the Great Basin. Although the Great Basin region has the least numerical influence on this flora, a full 5% of the Pryor Mountain flora is composed of northern range extensions of southern desert species.

INTRODUCTION

The flora of the Pryor Mountains is distinctive in Montana because it occurs at the juncture of the Great Plains, Rocky Mountain, and Great Basin Provinces. Here documented are 981 vascular plant taxa from the Pryor Mountains with a composite of my collections from the summers 1994-1995 and other botanical collections from 1978-1994. This survey of the Pryor Mountain flora provides a taxonomic checklist of the flora as well as an analysis of the relationship to surrounding floristic regions of western North America (Cronquist, 1982).

Statement of the Problem

The Pryor Mountain Region has elements of three floras, the Great Plains, Rocky Mountain, and Great Basin. However, botanists have described it as Great Basin in character (Dorn, 1978; Lichvar et al., 1985; Kratz, 1988; Lesica and Shelly, 1991; Achuff and Lesica, 1992). What actually dominates in the Pryor Mountains? The area has also been described as rich in diversity (Achuff and Lesica, 1992). How diverse is the Pryor Mountain flora compared with other regions of the western United States? How does its richness

compare with another reputedly diverse area in Montana, the Centennial Valley?

Description of the Pryor Mountain Study Area

Physical

The Pryor Mountain study area is located in Carbon County in southcentral Montana. This region lies between 45 degrees north latitude at the south boundary (the Montana-Wyoming line) and 45.27 degrees latitude at the north (Crow Indian Reservation) and is primarily in Custer National Forest and the Bureau of Land Management districts. The eastern boundary is at -108.88 degrees longitude, the Big Horn River, and the western boundary is -108.16 degrees, Hunter Creek, west of Montana Highway 310 (Figure 1). The study region covers approximately 1286 square kilometers.

Geology

The Pryor Mountains consist of four major crustal blocks--West Pryor Mountain, Northeast Pryor block, Red Pryor Mountain, and East Pryor Mountain--each of which is elevated at the northeast corner and downwarped on the southwest side. These can be visualized as trap-door blocks with uplifted corners which form steep eastern scarps and gentle southwestern dip slopes (Orrell, 1988; Blackstone, 1978) (Figure 2).

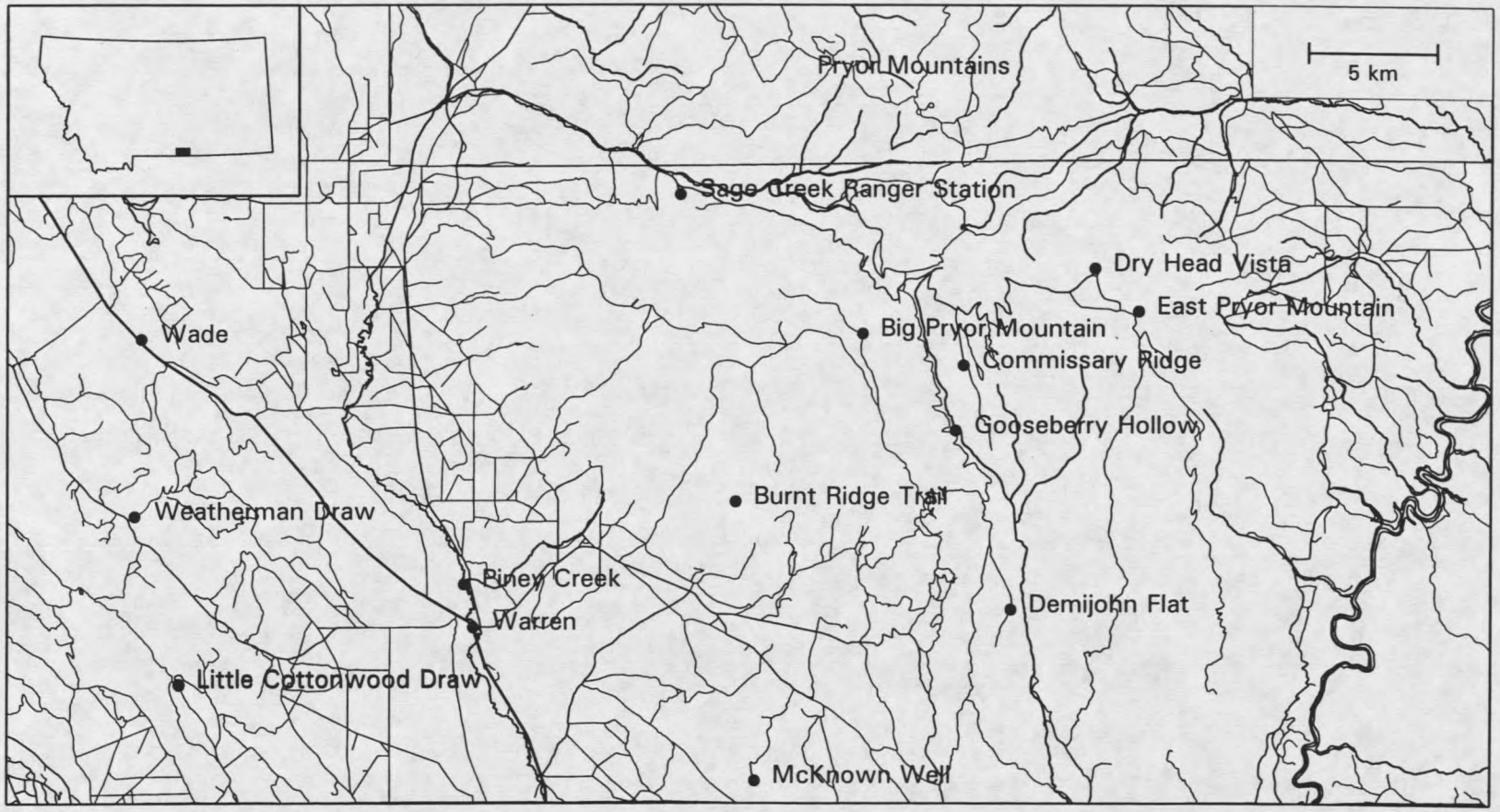

Figure 1. Map of the location of the Pryor Mountain Study Area with major drainages and roads.

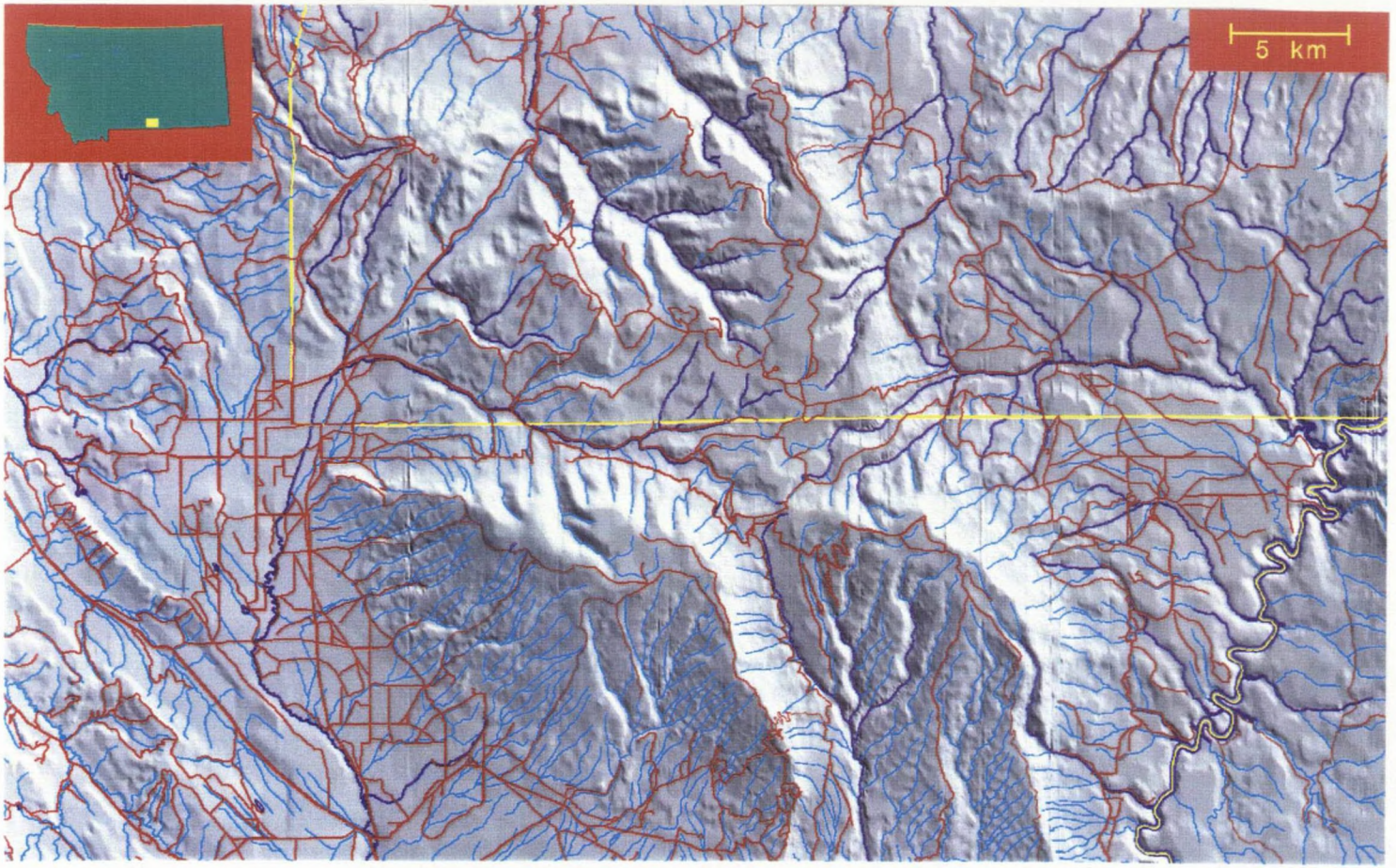

Figure 2. Relief map of the entire Pryor Mountains showing four uplifted blocks. The yellow Big Horn-Carbon County lines separate the Crow Reservation in the north from the Forest Service, Bureau of Land Management and National Park Service lands to the south. Major roads, permanent and intermittent drainages are in red, blue and cerulean.

The stratigraphic section of the Pryor Mountains exposes Precambrian through Cretaceous rocks, a span of about 550 million years, with all except the Silurian represented. Most visible are the Paleozoic Era Bighorn and Jefferson Dolomites (165 m) and the Madison Limestone Group (159 m). The Mesozoic Era presents the noticeable "Triassic Redbeds" in the Chugwater siltstone (175 m) and the Cloverly Formation (111 m) as well as other smaller formations.

Soils

Soils in the Pryors are mollisols, aridisols, and entisols, represented in order of declining organic matter content. In general, soils in the northeast Pryor Mountains are sandy or silty well-drained loams and are often calcareous (Parker et al., 1978). The soils in the south and west portions of the Pryors have a higher clay content, are often saline, and plant productivity is low due to aridity (Develice and Lesica, 1993). Typical pH of the saltbush-sagebrush desert measures 8.5 while mixed grass prairie is 7.5 (Knight et al., 1987).

Climate

The Pryor Mountains lie to the east of the Absaroka-Beartooth Mountains and in the rainshadow. Precipitation ranges from 17 cm to 48 cm annually and elevations range from 1305 m to 2796 m above sea level.

The climate in the higher, northeast Pryor Mountains is cool and has a mean annual precipitation estimated at 48 cm (USDA-SCS, 1981). Climate in the southern portion of the Pryor Mountains is cool temperate and semi-arid. Bridger, Montana, 16 km northwest of the Pryors, receives an average of 30.48 cm of precipitation annually, and temperatures vary from an average of -10 degrees centigrade in January to an average 22 degrees C in July. Lovell, Wyoming, 20.8 km south of the mountains, receives an average of 17 cm precipitation annually and temperatures range from an average -16 C in January to an average 24 degrees C in July (Knight et al., 1987). During the two years of this study, 1994 was a very dry year with only 10 cm of rain during the spring months, March through June (Bridger, Montana). In 1995, precipitation recorded for the same months (Pryor, Montana) was 26 cm.

Human History of the Pryor Area

Settlement

Excavations document human occupation over the past 12,000 years. The first inhabitants were called the "Sheepeaters" (Bonnichisen and Young, 1979). The flat surfaces atop the Pryor Mountains were unglaciated and therefore attracted these inhabitants. Their sites are marked by projectile points and tipi rings on East Pryor Mountain and down the Crooked Creek drainages (Bonnichisen and Oliver, 1981). A cave in Bear Canyon, on the

southwest side, revealed grains of wheatgrass (*Elymus*) radiocarbon dated 10,650 yrs BP (Bonnichsen et al., 1981).

The Crow Indians arrived from the Great Lakes region in the late 1700's to settle in the Pryor Mountains, which were then called the "Arrowhead Mountains" (Harvey, 1974). Forced treaties eventually shuffled them to the north and northeast Pryors while the U.S. Government occupied lands to the south. The Indians used wild plants in the Pryors and relied on, among many others, the roots of American Bistort (*Polygonum bistortoides*) for food, the stems of Blueflax (*Linum lewisii*) for fiber, and the leaves of Gumweed (*Grindelia squarrosa*) for tea (Loendorf, 1968).

The Lewis and Clark Expedition passed the "Arrowhead Mountains" on the Yellowstone River, heading east in July of 1806. A member of that party, Sargent Nathaniel Pryor, "a man of charm and ability," according to Clark, stopped to camp on a dry creek. He was responsible for delivering 52 horses overland to Mandan, North Dakota. During the night, a rainstorm flooded the creek and the Crow Indians drove off the horses. Both the creek and the mountains are named for Sgt. Pryor (De Voto, 1953).

Trappers and mountain men, heading west, went through Pryor Gap and followed the nearby Bozeman and Bridger Trails until the 1860's. Eastern settlers arrived in the Pryors by 1879, where they cut timber and grazed cattle and sheep. The railroad increased access by humans until the drought of the

1930's evicted settlers to other sites. This left the Bowler Flat area desolate (Harvey, 1974). Ranches continue to function in the Pryors today at Sage and Crooked Creeks because of available water.

Today human use includes oil drilling in Elk Basin, sporadic uranium and bentonite mining, hunting, recreation, and grazing. This rangeland in the Pryors was described by Ross and Hunter (1976) as of the poorest condition in Carbon County. It is not uncommon to see whole acres of cheatgrass (*Bromus tectorum*) following grazing. Primary productivity, especially in the arid region, is low (Kratz, 1988). He measured vegetative production of desert communities to be from 4 to 12 grams/square meter. Sustained human activity threatens this sparse vegetation by disruption and removal of slow-growing plant life.

The Pryor Mountain Wild Horse Range was established on East Pryor Mountain by the Bureau of Land Management (BLM) in 1968. The herd size is controlled at 122 horses by a BLM administered adoption program. Its goal is protection of the plant and native animal life in the Pryor Mountains.

Botanical Exploration

Botanical collectors, usually as part of government surveys, traversed the Oregon Territory ("all of the west about the Missouri, Yellowstone and Columbia Rivers") to send specimens back east to professional botanists for identification. In 1833 the Big Horn River carried Nathaniel Wyeth of

Cambridge, Massachusetts, as he ventured west for the Astor Fur Trading Company (Wyeth, 1833) (Figure 3). Collecting plants all the way west to Columbia Falls, Wyeth sent one collection with a letter to Thomas Nuttall in Cambridge. He added a postscript that read: "P.S. By the notes on the paper my journal will show the place from which the plant comes if kept in its proper sheet until I come home" (Young, 1899). He also wrote that "the earth is decorated with a variety of beautiful flowers and all unknown to me." Unfortunately, that collection was lost but the plants gathered on the return trip as far east as the Missouri River did arrive at their destination. Wyeth passed through southern Montana along the Big Horn River on August 12, 1933.

The preservation of Wyeth's specimens was excellent and Nuttall's analysis of 113 species of flowering plants shows that 51 were determined new to science (Graustein, 1967). One new genus represented by a stout "dwarf sunflower" Nuttall named for Wyeth, *Wyethia.* Others from this list still found in the Pryor Mountains today include *Ranunculis glaberrimus, Grindelia squarrosa* and *Oxytropis lagopus* (Nuttall, 1834). These specimens remain at the Philadelphia Academy of Sciences Herbarium (where Nuttall examined them) with duplicates at the New York Botanical Garden Herbarium.

In 1859 Raynolds explored in the "headwaters of the Yellowstone and Missouri Rivers, and of the mountains in which they rise," and these observations were published for Congress in 1867 (Raynolds, 1867) (Figure 4).

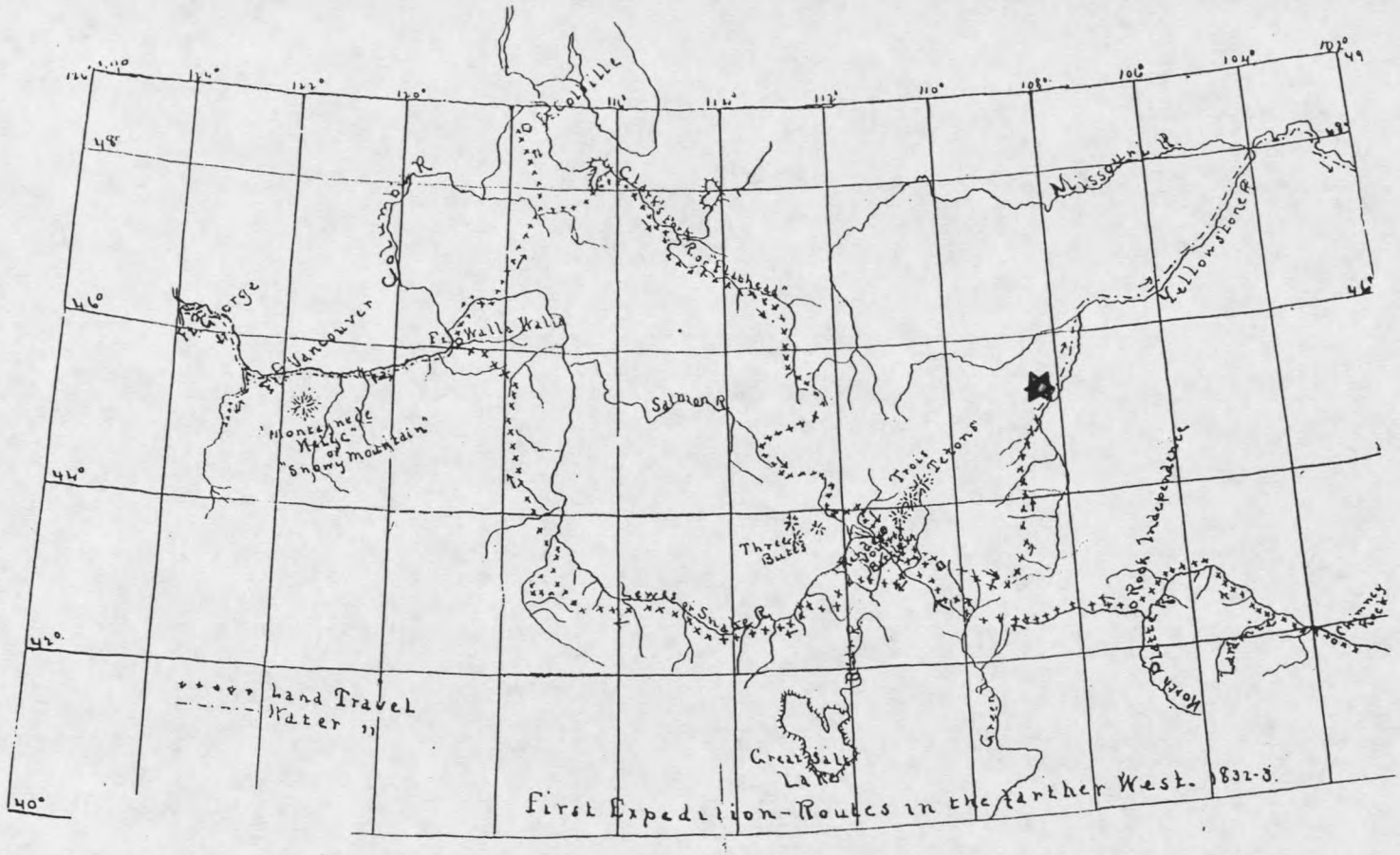

Figure 3. Map of Nathaniel Wyeth showing relationship to Pryor Mountains by his Big Horn River passing in August of 1833.

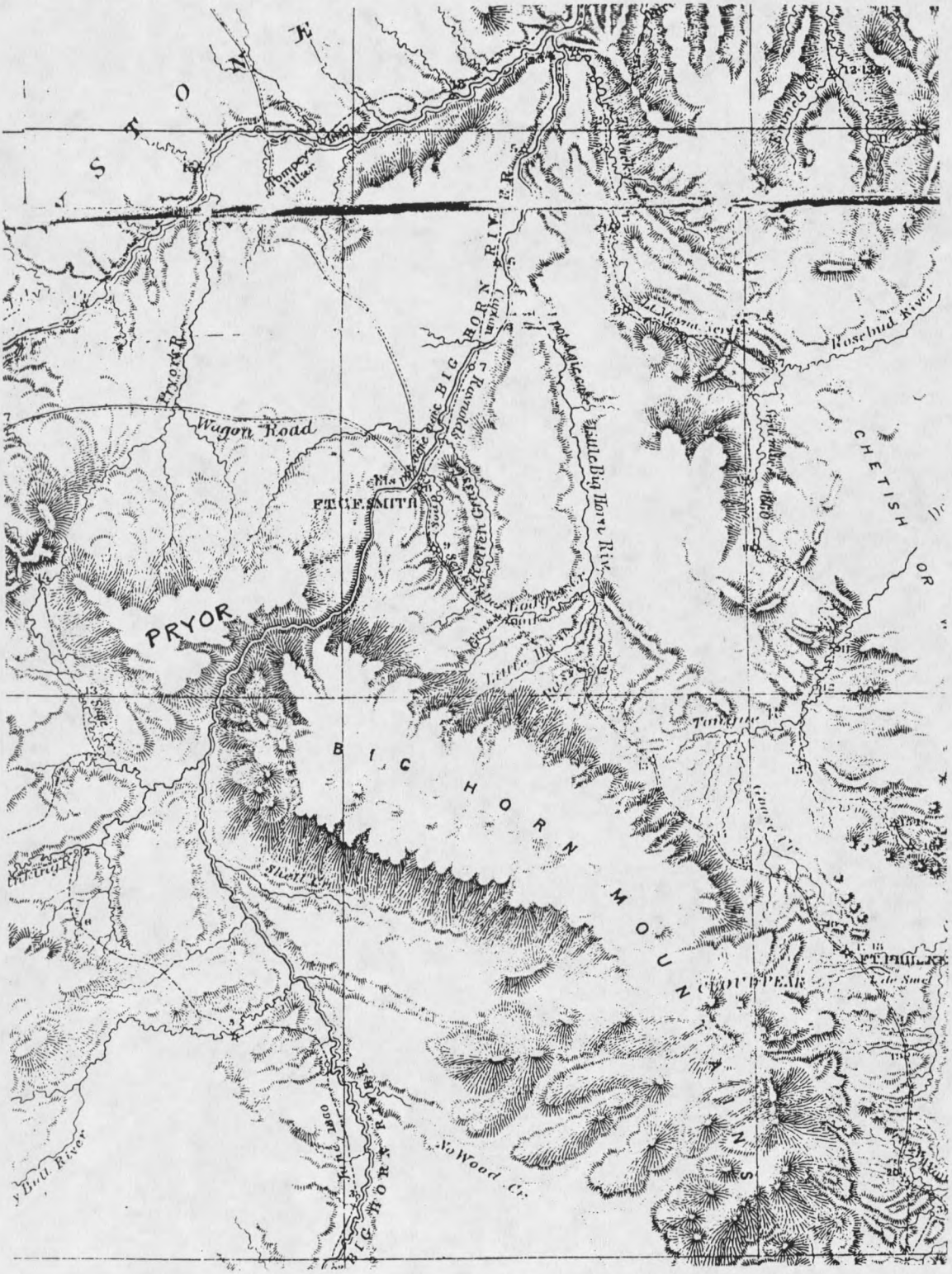

Figure 4. Brigadier Raynolds' Expedition Map of 1859 showing the Pryor Mountains and Big Horn River southwest of Fort Smith.

F. V. Hayden's plant specimens from that excursion were sent to St. Louis, to Dr. Englemann, a professional botanist whose private collection formed the nucleus of the Missouri Botanical Garden. The mosses and liver worts were identified by Professor Sullivan of Columbus, Ohio. The catalogue of plants and list of mosses and liverworts were not published in the Raynolds report to the Secretary of the War Department. Englemann did publish the 1853 plant list of collections of F. V. Hayden along the Yellowstone River as near to the Pryor Mountains as Fort Sarpy, now Hardin, Montana (Engelmann, 1862). Some listed species still in the study area are: *Nasturtium calycinum, Gaura coccinea, Oenothera caespitosa, Rhus trilobata* and *Psoralea esculenta.*

Frank Tweedy, a topographer with the United States Geological Survey, collected plants in 1881-1882 on the Crow Reservation and in 1886-1891 in Carbon County (Blankinship, 1905). J. W. Blankinship, Professor of Botany at the Montana Agricultural College, collected plants along the Big Horn River in 1890. Specimens of both Tweedy and Blankinship are in the Montana State University Herbarium (MONT).

W. E. Booth and J. C. Wright, both botanists at Montana State University, collected plants in the Pryors in the 1950's and 1960's, respectively, and deposited them in the herbarium, MONT (personal communication, J. H. Rumely). Robert Dorn, Wyoming botanist, first cited the Great Basin species in Carbon and Beaverhead Counties in Montana when he described notable

plants from the foothills and along the Bighorn Canyon (Dorn, 1978). Both Custer National Forest and the Bureau of Land Management have, over the years, monitored these special plants (South, 1980; Achuff and Lesica, 1992; Develice and Lesica, 1993).

Several more surveys were made from 1980 to 1994. Knight more thoroughly investigated the vegetation in the Bighorn Canyon and, with Lichvar and Collins, composed a checklist of vascular plants in 1983. Kratz analyzed the Great Basin vegetation for the Montana Heritage Program and named communities along a moisture gradient of 12-28 cm (Kratz, 1988). Develice, Achuff, Shelley and Lesica surveyed plants for the Bureau of Land Management from 1991 to 1993 (Lesica and Shelly, 1991; Achuff and Lesica, 1992; Develice and Lesica, 1993). Jennifer Lyman and Glenn Clifton, botanists, did surveys at Piney Creek and Arrow Ranch in 1992 and in 1994 (Clifton and Lyman, 1994).

THE FLORA OF THE PRYOR MOUNTAIN REGION

Paleofloras from Paleozoic to Cenozoic

Paleozoic floras of the western United States, compared with the eastern states, are rarely preserved. In the study region, the nearest Paleozoic representation of the flora is of Devonian Period (360 Ma) at Beartooth Butte in northwestern Wyoming. Plant remains consist of small axes of *Psylophyton wyomingensis* Dorf and suggest an estuarine environment (Dorf, 1934). During the Mesozoic Era (225-65 Ma), the gymnosperms were the dominant element as evidenced by *Araucarioxylon* and *Woodworthia* preserved as petrified logs, along with cycadeoids, ferns, and *Equisetum*, in the Petrified Forest National Park in east-central Arizona. In the Jurassic Morrison Formation in Utah and Montana, *Araucarioxylon, Osmundicaulis* and *Xenoxylon* (conifers and ferns)are also found (Tidwell, 1975).

By the Cretaceous Period, the angiosperms had appeared and were already competing for territory with the gymnosperms. Large palms, figs, poplar, and sassafras grew in warm, moist forests. They contrast sharply with the small-leaved sclerophyllous plants in the regions of these fossil localities today (Axelrod, 1950). Late Cretaceous (100 Ma) floras from the Medicine

Bow Formation in southcentral Wyoming contain species of *Metasequoia, Ficus, Cinnamomum* and *Magnolia* and indicate a warm-temperate to subtropical climate (Dorf, 1942). The floras mentioned are representative of the Pryor Mountain floras at the respective time periods.

Floras From Cenozoic To Present

An overview of the Cenozoic Era (65 Ma-present) shows that during the Eocene epoch (50 Ma) the world was undergoing a transformation from a climatic "greenhouse" mode in which the climate was warm, equitable and maritime, with narrow temperature gradients across latitudes and within oceans. The relatively low continents were flooded by the sea from time to time (McGowran, 1990).

From a floristic perspective, three major trends characterized this period from Eocene to Oligocene in the Rocky Mountains: (1) development of more distinct phytogeographic provinces from a homogenous Paleocene holarctic flora, (2) the early diversification in Eocene upland areas of temperate floras, and (3) the first appearance of many extant angiosperm genera and disappearance of many typically Cretaceous and Paleocene forms (Wing, 1985).

By the Cenozoic Era (65 Ma), many representations of paleofloras are evident and it is possible to construct a landscape with specific vegetation and

to infer the paleoclimate based on the physiognomy of those plants. Leaves with entire margins decreased from 85% to 10% from Eocene (50 Ma) to Pliocene (7 Ma) in North America, suggesting a reduction of temperature. Fluctuations during the Tertiary were calculated by this measure and are considered to have been correlated with changes in the earth's rotational axis (Wolfe, 1978). Eocene assemblages from central and northern Wyoming represent tropical conditions (MacGinitie, 1969).

Wood anatomy also indicates tropical versus temperate environment. Primitive scalariform perforation plates and diffuse porous rings reflect the former, and simple perforation plates and grouped porous rings mirror the latter. Seasonality required larger and smaller conducting vessels which enhanced tenfold the transport of fluids (Wheeler and Baas, 1991). By late Eocene, seasonal features were evident in subtropical and temperate species. Clustered vessels, ring porosity, and helical thickening are seen in Gallatin Fossil Forest specimens of *Alnus latissima* and *Carpnius saximontana* (Wheeler, 1977).

During the Tertiary Period and extending into the Quarternary (2.5 Ma-present), the climatic history of the Rocky Mountains was dominated by cooling mid-Tertiary and Quarternary, drying from Miocene (26 Ma) into Pleistocene (2.5 Ma) due to increasing elevation of Cascades and Sierra Nevada, and Pleistocene fluctuations between glacio-pluvial and warm-dry ages (Antevs,

1952). With these climatic trends, the vegetation of the Tertiary was marked by extensive migrations of plant groups, rapid evolution in situ, and massive extinctions in response to these climatic changes. In this "icehouse" state, temperature gradients were steeper, climate was continental with stronger seasonality, and oceanic circulation was more vigorous. The poles had icecaps and sea level was lower, so that the extent of epicontinental seas was restricted (McGowran, 1990).

Paleocene (60 Ma) formations were deposited in basins between the mountains as the Laramide Orogeny uplifted the new Rocky Mountains. The Paleocene Fort Union Formation, exposed in the Big Horn Basin, extends through Montana, Wyoming, and the Dakotas. It contains both extensive coalbeds and a diversified flora in which were described 170 recognizable fossils of algae, fungi, ferns, cycads, conifers, and ginkgos (Brown, 1962). The angiosperms alone include palms, willows, magnolias, witchazel, sweetgum, maples, and even breadfruit (*Arctocarpus*). This Fort Union assemblage was a lowland flora of rolling hills, deposited by braided streams onto a floodplain. Two different ecological habitats are suggested by the warm tropical climate plants intermingled with the temperate ones. The large leaves with toothed margins, indicative of adaptation to a temperate climate, outnumbered the entire margined ones, ten to one. The ferns, figs, breadfruit and palms were interpreted as relics of a warm tropical flora. While palms have been found as

far north as the Yellowstone River in Montana, this flora was generally considered mesophytic in a warm temperate environment with a medium amount of precipitation distributed throughout the year (Brown, 1962) Eocene fossils in the Green River Formation of Wyoming and Colorado include woodland types of *Celtis, Pinus, Platanus,* and *Rhus* and subtropic scrubs of *Cassia, Mimosites,* and *Passiflora* (Brown, 1962). It has been interpreted that altitudinal effects are evidenced by cooler valleys accommodating montane conifer forests of *Picea, Pinus, Larix*, and *Tsuga*.

Oligocene Ruby floras in southwestern Montana show a xeric coniferous-deciduous association without subtropical elements, suggesting a cooling trend (Becker, 1961). These contain specimens of *Abies, Acer, Cercocarpus, Mahonia, Ribes,* and *Rosa.* The Late Oligocene Florissant Lakebeds in central Colorado contained 87 genera from 3 areas: coriaceous-leaved oaks and chaparral from dry foothills, a lakeshore group including *Pinus, Pseudotsuga, Populus, Ribes, Rhus, Salix, Sequoia*, and broadleaved trees of *Ulmus* and *Tilia* from wet valley margins, and conifers from higher peaks. These suggested a warm temperate and xeric environment (MacGinitie, 1953). The Florissant pollen showed xeric genera of *Elaeagnus* and *Sarcobatus* (Leopold, 1965).

The Columbia Plateau assemblages provide evidence that the northern Rocky Mountain region was probably occupied primarily by coniferous forests

during the Oligocene (Wolfe, 1987). Miocene (25 Ma) floras were less rich than Oligocene floras, and observable is the absence of the Eastern and Asian like broad leaved genera. With progressive loss of moisture, *Artemisia* and associated Asteraceae pollen began to predominate the Upper Miocene of the northern Great Basin (Gray, 1964). The Gramineae and Chenopodiaceae became common as did extant genera such as *Sphaeralcea*, in the Malvaceae family. By the end of the Miocene, moisture had decreased in eastern Oregon and the Great Basin as a result of the rising of the Cascades and northern Sierra Nevada (Wolfe, 1978). The cooler and dryer climate was evidenced by the smaller leaf size and sclerophyllous nature of many species (Axelrod and Raven, 1985). In spite of the profound effects of elevation, precipitation, and temperature changes on the flora, the temperature only ranged about 15 degrees centigrade and the altitude about 3000 meters in North America throughout the Cenozoic Era (Wolfe, 1978).

Floras from the Pliocene contain species which indicate a close relationship to those presently growing in western north America. The Pliocene flora is essentially modern and includes such genera as *Acer, Populus, Prunus, Salix, Cercocarpus* and *Mahonia* (Chaney, 1959).

Palynological evidence indicates that *Juniperus osteosperma*, found at the very northern edge of its range in the Pryors, was already differentiated during the Pliocene (Vasek, 1966). With the rising Sierra Nevada and Cascade

Ranges, dryer climate, and decreased seasonal rain, a flora characteristic of seasonally cool, xeric climates invaded. The grassland, sage, and semidesert taxa proliferated; thus we see diverse genera of *Aster, Astragalus, Cryptantha, Eriogonum, Haplopappus, Penstemon* and *Senecio*, as well as *Gilia* in the Pliocene (Axelrod and Ting, 1960).

Present Day Flora

The present day flora of the Pryor Mountain area can best be described in the context of its plant communities. In various studies in the Pryor Mountains, South (1980) listed 12 Pryor Mountain Ecosystems, Kratz (1988) described 4 plant community types in the south Pryors, and Develice and Lesica (1993) cited 33 vegetation types on BLM land. We use four general vegetation zones for the purpose of describing the general ecological amplitude of each species in the Pryor region. These closely follow Habeck (1987) and have been modified to fit the desert on the south side of the Pryor Mountains. Dominant species are listed for each vegetational zone.

The four vegetational zones in this study are: (1) riparian, (2) desert/barren, (3) sagebrush/grassland, and (4) montane forest/subalpine meadow. They are described below:

(1) Riparian - any place with streams or ponds and includes elevations from 1230-2500 meters. Common dominant species are: Betula

occidentalis, Populus deltoides, Populus angustifolium, Salix exigua, Cornus sericea, Acer glabrum, Clematis linguisticifolia, Rosa woodsii, Ribes cetosum, Hordeum jubatum, Glyceria grandis, Elymus canadensis, Epilobium ciliatum and *Mertensia ciliata.*

(2) Desert/Barren - this zone is characterized by low productivity due to aridity and soils of shale, clay, and bentonitic material with saline or alkaline substrate. Elevation ranges from 1200-1600 meters, and in the Pryors this zone is confined to the southern and western sides. Characteristic species are *Atriplex confertifolia, A. canescens, A. nuttallii, A. spinosa, Sarcobatus vermiculatus, Artemisia spinescens, A. pedatifida, Chrysothamnis nauseosus, Agropyron spicatum, A. smithii, Oryzopsis hymenoides, Poa juncifolia, Platyschukuhria integrifolia, Allium textile, Opuntia polyacantha, Musineon divaricatum, Eriogonum brevecaule, Halogeton glomeratus* and *Juniperus osteosperma.*

(3) The Sagebrush/Grassland (1500-1900 meters) has more sandy and rocky soils and is often calcareous. Characteristic species include *Juniperus osteosperma, Cercocarpus ledifolius, Artemisia tridentata, A. nova, Symphoricarpos oreophylos, Bouteloua gracilis, Agropyron spicatum, Aristida purpurea, Koleria cristata, Carex rossii, Gutierrezia sarothrae, Krascheninnikovia lanata, Petrophytum caespitosum, Opuntia polyacantha, Hymenoxys acaulis* and *Phlox hoodii.*

(4) The Montane Forest/Subalpine Meadow (1800-2600 meters) is dominated by mostly conifers. Grasses and forbs are also present, the forbs often in cushion habit in the subalpine meadow. Dominants include: *Pseudotsuga menziesii, Abies lasiocarpa, Picea engelmanii, Pinus flexilis, Artemisia tridentata, Poa alpinum, Phleum alpinum, Carex rossii, Agropyron spicatum, Vulpia kingii, Arnica cordifolia, Lupinus sericeus, Vaccinium scoparium, Castilleja pulchellum, Gentiana affinis, Erigeron caespitosus, Phlox caespitosus* and *Solidago radiata.*

Relationship of Pryor Mountain Flora to Other Floristic Provinces

Ten floristic groups and ten floristic provinces have been identified in the United States (Gleason and Cronquist, 1964). The flora of each province is a floristic group and the land surface refers to the province. These were later revised into 13 floristic provinces and 9 subprovinces in North America (Cronquist, 1982). The Pryor Mountains occur at the western edge of the Prairies Province, the eastern margin of the Rocky Mountain Province, and the northeastern periphery of the Great Basin Province. Thus we might expect to find a blend of floristic elements from all three provinces.

Plants typical of the Prairies Province occur in the northeast section of the Pryors at the Big Horn River, where the rainfall at Fort Smith is 48 cm per year. These include: *Amorpha canescens, Calylophus serrulatus, Andropogon*

gerardii, Bouteloua curtipendula, Echinacea pallida var. *angustifolia, Liatris punctata, Dalea purpurea, Andropogon scoparius, Celtis occidentalis, Tradescantia bracteata, Tradescantia occidentalis, Triodanis leptocarpa, Triodanis perfoliata* and *Smilax herbacea* (Lichvar et al., 1985). Where the Wyoming Basin and Great Plains meet, there exist sod-forming grasslands mixed with rhizomatous wheatgrasses and dominated by *Bouteloua gracilis* and *Agropyron smithii* intermixed with *Artemisia tridentata* and other sagebrush species. These communities are the product of continental climate with growth moisture arriving in early summer rainfall (Habeck, 1987).

The Rocky Mountain elements occur at higher elevations in the Pryors, often on the north and northeast sides where it is relatively moist and cool. Characteristic taxa include: *Abies lasiocarpa, Picea engelmannii, Pseudotsuga menziesii, Pinus ponderosa, Mahonia repens, Arnica cordifolia, and Calypso bulbosa* as well as various species of *Lupinus, Erigeron, Eritrichium, Claytonia, Potentilla, Draba, Lesquerella, Gentiana* and *Saxifraga.*

The Great Basin species are best represented in the Pryor Mountains at the arid south side where the rainfall is about 17 cm per year as recorded in Lovell, Wyoming (Knight et al., 1987). Plants characteristic of this more southern desert flora are: *Artemisia tridentata, Artemisia spinosa, Atriplex confertifolia, Cercocarpus ledifolius, Tetradymia spinosa, Sarcobatus vermiculatus, Agropyron spicatum,* and *Juniperus osteosperma.*

METHODS/RESULTS

Floristic Survey

A floristic survey of the Pryor Mountains was conducted between March 28 and August 20, 1994, and April 28 and August 10 of 1995. The area was systematically sampled to include the complete range of habitats and geography. Sample plots were visited repeatedly during the two consecutive field seasons. Every effort was made to equally distribute collecting in the four general vegetational zones: riparian, desert, sagebrush/grasslands, and montane forest/subalpine meadow. At each location, voucher specimens of all fruiting and flowering specimens were collected. Habitat information such as elevation, substrate, and associated species were also recorded for each specimen.

The specimens were identified at the MSU herbarium during the academic years of 1993, 1994, and 1995, using floras of Dorn (1984, 1992), Hitchcock and Cronquist (1961, 1964, 1973), Hitchcock et al. (1959, 1969), Cronquist (1955, 1989), Rollins (1993), and Barneby (1964). A collection of 845 plant specimens was deposited into the holdings of the Montana State University Herbarium (MONT). Also deposited were 158 specimens of Tom

Jacobsen, who began this project. Collection identifications were verified with herbarium specimens. Confirmation of many specimens was by Dr. J. H. Rumely. Dr. Carl Wambolt verified the *Artemisia* specimens and Don Heinze, the *Salix* specimens.

Following specimen identification, an annotated checklist as compiled (Appendix A). Duplicate species were eliminated, which left 511 McCarthy and 35 Jacobsen specimens. Floristic publications were then searched for additional taxa listed for the Pryor region. These include: Dorn (1978) south Pryor foothills, 9 species; South (1980) northside Custer Forest Service, 42 species; Lichvar et al. (1985) from the Big Horn National Recreation Area, 259 species; Kratz (1988) southwestern section, 2 species; Lesica and Shelly (1991) southside BLM land, 32 species; Achuff and Lesica (1992) southside BLM land, 1 species; Chadde et al. (1992) northside CFS, 22 species; Lyman (1992) Arrow Ranch on Sage Creek, northside, 12 species, Develice and Lesica (1993), BLM land, 18 species; Clifton and Lyman, Piney Creek area, southwest area, 19 species; Clifton (1994), entire Pryors, 15 species; and Thompson (1994), southside, 4 species. These additional species are integrated into the single checklist for the Pryor Mountain region (Appendix A).

Effort was made to update species names to their current nomenclature (example: *Eriogonum chrysocephalum* = *E. brevecaule*). Vegetation zones of collections were carefully determined by specimen label information, as in the

case of Lichvar et al. from the Bighorn Canyon National Recreation Area herbarium in Lovell, WY. Ron Hartman and E. Nelson at the University of Wyoming Herbarium (phone communication) provided answers to many questions concerning the herbarium vouchers from the Lichvar et al. study. In the Dorn, Achuff, and Kratz lists, descriptions in the accompanying text revealed the vegetation zone. Lyman, Clifton, and Thompson supplied specific site information (personal communication). The Custer National Forest Service, Bureau of Land Management and Montana Natural Heritage reports were searched for site descriptions to designate vegetational zones. A few were judiciously assigned based on known habitats in other areas of Wyoming and Montana (Dorn 1984, 1992).

The final annotated checklist of the Pryor Mountain plants documents 75 families and a total of 981 taxa (Appendix A).

Comparative Floras

The flora of the Pryor Mountain region was compared with 11 regional floras chosen from available theses of floristic surveys of western North America (Figure 5; Culver, 1994). The original compilation of this large list was done by Denise Culver in 1994 as a masters degree student in Biology at Montana State University. The floras are drawn from 7 states and from areas ranging in size from 341 square kilometers to 34,000 square kilometers. The

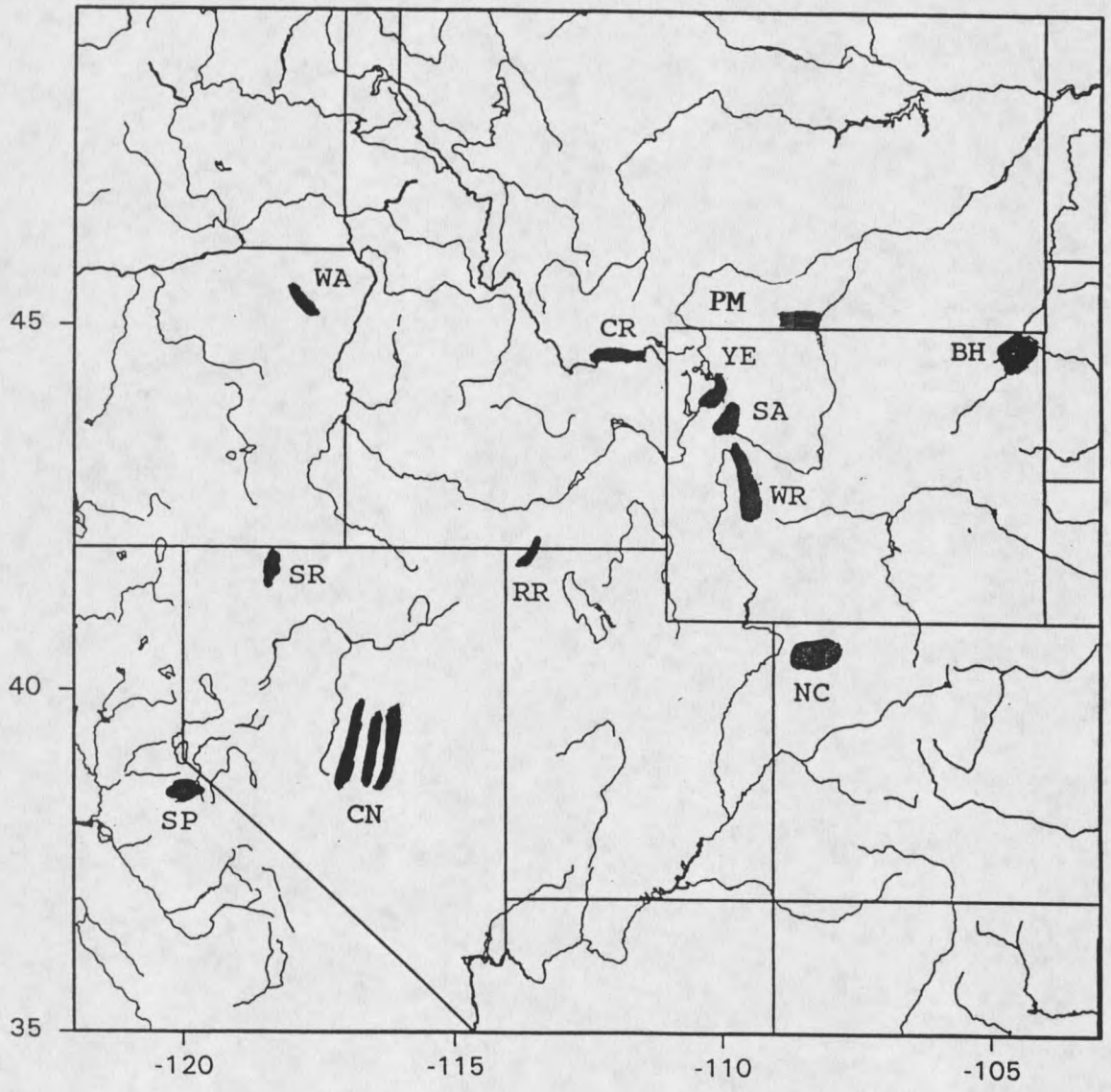

Figure 5. Locations of the selected floristic surveys of western North America. (After Culver, 1994)

floras from the floristic regions and provinces of North America according to Cronquist (1982) are shown in Table 1.

Table 1. Regions and provinces of North America selected for comparative floristic surveys.

Province	Region
North American Prairies	Northwest Black Hills, WY
Vancouverian	Sonora Pass, CA Wallowa Mountains, OR
Rocky Mountain	Centennial Region, MT Yellowstone Headwaters, WY Western Wind River Range, WY Southeastern Absarokas, WY Flat Tops and White River Plateau, CO
Great Basin	Raft River Range, UT Toiyabe, Toquima, and Monitor Ranges, NV Santa Rosa Range, NV

A total of 3276 native, exotic, terrestrial and aquatic species were recorded from the 12 western North American floras including the Pryor Mountain region. The authors of the floras, observed number of taxa, and area of the floras are given in Table 2.

Table 2. Data used in the statistical analysis.

Region	Abbv.	Reference	Observed # Species	Area (km^2)
Pryor Mountains, MT	PM	McCarthy et al., Appendix A	981	1,278
Centennial Region, MT	CR	Culver, 1994 Dorn, 1968 Lowry, 1979	766	1,347
Yellowstone, WY	YE	Snow, 1989	887	3,820
Southeast Absarokas, WY	SA	Kirkpatrick, 1987	902	4,351
Western Wind Rivers, WY	WR	Fertig, 1992	1029	4,403
Flat Tops and White River Plateau, CO	NC	Vanderhorst, 1993	882	6,475
NW Black Hills, WY	BH	Marriot, 1985	976	6,475
Raft River, UT	RR	Preece, 1950	318	341
Santa Rosa Range, NV	SR	Charlet, 1991	375	1,595
Toiyabe, Toquima & Monitor Ranges, NV	CN	Goodrich, 1981	1,064	34,000
Sonora Pass, CA	SP	Lavin, 1983	824	2,500
Wallowa Mountains, OR	WA	Mason, 1975 Abrams, 1950, 1953, 1955 Abrams & Ferris, 1960	907	714

Quantitative Analysis

Relationship of Floras

The degree of similarity between sites was determined by calculating the Jaccard's (1908) Index. Jaccard's Index is based on the shared presence (not absence) of species between two floras. A rectangular data matrix consisting of 3276 taxa as rows and 12 floras as columns was constructed to generate distance measures. Similarities between floras were clustered (Table 3). The distances obtained from similarity matrices were subjected to cluster analysis via the unweighted pair group method using arithmetic average (UPGMA) in the NT-SYS-pc program. Only one dendrogram was found from the cluster analysis and this had a cophenetic correlation coefficient of 0.94. A Mantel t test was performed and the resulting 5.015 + value of p = 1.000 strongly suggest that there is no significant difference between the matrix and the derived dendrogram distances. Using this cluster analysis, the Pryor Mountains are more similar to the Black Hills flora (37%) than any other flora compared. (Jaccard's similarity coefficient in Table 3; see also Figure 6).

Species Richness

Species richness (number of species/1000 km squared) of the Pryor Mountain region was compared to the other floras. The data were first standardized to an area of 1000 kilometers to compensate for the effect of

Table 3. Percent similarities between all possible pairs of the regions based on Jaccard's coefficient of similarity.

	CR	YE	BH	SA	NC	WR	WA	SP	CN	SR	RR	PM
CR	1.00											
YE	0.39	1.00										
BH	0.24	0.24	1.00									
SA	0.36	0.48	0.23	1.00								
NC	0.30	0.39	0.26	0.33	1.00							
WR	0.39	0.55	0.23	0.48	0.41	1.00						
WA	0.28	0.32	0.16	0.25	0.25	0.31	1.00					
SP	0.18	0.20	0.12	0.18	0.18	0.21	0.24	1.00				
CN	0.20	0.21	0.17	0.19	0.21	0.22	0.20	0.26	1.00			
SR	0.18	0.17	0.10	0.15	0.15	0.16	0.21	0.19	0.21	1.00		
RR	0.21	0.19	0.12	0.16	0.20	0.18	0.19	0.16	0.18	0.28	1.00	
PM	0.31	0.33	**0.37**	0.33	0.30	0.31	0.22	0.15	0.22	0.15	0.18	1.00

Abbreviations for the regions:
CR - Centennial Region, MT; YE - Yellowstone Headwaters, WY; BH - Black Hills, WY; SA - Southeastern Absarokas, WY; NC - Flat Tops and White River Plateau, WY; WR - Wind River Range, WY; WA - Wallowa Mountains, OR; SP - Sonora Pass, CA; CN - Toiyabe, Toquima & Monitor Ranges, NV; SR - Santa Rosa Range, NV; RR - Raft River Range, UT; PM - Pryor Mountains, MT.

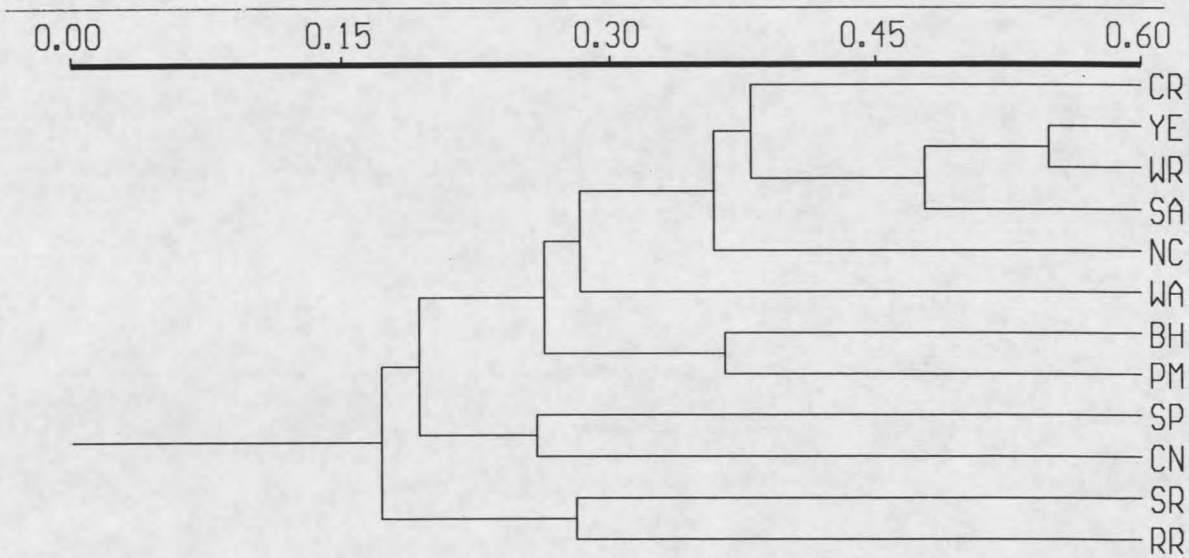

Figure 6. Floristic affinities of the Pryor Mountains based on pairwise comparisons (Jaccard, 1908) and cluster analysis.

Abbreviations for the regions: CR - Centennial Region, MT; YE - Yellowstone Headwaters, WY; BH - Black Hills, WY; SA - Southeastern Absarokas, WY; NC - Flat Tops and White River Plateau, WY; WR - Wind River Range, WY; WA - Wallowa Mountains, OR; SP - Sonora Pass, CA; CN - Toiyabe, Toquima & Monitor Ranges, NV; SR - Santa Rosa Range, NV; RR - Raft River Range, UT; PM - Pryor Mountains, MT.

different-sized areas (Whitaker, 1975): observed number of taxa divided by log area = adjusted number of taxa divided by the log (1000 kilometers squared). After modifying the effect of different-sized areas, the species-area richness of the Pryor Mountain region at 948, is higher than the mean of 716 (Table 4).

Table 4. Species richness relationship between number of observed and adjusted taxa (mean = 716).

Flora Abbv.	Observed # Species	Area (km^2)	# Species/ 1000 km2
PM	981	1,278	948
CR	766	1,347	734
YE	887	3,820	743
SA	902	4,351	744
WR	1029	4,403	847
NC	882	6,475	694
BH	976	6,475	768
RR	318	341	377
SR	375	1,595	351
CN	1,064	34,000	704
SP	824	2,500	728
WA	907	714	954

Abbreviations for the regions:
CR - Centennial Region, MT; YE - Yellowstone Headwaters, WY; BH - Black Hills, WY; SA - Southeastern Absarokas, WY; NC - Flat Tops and White River Plateau, WY; WR - Wind River Range, WY; WA - Wallowa Mountains, OR; SP - Sonora Pass, CA; CN - Toiyabe, Toquima & Monitor Ranges, NV; SR - Santa Rosa Range, NV; RR - Raft River Range, UT; PM - Pryor Mountains, MT.

PRYOR MOUNTAINS AS A NORTHERN REFUGE FOR SOUTHERN DESERT SPECIES

In spite of predominant Great Plains and Rocky Mountain influences, the Pryor Mountains have a small but distinct representation from southern floras. In fact, 5% (53 species) of the flora represent northernmost populations of otherwise more southern desert species. The Bighorn Basin was probably a migrational pathway between the Pryor Mountains and the Red Desert of southwest Wyoming (Achuff and Lesica, 1992). Dorn (1978) discussed "the Great Basin species" in the south foothills of the Pryor Mountains and along the Big Horn Canyon. He mentioned *Juniperus osteosperma*, *Artemisia nova* and *Atriplex* spp. as representing such species. Dorn also described an 1800 square km area bordering the Wyoming line as similar to the Centennial Valley in southwest Montana. The vegetation of the Centennial Valley and the Pryors is physiognomically similar and the areas may also be climatically similar. Numerous species of desert plants centered in the Great Basin reach the northern limit of their range in the Pryor region (Lichvar et al., 1985). Most of the sensitive plant taxa listed by the Bureau of Land Management share this pattern of distribution. Besides *Juniperus osteosperma*, these include *Astragalus geyeri, Astragalus grayi*, *Astragalus oreganus, Cryptantha scoparia,*

Eriogonum salsuginosum, Grayia spinosa, Leptodactylon caespitosum, Mentzelia pumila, and *Nama densum*.

Species with strong southern affinities are listed below. Chenopodiaceae contains six species that are centered in the Great Basin desert and which are in the Pryors: *Atriplex canescens, Atriplex confertifolia, Atriplex gardneri, Suaeda fruticosa, Suaeda torreyana,* and *Sarcobatus vermiculatus.* The Asteraceae southern desert species are represented in the Pryors by *Artemisia pedatifida, A. spinescens, Hymenoxys torreyana, Malacothrix torreyi, Platyschkuhria integrifolia, Sphaeromeria capitata, Townsendia incana, T. spathulata, Wyethia scabra* and *Xylorhiza glabriuscula.* In the Fabaceae, *Astragalus chamaeluce, A. grayi, A. geyeri* and *A. hyalinus* are of Great Basin origin and occur in the Pryor Mountains. The Polemoniaceae has southern desert representatives in the Pryors including *Gilia inconspicua* and *G. leptomeria.* Two representatives of the Boraginaceae from southern deserts occuring at their northern limits in the Pryors are *Cryptantha flavoculata* and *C. scoparia.* The Brassicaceae contains five species from southern deserts in the Pryors: *Malcomia africana (Asian origin), Physaria acutifolia, Stanleya tomentosa, S. pinnata* and *Streptanthella longirostis. Phacelia ivesiana, P. glandulosa* and *Nama densum* of the Hydrophyllaceae are of Great Basin origins and in the Pryors.

A migration route for Great Basin species from Nevada and Utah runs northeast through the southwestern desert of Wyoming, northward through the Bighorn Basin to the dry Pryor Mountain Desert. This pattern was first proposed for *Juniperus osteosperma,* collected 6 miles north of Warren, Montana, and described by Little in 1952 (Vasek, 1966) (Figure 7). Kratz (1988) also cites the occurrence of *Juniperus osteosperma* in Montana at the northern edge of its continental range and at the northern edge of the Pinyon-Juniper Zone.

While *Juniperus osteosperma* is commonly associated with *Pinus edulis* or *Pinus monophylla* in the Great Basin, it does form "pure stands at lower elevations and often extends into the Sagebrush Zone" (Cronquist et al., 1972). In the Pryor Mountain study area, *Juniperus osteosperma* occurs as scattered individuals at low elevations, dominates dense stands at mid-elevations and grades into mixed stands with *Pinus flexilis* and *Juniperus scopulorum* at higher, perhaps wetter, elevations. This Great Basin vegetation in the south Pryor Mountains was described as four community types occuring on a moisture gradient. The communities were determined by moisture availability from least (10 cm) to most (29 cm): *Atriplex gardneri/Artemisia spinescens, Artemisia pedatifida/Agropyron spicatum, Artemisia nova/Agropyron spicatum* and *Juniperus osteosperma/Artemisia nova* (Kratz, 1988).

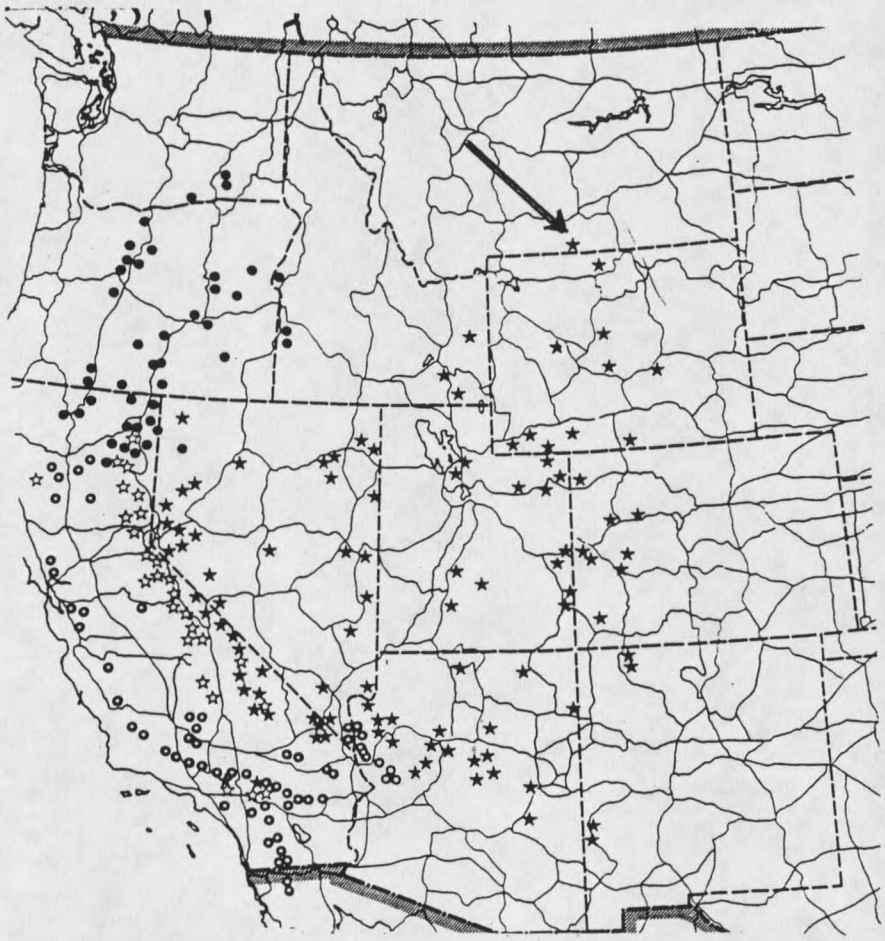

Figure 7. *Juniperus osteosperma* distribution (*) at northern limit in the Pryor Mountains.

Where moisture is a limiting factor, xerophytic plant communities possess fewer species than do the communities of mesophytic regions, but the number of communities per unit of area is likely to be larger than in regions of adequate moisture (Stebbins, 1952).

Twenty-three communities of Great Basin associated plants were identified on BLM Lands in the Pryor Mountains. Some of these vegetation types had not been reported from elsewhere and others are globally rare (Develice and Lesica, 1993).

Weber (1962) notes a similar pattern in the south Rockies where the desert flora penetrated far into the Rockies in western Colorado by way of warm river valleys, canyon walls, and arid plateaus. Here, characteristic genera are similar to those in the Pryors: *Astragalus, Atriplex, Cryptantha, Phacelia,* and *Gilia*. The flora of Idaho also had xerophytes extend northward from the arid and semi-arid intermountain trough of Utah and Nevada. These genera are: *Atriplex, Artemisia*, *Chrysothamnus, Grayia*, and *Gutierrezia* (Daubenmire, 1952).

Unusual substrates in the Pryors harbor species otherwise centered in the Great Basin. *Eriogonum brevecaule* grows on heavy clay soils, *Lesquerella* and *Astragalus spathulatus* on stony soils, *Leptodactylon caespitosum* thrives on gypsum, and *Eriogonum salsuginosum* on bentonitic clay (Reveal, 1979).

Xylorhiza, Machaeranthera, and *Stanleya* flourish in selenium rich soils (Weber, 1968). All are found in the Pryor Mountain study area.

In conclusion, the distribution pattern of the southern desert flora, represented by *Juniperus osteosperma,* ranges from the states of Nevada and Utah, up through southern Wyoming and the Bighorn Basin to the Pryor Mountains of southcentral Montana (Figure 7). *Sphaeromeria capitata* also illustrates this pattern with collections in the Escalente Range in Garfield County, Utah (Holmgren et al., 1976), southwest Wyoming, and southcentral Montana. This model is typical and represents 53 species or 5% of the Pryor Mountain flora. These 53 taxa are noted by an asterisk (*) in the checklist in Appendix A.

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APPENDICES

APPENDIX A

CHECKLIST OF VASCULAR PLANTS OF THE PRYOR MOUNTAINS

Table 5. Annotated checklist of vascular plants for the Pryor Mountains. References are M = McCarthy; J = Jacobsen; D = Dorn; S = South; LK = Lichvar, Collins, Knight; K = Kratz; CJ = Chadde, Johnson; LS = Lesica, Shelly; AL = Achuff, Lesica; DL = Develice, Lesica; L = Lyman, CL = Clifton, Lyman; C = Clifton; T = Thompson. Vegetation Zones: RI = Riparian; DT = Desert; SG = Sagebrush/Grassland; MF = Montane Forest/Subalpine Meadow.
* Southern desert species with northern limits in the Pryor Mountains.

Family	Genus	Species	REF	RI	DT	SG	MF
PTERIDOPHYTES							
Equisetaceae	*Equisetum*	*arvense* L.	M				X
	Equisetum	*hymenale* L.	LK	X			
	Equisetum	*laevigatum* A. Br.	CL	X			
	Equisetum	*variegatum* Schleich. ex Weber & Mohr	S	X			
Polypodiaceae	*Asplenium*	*trichomanes-racemosum* L.	M				X
	Cheilanthes	*feei* Moore	M			X	X
	Cryptogamma	*stelleri* (Gmel.) Prantl	M				X
	Cystopteris	*fragilis* (L.) Bernh.	M				X
	Pellaea	*breweri* Eaton	M				X
	Pellaea	*glabella* Mett ex Kulm	M				X
	Pellaea	*occidentalis* (E. Nels.) Rydb.	LK				X
	Polystichum	*lonchitis* (L.) Roth	LK				X
	Woodsia	*oregana* Eaton	M	X			X
	Woodsia	*scopulina* Eaton	LK			X	
Selaginaceae	*Selaginella*	*densa* Rydb.	LK				X
GYMNOSPERMS							
Cupressaceae	*Juniperus*	*communis* L.	M	X			
	Juniperus	*horizontalis* Moench.	M	X			
*	*Juniperus*	*osteosperma* (Torrey) Little	M		X	X	
	Juniperus	*scopulorum* Sarg.	M			X	

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Pinaceae	*Abies*	*lasiocarpa* (Hook.) Nutt.	M				X
	Picea	*engelmanii*	S				X
	Picea	*glauca* (Moench) Voss	M				X
	Pinus	*contorta*	S				X
	Pinus	*flexilis* James	M			X	X
	Pinus	*ponderosa* Dougl. ex Laws & Laws	M			X	
	Pseudotsuga	*menziesii* (Mirb.) Franco	M				X
ANGIOSPERMS							
Aceraceae	*Acer*	*glabrum* Torrey var. *glabrum*	M	X			X
	Acer	*negundo* L.	M				X
Agavaceae	*Yucca*	*glauca* Nutt.	M			X	
Amaranthaceae	*Amaranthus*	*blitoides* Wats.	LK	X			
Anacardiaceae	*Rhus*	*glabra* L.	LK	X			
	Rhus	*trilobata* Nutt.	M		X	X	
	Toxicodendron	*rydbergii* (Small ex Rydb.) Greene	LK			X	
Apiaceae	*Berula*	*erecta* (Huds.) Cov. var. *incisa* (Torr.) Cronq.	LK	X			
	Bupleurum	*americanum* Coult & Rose	M	X		X	X
	Conium	*maculatum* L.	LK	X			
	Cymopteris	*acaulis* Pursh (Raf.)	M		X	X	
	Cymopteris	*terebinthinis* (Hook.) T. & G.	J			X	
	Heracleum	*sphondylium* L. var. *lanatum* (Michx.) Dorn	M				X
	Lomatium	*cous* (Wets.) Coult. & Rose	M				X
	Lomatium	*dissectum* (Nutt.) Math & Corstr. var. *multifidum*	M	X			
	Lomatium	*foeniculaceum* (Nutt.) Coult & Rose	LK			X	
	Lomatium	*orientale* Coult & Rose	J			X	
	Lomatium	*triternatum* (Pursh) Coult & Rose ssp. *platycarpum* (Torr.) Cronq.	LK			X	

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Apiaceae	*Musineon*	*divaricatum* (Pursh.) Nutt. ex T. & G.	M		X		X
	Musineon	*vaginatum* Rydb.	M	X			X
	Osmorhiza	*chilensis* H. & A.	M	X			
	Osmorhiza	*depauperata* Phil.	LK				X
	Osmorhiza	*longistylis* (Torr.) DC	LK	X			
	Perideridia	*gairdneri* (H. & A.) Mathias	M			X	
	Sanicula	*merilandica* L.	LK			X	
	Shoshonea	*pulvinata* Evert & Cons.	CJ				X
Apocynaceae	*Apocynum*	*androsaemifolium* L.	LK	X			
Asclepiadaceae	*Asclepias*	*speciosa* Torrey	M	X			
	Asclepias	*viridiflora* Raf.	M		X		
Asteraceae	*Achillea*	*millefolium* L.	M	X			X
	Agoseris	*glauca* (Pursh.) Raf. var. *dasycephala* (Torrey & A. Gray) Jeps.	M				X
	Agoseris	*glauca* (Pursh.) Raf. var. *glauca*	M				X
	Ambrosia	*artemisifolia* L. var. *elatior* (L.) Desc.	LK			X	
	Ambrosia	*psilostacya* DC var. *coronopifolia* (T. & G.) Farw.	LK			X	
	Ambrosia	*trifida* L. var. *trifida*	LK			X	
	Anaphalis	*margaritacea* (L.) Bentham & Hooker	M				X
	Antennaria	*alpina* (L.) Gaerth var. *media*	M				X
	Antennaria	*dimorpha* (Nutt.) T. & G.	LS			X	
	Antennaria	*lanata* (Hook.) Greene	C				X
	Antennaria	*luzuloides* T. & G.	CJ				X
	Antennaria	*media* Greene	C				X
	Antennaria	*microphylla* Rydb.	M			X	X
	Antennaria	*parvifolia* Nutt.	LS			X	
	Antennaria	*racemosa* Hook.	M				X

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Asteraceae	*Antennaria*	*rosea* Greene ssp. *rosea*	CL			X	
	Antennaria	*umbrinella* Rydb.	M				X
	Arctium	*minus* (Hill) Bernh.	LK			X	
	Arnica	*cordifolia* Hook.	M				X
	Arnica	*fulgens* Pursh.	J				X
	Arnica	*latifolia* Bong.	M	X			X
	Arnica	*longifolia* Hook.	CJ				X
	Arnica	*mollis* Hook.	M				X
	Arnica	*rydbergii* Greene	M				X
	Arnica	*sororia* Greene	J				X
	Artemisia	*biennis* Willd.	LS			X	
	Artemisia	*campestris* L.	M			X	
	Artemisia	*campestris* L. ssp. *borealis* (Pall.) Hall & Clem. var. *scouleriana* (Bess.) Cronq.	LK	X			
	Artemisia	*cana* Pursh	M	X			
	Artemisia	*dracunculis* L.	LK	X			
	Artemisia	*frigida* Willd.	M			X	X
	Artemisia	*longifolia* Nutt.	LS			X	
	Artemisia	*ludoviciana* Nutt. var. *ludoviciana*	LK	X			
	Artemisia	*michauxiana* Bess.	M				X
	Artemisia	*norvegica* Fries.	S				X
*	*Artemisia*	*nova* A. Nels.	M			X	
*	*Artemisia*	*pedatifida* Nutt.	M		X		
*	*Artemisia*	*spinescens* Eaton	M		X		
	Artemisia	*tridentata* Nutt. var. *tridentata*	M		X		
	Artemisia	*tridentata* Nutt. var. *wyomingensis* (Beetle & Young) Welsh	M		X		

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Asteraceae	*Artemisia*	*tridentata* Nutt. var. *vaseyana*	M				X
	Aster	*alpigenus* (T. & G.) Gray	DL			X	
	Aster	*chilensis* Nees. ssp. *adsendens* (Lindl.) Cronq.	LK	X			
	Aster	*ciliolatus* Lindl.	LK	X			
	Aster	*conspicuus* Lindl.	DL				X
	Aster	*eatonii* (Gray) Howell	M	X			
	Aster	*falcatus* Lindl. var. *falcatus*	T		X		
	Aster	*foliaceus* Lindl. in DC var. *apricus* Gray	M				X
	Aster	*hesperius* Gray	LK	X			
	Aster	*laevis* L.	CJ				X
	Aster	*occidentalis* (Nutt.) T. & G.	M				X
	Aster	*perelegans* Nels. & Macbr.	CJ				X
	Aster	*scopulorum* Gray	S				X
	Balsamorhiza	*incana* Nutt.	M				X
	Balsamorhiza	*sagittata* (Pursh) Nutt.	M				X
	Bidens	*cernua* L.	LK	X			
	Brickellia	*grandiflora* (Hook.) Nutt. var. *grandiflora*	LK			X	
	Centaurea	*repens* L.	CL		X		
	Chaenactis	*alpina* (Greene) Cock. ex Stockw. var. *leucopsis*	M				X
	Chaenactis	*douglasii* (Hook.) H. & A.	M		X		X
	Chaenactis	*douglasii* (Hook.) H. & A. var. *achilleaefolia* (H. & A.) A. Nels.	M		X		
	Chrysanthemum	*leucanthemum* L.	LK	X			
	Chrysopsis	*villosa* (Pursh) Shinn.	S			X	
*	*Chrysothamnus*	*linefolius* Greene	T	X			
	Chrysothamnus	*nauseosus* (Pallas ex Pursh.) Britt	M		X	X	
*	*Chrysothamnus*	*viscidiflorus* (Hook.) Nutt.	M		X		

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Asteraceae	*Chrysothamnus*	*viscidifolius* var. *lanceolatus* (D.C. Eat.) Rydb.	LK		X		
	Cichorium	*intybus* L.	LK			X	
	Cirsium	*arvense* (L.) Scop.	M	X			
	Cirsium	*arvense* (L.) Scop. var. *arvense*	M				X
	Cirsium	*flodmanii* (Rydb.) Arthur	L	X			
	Cirsium	*hookerianum* Nutt.	DL			X	
	Cirsium	*polyphyllus*	S				X
	Cirsium	*scariosum* Nutt.	CJ				X
	Cirsium	*eatonii* Gray & Robbins	CJ				X
	Cirsium	*undulatum* (Nutt.) Spreng	LS		X		
	Cirsium	*vulgare* (Savi) Tenore	CL			X	
	Conyza	*canadensis* (L.) Cronq.	M				X
	Crepis	*acuminata* Nutt.	M		X	X	X
	Crepis	*atribarba* Heller	J				X
	Crepis	*intermedia* Gray	LK			X	
	Crepis	*modocensis* Greene ssp. *modocensis*	LK			X	
	Crepis	*occidentalis* Nutt.	J			X	
	Crepis	*runcinata* (James) T. & G.	LK				X
	Echinacea	*pallida* Nutt. var. *angustifolia* (DC) Cronq.	LK			X	
	Erigeron	*acris* L.	DL			X	
	Erigeron	*allocotus* Blake	M				X
	Erigeron	*caespitosus* Nutt.	M		X	X	X
	Erigeron	*compositus* Pursh. var. *glabratus*	M				X
	Erigeron	*corymbosus* Nutt.	LK	X			
	Erigeron	*divergens* T. & G.	DL			X	
	Erigeron	*eatonii* Gray	M			X	

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Asteraceae	*Erigeron*	*glabellus* Nutt. var. *glabellus*	LK	X			
	Erigeron	*ochroleucas* Nutt. var. *scribneri*	M			X	X
	Erigeron	*ochroleucus* Nutt.	M				X
	Erigeron	*ochroleucus* Nutt. var. *ochroleucus*	M				X
	Erigeron	*peregrinus* (Banks ex Pursh.) Greene	CJ				X
	Erigeron	*pumilus* var. *pumilus* Nutt.	M		X		X
	Erigeron	*radicatus* Hook.	M				X
	Erigeron	*rydbergii* Chronq.	M				X
	Erigeron	*simplex* Greene	S				X
	Erigeron	*speciosus* (Lindl.) B.C. var. *speciosus*	M				X
	Erigeron	*strigosus* Muhl. ex Willd.	LK	X			
	Erigeron	*subtrinervis* Rydb. ex Porter & Britt.	L			X	
	Erigeron	*ursinus* Eaton	M				X
	Gaillardia	*aristata* Pursh.	M	X			
	Grindelia	*squarrosa* (Pursh) var. *quasiperennis* Lunell	M		X		
	Gutierrezia	*sarothrae* (Pursh) Britt & Rusby	M				X
	Happlopappus	*acaulis* (Nutt.) Gray	J		X		
	Happlopappus	*armeroides* (Nutt.) Gray	M		X	X	X
	Happlopappus	*uniflorus* (Hook.) T. & G.	M				X
	Happlopappus	*lanunginosus* Gray	M				X
	Helianthella	*quinquenervis* (Hook.) Gray	LK				X
	Helianthus	*annuus* L.	LS		X		
	Helianthus	*nuttallii* T. & G.	LK			X	
	Helianthus	*petiolaris* Nutt.	M		X		
	Helianthus	*rigidus* (Cass.) Desf. var. *subrhomboideus* (Rydb.) Cronq.	LK			X	
	Heterotheca	*horrida* (Rydb.) Harms	M				X

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Asteraceae	*Hieracium*	*cynoglossoides* Arv. Touv.	LK			X	
	Hieracium	*albiflorum* Hook.	M	X			
	Hieracium	*canadense*	CJ				X
	Hymenopappus	*filifolius* Hook.	J			X	
	Hymenopappus	*filifolius* Hook. var luteus	D			X	
	Hymenopappus	*polycephalus* Osterh.	D			X	
	Hymenoxys	*acaulis* (Pursh.) Parker	M		X	X	X
*	*Hymenoxys*	*torreyana* (Nutt.) Parker	M			X	X
	Iva	*axillaris* Pursh	LK	X			
	Iva	*xanthifolia* Nutt.	LK	X			
	Lactuca	*ludoviciana* (Nutt.) Ridd.	LK	X			
	Lactuca	*oblongifolia* Nutt.	LK	X			
	Lactuca	*serriola* L.	M	X			
	Liatris	*punctata* Hook.	T			X	
	Logfia	*arvensis* (L.) Holub	LK			X	
	Lygodesmia	*juncea* (Pursh) D. Don	LK		X		
	Lygodesmia	*spinosa*	S			X	
	Machaeranthera	*canescens* (Pursh) Gray	DL			X	
	Machaeranthera	*grindeloides* (Nutt.) Shinners	M		X	X	
	Machaeranthera	*tanacetifolia* (H.B.K.)	M		X		
	Malocothrix	*sonchoides* (Nutt.) T. & G.	LK	X			
*	*Malocothrix*	*torreyi* Gray	D			X	
	Microseris	*nutans* (Hook.) Schultz-Bip.	LK				X
	Nothocalais	*cuspidata* (Pursh) Greene	LK			X	
	Nothocalais	*nigrescens* (Henderson) Heller	M				X
	Nothocalais	*troximoides* (Gray) Greene	M		X		

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Asteraceae	*Picrandeniopsis*	*oppositifolia* (Nutt.) Rydb. ex Britt.	LK			X	
	Platyschkuhria	*integrifoila* (Gray) Rydb. var. *oblongifolia*	C		X		
*	*Platyschkuhria*	*integrifolia* (Gray) Rydb.	M		X		
	Ratabida	*columnifera* (Nutt.) Woot. & Standl.	LK			X	
	Rudbeckia	*lancinata* L. var. *ampla* (A. Nels.) Cronq.	LK			X	
	Senecio	*canus* Hook.	M		X	X	
	Senecio	*crassulus* Gray	LS			X	
	Senecio	*cymbalarioides* Buek	S				X
	Senecio	*dimorphophyllus* Greene var. *dimorphophyllus*	J				X
	Senecio	*eremophilius* Richards	LK	X			
	Senecio	*hydrophylis* Nutt.	M	X			
	Senecio	*integerrimus* Nutt. var. *exaltatus* (Nutt.)Cronq.	J			X	
	Senecio	*pauciflorus* Pursh.	M				X
	Senecio	*pauperculus* Michx	M	X			
	Senecio	*plattensis* Nutt.	M			X	
	Senecio	*pseudaureus* Rydb.	CJ				X
	Senecio	*serra* Hook.	LK	X			
	Senecio	*sphaerocephalis* Greene	M				X
	Senecio	*streptanthifolius* Greene var. *streptanthifolius*	M				X
	Solidago	*canadensis* L. var. *salebrosa* (Piper) Jones	LK	X			
	Solidago	*gigantea* Ait. var. *serotina* (Kuntze) Cronq.	LK	X			
	Solidago	*missouriensis* Nutt. var. *missouriensis*	M		X		X
	Solidago	*mollis* Bartl.	S			X	
	Solidago	*multiradiata* Ait.	DL				X
	Solidago	*rigida* L. var. *humilis* Porter	LK	X			
	Solidago	*sparsiflora* Gray	DL				X

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Asteraceae	*Solidago*	*spathulata* DC var. *nana* (Gray) Cronq.	LK				X
	Sonchus	*asper* (L.) Hill	LK	X			
	Sonchus	*oleraceous* L.	LK	X			
	Sonchus	*ulginosus* Bieb.	LK	X			
*	*Sphaeromeria*	*capitata* Nutt.	J			X	X
	Stephanomeria	*runcinata* Nutt.	M		X		
	Stephanomeria	*tenuifolia* (Raf.) Hall	CJ				X
	Taraxacum	*laevigatum* (Willd.) DC	S			X	
	Taraxacum	*officionale* Weber	CJ				X
	Tetradymia	*canescens* DC	LK		X		
*	*Tetradymia*	*spinosa* H. & A.	M		X		
	Thelesperma	*subnudum* Rydb.	LS			X	
	Townsendia	*hookeri* Beaman	J			X	
*	*Townsendia*	*incana* Nutt.	M		X	X	
	Townsendia	*parryi* Eaton	M			X	X
	Townsendia	*spathulata* Nutt.	M		X		
	Tragopogon	*dubius* Scop.	M		X		
*	*Wyethia*	*scabra* Hook.	M		X		
	Xanthium	*strumarium* L.	LK	X			
*	*Xylorhiza*	*glabriuscula* Nutt.	M		X	X	
Berberidaceae	*Mahonia*	*repens* (Lindl.) G. Don	M	X			
Betulaceae	*Alnus*	*incana* (L.) Moench	S	X			
	Betula	*occidentalis* Hook., var. *occidentalis*	M	X			
Boraginaceae	*Asperugo*	*procumbens* L.	LK	X			
	Cryptantha	*ambigua* (Gray) Greene	M			X	
	Cryptantha	*bradburia*	S			X	

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Boraginaceae	*Cryptantha*	*cana* (A. Nels) Payson	M		X	X	
	Cryptantha	*celosiodes* (Eastw.) Payson	M	X	X	X	
*	*Cryptantha*	*flavoculata* (A. Nels.) Payson	M			X	
	Cryptantha	*kelseyana* Greene	M		X		
	Cryptantha	*minima* Rydb.	M			X	
*	*Cryptantha*	*scoparia* A. Nels.	LS		X		
	Cryptantha	*spiculifera* (Piper) Payson	M		X		
	Cryptantha	*torreyana* (Gray) Greene	LS		X		
	Cryptantha	*watsonii* (Gray) Greene	LS		X		
	Cynoglossum	*officinale* L.	M	X			
	Eritrichium	*howardii* (Gray) Rydb.	M				X
	Eritrichium	*nanum* (Vill.) Schrad. ex Gaudin	M				X
	Hackelia	*deflexa* (Wahlenb.) Opiz	M	X			
	Hackelia	*floribunda* (Lehm.) I.M. Johnst.	LK			X	
	Lappula	*myosotis* Wolf	LS		X		
	Lappula	*redowskii* (Hornem.) Greene	M		X		
	Lappula	*redowskii* (Hornem.) Greene var. *cupulata*	C			X	
	Lithospermum	*incisum* Lehm.	M			X	
	Lithospermum	*ruderale* (Doug.) ex Lehm.	M				X
	Mertensia	*ciliata* (James ex Torrey) G. Don.	M	X			
	Mertensia	*oblongifolia* (Nutt.) G. Don	M				X
	Mertensia	*viridis* (A. Nels.) A. Nels.	LK			X	
	Myosotis	*alpestris* Schmidt	M				X
	Onosmodium	*molle* Michx. var. *molle*	LK			X	
	Onosmodium	*molle* Michx. var. *occidentale* (Mack) I.M. Johnst.	LK			X	
	Tiquilia	*nuttallii* Hook. Richardson	LK		X		

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Brassicaceae	*Allysum*	*allysiodes* (L.) L.	LK			X	
	Alyssum	*desertorum* Staph	M			X	
	Arabis	*demissa* Greene var. *languida* Roll.	LK			X	
	Arabis	*drummondii* Gray	M				X
	Arabis	*glabra* (L.) Bernh.	J				X
	Arabis	*hirsuta* (L.) Scop.	LK			X	
	Arabis	*holboellii* Hornem. var. *holboellii*	M			X	
	Arabis	*holboellii* Hornem. var. *retrofractra*	J			X	
	Arabis	*holboellii* Hornem. var. *pendulocarpa* (A. Nels.) Roll.	LK			X	
	Arabis	*holboellii* Hornem. var. *pinetorum* (Tidestr.) Rollins	C				X
	Arabis	*lignifera* A. Nelson	M				X
	Arabis	*microphylla* Nutt.	J		X		
	Arabis	*microphylla* Nutt. var. *saximontana* Rollins	M				X
	Arabis	*nuttallii* Robinson	M				X
	Arabis	*sparsiflora* Nutt. var. *columbiana*	M			X	
	Barbarea	*orthoceras* Ledeb.	M	X			
	Camelina	*microcarpa* Andrz. ex D.C.	M		X		
	Capsella	*bursa-pastoris* (L.) Medic. var. *bursa-pastoris*	LK	X			
	Cardaria	*chalapensis* (L.) Hand.-Mazz.	LK	X			
	Cardaria	*pubescens* (C.A. Mey.) Jarmol.	LK	X			
	Chorispora	*tenella* (Pall.) DC	LK	X			
	Conringia	*orientalis* (L.) Dumort	M		X		
	Descurainia	*pinnata* (Rydb.) Hitch. var. *intermedia*	M			X	
	Descurainia	*pinnata* (Walt.) var. *nelsonii* (Rydb.) Peck	M		X		
	Descurainia	*pinnata* (Walt.) Britt. var. *halictorum*	LK		X		
	Descurania	*richardsonii* (Sweet) Schultz var. *viscosa*	M		X		

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Brassicaceae	*Descurania*	*sophia* (L.) Webb ex Prantl	M	X	X		
	Draba	*cana* Rydb.	M				X
	Draba	*crassifolia* Grah.	M				X
	Draba	*incerta* Payson	S				X
	Draba	*nemorsa* L.	M				X
	Draba	*oligosperma* var. *oligosperma* Hook.	M				X
	Draba	*praealta* Greene	LK				X
	Draba	*reptans* (Lam.) Fern var. *reptans*	M			X	
	Draba	*reptans* (Lam.) Fern.	M		X		
	Erysimum	*asperum* (Nutt.) D.C.	M			X	X
	Erysimum	*cheiranthoides* L.	M			X	
	Erysimum	*inconspicuum* (Wats.) MacM	M				X
	Hesperis	*matronalis* L.	M			X	
	Lepidium	*densiflorum* Schrad. var. *densiflorum*	M	X		X	
	Lepidium	*perfoliatum* L.	M		X	X	
	Lepidium	*virginicum* L. var. *pubescens* (Greene)	J			X	
	Lesquerella	*alpina* (Nutt.) Wats.	M			X	X
	Lesquerella	*lesicii* Rollins	M			X	
	Lesquerella	*ludoviciana* (Nutt.) Wats.	M		X		X
*	*Malcomia*	*africana* (L.) R. Br.	M		X		
	Nasturtium	*officionale* R. Br.	M	X			
*	*Physaria*	*acutifolia* Rydb.	M		X		
	Physaria	*didymocarpa* (Hook.) Gray	M		X		
	Rorippa	*calycina* (Engelm.) Rydb.	LK	X			
	Rorippa	*curvipes* Greene	LK	X			
	Rorippa	*sinuata* (Nutt.) Hitchc.	M	X			

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Brassicaceae	*Schoencrambe*	*linefolia* (Nutt.) Greene	M		X		
	Sisimbrium	*loeselii* L.	M			X	
	Sisymbrium	*altissimum* L.	LK			X	
	Sisymbrium	*linefolium* (Nutt.) Nutt. ex T. & G.	LK			X	
	Smelowskia	*calycina* (Steph. ex Willd.) C. A. Mey var. *americana* (Regel & Herd.) Drury & Roll.	LK				X
*	*Stanleya*	*pinnata* (Pursh) Britt	M	X			
	Stanleya	*tomentosa* Parry	M			X	
*	*Streptanthella*	*longirostis* (Wats.) Rydbg.	M		X		
	Thlaspi	*arvense* L.	M	X			
Cactaceae	*Coryphanta*	*missouriensis* (Sweet) Britt & Rose	J			X	
	Opuntia	*polyacantha* Haw.	M		X		
*	*Pediocactus*	*simpsonii* (Engelm.) Britt. & Rose var. *simpsonii*	LK			X	
Campanulaceae	*Campanula*	*rotundifolia* L.	M	X		X	X
	Triodanis	*leptocarpa* (Nutt.) Niewl.	LK			X	
	Triodanis	*perfoliata* (L.) Niewl. var. *perfoliata*	LK			X	
Cannabaceae	*Humulis*	*lupulus* L. var. *neomexicana* Nels. & Ckll.	LK	X			
Cappparaceae	*Cleome*	*lutea* Hook.	M		X		
	Cleome	*serrulata* Pursh	LK	X			
	Polanisia	*dodecandra* (L.) DC ssp. *trachysperma* (T. & G.) Iltis	LK				X
Caprifoliaceae	*Sambucus*	*canadensis* L. var. *canadensis*	LK	X			
	Sambucus	*cerulea* Raf. var. *cerulea*	LK			X	
	Symphoricarpos	*oreophilus* Gray	M			X	X
	Symphoricarpus	*albus* L. Blake	M	X			
	Symphoricarpus	*occidentalis* Hook.	M	X			

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Caryophyllaceae	*Arenaria*	*congesta* Nutt. var. *congesta*	M				X
	Arenaria	*hookeri* Nutt.	M		X	X	
	Arenaria	*laterifolia* L.	M	X			X
	Arenaria	*nuttallii* Pax	M			X	
	Arenaria	*obtusiloba* (Rydb.) Fern	M				X
	Arenaria	*rubella* (Walenb.) Smith	M			X	X
	Cerastium	*arvense* L.	M			X	X
	Cerastium	*berringianum* Cham. & Schlecht.	S				X
	Cerastium	*nutans* Raf. var. *nutans*	LK			X	
	Lychnis	*alba* Miller	M		X		
	Paronychia	*sessiliflora* Nutt.	M		X	X	
	Silene	*antirrhina* L.	DL				X
	Silene	*cserei* Baumg.	L				X
	Silene	*menziesii* Hook.	M	X			
	Stellaria	*longifolia* Muhl. ex Willd.	M				X
	Stellaria	*media* (L.) Vill.	LK	X			
	Vaccaria	*pyramidata* Medic.	M				X
Chenopodiaceae	*Atriplex*	*argentea* Nutt.	M		X		
*	*Atriplex*	*canescens* (Pursh.) Nutt.	M		X		
*	*Atriplex*	*confertifolia* (Torrey & Frem.) Wats.	M		X		
*	*Atriplex*	*gardneri* (Moq.) Dietr	M	X	X		
	Atriplex	*herterosperma* Bunge	LK	X			
	Atriplex	*patula* L.	S		X		
	Atriplex	*rosea* L.	LK	X			
	Atriplex	*sucleyi* (Torrey) Rydb.	M		X		

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Chenopodiaceae	*Chenopodium*	*album* L.	LS		X		
	Chenopodium	*berlandieri* Moq. var. *zschackei* (J. Murr.) J. Murr.	LK			X	
	Chenopodium	*capitatum* (L.) Asch.	J				X
	Chenopodium	*desiccatum* A. Nels.	DL		X		
	Chenopodium	*fremontii* Wats. var. *fremontii*	M			X	
	Chenopodium	*leptophyllum* (Moq.) Nutt. ex Wats.	M			X	
	Chenopodium	*watsonii* A. Nels.	M			X	
	Corispermum	*hyssopifolium* L.	LK	X			
*	*Grayia*	*spinosa* (Hook.) Moq.	M		X		
*	*Halogeton*	*glomeratus* (Bieb.) Meyer	M		X		
*	*Kochia*	*americana* Wats.	LK		X		
	Kochia	*scoparia* (L.) Schrad.	LK		X		
*	*Kraschenninnikovia*	*lanata* (Pursh.) Meeuse & Smit	M		X		
	Monolepsis	*nuttalliana* (Schultes) Greene	M		X		
	Salsola	*iberica* Sennen & Pau	M		X		
*	*Sarcobatus*	*vermiculatis* (Hook.) Torrey	M		X		
*	*Suaeda*	*fruticosa* (L.) Forsk.	LK		X		
	Suaeda	*moquinii* (Torrey) Greene	C		X		
*	*Suaeda*	*nigra* (Raf.) Macbr.	J		X		
Commelinaceae	*Tradescantia*	*bracteata* Small ex Britt.	LK	X			
	Tradescantia	*occidentalis* (Britt.) Smyth var. *occidentalis*	LK	X			
Convovulaceae	*Convovulus*	*arvensis* L.	LK	X			
	Ipomea	*leptophylla* Torr.	LK			X	
Cornaceae	*Cornus*	*canadensis* L.	CJ	X			
	Cornus	*serecia* L.	M	X			
	Cornus	*stolonifera* Michx.	M	X			

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Crassulaceae	*Sedum*	*lanceolatum* Torrey var. *lanceolatum*	M			X	X
	Sedum	*rhodanthum* Gray	M				X
	Sedum	*stenopetalum* Pursh	S				X
Cyperaceae	*Carex*	*aperta* Boott.	M	X			
	Carex	*aquatilis* Wallenb.	LK	X			
	Carex	*athrostachya* Olney	CJ				X
	Carex	*aurea* Nutt.	M				X
	Carex	*brunnescens* (Pers.) Poir.	CJ				X
	Carex	*capitata* L.	M	X			
	Carex	*douglasii* Boott.	CL	X			
	Carex	*elynoides* Holm.	LK	X			
	Carex	*filifolia* Nutt.	S				X
	Carex	*geyeri* Boott	M				X
	Carex	*gynocrates* (Wormsk.) ex Drejer	M				X
	Carex	*haydeniana* Olney	M				X
	Carex	*heliophyla* Mack.	LK			X	
	Carex	*hoodii* Boott	LK			X	
	Carex	*interior* Bailey	LK	X			
	Carex	*lanuginosa* Mich.	M				X
	Carex	*microptera* Mack.	M	X			
	Carex	*nebrascensis* Dewey	M	X			
	Carex	*oederi* Retz	LK	X			
	Carex	*parryana* Dewey var. *parrayana*	LK			X	
	Carex	*pennsylvanica* Lam.	LS				X
	Carex	*petasata* Dewey	CJ				X
	Carex	*praticola* Rydb.	CL	X			

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Cyperaceae	*Carex*	*raynoldsii* Dewey	LK				X
	Carex	*rossii* Boott.	LS				X
	Carex	*rostrata* Stokes ex With.	M	X			
	Carex	*rupestris* Allioni	DL				X
	Carex	*scirpoidea* Michx	M				X
	Carex	*sprengelii* Dewey ex Spreng.	LK			X	
	Carex	*utriculata* Boott in Hook.	M				X
	Carex	*vallicola* Dewey	DL				X
	Carex	*viridula* Michx.	LK	X			
	Carex	*vulpinoidea* Michx.	LK	X			
	Eleocharis	*macrostachys*	CL	X			
	Eleocharis	*palustris* (L.) R. & S.	LK	X			
	Scirpis	*validus* Vahl.	M	X			
	Scirpus	*acutus* Muhl ex Bigel	CL	X			
	Scirpus	*americanus* Pers.	CL	X			
	Scirpus	*pallidus* (Britt.) Fern	LK	X			
	Scirpus	*pungens* Vahl.	LK	X			
Elaeagnaceae	*Elaeagnus*	*angustifolia* L.	M	X			
	Shepherdia	*argentea* (Pursh.) Nutt.	M		X		
	Shepherdia	*canadensis* (L.) Nutt.	M				X
Ericaceae	*Arctostaphylos*	*uva-ursi* (L.) Spreng.	S				X
	Pyrola (Orthilla)	*asarifolia* Michx.	LK				X
	Pyrola	*chlorantha* Sw.	M				X
	Pyrola	*secunda* L.	LK				X
	Vaccinium	*scoparium* Leiberg ex Cov.	M				X

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Euphorbiaceae	*Euphorbia*	*cyparissias* L.	LK	X			
	Euphorbia	*esula* L.	LK	X			
	Euphorbia	*glyptosperma* Engelm.	LK			X	
	Euphorbia	*robusta* (Engelm.) Small	M		X	X	
Fabaceae	*Astragalus*	*adsurgens* Pallas	M		X	X	
	Astragalus	*adsurgens* var. *robustior* Hooker	M				X
	Astragalus	*agrestis* Dougl. ex G. Don	M			X	
*	*Astragalus*	*aretiodes* (Jones) Barneby	J				X
	Astragalus	*atropubescens* Coult. & Fish.	M		X		
	Astragalus	*bisulcatus* (Hook.) Gray	J		X		
	Astragalus	*canadensis* L. var. *canadensis*	LK	X			
	Astragalus	*ceramicus* Sheld. var. *filifolius*	LK			X	
*	*Astragalus*	*chamaeluce* Gray	M			X	
	Astragalus	*cibarius* Sheld.	M				X
	Astragalus	*crassicarpus* Nutt.	M			X	X
	Astragalus	*drummondii* Dougl. ex Hook.	M	X		X	
*	*Astragalus*	*geyeri* Gray	M		X		
	Astragalus	*gilviflorus* Sheld.	M			X	
	Astragalus	*gracilis* Nutt.	M			X	
*	*Astragalus*	*grayi* Parry ex Wats.	M			X	
	Astragalus	*hyalinus* Jones	M		X		
	Astragalus	*kentrophyta* Gray	LK		X		
	Astragalus	*lentiginosus* Dougl. ex Hook. var. *platyphyllidus* (Rydb.) Peck	M				X
	Astragalus	*lotiflorus* Hook.	LK			X	
	Astragalus	*miser* Dougl.	M			X	X
	Astragalus	*miser* Dougl. var. *decumbens* (Nutt. ex T. & G.) Cronq.	M			X	

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Fabaceae	*Astragalus*	*missouriensis* Nutt.	J			X	
*	*Astragalus*	*oreganus* Nutt.	M		X		
	Astragalus	*plattensis* Nutt.	M			X	
	Astragalus	*purshii* Dougl. ex Hook var. *purshii*	M			X	X
	Astragalus	*robbinsii* (Oakes) Gray	CJ				X
	Astragalus	*spathulatus* Sheld.	M		X	X	
	Astragalus	*vexilliflexis* Sheld	M		X		
	Glycyrrhiza	*lepidota* Pursh	M	X	X		X
	Hedysarum	*boreale* Nutt. var. *boreale*	M		X	X	X
	Hedysarum	*sulphurescens* Rydb.	M				X
	Lupinus	*argenteus* Pursh.	M				X
	Lupinus	*pusillus* Pursh	LS				X
	Lupinus	*serecius* Pursh	S				X
	Lupinus	*wyethii* Wats.	LK			X	
	Medicago	*lupulina* L.	M	X			
	Medicago	*sativa* L.	LK	X			
	Melilotus	*albus* Medic.	LK			X	
	Mellilotus	*officinalis* (L.) Pallas	M	X			
	Onobrychis	*vicifolia* Scop.	M		X		
	Oxytropis	*besseyi* (Rydb.) var. *argophylla* Barneby	M		X		
	Oxytropis	*besseyi* Rydb.	M	X	X	X	
	Oxytropis	*besseyi* (Rydb.) Blank. var. *besseyi*	LK		X		
	Oxytropis	*besseyi* (Rydb.) Blank. var. *fallax*	LK		X		
	Oxytropis	*campestris* (L.) D.C. var. *gracilis*	M				X
	Oxytropis	*deflexa* (Pall.) DC	LK		X		
	Oxytropis	*lagopus* Nutt. var. *atropurpurea* (Rydb.) Barneby	M			X	

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Fabaceae	*Oxytropis*	*lagopus* Nutt. var. *lagopus* Barneby	M				X
	Oxytropis	*lambertii* Pursh	S			X	
	Oxytropis	*riparia* Litv.	M				X
	Oxytropis	*sericea* Nutt.	M		X		X
	Oxytropis	*splendens* Dougl. ex Hookeri	L			X	
	Dalea	*occidentale* (Heller ex Britt. & Kearn.) Fern	LK	X			
	Dalea	*purpureum* (Vent.) Rydb.	LK			X	
	Psoralea	*esculenta* Pursh	S			X	
	Psoralea	*lanceolata* Pursh	LK	X			
	Psoralea	*tenuiflora* Pursh var. *tenuiflora*	LK			X	
	Sphaerophysa	*salsula* (Pallas) DC	LK	X			
	Thermopsis	*rhombifolia* (Nutt. ex Pursh) Nutt. ex Richards.	LK			X	
	Trifolium	*hybridum* L.	LK	X			
	Trifolium	*pratense* L.	LK	X			
	Trifolium	*repens* L.	M	X			
	Vicia	*americana* Muhl. ex Willd. var. *minor*	CL				
	Vicia	*americana* Muhl. ex Willd. var. *truncata*	M				X
Fumariaceae	*Corydalis*	*aurea* Willd.	LK	X			
Gentianaceae	*Gentiana*	*affinis* Griseb.	M				X
	Swertia	*radiata* (Kell.) Kuntz	M				X
	Erodium	*cicutarium* (L.) L'Her.	LK	X			
Geraniaceae	*Geranium*	*richardsonii* Fisch & Traunty	M	X			
	Geranium	*viscossissimum* Fisch & Meyer ex Meyer	M	X			X

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Grossulariaceae	*Ribes*	*americanum* Mill.	LK	X			
	Ribes	*aureum* Pursh.	M	X		X	
	Ribes	*cereum* Dougl.	M				X
	Ribes	*hudsonianum* Richards.	L	X			
	Ribes	*lacustre* (Pers.) Poiret	M	X			X
	Ribes	*montegenum* McClatchie	S				X
	Ribes	*oxycanthiodes* L. var. *setosum* (Lindl.) Dorn	M				X
	Ribes	*viscossissimum* Pursh. var. *viscosissimum*	M				X
Hydrophyllaceae	*Ellisia*	*nyctelea* (L.) L.	M		X		
*	*Nama*	*densum* Lemmon var. *parviflorum* (Greenm.) Hitch.	LS		X		
	Nemophylla	*breviflora* Gray	M				X
*	*Phacelia*	*glandulosa* Nutt.	M		X		
	Phacelia	*hastata* Doug. ex Lehm. var. *leucophylla* (Torr.) Cronq.	M			X	
*	*Phacelia*	*ivesiana* Torrey	M			X	
	Phacelia	*linearis* (Pursh.) Holz.	M		X	X	
	Phacelia	*serecia* (Grah. ex Hook.) Gray	LK				X
Iridaceae	*Iris*	*missouriensis* (Nutt.)	M			X	
	Sisyrinchium	*angustifolium* Mill.	LK			X	
	Sisyrinchium	*montanum* Greene	M				X
Juglandaceae	*Juglans*	*cineria* L.	LK	X			
Juncaceae	*Juncus*	*balticus* Willd. var. *montanus* Engelman.	LK	X			
	Juncus	*confusus* Cov.	L	X			
	Juncus	*ensifolius* var. *montanus* Wilkst.	M	X			
	Juncus	*longistylis* Torr. var. *longistylis*	LK	X			
	Juncus	*parryi* Engelm.	LK				X
	Juncus	*regelii* Buch.	LK	X			

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Juncaceae	*Juncus*	*tenuis* Willd. var. *dudleyi* (Wieg.) F.J. Herm.	LK	X			
	Juncus	*tenuis* Willd. var. *tenuis*	LK	X			
	Juncus	*torreyi* Cov.	M	X			
	Juncus	*tracyi* Rydb.	M	X			
	Luzula	*campestris* (L.) DC. var. *multiflora* (Ehrh.) Celak	M				X
	Luzula	*spicata* (L.) DC	C				X
	Triglochin	*maritimum* L.	M		X		
Lamiaceae	*Hedeoma*	*drummondii* Benth.	M		X		
	Hedeoma	*hispidum* Pursh	DL			X	
	Marrubium	*vulgare* L.	M			X	
	Mentha	*arvensis* L.	M	X			
	Monarda	*fistulosa* L. var. *menthaefolia*	M				X
	Nepeta	*cataria* L.	LK	X			
	Prunella	*vulgaris* L.	L	X			
Lamiaceae	*Scutellaria*	*galericulata* L.	LK	X			
	Stachys	*palustrisL.* var. *pilosa*	LK	X			
Lentibulariaceae	*Utricularia*	*vulgaris* L.	LK	X			
Liliaceae	*Allium*	*brevistylum* Wats.	M	X			X
	Allium	*cernum* Roth	M		X		X
	Allium	*geyeri* Wats.	LK	X			
	Allium	*textile* Nels. & Macbr.	M		X	X	
	Asparagus	*officinalis* L.	LK			X	
	Calochortis	*gunnisonii* Wats.	M				X
	Calochortus	*bruneaunis* Nels. and Macbr.	M	X			
	Calochortus	*nuttallii* T. & G.	M		X	X	X
	Disporum	*hookeri* (Torrey) Nicholson	C				X

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Liliaceae	*Disporum*	*trachycarpum* (Wats.) Benth. & Hooker	M				X
	Erythronium	*grandiflorum* Pursh.	M				X
	Fritillaria	*atropurpurea* Nutt.	M				X
	Fritillaria	*pudica* (Pursh) Spreng.	M				X
	Leucocrinum	*montanum* Nutt. ex Gray	LK			X	
	Lilium	*philadelphicum* L. var. *andinum* (Nutt.) Ker.	LK				X
	Lloydea	*serotina* (L.) Salisb.ex Reichenb.	M				X
	Smilacina	*racemosa* (L.) Desf.	M				X
	Smilacina	*stellata* (L.) Desf.	M	X			X
	Smilax	*herbacea* L. var. *lasioneuron* (Hook.) A. DC.	LK	X			
	Veratrum	*californicum* Durand	M				X
	Zigadenus	*elegans* Pursh.	M				X
	Zigadenus	*venenosus,Wats.* var. *gramineus*	M				X
Linaceae	*Linum*	*lewisii* Pursh.	M			X	X
	Linum	*rigidum* Pursh	S			X	
Loasaceae	*Mentzelia*	*albicaulis* (Doug. ex Hook.) Doug. ex T. & G.	M		X		
	Mentzelia	*decapetala* (Pursh. ex Sims) Urban & Gilg.	M		X		
	Mentzelia	*dispersa* Wats.	LS		X		
*	*Mentzelia*	*pumila* T. & G.	J		X		
Malvaceae	*Malva*	*parviflora* L.	LK	X			
	Sphaeralcea	*coccinia* (Nutt.) Rydberg	M		X	X	
Nyctaginaceae	*Abronia*	*fragrans* Nutt. ex Hook.	M		X		
	Mirabilis	*linearis* (Pursh.) Heimerl	M		X		

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Onagraceae	*Calylophus*	*serrulatus* (Nutt.) Raven	LK			X	
	Camissonia	*andina* (Nutt.) Raven	D			X	
	Camissonia	*minor* (A. Nelson) Raven	D			X	
*	*Camissonia*	*scapoidea* (T. & G.) Raven	M		X		
*	*Camissonia*	*parvula* (Nutt. ex T. & G.) Raven	LS			X	
	Circaea	*alpina* L. var. *alpina*	LK	X			
	Epilobium	*anagallidifolium* Lam.	M				X
	Epilobium	*angustifolium* L.	M				X
	Epilobium	*ciliatum* Raf.	M	X			X
	Epilobium	*ciliatum* Raf. var. *glandulosum* (Lemh.) Hoch & Raven	LK	X		X	
	Epilobium	*clavatum* Trel.	C	X			
	Epilobium	*latifolium* L.	M				X
	Epilobium	*paniculatum* Nutt. ex T. & G.	LK			X	
	Gaura	*coccinea* Nutt. ex Pursh.	M		X		
	Gaura	*parviflora* Dougl. ex Hookeri	LK	X			
	Gayophytum	*ramossisimum* T. & G.	LK			X	
	Oenothera	*albicaulis* Pursh.	M		X		
	Oenothera	*caespitosa* Nutt.	M				X
	Oenothera	*depressa* Greene	LK			X	
	Oenothera	*latifolia* (Rydb.) Munz	LS		X		
	Oenothera	*nuttallii* Sweet	M			X	
	Oenothera	*pallida* Lindl	M			X	
	Oenothera	*villosa* Thumb	M				X

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Orchidaceae	*Calypso*	*bulbosa* (L.) Oakes	M				X
	Corallorhiza	*maculata* Raf.	LK			X	
	Corallorhiza	*striata* Lindl.	M				X
	Goodyera	*oblongifolia* Raf.	S				X
	Habenaria	*hyperborea* (L.) R. Br.	M	X			X
	Habenaria	*unalascensis* (Spreng.) Wats.	M	X			X
	Habenaria	*viridis* (L.) R. Br.	M				X
	Plantanthera	*dilatata* (Pursh.) Lindl. ex Beck	LK	X			
Orobanchaceae	*Orobanche*	*fasciculata* Nutt.	LS			X	
	Orobanche	*ludoviciana* Nutt.	LS			X	
	Orobanche	*uniflora* L.	M			X	
Plantaginaceae	*Plantago*	*major* L.	LK	X			
	Plantago	*patagonia* Jacq.	M		X		
Poaceae	*Agropyron*	*cristatum* (L.) Gaertn.	M	X			
	Agropyron	*dasystachyum*	S			X	
	Agropyron	*intermedium* (Host) Beauv.	M		X		
	Agropyron	*repens* (L.) Beauv.	LK	X			
	Agropyron	*riparium* Scribn. & Sm.	LK	X			
	Agropyron	*smithii* Rydb.	S			X	
	Agropyron	*spicatum* (Pursh) Gould	M	X			X
	Agropyron	*subsecundum*	S			X	
	Agropyron	*trachycaulum* (Link) Malte ex Lewis	LK	X			
	Agropyron	*elongatum* (Host) Beauv.	LK	X			
	Agrostis	*alba* L. var. *palustris* (Huds.) Pers.	LK	X			
	Agrostis	*exarata* Trin.	M	X			
	Agrostis	*scabra* Willd.	S	X			

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Poaceae	*Agrostis*	*stolonifera* L.	M	X			
	Alopecurus	*arundinaceus* Poir	M		X		
	Andropogon	*gerardii* Vitman	LK			X	
	Andropogon	*scoparius* Michx. var. *scoparius*	LK			X	
	Aristida	*fendleriana* Steud.	LK		X		
	Aristida	*longiseta* Steud.	S			X	
	Aristida	*purpurea* Nutt.	M		X		
	Avena	*sativa* L.	LS		X		
	Beckmannia	*syzigachne* (Steudel) Fern	CL	X			
	Bouteloua	*curtipendula* (Michx.) Torr. var. *curtipedula*	LK			X	
	Bouteloua	*gracilis* (H.B.K.) Lag	M		X		
	Bromus	*carinatus* Hook. & Arn. var. *carinatus*	M	X			X
	Bromus	*carinatus* Hook. & Arn. var. *linearis*	M	X			
	Bromus	*ciliatus* L.	LK	X			
	Bromus	*commutatus* Schrad.	LK			X	
	Bromus	*inermis* Leyss.	M	X			
	Bromus	*japonicus* Thunb.	S			X	
	Bromus	*tectorum* L.	M	X			
	Calamagrostis	*canadensis* (Michx.) Beauv.	L	X			
	Calamagrostis	*purpurascens* R. Br.	LK				X
	Calamagrostis	*rubescens* Buckl.	CJ				X
	Calamovilfa	*longifolia* (Hook.) Scribn. var. *longifolia*	LK	X			
	Catabrosa	*aquatica* (L.) Beauv.	CL	X			
	Dactylus	*glomerata* L.	M				X
	Danthonia	*intermedia* Vasey	S				X
	Danthonia	*unispicata* (Thurb.) Munro ex Macoun	DL			X	

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Poaceae	*Deschampsia*	*caespitosa* (L.) Beauv.	M				X
	Deschampsia	*elongata* (Hook.) Munro	M	X			X
	Distichlis	*spicata* (L.) Greene var. *stricta* (Torr.) Scribn.	LK	X			
	Echinochloa	*crusgalli,crusgalli*	LK	X			
	Elymus	*canadensis* L.	M	X			
	Elymus	*cinerius* Scribn. & Merr.	LK	X			
	Elymus	*elymoides* (Raf.) Sweezy	M	X	X		
	Elymus	*glaucus* Buckl. var. *glaucus*	LK	X			
	Elymus	*trachycaulis* (Link) Gould ex Shinners	M				X
	Elymus	*virginicus* L. var. *submuticus* Hook.	LK	X			
	Elytrigia	*intermedia*	CL			X	
	Festuca	*idahoensis* Elmer	M				X
	Festuca	*ovina* L.	M				X
	Festuca	*pratensis* Huds.	M	X			
	Glyceria	*grandis* Wats.	S	X			
	Glyceria	*striata* (Lam.) Hitchc.	M	X			
	Hordeum	*brachyantherum* Nevski	M	X			
	Hordeum	*jubatum* L.	M		X		
	Koeleria	*macrantha* (Ledeb.) Schultes	M			X	X
	Koeleria	*pyramidata*	DL				X
	Leucopoa	*kingii* (Wats.) Weber	M				X
	Melica	*bulbosa* Geyer ex Porter & Coult	M				X
	Melica	*spectabilis* Scribn.	S			X	
	Melica	*subulata* (Griseb.) Scribn. var. *pamellii* (Scribn.) C.L. Hitchc.	LK			X	
	Muhlenbergia	*asperifolia* (Nees & Meyer ex Trin.) Parodi	C	X			
	Muhlenbergia	*racemosa* (Michx.) B.S.P.	LK			X	

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Poaceae	*Muhlenbergia*	*richardsonis* (Trin.) Rydb.	CL			X	
	Munroa	*squarrosa* (Nutt.) Torrey	LS			X	
	Orozopsis	*micrantha* (Trin. & Rupr.) Thurb.	LK			X	
	Oryzopsis	*hymenoides* (Roem & Schult.) Richer ex Piper	M		X		
	Pascopyrum	*smithii*	CL			X	
	Phalaris	*arundinacea* L.	M	X			X
	Phleum	*alpinum* L.	M				X
	Phleum	*pratensis* L.	M	X			
	Phragmites	*australis* (Cav.) Trin. ex Steud.	LK	X			
	Poa	*alpina* L.	M				X
	Poa	*arida* Vasey	LK		X		
	Poa	*bulbosa* L.	LK			X	
	Poa	*compressa* L.	M				X
	Poa	*cusicii* Vasey	LK			X	
	Poa	*fendleriana* (Stend.) Vasey	M				X
	Poa	*glaucifolia* Scribn. & Williams ex Williams	C	X			
	Poa	*interior* Rydb.	S			X	
	Poa	*juncifolia* var. *ampla* Scribn.	M				X
	Poa	*nervosa* (Hook.) Vasey	DL				X
	Poa	*pratensis* L.	M				X
	Poa	*sandbergii* Vasey	LK			X	
	Poa	*scabrella* (Thurb)Ben	K		X		
	Poa	*secunda* Presl.	M	X			
	Poa	*trivalis* L.	M				X
	Polypogon	*monspeliensis* (L.) Desf.	M	X			
	Pseudoregneria	*spicata* ssp. *spicata*	CL			X	

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Poaceae	*Puccinellia*	*nuttalliana* (Schult.) Hitchc.	C	X			
	Schedonnardus	*paniculatus* (Nutt.) Trel.	CL			X	
	Setaria	*viridis* (L.) Beauv.	LK	X			
	Spartina	*gracilis* Trin.	C	X			
	Spartina	*pectinata* Link	LK	X			
	Sphenophylis	*obtusata* (Michx.) Scribn. var. *major* (Torr.) K.S. Erdm.	LK	X			
	Sporobolis	*aeroides* (Torrey) Torrey	M	X	X		
	Sporobolis	*cryptandrus* (Torr.) Gray	LK			X	
	Stipa	*columbiana* Macoun	S			X	
	Stipa	*comata* Prin. & Rupr.	M		X		
	Stipa	*hymenoides*	CL			X	
	Stipa	*lettermannii* Vasey	LK			X	
	Stipa	*nelsonii* ssp. *dorsi*	CL			X	
	Stipa	*occidentalis* Thurb. ex Wats.	CJ				X
	Stipa	*viridula* Trin.	M			X	
	Stipa	*williamsii* Scribn.	LK			X	
	Trisetum	*canescens* Buckl.	M	X			
	Trisetum	*spicatum* (L.) Richt.	M				X
	Vulpia	*octoflora*	LK			X	
Polemoniaceae	*Collomia*	*linearis* Nutt.	M	X			X
	Collomia	*tinctora* Kell.	J		X		
*	*Gilia*	*leptomeria* Gray	D			X	
	Gilia	*pinnatifida*	LK	X			
*	*Gilia*	*tweedii* Rydb.	D			X	
	Ipomopsis	*congesta* var. *viridis* (Hook.) Grant	M				X
*	*Ipomopsis*	*pumila* (Nutt.) Grant	D			X	

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Polemoniaceae	*Ipomopsis*	*spicata* (Nutt.) Grant	M			X	X
*	*Leptodactylon*	*caespitosum* Nutt.	M		X		
	Leptodactylon	*pungens(Torrey)* Torrey ex Nutt.	M		X		
	Linanthus	*septentrionalis*	LK			X	
	Microsteris	*gracilis* (Hook.) Greene var. *gracilis*	M				X
	Phlox	*andicola* E. Nels	M			X	
	Phlox	*caespitosa* Nutt.	M				X
	Phlox	*hoodii* Richardson	M		X	X	
	Phlox	*longifolia* Nutt.	M				X
	Phlox	*multiflora* A.Nels(Nutt.)Parker	J				X
	Phlox	*muscoides* Nutt.	M		X		
	Phlox	*pulvinata* (Wherry) Cronq.	J				X
	Polemonium	*occidentale* Greene var. *occidentale*	LK				X
	Polemonium	*pulcherrimum* Hook. var. *pulcherrimum*	LK				X
	Polemonium	*viscosum* Nutt.	LK			X	
*	*Eriogonum*	*X* lagopus	LS			X	
	Eriogonum	*annuum* Nutt.	LK	X			
	Eriogonum	*brevecaule* Nutt. var. *brevecaule*	M		X		X
	Eriogonum	*brevicaule* Nutt. var. *canum* (Stokes) Dorn	T		X		
	Eriogonum	*caespitosum* Nutt.	M			X	X
	Eriogonum	*cernuum* Nutt.	LS			X	
	Eriogonum	*chrysops* Rydb.	S				X
	Eriogonum	*flavum* Nutt. var. *piperi* (Greene) Jones	J		X		
	Eriogonum	*flavum* Nutt. var. *flavum*	M		X	X	X
	Eriogonum	*mancum* Rydb.	LS			X	
	Eriogonum	*ovalifolium* Nutt.	J			X	

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Polygonaceae	*Eriogonum*	*pauciflorum* Pursh	LS		X		
*	*Eriogonum*	*salsuginosum*	M		X		
	Eriogonum	*strictum* Benth.	S				X
	Eriogonum	*umbellatum* Torrey var. *umbellatum*	M	X			
	Eriogonum	*umbellatum* Torrey var. *subalpinum*	M	X			X
	Polygonum	*aviculare* L.	LK			X	
	Polygonum	*bistortoides* Pursh.	M				X
	Polygonum	*douglasii* Greene	LS			X	
	Polygonum	*lapathifolium* L.	LK	X			
	Polygonum	*viviparum* L.	M				X
	Rumex	*crispus* L.	LK	X			
	Rumex	*triangulivalvis* (Danser) Rech. F.	LK	X			
	Rumex	*venosus* Pursh.	M		X		
Portulacaceae	*Claytonia*	*lanceolata* Pursh	M				X
	Claytonia	*perfoliata* Donn	M	X			
	Lewisia	*pygmaea* (Gray) Robins.	M				X
	Lewisia	*rediviva* Pursh.	M				X
	Montia	*perfoliata* (Donn.) Howell var. *perfoliata*	LK	X			
	Portulaca	*oleracea* L.	LK	X			
	Potamogeton	*filiformis* Pers.	LK	X			
Primulaceae	*Androsace*	*septentrionalis* L.	M				X
	Dodecatheon	*conjugens* Greene	M				X
	Dodecatheon	*pulcellum* (Raf.) Merrill	M	X			X
	Douglasia	*montana* Gray	M				X
	Lysamachia	*ciliata* L.	LK	X			

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Ranunculaceae	*Actaea*	*rubra* (Aiton) Willd.	M	X			X
	Anemone	*cylindrica* Gray	L			X	
	Anemone	*multifida* Poir var. *multifida*	M				X
	Anemone	*parviflora* Michx.	S				X
	Anemone	*patens* L.	M				X
	Clematis	*columbiana* (Nutt.) var. *tenuiloba*	M				X
	Clematis	*columbiana* var. *columbiana* (Nutt.) T. & G.	M				X
	Clematis	*hirsutissima* Pursh	M				X
	Clematis	*liguisticifolia* Nutt.	M	X			
	Clematis	*occidentalis* var. *grosserrata*	M				X
*	*Delphinium*	*andersonii* Gray	LS		X		
	Delphinium	*bicolor* Nutt.	M				X
*	*Delphinium*	*geyeri* Greene	AL	X			
	Ranunculis	*aquatilis* L. var. *capillaceous*	J	X			
	Ranunculus	*acriformis* Gray	L	X			
	Ranunculus	*aquatilis* L.	M	X			
	Ranunculus	*cymbalaria* Pursh.	J	X			
	Ranunculus	*glaberrimus* Hook. var. *ellipticus* (Greene) Greene	M				X
	Ranunculus	*macounii* Britt.	LK			X	
	Ranunculus	*pennsylvanicus* L.f.	LK			X	
	Ranunculus	*testiculatis* Crantz	LK	X			
	Ranunculus	*uncinatus* var. *uncinatus* G. Don ex G. Don	M				X
	Thalictrum	*dasycarpum* Fisch.et al.	LK	X			
	Thalictrum	*fendleri* Engelm. ex Gray var. *fendleri*	LK			X	
	Thalictrum	*occidentale* Gray	M				X
	Thalictrum	*sparsiflorum* Turcz. ex Fisch. & Meyer	S				X
	Thallictrum	*venulosum* Trel.	M	X			

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Rhamnaceae	*Ceanothus*	*velutinous* Dougl. ex Hook.	M				X
Rosaceae	*Agrimonia*	*gryposepala* Wallr.	LK	X			
	Amelanchier	*alnifolia* (Nutt.) Nutt. ex Roem.	M	X			
*	*Cercocarpus*	*ledifolius* Nutt.	M			X	
	Crataegus	*douglasii* Lindl.	S	X			
	Fragaria	*vesca* L.	M	X			X
	Fragaria	*virginiana* Miller	M				X
	Geum	*alleppicum* Jacq.	LK			X	
	Geum	*macrophyllum* Willd. var. *perincisum*	M	X			
	Geum	*rossii* (R. Br.) Ser.	M			X	
	Geum	*triflorum* Pursh.	M				X
	Ivesia	*gordonii* (Hook.) T. & G.	M			X	X
	Kelseya	*uniflora* (Wats.) Rydb.	M			X	
	Pentaphylloides	*floribunda* (Pursh.) Love	M				X
	Petrophyton	*caespitosum* (Nutt.) Ryd.	M			X	X
	Physocarpus	*malvaceous* Greene	M	X			
	Physocarpus	*monogynous* (Torrey) Coult	M	X			
	Potentilla	*anserina* L.	LK	X			
	Potentilla	*biennis* Greene	M	X			
	Potentilla	*concinna* var. *macouni* (Rydb.) C.L. Hitch	M				X
	Potentilla	*diversifolia* Lehm. var. *diversifolia*	M				X
	Potentilla	*fissa* Nutt.	LK			X	
	Potentilla	*glandulosa* Lindl.	M				X
	Potentilla	*gracilis* Dougl. ex Hook. var. *glabrata* (Lemh.) Hitchc.	M				X
	Potentilla	*gracilis* Dougl. ex Hook. var. *brunnescens* (Rydb.) Hitchc.	M				X
	Potentilla	*gracilis* Dougl. var. *flabelliformis*	M				X

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Rosaceae	*Potentilla*	*gracilis* var. *gracilis* Dougl. ex Hook.	M				X
	Potentilla	*hippiana* Lehm.	LS				X
	Potentilla	*norvegica* L. ssp. *monspeliensis* (L.) Asch. & Graebn.	LK	X			
	Potentilla	*ovina* Macoun var. *ovina*	M				X
	Potentilla	*paradoxa* Nutt.	LK	X			
	Potentilla	*pennsylvanica* L.	M	X			
	Potentilla	*plattensis* Nutt.	M				X
	Prunus	*americana* Marsh	LK	X			
	Prunus	*virginiana* L.	M				X
	Rosa	*sayi* Schwein.	M	X			
	Rosa	*woodsii* Lindl.	M	X			X
	Rubus	*idaeus* L.	M				X
	Rubus	*parviflorus* Nutt.	M				X
	Spiarea	*betulifolia* Pallas var. *lucida* (Dougl.) Hitchc.	M	X			X
Rubiaceae	*Galium*	*aparine* L. var. *echinospermon* (Wallr.)Farw.	M	X			
	Galium	*aparine* L. var. *aparine*	M	X			
	Galium	*bifolium* Wats.	C				X
	Galium	*boreale* L.	M				X
	Galium	*trifidum* L.	M				X
	Galium	*triflorum* Michx	M	X			
	Galium	*verum* L.	M				X
Salicaceae	*Populus*	*acuminata* Rydb.	M	X			
	Populus	*alba* L.	LK	X			
	Populus	*angustifolia* James	M			X	
	Populus	*balsamifera* L.	M	X			
	Populus	*deltoides* Marsh	S	X			

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Salicaceae	*Populus*	*deltoides* Marsh ssp. *monilifera* (Ait.) Echenw.	LK	X			
	Populus	*tremuloides* Michx	M	X			
	Salix	*amygdaloides* Anderss.	LK	X			
	Salix	*bebbiana* Sarg. var. *bebbiana*	M	X			
	Salix	*boothii* Dorn	M	X			
	Salix	*drummondiana* Barr. ex Hook.	LK	X			
	Salix	*bracteosa* var. *paysoniana* (Pennell) Cronq.	M	X			
	Salix	*cystopteridifolia* Rydb.	M				X
	Salix	*lutea* Nutt.	M	X			
	Salix	*monticola* Bebb.	LK	X			
	Salix	*myrtillifolia* Anderss. var. *novae-angliae*	J	X			
	Salix	*planifolia* Pursh. var. *planifolia*	M	X			
Santalaceae	*Comandra*	*umbellata* (L.) Nutt.	M		X		
	Comandra	*umbellata* var. *pallida* (L.) Nutt.	M				X
Saxifragaceae	*Boykinia*	*heucheriformis* (Rydb.) Rosend	LK	X			
	Conimitella	*williamsii* (D.C. Eat.) Rydb.	LK				X
	Heuchera	*cylindrica* Dougl. ex Hookeri	L				X
	Heuchera	*grossularifolia* Rydb.	S				X
	Heuchera	*parviflora* var. *dissecta* M. Jones	M			X	X
	Heuchera	*parviflora* var. *utahensis* (Rydb.) Garrett	M	X			X
	Lithophragma	*glabrum* Nutt.	M				X
	Lithophragma	*parviflorum* (Hook.) Nutt. ex T & G.	M			X	X
	Mitella	*pentandra* Hook.	CJ				X
	Mitella	*stauropetala* Piper	M				X
	Mitella	*trifida* Grah.	DL				X
	Parnassia	*palustris* L. var. *montanensis* (Fern. & Rydb.) C.L. Hitchc.	LK				X

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Saxifragaceae	*Saxifraga*	*cespitosa* L. var. *minima* Blank	M				X
	Saxifraga	*oregana* A. Nals. var. *subapetala*	J				X
	Saxifraga	*oregana* Howell var. *montanensis*	C	X			
	Saxifraga	*rhomboidea* Greene	M				X
	Sullivantia	*hapemanii* (Coult. & Fisch.) Coult	M	X			
	Telesonix	*heucheriformis* (Rydb.) Rydb.	M				X
Scrophulariaceae	*Besseya*	*wyomingiensis* (A. Nels.) Rydb.	M				X
*	*Castilleja*	*angustifolia* (Nutt.) G.Don var. *dubia* A.Nels.	J			X	
	Castilleja	*chromosa* A. Nels.	M		X	X	
	Castilleja	*cusicii* Greenm.	M				X
	Castilleja	*linearifolia* Benth.	M				X
	Castilleja	*miniata* Dougl. ex Hook.	M				X
	Castilleja	*pallescens* (Gray) Greenm.	M				X
	Castilleja	*pilosa* (S.Wats.)Rydb. var. *longispica* (A.Nels) N. Holmgren	M				X
	Castilleja	*pulchella* Rydb.	M				X
	Castilleja	*rhexifolia* Rydb.	M				X
	Castilleja	*sessiliflora* Pursh.	M				X
	Collinsia	*parviflora* Lindl.	M				X
	Linaria	*dalmatica* (L.) Miller	M				X
	Mimulus	*guttatus* DC var. *guttatus*	M	X			
	Mimulus	*suksdorfia* Gray	LK			X	
	Orthocarpus	*luteus* Nutt.	M				X
	Pedicularis	*bracteosa* var. *bracteosa* Benth. & Hooker	M				X
	Pedicularis	*cystopteridifolia* Rydb.	M				X
	Penstemon	*albidus* Nutt.	K			X	
	Penstemon	*aridus* Rydb.	M			X	

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Scrophulariaceae	*Penstemon*	*attenuatus* Doug. ex Lindl. var. *pseudoprocerus* (Rydb.) Cronquist	M			X	X
	Penstemon	*caryi* Pennell	M			X	X
	Penstemon	*confertus* Dougl. var. *procerus* (Dougl. ex Gray) Cov.	LK				X
	Penstemon	*cyaneus* Pennell	L			X	
	Penstemon	*eriantherus* Pursh. var. *eriantherus*	M			X	X
	Penstemon	*glaber* Pursh	LK			X	
*	*Penstemon*	*laricifolius* H. & A. var. *laricifolius*	M		X	X	
	Penstemon	*nitidis* Dougl. ex Bentham	M		X	X	
	Penstemon	*procerus* Doug. ex Grah.	M				X
	Penstemon	*radicosus* A. Nels.	LK			X	
	Verbascum	*thapsus* L.	LK		X		
	Veronica	*americana* Schwein ex Benth.	M	X			
	Veronica	*anagallus-aquatica* L.	M	X			
	Veronica	*biloba* L.	M				X
	Veronica	*peregrina* L. var. *xalapensis* (H.B.K.) St. John & Warren	LK			X	
Solanaceae	*Hyoscyamus*	*niger* L.	J			X	
	Physalis	*heterophylla* Nees var. *heterophylla*	LK	X			
	Solanum	*dulcamara* L.	M	X			
	Solanum	*triflorum* Nutt.	LK	X			
Tamaricaceae	*Tamarix*	*chinensis* Loureiro	D			X	
Typhaceae	*Typha*	*angustifolia* L.	LK	X			
	Typha	*latifolia* L.	LK	X			
Ulmaceae	*Celtis*	*occidentalis* L.	LK	X			
	Ulmus	*pumila* L.	LK	X			
Urticaceae	*Parietaria*	*pennsylvanica* Muhl. ex Willd.	LK				X
	Urtica	*dioica* L. var. *gracilis*	M	X			

Table 5. Continued.

Family	Genus	Species	REF	RI	DT	SG	MF
Valerianaceae	*Valeriana*	*acutiloba* var. *pubicarpa* Rydb.	M				X
	Valeriana	*dioica* L.	M				X
	Valeriana	*edulis* Nutt. ex T. & G.	M				X
	Valeriana	*sitchensis* Bong.	S				X
Verbenaceae	*Verbena*	*bracteata* Leg & Rothr.	M	X			X
	Verbena	*hastata* L.	LK	X			
Violaceae	*Viola*	*adunca* Smith var. *adunca*	J	X			
	Viola	*adunca* var. *bellidifolia* Smith	M				X
	Viola	*canadensis* var. *canadensis* L.	M				X
	Viola	*nephrophylla* Greene	CJ				X
	Viola	*nuttallii* Pursh	LS				X
	Viola	*orbiculata* Geyer ex Holz.	CJ				X
	Viola	*praemorsa* Dougl. ex Lindl.	M				X
	Viola	*purpurea* Kell.	DL				X
	Viola	*vallicola* A. Nels.	LK			X	
Vitaceae	*Vitis*	*riparia* Michx.	LK	X			

APPENDIX B

ADDITIONS TO ENTIRE TAXA DATA SET OF 3217

Table 6. 59 Pryor Mountain Additions to the Entire Taxa Data Set of 3217 as presented in Culver (1994).

Genus/Species	Family
Antennaria rosea	Caryophyllaceae
Arabis sparsiflora var. *columbiana*	Brassicaceae
Artemisia longifolia	Asteraceae
Astragalus atropubescens	Fabaceae
Astragalus aretioides	Fabaceae
Astragalus lentiginosus var. *platyphyllides*	Fabaceae
Astragalus grayi	Fabaceae
Astragalus crassicarpus var. *crassicarpus*	Fabaceae
Astragalus ceramicus var. *filifolius*	Fabaceae
Camissonia scapoidea	Onagraceae
Carex aperta	Cyperaceae
Chaenactis alpina var. *leucopsis*	Asteraceae
Chenopodium watsonii	Chenopodiaceae
Chrysothamnis linefolius	Asteraceae
Cirsium polyphyllus	Asteraceae
Conmitella williamsii	Saxifragaceae
Cryptantha watsonii	Boraginaceae
Cryptantha scoparia	Boraginaceae
Descurania richardsonii var. *viscosa*	Brassicaceae
Disporum hookeri	Liliaceae
Eleocharis macrostachys	Cyperaceae
Erigeron compositus var. *glabratus*	Asteraceae
Erigeron allocotus	Asteraceae
Eritrichium howardii	Boraginaceae
Festuca ovina	Poaceae
Galium verum	Rubiaceae
Habenaria viridis	Orchidaceae
Hymenopappus filifolius var. *luteus*	Asteraceae
Ipomoea leptophylla	Convovulaceae

Table 6. Continued.

Genus/Species	Family
Ipomopsis congesta var. *viridis*	Polemoniaceae
Juglans cineria	Juglandaceae
Lappula redowskii var. *cupulata*	Brassicaceae
Leptodactylon caespitosum	Polemoniaceae
Leucopoa kingii	Poaceae
Lupinus pusillus	Fabaceae
Lupinus wyethii	Fabaceae
Machaeranthera tanacetifolia	Asteraceae
Malacothrix sonchoides	Asteraceae
Malva parviflora	Malvaceae
Musineon vaginatum	Apiaceae
Oenothera depressa	Onagraceae
Oxytropis besseyi var. *Fallax*	Fabaceae
Oxytropis besseyi var. *argophylla*	Fabaceae
Oxytropis riparia	Fabaceae
Oxytropis splendens	Fabaceae
Penstemon caryi	Scrophulariaceae
Phacelia glandulosa	Hydrophyllaceae
Platyschkuhria integrifolia var. *oblongifolia*	Asteraceae
Potentilla concinna var. *macouni*	Rosaceae
Rorippa calycina	Brassicaceae
Sambucus canadensis var. *canadensis*	Caprifoliaceae
Shoshonea pulvinata	Apiaceae
Silene csereii	Caryophyllaceae
Sisyrinchium angustifolium	Iridaceae
Stanleya tomentosa	Brassicaceae
Sueada fruticosa	Chenopodiaceae
Sueada moquinii	Chenopodiaceae
Trisetum canescens	Poaceae
Wyethia scabra	Asteraceae