

To The University of Wyoming:

The members of the Committee approve the thesis of Joseph L.M. Charboneau  
presented on January 31, 2013.

Ronald L. Hartman, Chairperson

Larry C. Munn, External Department Member

Gregory K. Brown

APPROVED:

Gregory K. Brown, Department Chair, Department of Botany

B. Oliver Walter, Dean, College of Arts and Sciences

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This study marks the first floristic inventory of Valley and Phillips counties on the glaciated plains of northeastern Montana. The 8,954 sq mi (23,191 sq km) study area was surveyed for all vascular plant taxa on lands managed by the Bureau of Land Management, U.S. Fish and Wildlife Service, State of Montana, American Prairie Reserve, and The Nature Conservancy. Elevation ranges from 2,020–5,720 ft (616–1,743 m). In the summers of 2010 and 2011, 12,785 voucher specimens were collected from 308 sites documenting 761 unique taxa, 717 species, and 358 genera from 86 families. Among these are 108 taxa exotic to Montana, nine noxious weed species, and 15 taxa of conservation concern. Approximately 32% of the taxa collected are newly documented within the area. Results are enumerated in an annotated checklist and vegetation types are described. Analyses of the study's sampling adequacy are also discussed.

A FLORISTIC INVENTORY OF PHILLIPS AND VALLEY COUNTIES,  
MONTANA, U.S.A.

by  
Joseph L.M. Charboneau

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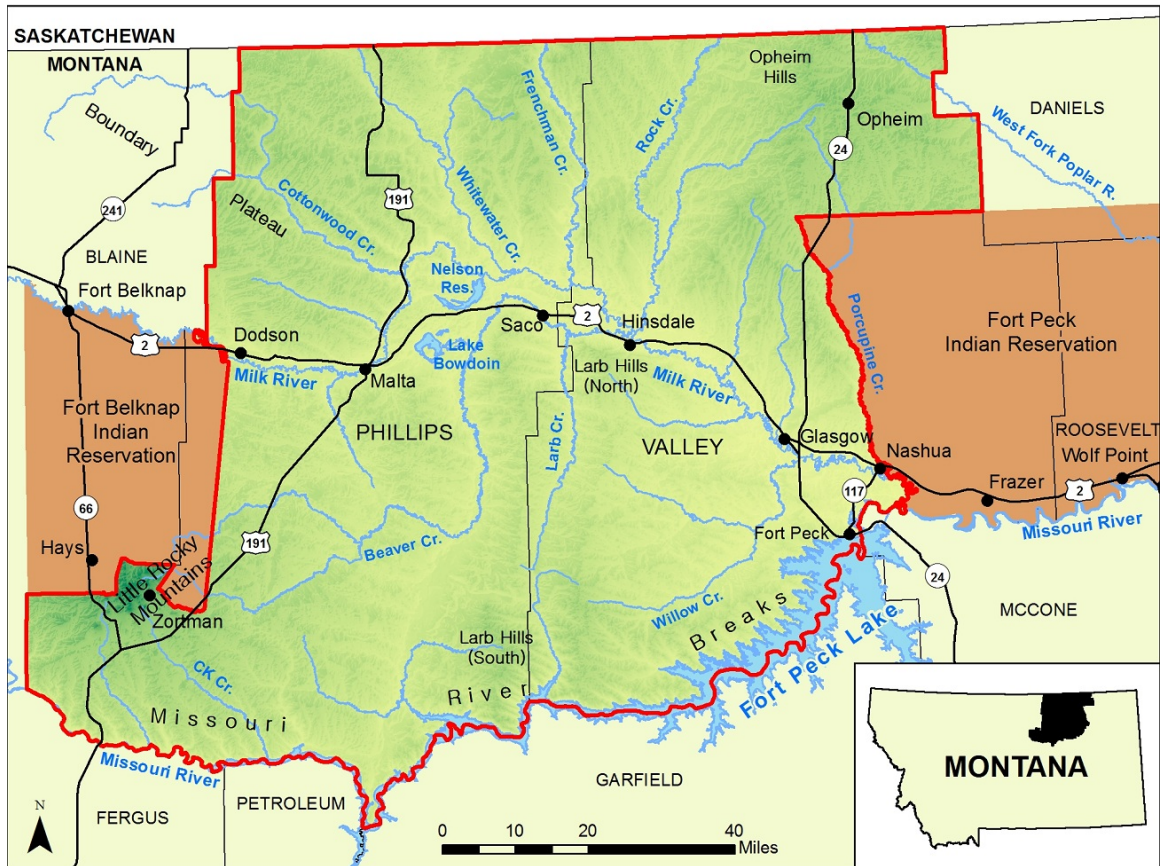
## CHAPTER I

### INTRODUCTION

We report on a vascular plant inventory of public and private lands in Phillips and Valley counties in northeastern Montana (Fig. 1). The study area is bound by Canada to the north, the Missouri River to the south, Daniels County and Fort Peck Indian Reservation to the east, and Blaine County and Fort Belknap Indian Reservation to the west. Elevation ranges from approximately 2,020 ft to 5,720 ft (616 m to 1,743 m).

The study area is located within the North American Prairies floristic province near the edge of the Rocky Mountain province (Takhtajan 1986), although Lavin and Seibert (2011) have suggested that the area has a greater floristic affinity to the Intermountain region than to the Great Plains. Botanical exploration of the area began in 1805 and 1806 when the Lewis and Clark Expedition traveled along the Missouri River (Phillips 2003). Past treatments that have covered the area include Rydberg (1932; peripherally), *Atlas of the Flora of the Great Plains* (GPFA 1977), and *Flora of the Great Plains* (GPFA 1986). State floras include *Vascular Plants of Montana* (Dorn 1984) and the recently published *Manual of Montana Vascular Plants* (Lesica 2012). The area is one of many on the western Great Plains for which basic floristic knowledge has been lacking (GPFA 1986). Indeed, the area was not previously well collected: fewer than 1,400 specimens from this area larger than the State of New Jersey are vouchered at the Montana State University Herbarium and the University of Montana Herbarium (MONT 2012; MONTU 2012).

This botanical inventory is part of the larger effort by the Rocky Mountain Herbarium (RM) to map in relatively fine detail the geographic distributions of species

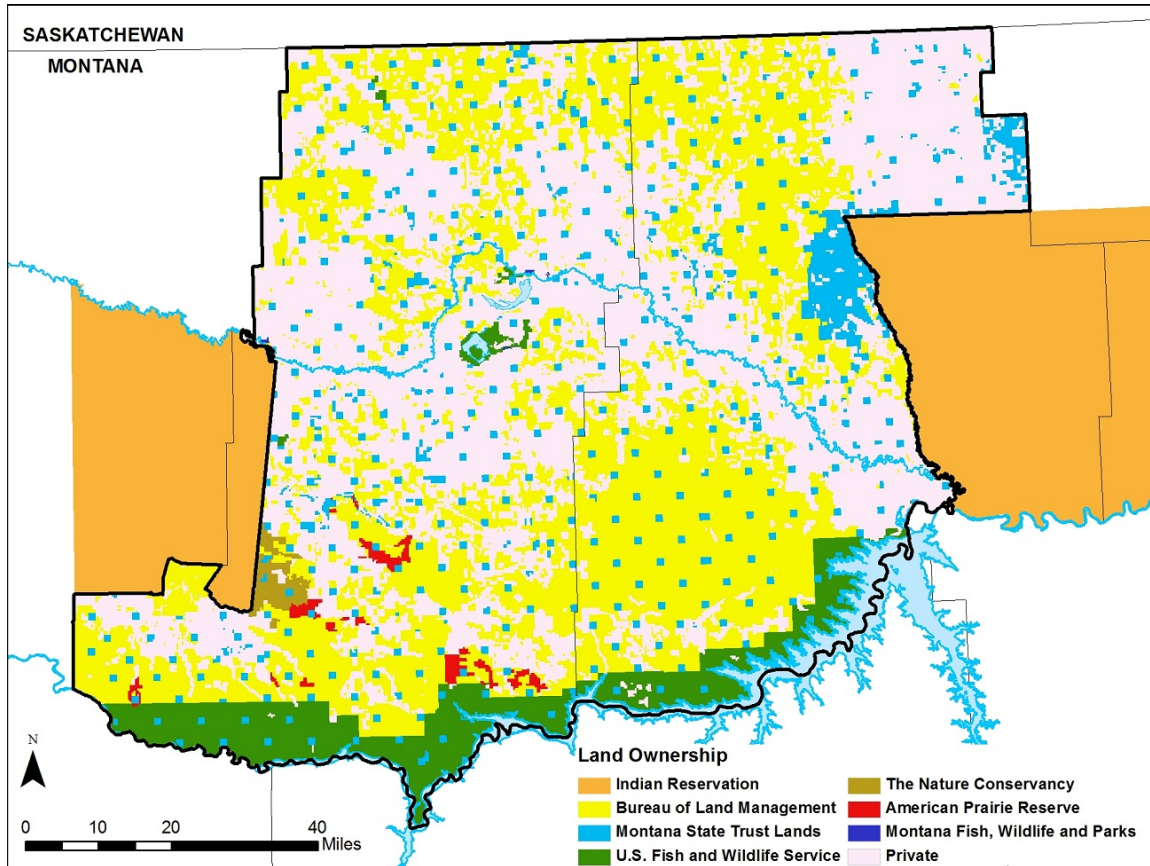


**Fig. 1. General map of the study area (outlined in red), which comprises 8,954 sq mi (23,191 sq km) in northeastern Montana. Elevation ranges from 2,020–5,720 ft (616–1,743 m).**

based on vouchered specimens and to produce a flora of the greater Rocky Mountain region (Hartman 1992; Hartman & Nelson 2008; Hartman et al. 2009). To this end, 61 major floristic inventories (48 as master’s degree projects) have been conducted during the past 34 years in Arizona, Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, Oregon, South Dakota, Utah, Washington, and Wyoming (e.g. Reif et al. 2009, Kesonie and Hartman 2011; Kuhn et al. 2011; Lukas et al. 2012). Over 650,000 new collections have been obtained by graduate students, staff, and research associates of RM. These specimens form the core of the RM Plant Specimen Database (730,000 specimen records, 45,000 specimen images, and 4,000 field images; Hartman et al. 2009).

*Study area.*—Various federal and state government agencies manage lands in the area (Fig. 2). In Phillips County, 1,689 sq mi (4,374 sq km) of Bureau of Land Management (BLM) lands are managed by the Malta BLM Field Office or in the southwest corner of the county as part of the Upper Missouri River Breaks National Monument, which is administered directly by the Montana/Dakotas BLM. The Glasgow BLM Field Office manages 1,581 sq mi (4,095 sq km) in Valley County. Also covered were 603 sq mi (1,563 sq km) of U.S. Fish and Wildlife Service lands including Charles M. Russell National Wildlife Refuge north of the Missouri River as well as Bowdoin National Wildlife Refuge. The area also includes 631 sq mi (1,635 sq km) managed by the state, mostly as Montana State Trust Lands or by Montana Fish, Wildlife, and Parks. Private lands visited include the American Prairie Reserve, 51 sq mi (133 sq km) in southern Phillips County and the Matador Ranch, 49 sq mi (123 sq km), owned and operated by The Nature Conservancy in southwestern Phillips County. In total, 4,604 sq mi (11,924 sq km) were accessible for collection within the 8,954 sq mi (23,191 sq km) area (the entirety of Phillips and Valley Counties exclusive of lands on the Fort Peck and Fort Belknap Indian Reservations). There are four wilderness study areas (WSAs) managed by the BLM: Antelope Creek WSA (19 sq mi/50 sq km) and part of Cow Creek WSA (53 sq mi/138 sq km in total) in the Upper Missouri River Breaks National Monument, Bitter Creek WSA (92 sq mi/239 sq km) in northern Valley County, and Burnt Lodge WSA (21 sq mi/56 sq km) in the Larb Hills (South). Grasslands National Park of Canada is located just north of the area in Saskatchewan.

*Physiography.*—The area is located on the Glaciated Missouri Plateau subregion of the northwestern portion of the Great Plains physiographic region (Fenneman 1916).



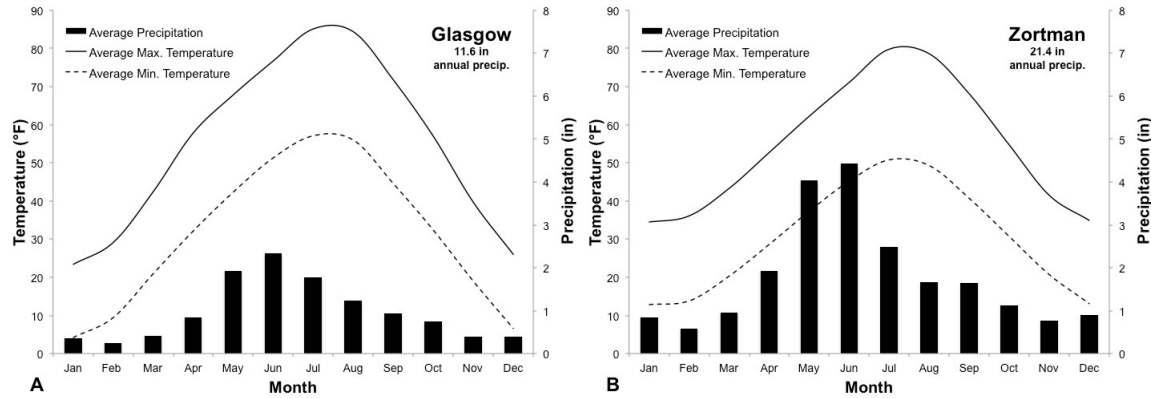
**Fig. 2. Land ownership in the study area (outlined in black). Collections were made on lands owned by the Bureau of Land Management, U.S. Fish and Wildlife Service, State of Montana, American Prairie Reserve, and The Nature Conservancy.**

Fig. 1 shows topographic features and bodies of water in the area. The vast majority of the area was glaciated during the Pleistocene (Colton et al. 1961; Fullerton and Colton 1986). Most of the area lies on broadly rolling hills with typically dry drainages, locally called coulees. Grasses dominate these rolling hills with sagebrush (*Artemisia* spp.) abundant in some areas as well. Topographic relief is greater in the south on the Missouri River Breaks, where steep slopes can be covered with ponderosa pine woodlands. The Little Rocky Mountains, one of several forested island mountain ranges in central Montana, rise about 2,000 ft (610 m) above the surrounding plains in southwestern

Phillips County and southeastern Blaine County. The summit of Antoine Butte at 5,720 ft (1,743 m) is the highest point in the Little Rockies and the study area.

The entire area is located within the Missouri River watershed. Most of the area drains into the Milk River except several drainages leading directly to the Missouri River in the south and in part of northeastern Valley County, which is in the Poplar River watershed. The Milk River nearly bisects the area, entering in the west near Dodson and reaching its confluence with the Missouri River in the east (Fig. 1). The Missouri River is dammed near the town of Fort Peck by Fort Peck Dam, which was constructed by the U.S. Army Corps of Engineers during the 1930s (Bandy et al. 2004). Fort Peck Lake forms the shoreline of the Missouri River for much of its length within the area.

*Climate.*—The region has a cold semi-arid climate (Köppen-Geiger climate classification BSk; Peel et al. 2007), characterized by warm to hot summers and long cold winters (Bingham et al. 1984; Bandy et al. 2004; NCDC 2012). Average daily maximum temperatures range from 49.7°F to 60.2°F (9.8°C to 15.7°C), with the north cooler than the south (PRISM 2004). Average daily minimum temperatures range from 26.1°F to 36.1°F (-3.3°C to 2.3°C), again generally lower in the north than in the south (PRISM 2004). Average annual precipitation is relatively low, ranging from 10.5 in to 21.7 in (26.7 cm to 55.1 cm) in the Little Rocky Mountains (PRISM 2004). Areas of locally high elevations tend to receive more precipitation, including the Little Rockies. About half of the annual precipitation falls in the months of May, June, and July (Fig. 3; NCDC 2012; WRCC 2012). Severe thunderstorms throughout the summer can bring locally heavy precipitation as well as damaging winds and hail (Bingham et al. 1984).

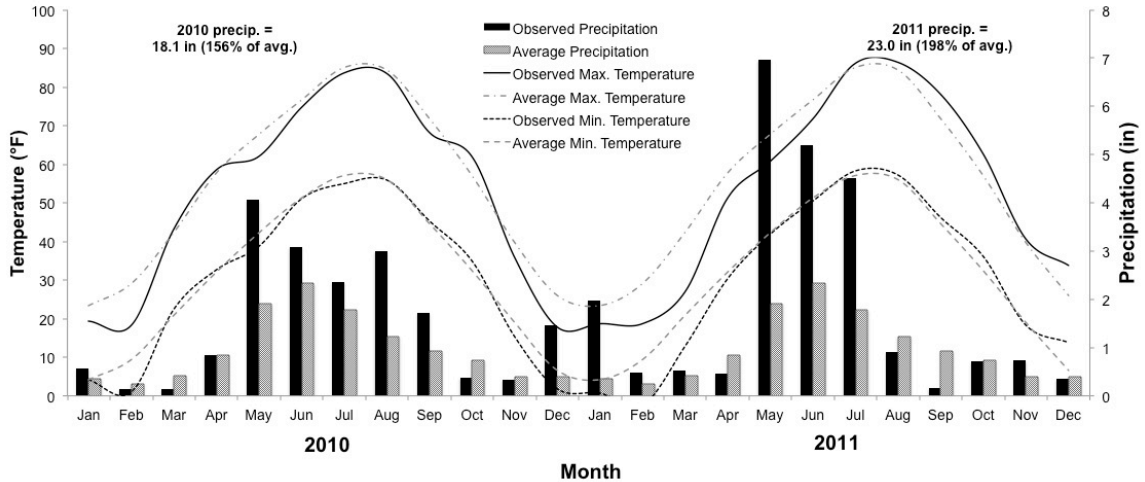


**Fig. 3. Average precipitation, maximum and minimum temperatures for Glasgow, MT (A; NCDC 2012) and Zortman, MT (B; WRCC 2012). Glasgow (on the plains) experiences greater seasonal temperature extremes and lower precipitation than Zortman (in the Little Rocky Mountains).**

Precipitation was well above normal throughout most of the area in both field seasons of this inventory (2010 and 2011). Annual precipitation in 2010 at Glasgow was 18.1 in (46.0 cm; 156% of average) and in 2011 was 23.0 in (58.4 cm; 198% of average), the highest ever recorded in Glasgow (Fig. 4; NCDC 2012; NWS 2012). In addition, the 108.6 in (275.8 cm) of snow that fell in Glasgow during the winter of 2010 and 2011 were the most ever recorded, more than three times greater than the average of 36 in (91 cm; NWS 2012). This abnormally high level of precipitation created excellent conditions for conducting a floristic inventory, but brought extensive flooding as well.

*Geology.*—Three main events define the surficial geology of the area: the deposition of sedimentary rocks in a shallow inland sea during the Late Cretaceous, the formation of the Little Rocky Mountains during the early Paleogene, and the glaciation of nearly the entire area during the Pleistocene.

Throughout most of the area, the geologic layers exposed at the surface were deposited during the Late Cretaceous when a large, shallow, inland sea known as the Western Interior Seaway covered the region (Marshak 2005). Formations exposed from



**Fig. 4. Observed temperatures and precipitation during the study (2010–2011) compared to averages for Glasgow, MT (NCDC 2012). Precipitation was well above average in both years and was the highest ever recorded in 2011.**

this time period are, from oldest to youngest, the Claggett shale, the Judith River formation, the Bearpaw shale, the Fox Hills sandstone, and the Hell Creek formation (Collier 1918; Vuke et al. 2007). The most commonly exposed of these Cretaceous age materials is the Bearpaw shale (Vuke et al. 2007). It consists of mostly dark-gray shale of marine origin and in some areas forms badlands and sticky clay soils known locally as gumbo (Collier 1918; Jensen and Varnes 1964). Localized bentonite layers in the Bearpaw shale, derived from volcanic ash deposits, have been mined in the area (Jensen and Varnes 1964; Bandy et al. 2004).

A structure called the Bowdoin dome exists in the central and northern portion of the area, centered about Nelson Reservoir and Lake Bowdoin (Bandy et al. 2004). Strata dip very slightly away from the center of the dome in all directions, which has resulted in weathering of younger overlying material and surface exposures of two older formations, the Claggett shale and the Judith River formation (Collier 1918; Vuke et al. 2007). The older Claggett shale, which outcrops at the center of the dome, consists of a dark-gray

marine shale similar to the Bearpaw shale. The Judith River formation, which outcrops on the periphery of the dome, consists of sandstones and shale of a freshwater depositional environment (Collier 1918; Jensen and Varnes 1964). The Bowdoin dome has trapped natural gas in underlying Colorado Group sandstones (Bandy et al. 2004). Natural gas production from this dome has occurred since the early part of the 20<sup>th</sup> century and continues today (Bandy et al. 2004).

The Fox Hills sandstone and Hell Creek formation (famous for its dinosaur fossils; Jensen and Varnes 1964) outcrop in the southern part of the area as well as parts of northeastern Valley County (Collier 1918; Vuke et al. 2007). These consist of mostly sandstones (Bandy et al. 2004). The sandstones of the Hell Creek formation are more erosion resistant than the surrounding Bearpaw shale and so often cap hills, particularly in the southern part of the area (Jensen and Varnes 1964).

The Flaxville gravel, derived from alluvial terrace deposits from the late Neogene and early Quaternary, is exposed in small areas of the northern part of the area (Bandy et al. 2004). Resistant to erosion, it caps uplands and benches where it is exposed (Collier 1918). Alluvium from the Quaternary is present in the Milk River Valley and lower parts of larger creeks as well as on the Missouri River upstream of Fort Peck Lake (Bandy et al. 2004; Vuke et al. 2007).

The Little Rocky Mountains were formed during an early Paleogene orogeny in which intrusive igneous rocks uplifted Precambrian basement rocks and overlying Paleozoic and Mesozoic sedimentary rocks around the periphery of the range (Knechtel 1959). Precambrian metasedimentary and metavolcanic rocks outcrop along with igneous rocks in the center of the Little Rockies (Knechtel 1959; Bandy et al. 2004; Vuke et al.



2007). These igneous rocks at the core were intruded about 60 million years ago from alkaic magma (Wilson and Kyser 1988; Bandy et al. 2004). Gold and silver have been mined in the Little Rockies since 1884 in a variety of operations (Wilson and Kyser 1988; Bandy et al. 2004).

The sedimentary rocks overlying the Little Rocky Mountains were uplifted during the orogeny and subsequently have been eroded away over the core of the range, remaining at the periphery (Knechtel 1959; Vuke et al. 2007). The most prominent rocks exposed at the surface are erosion resistant carbonaceous rocks from the Paleozoic, including dolomites of the Bighorn formation from the Ordovician, the Jefferson limestone of the Devonian, and especially the Lodgepole and Mission Canyon limestones of the Mississippian (Knechtel 1959). Mesozoic rocks outcrop mostly in the foothills surrounding the Little Rockies and in small areas within the range. These are mostly shales but also some sandstones, conglomerates, and limestones (Knechtel 1959). Rocks from the Jurassic and Early Cretaceous are exposed in small areas around the periphery of the range but once on the plains, strata from the Upper Cretaceous dominate at the surface (Knechtel 1959, Vuke et al. 2007).

The Laurentide Ice Sheet covered the entire region during the late Illinoian glacial period (between 195,000 and 128,000 years ago) with the exception of the Little Rocky Mountains and an area east of Opheim within the Poplar River drainage (Colton et al. 1961; Fullerton and Colton 1986). Following this glacial period, extensive badlands formed subsequent to glaciation in the Wisconsinan (Fullerton and Colton 1986). Glaciers returned between 21,000 to 16,000 years ago during the late Wisconsinan, although to a much smaller extent than during the Illinoian (Fullerton and Colton 1986).

During this time large areas remained ice-free in southern Phillips County, on the Boundary Plateau in northern Phillips County, and in much of Valley County, excluding the central portion (Colton et al. 1961; Fullerton and Colton 1986). Prior to these glacial episodes, the Missouri River formed the broad valley that the Milk River now meanders through (Collier 1918; Bingham et al. 1984; Bandy et al. 2004). Blocked by glacial ice, the Missouri River became entrenched in its current channel during the Wisconsin (Collier 1918; Alden 1932).

*Paleovegetation.*—Vegetational history following deglaciation is somewhat uncertain because of a paucity of fossil pollen data from northern Montana (Barnosky 1989; Strong and Hills 2005). However, it is likely that after 12,000 years ago extensive grasslands similar to the present vegetation were established in the region, unlike areas further east and north, which supported long-standing wide bands of boreal forest following deglaciation (Strong and Hills 2005). Fossil pollen data from Guardipee Lake, Montana indicates that by 12,200 years ago, temperate grasslands with shrubs in mesic habitats were present in northern Montana east of the Rocky Mountains (Barnosky 1989). After 9,300 years ago these grasslands started to become more xeric as they are today (Barnosky 1989).

Less clear is the nature of the vegetation following the maximum extent of the Laurentide Ice Sheet about 20,000 years ago (Fullerton and Colton 1986) but prior to 12,000 years ago. There is no direct evidence for forests during this time, although the area may have been near the edges of both cordilleran and boreal forest belts. A dry deciduous boreal forest or aspen parkland may have existed south of the boreal/cordilleran forest zone in southern Saskatchewan (Klassen 1994), perhaps

approaching northern Montana. The existence of a belt of cordilleran forests during this time may explain the distribution of these tree species in the island mountain ranges of central Montana and the Cypress Hills in Canada (Thompson and Kuijt 1976; Strong and Hills 2005). Presumably such a cordilleran forest belt stretched across the lowlands but was isolated after 14,000 years ago onto the discontinuous highlands of the region (Strong and Hills 2005), including the Little Rocky Mountains. Thompson and Kuijt (1976) believed this a more plausible explanation for the distribution of cordilleran conifers in the Cypress and Sweetgrass hills than long distance dispersal of seeds by wind or birds.

*Soils.*—Substrates are important in determining the distribution of plant species (Krukeberg 2002), and in most of the area, soils rather than unweathered rocks are present at the surface. Ninety-seven soil series are described in the area from six of the 12 soil orders: Alfisols, Aridisols, Entisols, Inceptisols, Mollisols, and Vertisols (Bingham et al. 1984; Bandy et al. 2004). Many grassland soils that were previously considered Aridisols, including the Absher, Elloam, Phillips, and Thoeny series, are now classified as Alfisols (Bingham et al. 1984, Bandy et al. 2004). This reclassification was due to the moisture regimes of these soils now being considered ustic rather than aridic (Wang et al. 1990). Alfisols also have developed in the more typical environment of conifer forests in the Little Rocky Mountains (Bandy et al. 2004). Mollisols have developed on grasslands that are relatively well watered (Cooper et al. 2001). Entisols and Inceptisols are present where soils are poorly or moderately developed such as on uplands, in badlands and floodplains, and around rock outcrops (Bingham et al. 1984, Bandy et al. 2004). Finally,

Vertisols are described from grasslands on some of the high shrink-swell clays derived from the Clagget and Bearpaw shales (Bandy et al. 2004).

Many soils have developed from tills left following Illinoian and Wisconsinan glaciations. However, this till material is typically not far removed from its original source as the area was at the southern limit of the continental ice sheet and scouring power was minimal (Bandy et al. 2004). Therefore, these tills are derived primarily from Cretaceous shales. Tills are thickest in the northern part of the area, thinning to the south, or have been removed completely by erosion in some areas (Bingham et al. 1984; Bandy et al. 2004). A few large glacial erratics have been deposited from as far away as the Hudson Bay (Collier 1918; Bandy et al. 2004).

Through their influence on vegetation, soils have also affected human settlement and agriculture. Soils developed from marine shales or their tills can be highly alkaline. This alkalinity combined with relatively low precipitation in the region make much of the land unsuited for cultivation (Cooper et al. 2001). Many homesteaders, who started to arrive following the establishment of the Great Northern Railway in 1887 (Bandy et al. 2004; now operated by the BNSF Railway), saw their farms go bankrupt during the Great Depression (Bingham et al. 1984). The BLM now manages many of these lands that were repurchased by the federal government under the Bankhead-Jones Farm Tenant Act of 1937 (Mackie 1970; Cooper et al. 2001). Today, most of the area is utilized for cattle grazing, and to a lesser extent, sheep grazing (Bandy et al. 2004). Dryland farming of small grains, including spring wheat, barley, and oats, as well as irrigated farming along the Milk River are still important as well (Bingham et al. 1984; Bandy et al. 2004). Today about 17% of the area is under cultivation (MTNHP 2010). The unsuitability of most of

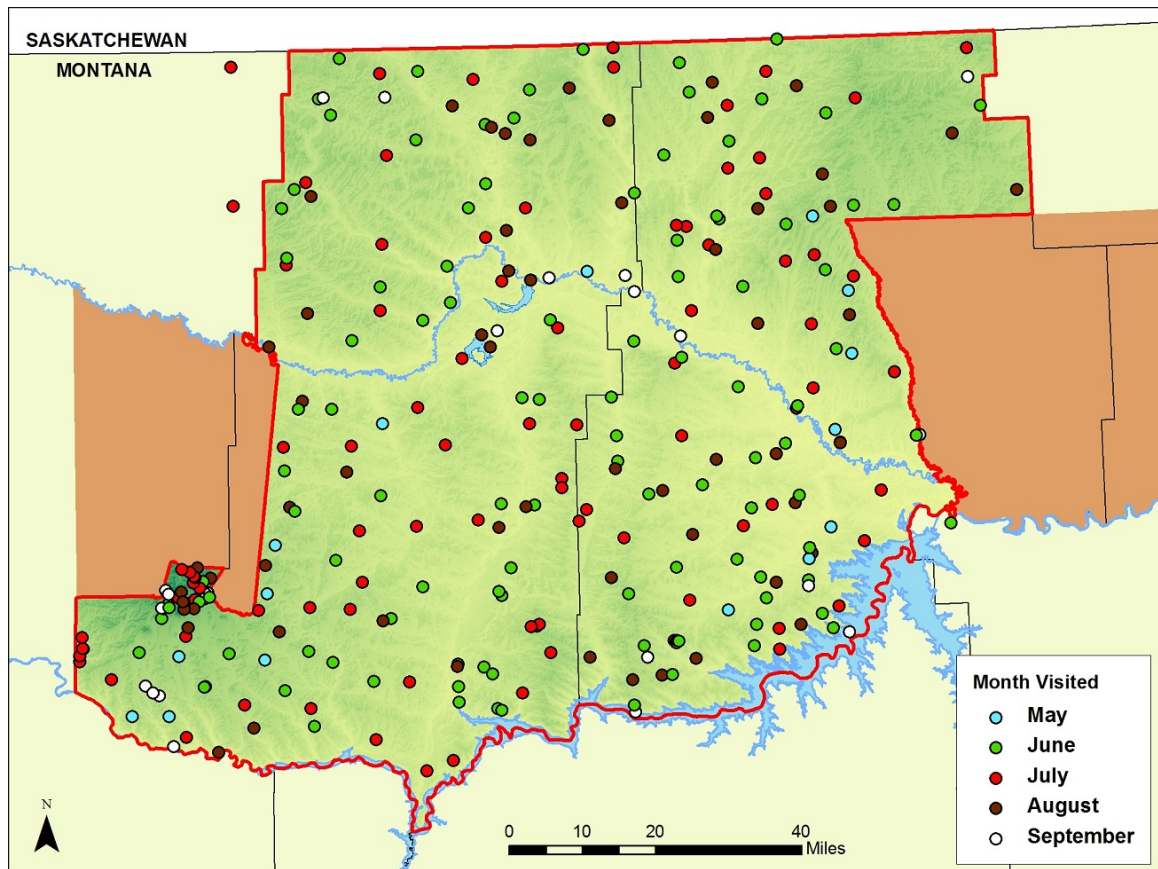
the area for cultivated agriculture and its use primarily as rangeland have left many of the grasslands and shrublands present relatively intact (Cooper et al. 2001).

## CHAPTER II

### METHODS

The methods used for this inventory largely follow those employed by other graduate students and staff at RM for other floristic inventories in the greater Rocky Mountain region (Hartman 1992; Hartman and Nelson 2008; Reif et al. 2009; Kesonie and Hartman 2011; Kuhn et al. 2011; Lukas et al. 2012). Our primary objective was to document the diversity of vascular plants across the area throughout the growing season through the collection of voucher specimens. As such, we chose individual collecting sites in the field rather than visiting a set of randomly distributed points. Collecting sites were selected for greatest potential diversity, often at the intersection of different vegetation types or on unique substrates, while spacing sites over the region during different months of the field season. At each collection site, we used the “meander” search strategy (Goff et al. 1982; Hartman 1992; Hartman and Nelson 2008). All species in flower or fruit or otherwise readily identifiable through vegetative characters were vouchered at each site visited and relevant habitat and location data (including GPS coordinates) were recorded. Specimens were collected within about 0.5 mi (0.8 km) of each recorded GPS point. Voucher specimens were collected, pressed, and dried in accordance with standard collecting techniques described in Hartman (1992) and Hartman and Nelson (2008).

J.L.M. Charboneau and B.E. Nelson made collections in the field seasons of 2010 and 2011. In 2010, we spent 53 person-days collecting between 8 June and 25 August and between 10 September and 21 September, generally alternating days collecting with days spent pressing. In 2011, between 10 May and 15 August, we spent 49 person-days



**Fig. 5. Collection sites depicted by month visited. Specimens were collected from 308 sites in 2010–2011 primarily in Phillips and Valley counties. The study area is outlined in red.**

collecting. In total, we made 12,785 collections from 308 sites at a density of 1.43 collections per sq mi (0.55 per sq km). Fig. 5 contains a map of collection sites.

Specimens were identified using a number of floras including Dorn’s *Vascular Plants of Montana* (1984), *Flora of the Great Plains* (GPFA 1986), Dorn’s *Vascular Plants of Wyoming* (2001), and *Flora of North America* (1993+). All identifications were checked against specimens in RM verified by specialists. Nomenclature follows that of the RM Plant Specimen Database (Hartman et al. 2009). Specimen data have been entered into this database and are available online (Hartman et al. 2009). All specimens are housed at RM, and duplicates will be sent to MONT, MONTU, and other herbaria.

We performed two types of analyses to assess the adequacy of our collecting in documenting the actual diversity of vascular plants. The first was a comparison of the environmental conditions and cover types sampled by our collection sites and a set of randomly placed points based on the non-stratified environmental parameter analysis described by Neldner et al. (1995). Using ArcGIS v. 10.0 (ESRI 2011) we classified ranges of three environmental variables across the area: elevation (USGS 2009), average annual precipitation, and average daily minimum temperature (PRISM 2004). We then created a raster file with these combinations and determined how many of these combinations were sampled by our collection sites and a set of random points within the same accessible lands we collected. We also repeated this analysis using land cover type data from MTNHP (2010) in place of the environmental data.

The second type of analysis used to evaluate our sampling adequacy was a comparison of the vascular plant diversity we observed to estimates of the true diversity present. We used EstimateS v. 8.2 (Colwell 2009) to make taxon accumulation curves by collection days elapsed both chronologically and from 50 randomizations of collecting order using the default settings. For this purpose we used all collections that were definitively identified even if they were eventually discarded for inadequate material. We estimated the total vascular plant diversity using both the non-parametric, asymptote-fitting Michaelis-Menten equation and parametric richness estimators (i.e. based on the number of taxa collected only once or twice) such as the bootstrap, second-order jackknife, and Chao 1 estimators (see Colwell and Coddington 1994 for a review of these methods). We compared these estimates of actual taxon diversity to the number of observed taxa to estimate the percentage of actual taxon diversity documented.



## CHAPTER III

### RESULTS AND DISCUSSION

Results of the inventory are included in the following sections: summary of taxa, vegetation types, taxa of conservation concern, exotic taxa and noxious weeds, newly documented taxa, and sampling adequacy.

#### SUMMARY OF TAXA

We collected 761 unique taxa from 86 vascular plant families. The families with the highest diversity are Asteraceae (134 taxa), Poaceae (111), Fabaceae (55), Brassicaceae (39), and Rosaceae (37). Genera with the greatest number of taxa observed are *Carex* (Cyperaceae; 21 taxa), *Astragalus* (Fabaceae; 19), *Elymus* (Poaceae; 18), *Poa* (Poaceae; 11), and *Potentilla* (Rosaceae; 11). Below is a summary of the plants collected during the study.

#### Taxa by taxonomic category:

Families	86
Genera	358
Species	717
Infraspecies	43
Putative hybrids	1
Unique taxa	761

#### Taxa by special category:

Exotic	108 (14.2%)
MT noxious weeds	10
Of conservation concern	15
New to study area	244 (32.1%)
County records	483

#### Taxa by major plant group:

Fern Allies	7
Ferns	7
Gymnosperms	7
Angiosperms	740

#### VEGETATION TYPES

Mackie (1970) and Cooper et al. (2001) are among the few descriptions of plant communities specific to the region. We describe 19 vegetation types organized into six physiognomic categories based on the dominant vegetation, taking inspiration from the

Montana Ecological Systems Field Guide (MTNHP 2012a). Delimitation of vegetation types across the landscape is often difficult as boundaries are often not clear-cut. The types we present are not meant to be completely distinct and often blend into one another. Abbreviations for vegetation types consist of an initial uppercase letter designating the physiognomic category followed by two lowercase letters for the unique vegetation type. If only one infraspecific taxon was found for a species, only the species name is listed in the vegetation type description.

### **Grasslands (G)**

*Mixedgrass prairie (Gmg).*—Mixedgrass prairie is the most common vegetation type, dominating over much of the rolling plains. Although some sources classify the grasslands of eastern Montana as shortgrass prairie (e.g. GPFA 1986), they are better classified as northern mixedgrass prairie (Coupland 1961; Singh et al. 1983). Cool season (C<sub>3</sub>) grasses dominate this mixedgrass prairie with a single short, warm season (C<sub>4</sub>) grass (*Bouteloua gracilis*) present to varying degrees (Singh et al. 1983). Cool season grasses dominant in mixedgrass prairie are *Elymus smithii*, *Hesperostipa comata*, *Koeleria macrantha*, *Nassella viridula*, and *Poa secunda* subspecies as well as the sedge *Carex filifolia*.

In addition to the dominant grass cover, *Selaginella densa* (spikemoss) can sometimes form significant ground cover in these grasslands. Shrub cover can range from low to moderate as mixedgrass prairie blends into sagebrush steppe. Shrubs commonly found are *Artemisia cana*, *Artemisia tridentata*, *Juniperus horizontalis*, and *Krascheninnikovia lanata* along with the cactus *Opuntia polyacantha* and the subshrub *Artemisia frigida*. Forb diversity is relatively high in mixedgrass prairie. *Achillea*

*millefolium*, *Antennaria* spp., *Astragalus adsurgens*, *Erigeron pumilus*, *Erysimum inconspicuum*, *Hedeoma hispidum*, *Heterotheca villosa*, *Hymenoxys richardsonii*, *Lomatium foeniculaceum*, *Oenothera suffrutescens*, *Packera cana*, *Penstemon* spp., *Phlox hoodii*, *Sphaeralcea coccinea*, and *Vicia americana* var. *minor* are commonly found.

The area's flora is more greatly influenced by regions to the west rather than by the eastern edge of the Great Plains (Lavin and Seibert 2011). Grasses of the tallgrass or "true" prairie such as *Andropogon gerardii*, *Hesperostipa spartea*, *Panicum virgatum*, *Sorghastrum nutans*, and *Sporobolus heterolepis* (Johnson and Larson 2007) indeed are entirely absent. But to say that the area is little influenced by the Great Plains flora as indicated by Lavin and Seibert (2011) is dependent on how one defines this flora. The Great Plains flora is in all parts recent and adventive, with species colonizing from peripheral ecosystems (GPFA 1986).

A variant of mixedgrass prairie occurs in the north where mesic grasslands on soils derived from fine-grained till are dominated by *Hesperostipa curtiseta* and *Elymus lanceolatus* (Coupland 1961; Cooper et al. 2001). This association will be discussed further with the moist coulee bottom and swale vegetation type.

*Upland prairie (Gup).*—Well-drained prairie uplands often have a distinctive suite of species in addition to those common on typical mixedgrass prairie. Sandstone outcrops and sandstone-derived soils are often present on uplands since sandstone erodes less easily than shale in this semiarid environment (Jensen and Varnes 1964). Thus many uplands often have sandier soil than surrounding areas. On these uplands, forbs such as *Astragalus gilviflorus*, *Comandra umbellata*, *Cryptantha* spp., *Eriogonum flavum*,

*Hymenopappus filifolius*, *Paronychia sessiliflora*, *Physaria spatulata*, *Stenotus armerioides*, *Tetraneuris acaulis*, and *Xanthisma grindelioides* are common. Typical shrubs include *Juniperus horizontalis*, *Krascheninnikovia lanta*, *Rhus trilobata*, *Yucca glauca* and the subshrub *Artemisia campestris* var. *pacifica*. Graminoids often growing in this habitat are *Achnatherum hymenoides*, *Bouteloua gracilis*, *Calamovilfa longifolia*, *Carex filifolia*, *Elymus spicatus*, *Hesperostipa comata*, and *Schizachyrium scoparium*.

*Montane meadows (Gmm).*—There are only a few montane meadows found on south exposures in the Little Rocky Mountains. These often have many grassland species found at lower elevations but also have a distinctive assemblage of forbs. Diagnostic forbs include *Balsamorhiza sagittata*, *Delphinium bicolor*, *Drymocallis glabrata*, *Lithospermum ruderales*, *Oxytropis spendens*, and *Solidago mollis*. Some diagnostic graminoids are *Calamagrostis purpurascens*, *Carex hoodii*, *Festuca saximontana*, and *Poa pratensis*. The shrub *Dasiphora fruticosa* can also be found in these open meadows.

### **Shrublands (S)**

*Sagebrush steppe (Sss).*—Sagebrush steppe intergrades extensively with mixedgrass prairie, sharing many of the same graminoid and forb species. It is most prevalent in the southern part of the area. Sagebrush (*Artemisia* spp.) cover is dependent on climatic and edaphic factors, with areas receiving a greater proportion of winter precipitation and greater soil moisture at depth likely to have higher sagebrush cover than pure grasslands (Knight 1994).

There are two primary sagebrush taxa forming sagebrush steppe: *A. tridentata* var. *wyomingensis* (Wyoming big sagebrush) and *A. cana* var. *cana* (silver sagebrush). *A. tridentata* is at its northeastern limit within the area (McArthur 1999), indeed, we never

encountered it north of the Milk River. *A. cana* is found throughout the area and is more tolerant of higher soil moisture than *A. tridentata* (Knight 1994) and as such can often form sagebrush steppe in moist coulees.

Other common shrubs in sagebrush steppe are *Atriplex gardneri*, *Ericameria nauseosa* var. *nauseosa*, and *Gutierrezia sarothrae* along with the cactus *Opuntia polyacantha* and the subshrub *Artemisia frigida*. Typical graminoids are *Bouteloua gracilis*, *Elymus elymoides* varieties, *E. smithii*, *Koeleria macrantha*, and *Poa secunda* subspecies. Forbs commonly found in sagebrush steppe include *Allium textile*, *Astragalus missouriensis*, *Atriplex argentea*, *Musineon divaricatum*, *Orobanche fasciculata*, *Senecio integerrimus* var. *scribneri*, and *Vicia americana* var. *minor*. As in mixedgrass prairie, *Selaginella densa* can form significant ground cover as well.

*Juniper steppe/woodland (Sjw)*.—This vegetation type is transitional between sagebrush steppe and ponderosa pine-juniper woodland, overlapping considerably both. It is found only in the south along the Missouri River Breaks where juniper shrubs, *Juniperus scopulorum*, *J. horizontalis* and their conspecific hybrid, *J. ×fassetii*, occur relatively sparsely on hillsides and coulees. *J. ×fassetii* (also known as *J. scopulorum* Sarg. var. *patens* Fassett) is a decumbent shrub intermediate in stature between the parental species that lacks the single-stemmed crown of *J. scopulorum* and the completely prostrate habit of *J. horizontalis* (Adams 2011). Other common shrubs include *Artemisia tridentata* and *Rhus trilobata*.

*Greasewood shrubland (Sgs)*.—Shrublands dominated by *Sarcobatus vermiculatus* (greasewood) are often found toward the bottom of coulees on soils derived from marine shales where there are saline soils and a high water table (MTNHP 2012a).

Other common shrubs in this vegetation type are *Artemisia tridentata*, *Atriplex gardneri*, and *Suaeda calceoliformis* along with the cactus *Opuntia polyacantha*. The forbs *Atriplex suckleyi*, *Dieteria canescens*, *Grindelia squarrosa*, *Iva axillaris*, and the exotic *Melilotus officinalis* are usually found. Common grasses include *Bouteloua gracilis*, *Distichlis spicata*, *Elymus elymoides* var. *elymoides*, *E. smithii*, *Hordeum jubatum* ssp. *intermedium*, and the exotic grass *Bromus japonicus*. Sagebrush steppe and juniper steppe/woodland often intergrade into these greasewood shrublands from upslope.

### **Forests and Woodlands (F)**

*Thicket and woody draw (Ftw).*—In steep coulees there is enough moisture to support thickets primarily of shrubs, especially *Prunus virginiana*, *Rhus trilobata*, and *Shepherdia argentea* but also *Amelanchier alnifolia*, *Cornus sericea*, *Juniperus* spp., *Ribes* spp., *Rosa woodsii*, and *Symphoricarpos occidentalis*. In the steepest, moistest coulees, trees such as *Acer negundo* var. *interius*, *Fraxinus pensylvanica*, *Juniperus scopulorum*, and *Populus deltoides* can be found. Typical grasses in these thickets are *Bromus inermis*, *Elymus canadensis*, *E. trachycaulus* var. *trachycaulus*, *Piptatherum micranthum*, and *Poa pratensis*. Forbs such as *Campanula rotundifolia*, *Geum triflorum*, *Glycyrrhiza lepidota*, *Maianthemum stellatum*, *Parietaria pensylvanica*, *Solidago missouriensis*, *Toxicodendron rydbergii*, and *Urtica dioica* are often found.

*Riparian cottonwood forest (Frc).*—Similar to woody draws and thickets, these riparian forests dominated by *Populus deltoides* (cottonwood) are found along the flood plains of the Milk and Missouri rivers and a few larger creeks. Other trees sometimes found in these riparian forests are *Acer negundo* varieties, *Fraxinus pensylvanica*, *Salix amygdaloides*, and *Salix eriocephala* var. *famelica*, along with the exotic tree *Elaeagnus*

*angustifolia*. Typical shrubs are *Prunus virginiana*, *Rosa woodsii*, *Salix exigua*, and *Symphoricarpos occidentalis*. Fluctuating water levels disturb these forests so weedy grasses such as *Echinochloa muricata*, *Panicum capillare*, and *Setaria viridis* are often found along with weedy forbs including *Euphorbia esula* varieties, *Kochia scoparia*, and *Xanthium strumarium*. Also commonly found are *Artemisia ludoviciana*, *Glycyrrhiza lepidota*, and *Solidago gigantea*. In many of these forests, human alteration of hydrology has resulted in highly altered old cottonwood stands with limited regeneration (MTNHP 2012a). Flooding during 2011, however, resulted in the establishment of many new cottonwood seedlings on the banks of the Milk and Missouri rivers.

*Ponderosa pine-juniper woodland (Fpj)*.—This habitat occurs only in parts of the Missouri River Breaks on steep drainages. The upper canopy is typically fairly open and made up of *Pinus ponderosa* (ponderosa pine), although *Pseudotsuga menziesii* (Douglas fir) may also be found on some of the steepest north exposures in southern Phillips County. Typically there is also a thick understory of junipers, both *Juniperus scopulorum* and *J. ×fassetii*. Surrounding vegetation types like sagebrush steppe and juniper steppe/woodland heavily influence ponderosa pine-juniper woodland vegetation. *Artemisia tridentata*, *Juniperus communis*, *Ribes cereum*, *Rhus trilobata*, and *Symphoricarpos occidentalis* are common shrubs. Graminoids such as *Carex inops*, *Elymus smithii*, *E. spicatus*, *Nasella viridula*, *Poa secunda* subspecies, and the exotic grass *Bromus japonicus* are typically found. *Parietaria pensylvanica*, *Phacelia linearis*, *Thermopsis rhombifolia* var. *rhombifolia*, and *Tragopogon dubius* are common forbs. Many of these woodlands and surrounding sagebrush steppe have a heavy cover of *Melilotus officinalis*, which was often seeded by land managers in revegetation projects

even though it can be highly invasive on the Northern Great Plains (Lesica and DeLuca 2000). In addition to shading out native vegetation, *M. officinalis* may allow other non-native plants to outcompete native ones by enriching soils with nitrogen (Lesica and DeLuca 2000).

*Montane ponderosa pine forest (Fpp).*—These forests are found only in the Little Rocky Mountains in dry areas at low elevations. Montane ponderosa pine forests occur from about 3,700 ft to 4,300 ft (1,130 m to 1,310 m) where they begin to transition into lodgepole pine forests. Above these elevations, ponderosa pine is more scarce and usually only on sunny, south exposures. Ponderosa pine is at the northern edge of its range within the area. In the Cypress Hills and the Sweetgrass Hills (only about 60 mi [100 km] further north than the Little Rockies), ponderosa pine is absent apparently because the climate is too cold (Breitung 1954; Thompson and Kuijt 1976; USGS 1999).

*Pinus ponderosa* is the dominant tree in these forests with *Juniperus scopulorum* present in the understory. The understory also includes such shrubs as *Arctostaphylos uva-ursi*, *Berberis repens*, and *Juniperus communis*. Representative grasses are *Danthonia spicata* and *Elymus albicans*. The suite of forbs found in these montane forests is quite different from those found in the ponderosa pine-juniper woodlands of the Missouri River Breaks. *Allium cernuum*, *Fragaria virginiana*, *Helianthus pauciflorus*, *Maianthemum stellatum*, *Monarda fistulosa*, *Solidago simplex*, and *Viola adunca* are typical forbs.

*Montane mixed conifer forest (Fmc).*—This forest type is found in the Little Rocky Mountains on mesic slopes at middle elevations. Tree canopy is made up of a mixture of the conifers *Pinus contorta* (lodgepole pine), *Pinus ponderosa*, and



*Pseudotsuga menziesii* along with the deciduous tree *Populus tremuloides* (aspen). Common shrubs are *Arctostaphylos uva-ursi*, *Berberis repens*, *Juniperus communis*, and *Shepherdia canadensis*. Representative grasses found in these forests are *Danthonia spicata*, *Elymus repens*, *E. spicatus*, *Phleum pratense*, and *Poa interior*. Common forbs include *Campanulua rotundifolia*, *Clematis occidentalis*, *Galium boreale*, *Linnaea borealis*, *Moehringia lateriflora*, *Osmorhiza chilensis*, *Prosartes trachycarpa*, and *Pterospora andromedea*.

*Lodgepole pine forest (Flp)*.—Lodgepole pine forests are found in the Little Rockies in dry areas at high elevations. These forests typically have a closed canopy and an understory depauperate of species. Moderate disturbance can add some diversity to these forests, but following fires, thick “doghair” stands of young trees sprout from serotinous cones (Knight 1994). Such stands are common in the Little Rockies. Mountain pine beetle infestations in these and other forests in the Little Rocky Mountains are minimal at this time. Shrubs found in lodgepole pine forests are *Ceanothus velutinus*, *Juniperus communis*, and *Salix scouleriana*. Other species commonly found include *Linnaea borealis*, *Orthilia secunda*, *Pterospora andromedea*, *Spiraea betulifolia*, and *Thermopsis rhombiolia* var. *rhombifolia*. There are no subalpine forests found in the Little Rockies. *Picea engelmannii* (Engelmann spruce) has been reported in the nearby Bearpaw Mountains (USGS 1999), which rise to a maximum elevation of 6,917 ft (2,108 m), nearly 1,200 ft (365 m) higher than the Little Rockies.

*Montane riparian forest (Fmr)*.—This forest type is found along moist creek bottoms in the Little Rocky Mountains. Mixed conifers (*Pinus contorta*, *Pinus ponderosa*, and *Pseudotsuga menziesii*) form the canopy with a thick understory of the

deciduous trees *Betula papyrifera* (paper birch) and *Populus tremuloides* and the shrubs *Amelanchier alnifolia*, *Cornus sericea*, *Juniperus communis*, *Prunus virginiana*, *Ribes* spp., *Salix bebbiana*, and *Shepherdia canadensis*. Typical grasses are *Bromus richardsonii*, *Phleum pratense*, *Poa palustris*, and *P. pratensis*. Common forbs include *Actaea rubra*, *Agrimonia striata*, *Equisetum arvense*, *Geranium richardsonii*, *Maianthemum racemosum*, *Mimulus guttatus*, various orchids, *Prosartes trachycarpa*, *Sanicula marilandica*, *Spiraea betulifolia*, and *Viola canadensis*. The presence of paper birch in the Little Rockies suggests the presence of boreal forests in the region following Pleistocene glaciations. Most of the flora of the Little Rockies, however, is more indicative of a cordilleran influence as in the Sweetgrass Hills (Thompson and Kuijt 1976) and to a lesser extent the Cypress Hills (Breitung 1954).

### **Wetlands (W)**

*Moist coulee bottom and swale (Wcb).*—Some prairie species are most typically found in moist coulee bottoms and swales. This habitat also grades into thickets and wooded coulees if there is enough moisture to support more woody vegetation and into persistent wetlands if there is surface water. Common forbs in moist coulee bottoms and swales include *Arnica* spp., *Artemisia ludoviciana*, *Cerastium arvense*, *Draba nemorosa*, *Geum triflorum*, *Glycyrrhiza lepidota*, *Potentilla* spp., *Veronica peregrina*, and *Zigadenus venenosus*. Common graminoids are *Carex brevior*, *C. praegracilis*, *Hordeum jubatum* varieties, and *Poa pratensis*. The shrubs *Artemisia cana*, *Juniperus horizontalis*, *Rosa woodsii*, and *Symphoricarpos occidentalis* can also be found. In vernal pools with seasonally standing water, *Eleocharis* spp., *Gnaphalium palustre*, *Myosurus minimus*,

*Navarretia intertexta*, *Plagiobothrys* spp., and *Veronica peregrina* are common. Several of the taxa of conservation concern that we found grow in these vernal pools.

The coulee bottoms and mesic grasslands of northeastern Valley County seem to be indicative of vegetation types more common to the north in Canada. In the Opheim Hills and to the east, the shrubs *Dasiphora fruticosa* and *Elaeagnus commutata* can also be found in moist swales. *Populus tremuloides*, rare on the plains of eastern Montana but more common further north in Canada (Coupland 1961; Cooper et al. 2001), can be found in some of the coulees of the Opheim Hills as well. A few species found nowhere else were present in these moist habitats: *Carex obtusata*, *Fragaria vesca*, *Geranium viscosissimum*, *Primula pauciflora*, *Viola nephrophylla*, and *Zizia aptera*. Many of these species are more common on the Canadian prairies further north (Budd 1979). Other species were only encountered elsewhere in the Little Rockies including *Carex bebbii*, *C. sprengelii*, *Delphinium bicolor*, *Heracleum maximum*, *Shepherdia canadensis*, and *Viola canadensis*. The grasses *Hesperostipa curtiseta* and *Elymus lanceolatus* were also frequently found in these locations. *Festuca hallii*, the principal grass of the fescue prairies of Canada (Coupland 1961), was found only once in the study in northeastern Valley County just a few miles south of Canada. This area receives slightly greater precipitation and is generally colder than the rest of the study area (PRISM 2004).

The *Hesperostipa curtiseta* and *Elymus lanceolatus* grasslands found in northeastern Valley County are much more common in Canada than in the U.S. However, they were once more prevalent in both countries before such sites, which are well suited to grain production, were put under cultivation (Cooper et al. 2001). Indeed, most of the lands east of Opheim are in cultivation and privately owned (Fig. 2). A sizable expanse of

this prairie association in a large area of Montana State Trust Lands along Dry Fork Creek in northern Valley County represents one of, if not the best, remaining of its kind in the U.S. (Cooper et al. 2001).

*Persistent wetland (Wpw).*—Most persistent wetlands are located around small reservoirs although they also occur along large creeks and small pools in creek beds where open water persists throughout the growing season. Around the periphery of wetlands, which may be submerged in the spring and early summer but are often dry by autumn, graminoids such as *Beckmannia syzigachne*, *Carex* spp., *Echinochloa muricata*, *Eleocharis palustris*, *Hordeum jubatum* subspecies, *Juncus arctius*, and *Poa palustris* are common along with the forbs *Glycyrrhiza lepidota*, *Mentha arvensis*, *Rumex* spp., *Xanthium strumarium*, and the noxious weed *Cirsium arvense*. Common shrubs on the periphery of wetlands are *Rosa woodsii* and *Salix exigua*. Occasionally the trees *Populus deltoides* and *Salix amygdaloides* may occur as well. Emergent aquatic plants typically growing in standing water throughout the growing season are *Alisma* spp., *Bolboschoenus* spp., *Persicaria* spp., *Sagittaria cuneata*, *Schoenoplectus* spp, and *Typha* spp. Common submerged aquatics are *Ceratophyllum demersum*, *Potamogeton* spp., *Ranunculus aquatilis*, and *Stuckenia pectinata*.

*Alkaline wetland (Wal).*—Because soils in most of the area are derived from marine shales, many wetlands are alkaline at least to some extent. Many species found in freshwater wetlands are also found in alkaline wetlands but the most alkaline typically have a unique assemblage including *Distichlis spicata*, *Glaux maritima*, *Hordeum jubatum* subspecies, *Puccinellia nuttalliana*, *Salicornia rubra*, *Spergularia marina*, and *Triglochin maritima*.

Sparsely vegetated alkaline pan areas are also common. These pan areas are formed above high points on the shale-till boundary beneath the soil surface. Salts from marine shales accumulate here and cause the formation of natric horizons in the subsoil, which greatly reduces infiltration of precipitation (Munn and Boehm 1983). Few plants can thrive in these water-stressed, alkaline conditions, so plant cover is very sparse with low diversity. *Dieteria canescens*, *Distichlis spicata*, *Elymus smithii*, *Hordeum jubatum* subspecies, *Iva axillaris*, *Monolepis nuttalliana*, *Polygonum aviculare*, *Puccinellia nuttalliana* and the subshrub *Atriplex gardneri* are among the few species typically encountered.

### **Sparsely Vegetated (V)**

*Badlands (Vbl).*—Badlands are common where marine shales are exposed. When wetted, these badlands form slick, alkaline clay that cracks extensively upon drying and erodes so rapidly that little vegetation can be established. The few species that can survive on badlands are often weedy and tolerant of alkalinity. These include *Atriplex suckleyi*, *Conringia orientalis*, *Eriogonum pauciflorum*, *Iva axillaris*, *Monolepis nuttalliana*, *Oenothera cespitosa*, *Penstemon nitidus*, and *Polygonum aviculare* occasionally with the shrubs *Atriplex gardneri*, *Sarcobatus vermiculatus*, and *Suaeda calceoliformis*.

Shale dunes, somewhat similar to badlands but less common, are found especially in the north in Bitter Creek WSA and the Frenchman Creek valley. These dunes are formed by the wind when shale weathers into sand-sized particles rather than clay minerals. *Juniperus horizontalis* typically stabilizes these dunes. Other species commonly found are *Artemisia longifolia*, *Eriogonum pauciflorum*, *Oenothera cespitosa*, *Rosa* spp., *Stephanomeria runcinata*, and *Thermopsis rhombifolia* var. *rhombifolia*.

*Rock outcrops (Vro).*—The Little Rocky Mountains have areas of both granitic and carbonate rock outcrops. *Cheilanthes feei*, *Draba cana*, *Erigeron compositus*, *Minuartia rubella*, *Poa glauca*, *Sedum lanceolatum*, *Townsendia hookeri*, and *Woodsia oregana* are among the herbaceous species found on these outcrops. The shrubs *Dasiphora fruticosa* and *Ribes cereum* can be found as well.

There are also several large areas of sparsely vegetated talus fields in the Little Rockies. *Ceanothus velutinus*, *Chamerion angustifolium*, *Prunus pensylvanica*, *Ribes* spp., and *Rubus idaeus* are typically found on this talus.

### **Disturbed (D)**

There are many disturbed habitats covered by weedy forbs and grasses (many are invasive). These are primarily found along roadsides but also in dry reservoir beds, on reservoir dams, and in reseeded fields formerly under cultivation. Areas disturbed by natural action such as fires, flooding, and animal burrows have many of the same species. Common forbs of these habitats include *Alyssum desertorum*, *Camelina microcarpa*, *Chamaesyce* spp., *Descurainia sophia*, *Grindelia squarrosa*, *Helianthus annuus*, *Kochia scoparia*, *Lepidium* spp., *Melilotus officinalis*, *Monolepis nuttaliana*, *Polygonum* spp., and *Thlaspi arvense*. Typical weedy grasses are *Agropyron cristatum*, *Bromus inermis*, *B. japonicum*, *B. tectorum*, *Eragrostis cilianensis*, and *Hordeum jubatum* subspecies.

A few species were only found planted and persisting at old homesteads and other such sites. These are *Caragana arborescens*, *Cotoneaster lucidus*, *Lonicera tatarica*, *Malus pumila*, *Ulmus americana*, and *Ulmus pumila*. *Syringa vulgaris* was also present but never collected at such sites.

## TAXA OF CONSERVATION CONCERN

Fifteen taxa of conservation concern were documented from 34 sites. These taxa are tracked by the Montana Natural Heritage Program with state ranks of S1, S2, or S3 or are listed as sensitive by the Bureau of Land Management (MTNHP 2012b). These taxa are indicated by a diamond (◆) in the annotated checklist and listed alphabetically below.

*Ammannia robusta* (Lythraceae) was found in a reservoir and adjacent mudflat.

Voucher: *Nelson 81384*.

*Anagallis minima* (Myrsinaceae) was found in vernal pools. Vouchers: *Charboneau 2486, 7921*.

*Bacopa rotundifolia* (Plantaginaceae) was found on the edge of a reservoir. Voucher: *Charboneau 9535*.

*Botrychium hesperium* (Ophioglossaceae) was found in a rocky disturbed area in lodgepole pine forest. Voucher: *Charboneau 2120*.

*Carex scoparia* var. *scoparia* (Cyperaceae) was found in a juniper thicket in the Missouri River Breaks and in a montane meadow. Vouchers: *Charboneau 2298, 7690*.

*Elodea bifoliata* (Hydrocharitaceae) was found floating in reservoirs. Vouchers: *Charboneau 9431, 9516, 9541*.

*Phlox andicola* (Polemoniaceae) was found in sagebrush steppe. Voucher: *Charboneau 5069*.

*Physaria brassicoides* (Brassicaceae) was found in a montane meadow. Voucher: *Charboneau 4812*.

*Physaria ludoviciana* (Brassicaceae) was found in mixedgrass prairie. Vouchers: *Charboneau 4862; Nelson 82012*.

*Plagiobothrys leptocladus* (Boraginaceae) was found in vernal areas. Vouchers: *Charboneau 1373b, 5791, 6144, 6870, 7209; Nelson 80119, 80180, 80542, 81590*.

*Psilocarphus brevissimus* var. *brevissimus* (Asteraceae) was found in a vernal area. Voucher: *Charboneau 7286a*.

*Ranunculus hyperboreus* (Ranunculaceae) was found floating in a creek. Voucher: *Charboneau 2462*.

*Senecio eremophilus* var. *eremophilus* (Asteraceae) was found in montane disturbed areas. Vouchers: *Charboneau 2141, 9167; Nelson 81011*.

*Sphenopholis intermedia* (Poaceae) was found in mixed conifer forest. Voucher: *Charboneau 2199*.

*Suckleya suckleyana* (Amaranthaceae) was found in dried reservoir bottoms and shores. Vouchers: *Charboneau 2736, 3354, 3843, 3860; Nelson 81378*.

#### **EXOTIC TAXA AND NOXIOUS WEEDS**

We collected 108 taxa exotic to Montana, comprising 14.2% of the taxa on the annotated checklist (Mincemoyer 2012). These taxa are indicated in the annotated checklist by an asterisk (\*). Nine species (10 taxa) of the 32 species recognized as noxious weeds by the Montana Noxious Weeds Program (2010) were documented. These were *Acroptilon repens*, *Centaurea diffusa*, *Centaurea stoebe*, *Cirsium arvense*, *Convolvulus arvensis*, *Cynoglossum officinale*, *Euphorbia esula* varieties, *Leucanthemum vulgare*, and *Tamarix chinensis*. In the annotated checklist these taxa are indicated by a square (■). The most widespread and common of these noxious weeds are *Euphorbia esula* varieties and *Cirsium arvense*. Two Montana regulated plants (priority three weeds) were also found: *Bromus tectorum* and *Elaeagnus angustifolia*.

#### **NEWLY DOCUMENTED TAXA**

The area's vascular flora was previously poorly documented. We collected 244 taxa that had previously been undocumented (Hartman et al. 2009; Kartesz 2011; MONT 2012; MONTU 2012, USDA 2012). This accounts for 32.1% of the 761 taxa. Of the 12,785 specimens we collected, 483 or about one in every 27 collections are county records in either Phillips County or Valley County.

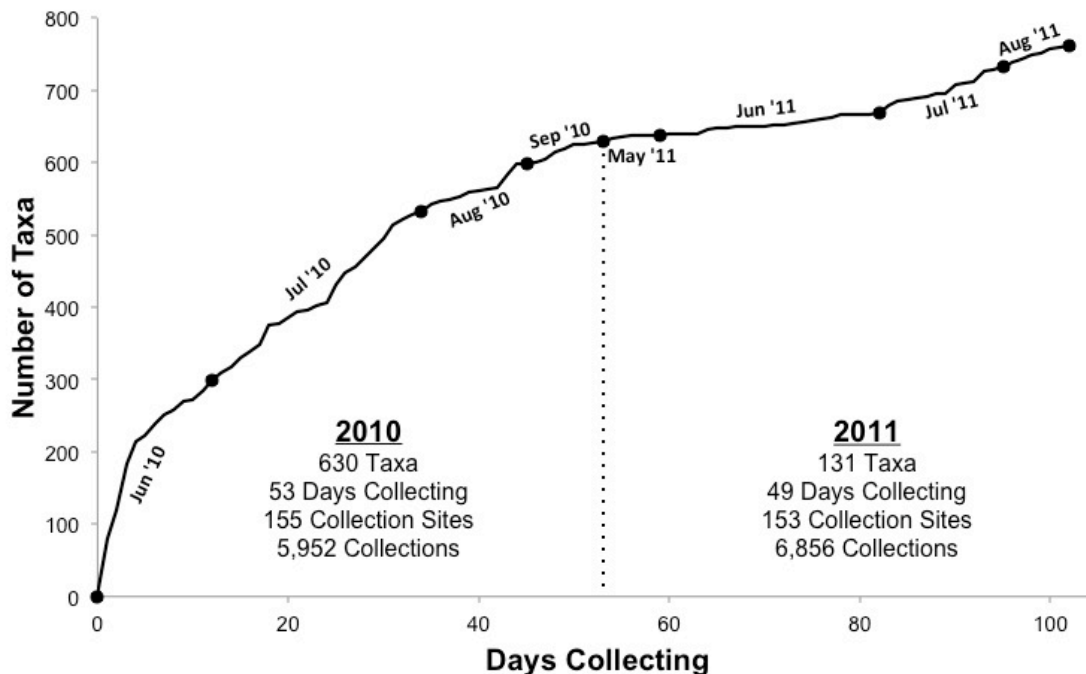


## **SAMPLING ADEQUACY**

*GIS analyses.*—In our assessment of the sampling adequacy of environmental conditions by our collection sites, we found that our sites did nearly as well as a set of random points. There were 66 combinations of elevation, average annual precipitation, and average daily minimum temperature classes within the lands accessible for collecting. Our actual collection sites were located in 42 of these combinations while a random set of the same number of points was located in 44 combinations. Our collection sites missed combinations comprising 2.2% of accessible lands, while the random points missed combinations totaling 1.1%.

While our collection sites sampled nearly as well as random points in environmental conditions, our collection sites outperformed random points in sampling land cover types. Thirty-nine land cover types are reported within accessible lands (MTNHP 2010). These are the same types described in the Montana Ecological Systems Field Guide (MTNHP 2012a). Our collection sites sampled 25 cover types, while the set of random points was only in 15. Our collection sites missed cover types totaling 1.1% of accessible lands, while random sites missed cover types making up 2.3%.

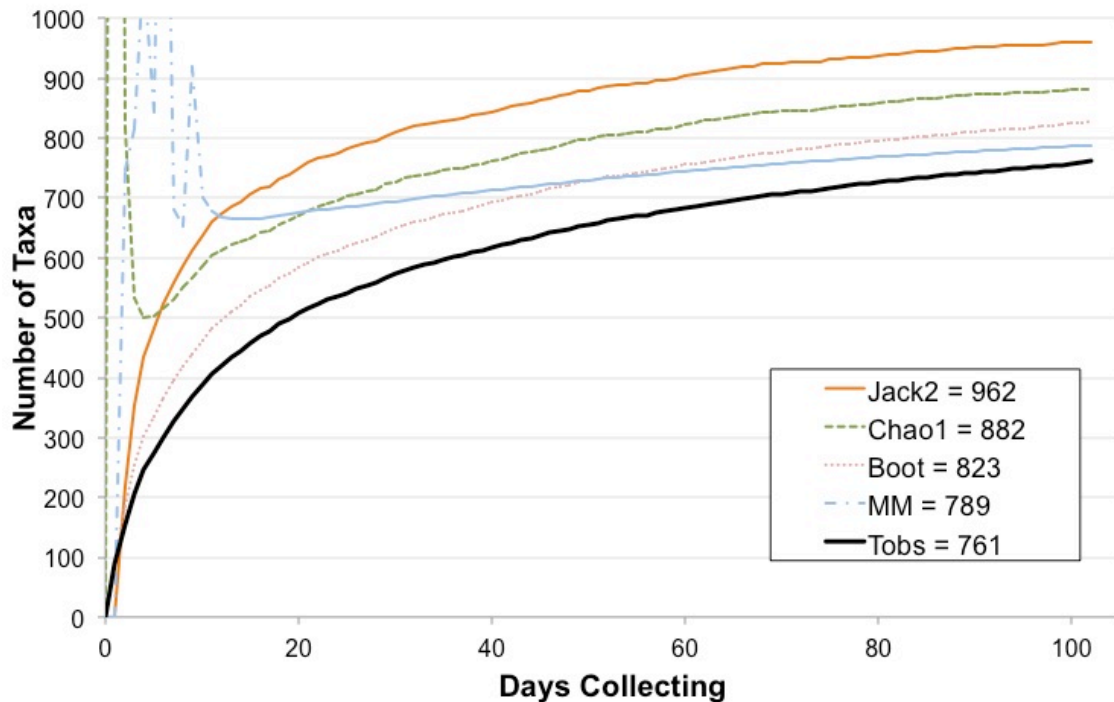
In both analyses, the frequency of collection sites and random points for the most part mirrored the frequency of environmental class combinations and land cover types of accessible lands, with important exceptions. Our actual sites oversampled rare combinations and cover classes such as those found in the Little Rocky Mountains while undersampling the most common combinations and classes. This allowed us to better document all of the taxa found in rare habitats. Random points also have the disadvantage of often being further from a road or trail than our actual collection sites.



**Fig. 6. Taxa accumulated by days collecting in chronological order. 761 taxa were collected in total: 630 during 2010 and an additional 131 for the first time in 2011. Data generated using EstimateS (Colwell 2009).**

*Taxon accumulation curves.*—Fig. 6 shows the taxon accumulation curve with collecting days added in chronological order. The number of taxa collected levels off in the second year of the inventory as few new taxa were encountered in May and June 2011, although almost 100 were encountered for the first time in July and August 2011. In total 630 taxa (almost 83%) were encountered during the first field season, and only an additional 131 were collected for the first time during the second field season.

Fig. 7 shows the taxon accumulation curve averaged from 50 randomizations of the order of collecting days. The curve levels off fairly well with 90% of observed taxon richness encountered by about 60 of 102 collecting days. The asymptote of the species accumulation curve as predicted by the Michaelis-Menten equation (see Colwell and Coddington 1994) reaches 789 taxa, only 28 more than we observed. Parametric



**Fig. 7. Average taxa accumulated from 50 randomizations of collecting day order with estimators of taxon diversity. The number of taxa estimated or observed follow these abbreviations: Jack2 = 2<sup>nd</sup> order jackknife estimator, Chao1 = Chao 1 estimator, Boot = bootstrap estimator, MM = Michaelis-Menten estimator, Tobs = taxa observed. Data generated using EstimateS (Colwell 2009).**

estimators gave higher estimates of diversity: the bootstrap estimator predicted 823 taxa, the Chao 1 estimator 882 taxa, and the second-order jackknife estimator 962 taxa. Thus we estimate that we collected between 79.1% and 96.5 % of the taxa growing in the area.

Our estimate of the actual diversity documented and our analyses of the environmental conditions and land cover types sampled by collection sites show we performed adequately in documenting the diversity of vascular plants. Because of the number of taxa documented for the first time in July and August of the second field season and the relatively short time spent collecting in September, the late summer and early fall likely would be the most worthwhile part of the growing season for further collecting.

## CHAPTER IV

### CONCLUSIONS

This inventory has greatly expanded the floristic knowledge of an 8,954 sq mi (23,191 sq km) area of northeastern Montana. Approximately one in 27 collections made (483 of 12,875) were county records in either Phillips County or Valley County, and about 32% of the taxa we documented were previously unknown from the area. In total, we collected 761 vascular plant taxa from 86 families, an estimated 79–97% of the actual vascular plant diversity present in the area. This study demonstrates there is still much to be learned about the flora of some parts of the contiguous United States.

## CHAPTER V

### ANNOTATED CHECKLIST

The checklist is organized by major groups of vascular plants (fern allies, ferns, gymnosperms, and angiosperms), then alphabetically by family and species.

Nomenclature follows that of the RM Plant Specimen Database (Hartman et al. 2009).

Collection data are available online at <http://www.rmh.uwyo.edu>. Below is a key to the abbreviations and symbols used with individual taxa. The format of each listing is as follows: *Taxon* Authority (**number of collections**) county; elevation; vegetation type.

#### County abbreviations:

**PH** Phillips      **VA** Valley

#### Habitat Types:

<b>D</b>	Disturbed	<b>Gup</b>	Upland prairie
<b>Flp</b>	Lodgepole pine forest	<b>Sgs</b>	Greasewood shrubland
<b>Fmc</b>	Montane mixed conifer forest	<b>Sjw</b>	Juniper steppe/woodland
<b>Fmr</b>	Montane riparian forest	<b>Sss</b>	Sagebrush steppe
<b>Fpj</b>	Ponderosa pine-juniper woodland	<b>Vbl</b>	Badlands
<b>Fpp</b>	Montane ponderosa pine forest	<b>Vro</b>	Rock outcrops
<b>Frc</b>	Riparian cottonwood forest	<b>Wal</b>	Alkaline wetland
<b>Ftw</b>	Thicket and wooded coulee	<b>Wcb</b>	Moist coulee bottom and swale
<b>Gmg</b>	Mixedgrass prairie	<b>Wpw</b>	Persistent wetland
<b>Gmm</b>	Montane meadow		

#### Symbols preceding taxa:

\* Taxon exotic to Montana  
■ Montana noxious weed  
◆ Taxon of conservation concern  
× Putative hybrid

### FERN ALLIES

#### Equisetaceae

*Equisetum arvense* L. (**13**) PH, VA; 2190–4570'; Fmr, Wpw  
*Equisetum ×ferrissii* Clute (**3**) PH; 2240–4570'; Fmr, Wpw  
*Equisetum hyemale* L. var. *affine* (Engelm.) A. A. Eaton (**5**) PH; 4000–4730'; Fmr  
*Equisetum laevigatum* A. Braun (**12**) PH, VA; 2200–4725'; Fpp, Ftw, Gmg  
*Equisetum ×mackaii* (Newman) Brichan (**1**) VA; 2230–2460'; Wpw  
*Equisetum ×nelsonii* (A. A. Eaton) J. H. Schaffn. (**1**) VA; 2460–2520'; Wcb

#### Selaginellaceae

*Selaginella densa* Rydb. (**118**) PH, VA; 2080–5400'; Gmg, Gup, Sss, Wcb

## FERNS

### Dryopteridaceae

*Cystopteris fragilis* (L.) Bernh. (14) PH, VA; 2230–5400'; Fmr, Ftw, Wcb

*Dryopteris filix-mas* (L.) Schott (2) PH; 3920–4430'; Fmr

*Woodsia oregana* D. C. Eaton var. *cathcartiana* (B. L. Rob.) C. V. Morton (9) PH, VA; 2040–5700'; Flp, Fmc, Fpj, Fpp, Voc

*Woodsia scopulina* D. C. Eaton ssp. *scopulina* (1) PH; 3920–4040'; Fmc

### Marsileaceae

*Marsilea vestita* Hook. & Grev. (4) PH, VA; 2140–2730'; Wcb, Wpw

### Ophioglossaceae

- ◆ *Botrychium hesperium* (Maxon & R. T. Clausen) W. H. Wagner & Lellinger (1) PH; 5310–5490'; Flp

### Pteridaceae

*Cheilanthes feei* T. Moore (7) PH; 3920–4730'; Voc

## GYMNOSPERMS

### Cupressaceae

*Juniperus communis* L. var. *depressa* Pursh (52) PH, VA; 2210–5720'; Flp, Fmc, Fmr, Fpj, Fpp, Ftw

*Juniperus ×fassetii* B. Boivin (23) PH, VA; 2040–5400'; Fpj, Ftw, Sjj, Sss

*Juniperus horizontalis* Moench (90) PH, VA; 2150–5530'; Ftw, Gmg, Gup, Sjj, Sss, Wcb

*Juniperus scopulorum* Sarg. (63) PH, VA; 2040–4880'; Fpj, Fpp, Ftw, Gup, Sjj, Sss, Wcb

### Pinaceae

*Pinus contorta* Douglas ex Loudon var. *latifolia* Engelm. (16) PH; 4080–5720'; Flp, Fmc, Fmr

*Pinus ponderosa* C. Lawson & P. Lawson var. *scopulorum* Engelm. (44) PH, VA; 2040–5700'; Fmc, Fmr, Fpj, Fpp

*Pseudotsuga menziesii* (Mirb.) Franco var. *glauca* (Beissn.) Franco (35) PH; 2730–5720'; Fmc, Fmr, Fpj

## ANGIOSPERMS

### Alismataceae

*Alisma gramineum* Lej. (5) PH, VA; 2430–2650'; Wpw

*Alisma triviale* Pursh (17) PH, VA; 2080–3070'; Wpw

*Sagittaria cuneata* E. Sheld. (21) PH, VA; 2080–3070'; Wpw

### Alliaceae

*Allium cernuum* Roth (9) PH; 2940–5700'; Fmc, Fmr, Fpj, Fpp, Gmm

*Allium textile* A. Nelson & J. F. Macbr. (86) PH, VA; 2040–4725'; Fpj, Gmg, Gup, Sgs, Sss

### Amaranthaceae

*Amaranthus albus* L. (4) PH, VA; 2140–2940'; D, Frc

*Amaranthus blitoides* S. Watson (4) PH, VA; 2230–2710'; D

- \* *Amaranthus retroflexus* L. (4) PH, VA; 2140–2560'; D, Frc

*Atriplex argentea* Nutt. var. *argentea* (22) PH, VA; 2210–2970'; D, Gmg, Sss, Vbl

*Atriplex confertifolia* (Torr. & Frém.) S. Watson (5) PH, VA; 2250–3100'; Gup, Sss, Vbl

- Atriplex dioica* Raf. **(3)** PH, VA; 2140–2190'; Wpw  
*Atriplex gardneri* (Moq.) D. Dietr. var. *gardneri* **(72)** PH, VA; 2140–3180'; Gmg, Sgs, Sss, Vbl
- \* *Atriplex heterosperma* Bunge **(5)** PH; 2160–2270'; Frc, Gmg  
*Atriplex patula* L. **(2)** VA; 2430–2780'; Wpw  
*Atriplex suckleyi* (Torr.) Rydb. **(66)** PH, VA; 2170–3300'; D, Gmg, Sgs, Sss, Vbl
- \* *Bassia hyssopifolia* (Pall.) Kuntze **(1)** VA; 2600–2650'; Sss  
*Chenopodium berlandieri* Moq. var. *zschackei* (Murr) Murr ex Asch. **(29)** PH, VA; 2140–4400'; D, Fpj, Frc, Ftw, Gup, Sgs, Wcb  
*Chenopodium desiccatum* A. Nelson **(6)** PH, VA; 2340–2940'; D, Gmg  
*Chenopodium fremontii* S. Watson **(6)** PH, VA; 2210–3070'; Fpj, Frc, Ftw, Sjj  
*Chenopodium glaucum* L. var. *salinum* (Standl.) B. Boivin **(7)** PH, VA; 2130–2840'; Frc, Wcb, Wpw  
*Chenopodium pratericola* Rydb. **(21)** PH, VA; 2080–3200'; D, Gmg, Gup, Sss, Wpw  
*Chenopodium rubrum* L. var. *rubrum* **(1)** PH; 2160'; Frc
- \* *Halogeton glomeratus* (M. Bieb.) C. A. Mey. **(1)** PH; 2800–2950'; Wcb
- \* *Kochia scoparia* (L.) Schrad. **(25)** PH, VA; 2140–2970'; D, Frc, Wcb  
*Krascheninnikovia lanata* (Pursh) A. Meese & A. Smit **(39)** PH, VA; 2190–3250'; Gmg, Gup, Sss
- Monolepis nuttalliana* (Schult.) Greene **(80)** PH, VA; 2040–3240'; D, Gmg, Sgs, Sss, Vbl, Wcb  
*Salicornia rubra* A. Nelson **(4)** PH; 2220–3070'; Sgs, Wal
- \* *Salsola tragus* L. **(14)** PH, VA; 2140–2800'; D, Gmg  
*Suaeda calceoliformis* (Hook.) Moq. **(19)** PH, VA; 2140–3070'; D, Sgs, Sss, Vbl, Wal  
*Suaeda nigra* (Raf.) J. F. Macbr. **(6)** PH, VA; 2330–3000'; Sgs, Sss, Vbl
- ◆ *Suckleya suckleyana* (Torr.) Rydb. **(5)** VA; 2200–2630'; D, Wpw

#### Anacardiaceae

- Rhus trilobata* Nutt. var. *trilobata* **(93)** PH, VA; 2040–4730'; Fpj, Ftw, Gmg, Gup, Sjj, Wcb  
*Toxicodendron rydbergii* (Small ex Rydb.) Greene **(12)** PH, VA; 2270–4330'; Ftw, Wcb

#### Apiaceae

- Cicuta maculata* L. var. *angustifolia* Hook. **(4)** PH, VA; 2620–3050'; Wpw  
*Cymopterus acaulis* (Pursh) Raf. **(14)** PH, VA; 2150–3010'; Gmg, Gup, Sss  
*Heracleum maximum* Bartr. **(7)** PH, VA; 3120–4830'; Fmr  
*Lomatium cous* (S. Watson) J. M. Coult. & Rose **(6)** PH, VA; 2800–5400'; Fmc, Fmr, Fpp, Gmg, Gmm, Wcb  
*Lomatium foeniculaceum* (Nutt.) J. M. Coult. & Rose var. *foeniculaceum* **(58)** PH, VA; 2040–3240'; Gmg, Gup, Sgs, Sss  
*Lomatium macrocarpum* (Nutt. ex Torr. & A. Gray) J. M. Coult. & Rose **(21)** PH, VA; 2190–5700'; Fpp, Gmg, Sss  
*Musineon divaricatum* (Pursh) Nutt. ex Torr. & A. Gray **(62)** PH, VA; 2040–3300'; Fpj, Gmg, Sgs, Sss  
*Osmorhiza chilensis* Hook. & Arn. **(6)** PH; 4000–5700'; Fmc, Fmr  
*Osmorhiza depauperata* Phil. **(6)** PH; 4120–5700'; Fmc, Fmr

*Perideridia montana* (Blank.) Dorn **(1)** PH; 4330–4760'; Fmc  
*Sanicula marilandica* L. **(9)** PH; 3920–5530'; Fmc, Fmr  
*Sium suave* Walter **(2)** VA; 2730–2940'; Wpw  
*Zizia aptera* (A. Gray) Fernald **(1)** VA; 3030–3150'; Wcb

### Apocynaceae

*Apocynum androsaemifolium* L. **(9)** PH; 4000–5490'; D, Fmc, Fmr, Fpp, Gmm  
*Apocynum cannabinum* L. **(5)** PH, VA; 2190–2740'; Gmg, Sgs, Wcb, Wpw  
*Asclepias pumila* (A. Gray) Vail **(2)** VA; 2580–2920'; Fpj, Sss  
*Asclepias speciosa* Torr. **(14)** PH, VA; 2220–3760'; D, Wcb, Wpw  
*Asclepias verticillata* L. **(1)** PH; 3000–3180'; Gmg  
*Asclepias viridiflora* Raf. **(5)** PH, VA; 2440–3100'; Fpj, Ftw, Gmg, Gup, Sss

### Araceae

*Lemna turionifera* Landolt **(3)** PH, VA; 2220–2740'; Wpw

### Asparagaceae

- \* *Asparagus officinalis* L. **(1)** PH; 2190'; Wpw
- Maianthemum racemosum* (L.) Link var. *amplexicaule* (Nutt.) Dorn **(19)** PH; 3920–5700'; Fmc, Fmr
- Maianthemum stellatum* (L.) Link **(21)** PH, VA; 2240–5530'; Fmc, Fmr, Fpp, Ftw, Wcb
- Yucca glauca* Nutt. **(12)** PH, VA; 2210–3760'; Gup

### Asteraceae

- Achillea millefolium* L. **(154)** PH, VA; 2040–5720'; D, Fmc, Fmr, Fpj, Gmg, Sjj, Sss, Wcb
- \*■ *Acroptilon repens* (L.) DC. **(1)** PH; 2270'; Frc
- Agoseris glauca* (Pursh) Raf. var. *dasycephala* (Torr. & A. Gray) Jeps. **(13)** PH, VA; 2400–3250'; Gmm, Sss, Wcb
- Agoseris glauca* (Pursh) Raf. var. *glauca* **(18)** PH, VA; 2440–5160'; Ftw, Gmg, Gmm, Sss, Wcb
- Agoseris parviflora* (Nutt.) D. Dietrich **(4)** PH, VA; 2040–2900'; Fpj, Gmg, Gup, Sss
- Almutaster pauciflorus* (Nutt.) Á. Löve & D. Löve **(1)** VA; 2780–2780'; Wpw
- Ambrosia artemisiifolia* L. **(7)** PH, VA; 2130–2770'; D, Ftw, Wcb, Wpw
- Ambrosia trifida* L. **(5)** PH, VA; 2210–2740'; Frc, Sgs, Wpw
- Anaphalis margaritacea* (L.) Benth. & Hook. **(3)** PH; 4160–4570'; Fmr
- Antennaria howellii* Greene ssp. *howellii* **(3)** PH; 4250–4725'; Flp, Fmc, Gmm
- Antennaria howellii* Greene ssp. *petaloidea* (Fernald) R. J. Bayer **(15)** PH, VA; 2040–5700'; Flp, Fmc, Fmr, Fpj, Fpp, Ftw, Gmg, Gmm, Sss
- Antennaria microphylla* Rydb. **(33)** PH, VA; 2210–3760'; Gmg, Sss, Wcb
- Antennaria parvifolia* Nutt. **(97)** PH, VA; 2040–5490'; Fpj, Gmg, Gmm, Gup, Sss, Wcb
- Antennaria racemosa* Hook. **(3)** PH; 4450–5700'; Flp, Fmc, Fmr
- Antennaria rosea* Greene **(31)** PH, VA; 2040–4900'; Fpj, Ftw, Gmg, Wcb
- \* *Arctium minus* Bernh. **(2)** PH; 4000–4080'; D, Fmr
- Arnica cordifolia* Hook. **(6)** PH; 3920–5160'; Flp, Fmc, Fmr, Fpp
- Arnica fulgens* Pursh **(29)** PH, VA; 2170–3250'; Gmg, Wcb
- Arnica sororia* Greene **(30)** PH, VA; 2040–3760'; Gmg, Sss, Wcb
- Artemisia biennis* Willd. var. *biennis* **(6)** PH, VA; 2130–2850'; Wcb, Wpw



- Artemisia campestris* L. var. *caudata* (Michx.) Palmer & Steyerl. (1) VA; 2720–2920'; Fpj
- Artemisia campestris* L. var. *pacifica* (Nutt.) M. Peck (32) PH, VA; 2130–5720'; Fpp, Gmg, Gup, Sss
- Artemisia cana* Pursh var. *cana* (38) PH, VA; 2130–3050'; Gmg, Sss, Wcb
- Artemisia dracunculus* L. (15) PH, VA; 2140–4020'; D, Frc, Ftw, Gmg
- Artemisia frigida* Willd. (66) PH, VA; 2130–4020'; Gmg, Gup, Sss, Wcb
- Artemisia longifolia* Nutt. (17) PH, VA; 2220–3200'; Fpj, Gmg, Sgs, Sss
- Artemisia ludoviciana* Nutt. var. *ludoviciana* (68) PH, VA; 2130–4890'; Frc, Ftw, Gmg, Gmm, Sss, Wcb, Wpw
- Artemisia tridentata* Nutt. var. *wyomingensis* (Beetle & Young) S. L. Welsh (14) PH, VA; 2200–2970'; Fpj, Sgs, Sjl, Sss
- Balsamorhiza sagittata* (Pursh) Nutt. (7) PH; 3920–5530'; Fmc, Fpp, Gmm
- Bidens cernua* L. (2) PH, VA; 2130–2270'; Frc, Wpw
- Bidens tripartita* L. (2) PH; 2160–2270'; Frc
- Brickellia eupatorioides* (L.) Shinnars var. *corymbulosa* (Torr. & A. Gray) Shinnars (1) PH; 2190'; Gup
- \* *Carduus acanthoides* L. (1) PH; 2240–2260'; Wpw
- \*■ *Centaurea diffusa* Lam. (1) VA; 2250–2400'; Wcb
- \*■ *Centaurea stoebe* L. ssp. *micranthos* (S. G. Gmelin ex Gugler) Hayek (7) PH, VA; 2720–5300'; D, Gmm, Wcb
- Chaenactis douglasii* (Hook.) Hook. & Arn. var. *douglasii* (18) PH, VA; 2180–3060'; Fpj, Gmg, Gup, Sss, Vbl
- \*■ *Cirsium arvense* (L.) Scop. (34) PH, VA; 2220–5720'; D, Fmr, Ftw, Wcb, Wpw
- Cirsium canescens* Nutt. (5) PH, VA; 2500–3440'; Fpj, Gmg, Wcb
- Cirsium flodmanii* (Rydb.) Arthur (15) PH, VA; 2430–4760'; Fpp, Wcb, Wpw
- Cirsium hookerianum* Nutt. (1) PH; 3090–3200'; Gup
- Cirsium undulatum* (Nutt.) Spreng. (28) PH, VA; 2200–4890'; D, Fpj, Fpp, Gmg, Sss, Wcb
- \* *Cirsium vulgare* (Savi) Ten. (9) PH, VA; 2240–4400'; Fmr, Wcb
- Conyza canadensis* (L.) Cronquist (44) PH, VA; 2130–3200'; D, Gmg, Sss, Wcb, Wpw
- Coreopsis tinctoria* Nutt. (9) PH, VA; 2130–2810'; D, Wpw
- Crepis atribarba* A. Heller (3) PH, VA; 2260–4570'; Fpp, Gup
- Crepis modocensis* Greene var. *modocensis* (8) PH, VA; 2330–2900'; Gmg, Gup, Sss
- Crepis occidentalis* Nutt. var. *costata* A. Gray (25) PH, VA; 2040–3760'; Fpj, Gmg, Sss
- Crepis runcinata* (E. James) Torr. & A. Gray var. *runcinata* (2) PH, VA; 2790–3150'; Wal, Wcb
- \* *Crepis tectorum* L. (10) VA; 2160–3250'; D, Gmg, Sss, Wcb
- Cyclachaena xanthifolia* (Nutt.) Fresen. (6) PH, VA; 2140–4020'; D, Frc
- Dieteria canescens* (Pursh) Nutt. var. *canescens* (52) PH, VA; 2100–3240'; D, Gmg, Sgs, Sss
- Dyssodia papposa* (Vent.) Hitchc. (1) PH; 2520–2560'; Sjl
- Echinacea angustifolia* DC. (2) PH, VA; 2250–3100'; Ftw, Gup

- Ericameria nauseosa* (Pall. ex Pursh) G. L. Nesom & G. I. Baird var. *graveolens* (Nutt.) Reveal & Schuyler (7) PH, VA; 2250–4880'; Frc, Gup, Sjlw, Wcb
- Ericameria nauseosa* (Pall. ex Pursh) G. L. Nesom & G. I. Baird var. *nauseosa* (18) PH, VA; 2190–2940'; Gmg, Gup, Sgs, Sss
- Erigeron caespitosus* Nutt. (30) PH, VA; 2230–5700'; Fpj, Fpp, Gmg, Gmm, Gup, Sss, Voc
- Erigeron compositus* Pursh (13) PH, VA; 2200–4730'; Gmg, Gup, Voc
- Erigeron corymbosus* Nutt. (2) PH, VA; 2720–4760'; Fpp, Wcb
- Erigeron glabellus* Nutt. var. *glabellus* (13) PH, VA; 2260–3250'; Ftw, Wcb
- Erigeron glabellus* Nutt. var. *pubescens* Hook. (2) PH, VA; 2390–2780'; Gmg, Wcb
- Erigeron pumilus* Nutt. var. *pumilus* (91) PH, VA; 2040–3760'; Fpj, Gmg, Gmm, Sss
- Erigeron speciosus* (Lindl.) DC. (3) PH; 3920–4830'; Fmr, Fpp
- Erigeron strigosus* Muhl. ex Willd. var. *septentrionalis* (Fernald & Wiegand) Fernald (1) PH; 4850–5530'; Fmc
- Erigeron strigosus* Muhl. ex Willd. var. *strigosus* (1) PH; 2900–3100'; Gmg
- Eurybia conspicua* (Lindl.) G. L. Nesom (3) PH; 3920–4880'; Fmc, Fmr
- Gaillardia aristata* Pursh (51) PH, VA; 2210–5700'; Fmc, Fpp, Gmg, Gup, Sss, Wcb
- Gnaphalium palustre* Nutt. (7) PH, VA; 2270–3010'; Frc, Wcb
- Grindelia squarrosa* (Pursh) Dunal (82) PH, VA; 2130–4880'; D, Gmg, Sgs, Sss, Wcb
- Gutierrezia sarothrae* (Pursh) Britton & Rusby (53) PH, VA; 2140–4480'; Gmg, Sgs, Sss
- Helenium autumnale* L. (1) PH; 2270'; Wpw
- Helianthus annuus* L. (64) PH, VA; 2080–4020'; D, Gmg, Sgs, Sss
- Helianthus maximiliani* Schrad. (14) PH, VA; 2250–3100'; Ftw, Wcb, Wpw
- Helianthus nuttallii* T. & G. ssp. *nuttallii* (8) PH, VA; 2130–2920'; Wcb, Wpw
- Helianthus nuttallii* Torr. & A. Gray ssp. *rydbergii* (Britton) R. W. Long (1) VA; 2260–2270'; Wpw
- Helianthus pauciflorus* Nutt. var. *subrhomboideus* (Rydb.) Cronquist (7) PH; 3920–4890'; Fmc, Fpp
- Helianthus petiolaris* Nutt. var. *petiolaris* (24) PH, VA; 2160–3130'; D, Gmg, Gup, Sss
- Heterotheca villosa* (Pursh) Shinnars var. *villosa* (98) PH, VA; 2080–5490'; Gmg, Gup, Sss
- Hieracium albiflorum* Hook. (1) PH; 4180–4430'; Flp
- Hieracium scouleri* Hook. (1) PH; 4470–4760'; Fpp
- Hieracium umbellatum* L. (10) PH; 3920–4890'; Flp, Fmc, Fmr, Fpp
- Hymenopappus filifolius* Hook. var. *polycephalus* (Osterh.) B. L. Turner (41) PH, VA; 2210–4760'; Gmg, Gup, Sss
- Hymenoxys richardsonii* (Hook.) Cockerell var. *richardsonii* (75) PH, VA; 2040–3440'; Fpj, Gmg, Gup, Sss
- Iva axillaris* Pursh (75) PH, VA; 2040–3440'; D, Fpj, Gmg, Sgs, Sss, Vbl, Wal
- Lactuca ludoviciana* (Nutt.) Riddell (3) PH; 4160–4570'; Fmr, Wpw
- \* *Lactuca serriola* L. (44) PH, VA; 2140–4890'; D, Gmg, Sgs, Sss, Wcb, Wpw
- \*■ *Leucanthemum vulgare* Lam. (1) PH; 4160–4570'; Fmr

- Liatris punctata* Hook. var. *punctata* (30) PH, VA; 2190–4880'; Fpp, Gmg, Gmm, Sss, Wcb
- \* *Logfia arvensis* (L.) Holub (53) PH, VA; 2100–5700'; Fpj, Gmg, Sss, Wcb  
*Lygodesmia juncea* (Pursh) D. Don ex Hook. (10) PH, VA; 2240–3100'; D, Gmg, Sss  
*Madia glomerata* Hook. (4) PH, VA; 2540–3010'; D, Ftw, Wcb, Wpw  
*Microseris nutans* (Hook.) Sch. Bip. (7) PH; 2440–3220'; Fpj, Gmg, Sss  
*Mulgedium pulchellum* (Pursh) G. Don (28) PH, VA; 2210–3100'; D, Ftw, Gmg, Sjjw, Wcb, Wpw  
*Nothocalais cuspidata* (Pursh) Greene (26) PH, VA; 2250–3300'; Gmg, Sss, Wcb  
*Packera cana* (Hook.) W. A. Weber & Á. Löve (74) PH, VA; 2040–5700'; Fpj, Gmg, Gup, Sjjw, Sss  
*Packera paupercula* (Michx.) Á. Löve & D. Löve (2) PH; 4160–4570'; Fmr  
*Picradeniopsis oppositifolia* (Nutt.) Rydb. ex Britton (9) PH, VA; 2340–3440'; D, Sss
- ◆ *Psilocarphus brevissimus* Nutt. var. *brevissimus* (1) PH; 2590–2600'; Wpw  
*Pyrrocoma lanceolata* (Hook.) Greene var. *lanceolata* (2) VA; 2730–2780'; Wpw  
*Ratibida columnifera* (Nutt.) Wootton & Standl. (89) PH, VA; 2080–4040'; Fpj, Gmg, Sss, Wcb
- ◆ *Senecio eremophilus* Richardson var. *eremophilus* (3) PH; 4240–5720'; D, Fmc  
*Senecio integerrimus* Nutt. var. *exaltatus* (Nutt.) Cronquist (4) PH, VA; 2600–2840'; Gmg, Wcb  
*Senecio integerrimus* Nutt. var. *integerrimus* (17) PH, VA; 2270–3250'; Gmg, Gup  
*Senecio integerrimus* Nutt. var. *scribneri* (Rydb.) T. M. Barkley (19) PH, VA; 2200–3240'; Gmg, Sgs, Sss  
*Solidago altissima* L. var. *gilvocanescens* (Rydb.) Semple (5) PH, VA; 2400–2850'; Wcb, Wpw  
*Solidago gigantea* Aiton (19) PH, VA; 2140–4890'; Fmr, Frc, Ftw, Wcb, Wpw  
*Solidago lepida* DC. var. *lepida* (4) PH, VA; 2520–4400'; Fmr, Gmg, Wcb  
*Solidago lepida* DC. var. *salebrosa* (Piper) Semple (4) PH; 4070–4880'; Flp, Fmr, Gmm  
*Solidago missouriensis* Nutt. (58) PH, VA; 2190–5160'; D, Ftw, Gmg, Sss, Wcb  
*Solidago mollis* Bartl. (13) PH, VA; 2190–4480'; Gmm, Gup, Wcb  
*Solidago nemoralis* Aiton var. *longipetiolata* (Mack. & Bush) E. J. Palmer & Steyerl. (13) PH, VA; 2470–5400'; Flp, Fmc, Fpj, Fpp, Ftw, Gmm, Sss  
*Solidago rigida* L. var. *humilis* Porter (19) PH, VA; 2270–4760'; Fpp, Ftw, Gmm, Wcb, Wpw  
*Solidago simplex* Kunth var. *simplex* (5) PH; 4100–5720'; D, Fpp
- \* *Sonchus arvensis* L. ssp. *uliginosus* (M. Bieb.) Nyman (24) PH, VA; 2160–4890'; Frc, Wcb, Wpw  
*Stenotus armerioides* Nutt. var. *armerioides* (15) PH, VA; 2300–3760'; Fpj, Gmg, Gup  
*Stephanomeria runcinata* Nutt. (19) PH, VA; 2210–4760'; Gmg, Gup, Sgs  
*Stephanomeria tenuifolia* (Raf.) H. M. Hall (8) PH, VA; 2230–3440'; Fpj, Gmg  
*Symphyotrichum ascendens* (Lindl.) G. L. Nesom (11) PH, VA; 2230–3050'; Wcb, Wpw  
*Symphyotrichum ciliatum* (Ledeb.) G. L. Nesom (3) PH, VA; 2130–2840'; Wpw

- Symphyotrichum ciliolatum* (Lindl.) Á. Löve **(9)** PH; 3920–4890'; Fmr, Gmm  
*Symphyotrichum eatonii* (A. Gray) G. L. Nesom **(3)** PH; 3920–4400'; Fmr  
*Symphyotrichum ericoides* (L.) G. L. Nesom var. *pansum* (S. F. Blake) G. L. Nesom **(10)** PH, VA; 2130–3050'; Wcb, Wpw  
*Symphyotrichum falcatum* (Lindl.) G. L. Nesom var. *commutatum* (Torr. & A. Gray) G. L. Nesom **(15)** PH, VA; 2140–4480'; Gmg, Gmm, Sss, Wpw  
*Symphyotrichum falcatum* (Lindl.) G. L. Nesom var. *falcatum* **(24)** PH, VA; 2160–4880'; D, Ftw, Gmg, Sss, Wcb, Wpw  
*Symphyotrichum laeve* (L.) Á. Löve & D. Löve var. *geyeri* (A. Gray) G. L. Nesom **(6)** PH, VA; 2140–4480'; Fmr, Fpp, Frc, Ftw  
*Symphyotrichum lanceolatum* (Willd.) G. L. Nesom var. *hesperium* (A. Gray) G. L. Nesom **(7)** PH, VA; 2130–3010'; Frc, Wcb, Wpw  
\* *Taraxacum erythrospermum* Andr. ex Besser **(50)** PH, VA; 2150–4725'; D, Gmg, Sss  
\* *Taraxacum officinale* Weber ex F. H. Wigg. **(7)** PH, VA; 2200–4725'; D, Gmg, Sss  
*Tetranneuris acaulis* (Pursh) Greene var. *acaulis* **(19)** PH; 2270–4760'; Fmc, Fpj, Fpp, Gmg, Gup, Sss  
*Townsendia exscapa* (Richardson) Porter **(1)** VA; 2150–2160'; Gmg  
*Townsendia hookeri* Beaman **(5)** PH, VA; 2190–4730'; Gmg, Gup, Voc  
\* *Tragopogon dubius* Scop. **(128)** PH, VA; 2040–5700'; D, Fpj, Gmg, Gup, Sgs, Sjj, Sss, Wcb  
*Xanthisma grindelioides* (Nutt.) D. R. Morgan & R. L. Hartm. var. *grindelioides* **(25)** PH, VA; 2210–3760'; Gmg, Gup, Sss  
*Xanthisma spinulosum* (Pursh) D. R. Morgan & R. L. Hartm. var. *spinulosum* **(19)** PH, VA; 2190–3060'; Gmg, Gup, Sss  
\* *Xanthium strumarium* L. **(51)** PH, VA; 2130–3070'; D, Frc, Wal, Wcb, Wpw
- Berberidaceae**  
*Berberis repens* Lindl. **(8)** PH; 3920–4880'; Flp, Fmc, Fmr, Fpp
- Betulaceae**  
*Betula occidentalis* Hook. **(1)** VA; 2230–2460'; Ftw  
*Betula papyrifera* Marshall var. *papyrifera* **(19)** PH; 3920–5530'; Fmc, Fmr
- Boraginaceae**  
*Cryptantha celosioides* (Eastw.) Payson **(14)** PH, VA; 2100–3440'; Gup  
*Cryptantha minima* Rydb. **(3)** VA; 2100–2210'; Gmg  
*Cryptantha spiculifera* (Piper) Payson **(20)** PH, VA; 2210–3760'; Gmg, Gup  
*Cryptantha torreyana* (A. Gray) Greene **(2)** PH; 2640–3060'; Fpj  
\*■ *Cynoglossum officinale* L. **(6)** PH; 2500–4725'; D, Gmm  
*Ellisia nyctelea* (L.) L. **(10)** PH, VA; 2240–2900'; D, Fpj, Sjj, Vbl  
*Hackelia deflexa* (Wahlenb.) Opiz var. *americana* (A. Gray) Fernald & I. M. Johnst. **(2)** PH; 2780–2960'; Ftw  
*Hackelia floribunda* (Lehm.) I. M. Johnst. **(4)** PH, VA; 2850–4400'; Fmr, Ftw, Wcb  
*Heliotropium curassavicum* L. var. *obovatum* DC. **(2)** PH; 2220–2400'; Wal  
*Lappula cenchrusoides* A. Nelson **(23)** PH, VA; 2100–3200'; D, Gmg, Gup, Sgs, Sss  
*Lappula occidentalis* (S. Watson) Greene var. *occidentalis* **(52)** PH, VA; 2160–4020'; D, Gmg, Gup, Sss, Wcb  
\* *Lappula squarrosa* (Retz.) Dumort. **(5)** PH, VA; 2720–4020'; D, Gmg, Sss

- Lithospermum incisum* Lehm. **(30)** PH, VA; 2200–4500'; Gmg, Gup, Sjlw, Sss  
*Lithospermum ruderale* Douglas ex Lehm. **(5)** PH; 3920–4730'; Fpp, Gmm  
*Mertensia lanceolata* (Pursh) DC. **(11)** PH, VA; 2190–3040'; Gmg, Wcb  
*Phacelia linearis* (Pursh) Holz. **(30)** PH, VA; 2040–5490'; Fpj, Gmg, Sss  
◆ *Plagiobothrys leptocladus* (Greene) I. M. Johnst. **(9)** PH, VA; 2440–2900'; Wcb, Wpw  
*Plagiobothrys scouleri* (Hook. & Arn.) I. M. Johnst. var. *hispidulus* (Greene) Dorn **(7)** PH, VA; 2430–3050'; Wcb, Wpw

### Brassicaceae

- \* *Alyssum alyssoides* (L.) L. **(8)** PH; 2480–5160'; D, Sss  
\* *Alyssum desertorum* Stapf **(49)** PH, VA; 2150–3300'; D, Gmg, Sss  
*Arabis eschscholtziana* Andr. **(1)** PH; 4190'; D  
*Arabis pycnocarpa* M. Hopkins var. *pycnocarpa* **(21)** PH, VA; 2040–5700'; Gmm, Wcb  
*Boechera collinsii* (Fernald) Áskell Löve & D. Löve **(63)** PH, VA; 2040–5700'; Gmg, Sss  
*Boechera grahamii* (Lehm.) Windham & Al-Shehbaz **(20)** PH, VA; 2260–4480'; Gmg  
*Boechera holboellii* (Hornem.) Á. Löve & D. Löve var. *secunda* (Howell) Dorn **(3)** PH, VA; 2290–3800'; D, Sss  
\* *Camelina microcarpa* Andr. ex DC. **(73)** PH, VA; 2080–5160'; D, Ftw, Gmg, Sss, Wcb  
\* *Capsella bursa-pastoris* (L.) Medik. **(5)** PH, VA; 2380–4400'; D  
\* *Chorispora tenella* (Pall.) DC. **(2)** PH, VA; 2150–2335'; D  
\* *Conringia orientalis* (L.) Dumort. **(23)** PH, VA; 2080–3240'; Gmg, Sgs, Sss, Vbl  
*Descurainia incana* (Bernh. ex Fisch. & C. A. Mey.) Dorn **(1)** PH; 2780–2940'; Ftw  
*Descurainia nelsonii* (Rydb.) Al-Shehbaz & Goodson **(1)** PH; 2210–2240'; Frc  
*Descurainia pinnata* (Walter) Britton var. *brachycarpa* (Richardson) Fernald **(56)** PH, VA; 2170–4400'; Fpj, Gmg, Sss  
\* *Descurainia sophia* (L.) Webb ex Prantl **(56)** PH, VA; 2160–3250'; D, Ftw, Gmg  
*Draba cana* Rydb. **(3)** PH; 3920–5700'; Voc  
\* *Draba nemorosa* L. var. *nemorosa* **(32)** PH, VA; 2150–4725'; Gmg, Wcb  
*Draba reptans* (Lam.) Fernald **(22)** PH, VA; 2040–4500'; Gmg, Gup, Sss  
*Erysimum asperum* (Nutt.) DC. **(16)** PH, VA; 2100–2820'; Gmg, Gup, Sss  
*Erysimum capitatum* (Douglas ex Hook.) Greene var. *purshii* (T. Durand) Rollins **(5)** PH, VA; 2170–3130'; Gmg, Gup, Sss  
*Erysimum cheiranthoides* L. **(5)** PH, VA; 2780–4190'; D, Ftw  
*Erysimum inconspicuum* (S. Watson) MacMill. **(74)** PH, VA; 2040–4760'; Fpj, Gmg, Gup, Sss, Wcb  
\* *Hesperis matronalis* L. **(2)** PH, VA; 2160–4830'; D  
\* *Lepidium campestre* (L.) R. Br. **(1)** PH; 4000–4400'; D  
*Lepidium densiflorum* Schrad. var. *densiflorum* **(40)** PH, VA; 2100–3440'; D, Gmg, Sss  
*Lepidium densiflorum* Schrad. var. *macrocarpum* G. A. Mulligan **(48)** PH, VA; 2040–3240'; D, Gmg, Sgs, Sss  
\* *Lepidium perfoliatum* L. **(13)** PH, VA; 2100–2930'; D, Gmg, Sgs, Sss

- Lepidium ramosissimum* A. Nelson var. *bourgeauanum* (Thell.) Rollins (2) VA; 2300–2970'; Gmg
- Lepidium ramosissimum* A. Nelson var. *ramosissimum* (2) VA; 2550–2740'; D
- \* *Malcolmia africana* (L.) R. Br. (1) VA; 2160–2170'; D
- Physaria arenosa* (Richardson) O'Kane & Al-Shehbaz var. *arenosa* (30) PH, VA; 2150–3300'; Gmg, Gup, Sju, Sss
- ◆ *Physaria brassicoides* Rydb. (1) PH; 4080–4500'; Fpp
- ◆ *Physaria ludoviciana* (Nutt.) O'Kane & Al-Shehbaz (2) PH, VA; 2520–2720'; Gmg
- Physaria spatulata* (Rydb.) Grady & O'Kane (24) PH, VA; 2210–3760'; Fpj, Gmg, Gup, Sss
- Rorippa curvipes* Greene var. *curvipes* (1) PH; 2550–2560'; Wpw
- Rorippa tenerrima* Greene (1) VA; 2730–2740'; Wpw
- \* *Sisymbrium altissimum* L. (30) PH, VA; 2080–3100'; D, Gmg, Gup, Sss, Wcb
- \* *Thlaspi arvense* L. (70) PH, VA; 2080–5160'; D, Ftw, Gmg, Sss, Wcb, Wpw
- \* *Turritis glabra* L. (9) PH, VA; 2640–5400'; D, Fmr, Ftw, Gmm

### Cactaceae

- Coryphantha missouriensis* (Sweet) Britton & Rose var. *missouriensis* (1) PH; 2310–2390'; Sgs
- Coryphantha vivipara* (Nutt.) Britton & Rose (7) PH, VA; 2600–3040'; Gmg, Sss
- Opuntia fragilis* (Nutt.) Haw. (7) PH, VA; 2040–3760'; Fpj, Gmg, Sss
- Opuntia polyacantha* Haw. var. *polyacantha* (63) PH, VA; 2080–3760'; Fpj, Gmg, Sgs, Sss

### Campanulaceae

- \* *Campanula rapunculoides* L. (1) PH; 4070–4330'; Fmr
- Campanula rotundifolia* L. (44) PH, VA; 2210–5720'; Fmc, Fmr, Ftw, Gmg, Wcb
- Triodanis leptocarpa* (Nutt.) Nieuwl. (3) PH, VA; 2360–2720'; Gmg, Sss

### Caprifoliaceae

- Linnaea borealis* L. var. *longiflora* Torr. (13) PH; 3920–5700'; Flp, Fmc, Fmr
- \* *Lonicera tatarica* L. (1) VA; 2720–2740'; D
- Symphoricarpos albus* (L.) S. F. Blake var. *albus* (2) PH; 2500–5530'; Fmc, Gmg
- Symphoricarpos albus* (L.) S. F. Blake var. *laevigatus* (Fernald) S. F. Blake (1) PH; 4180–4430'; Flp
- Symphoricarpos occidentalis* Hook. (58) PH, VA; 2080–4760'; Fpj, Frc, Ftw, Wcb, Wpw
- Symphoricarpos oreophilus* A. Gray var. *utahensis* (Rydb.) A. Nelson (3) PH; 3800–5700'; Fmc, Gmm

### Caryophyllaceae

- Cerastium arvense* L. var. *strictum* (Gaudin) W. D. J. Koch (60) PH, VA; 2240–5700'; Fpp, Ftw, Gmg, Gmm, Sss, Wcb
- Cerastium brachypodum* (Engelm. ex A. Gray) B. L. Rob. (3) PH, VA; 2720–2920'; Gmg, Wcb, Wpw
- \* *Cerastium fontanum* Baumg. ssp. *vulgare* (Hartm.) Greuter & Burdet (1) PH; 4180–4430'; Fmr
- Eremogone congesta* (Nutt.) Ikonn. var. *lithophila* (Rydb.) Dorn (11) PH; 2540–5700'; Gmg, Gmm, Sss, Wcb
- Minuartia rubella* (Wahlenb.) Hiern (3) PH; 3920–5700'; Voc

- Moehringia lateriflora* (L.) Fenzl **(8)** PH; 3920–4830'; Fmc, Fmr  
*Paronychia sessiliflora* Nutt. **(13)** PH, VA; 2210–3760'; Gmg, Gup  
 \* *Silene csereii* Baumg. **(6)** PH, VA; 2160–4400'; D, Fmr  
*Silene drummondii* Hook. var. *drummondii* **(2)** PH, VA; 2550–4430'; Flp, Gmg  
*Silene drummondii* Hook. var. *striata* (Rydb.) Bocquet **(10)** PH, VA; 2415–3760';  
 Fpp, Ftw, Gmg, Sss, Wcb  
 \* *Silene latifolia* Poir. **(1)** PH; 4470–4760'; Gmm  
*Spergularia marina* (L.) Griseb. **(3)** PH, VA; 2140–2620'; Wal, Wpw  
*Stellaria longifolia* Muhl. ex Willd. **(1)** PH; 4180–4430'; Fmr

### **Ceratophyllaceae**

*Ceratophyllum demersum* L. **(5)** PH, VA; 2540–3070'; Wpw

### **Cleomaceae**

*Cleome serrulata* (Pursh) DC. **(2)** PH; 2415–2850'; D, Wcb  
*Polanisia dodecandra* (L.) DC. var. *trachysperma* (Torr. & A. Gray) H. H. Iltis **(2)**  
 PH, VA; 2130–2400'; Gmg, Wpw

### **Commelinaceae**

*Tradescantia occidentalis* (Britton) Smyth var. *occidentalis* **(1)** VA; 2200–2210';  
 Gmg

### **Convolvulaceae**

- Calystegia macounii* (Greene) Brummitt **(2)** PH; 2270–3040'; Wcb, Wpw  
 \* *Calystegia sepium* (L.) R. Br. var. *angulata* (Brummitt) N. H. Holmgren **(2)** PH, VA;  
 2270–2600'; Wpw  
 \*■ *Convolvulus arvensis* L. **(10)** PH, VA; 2160–3100'; D, Ftw, Gmg  
*Cuscuta pentagona* Engelm. var. *pentagona* **(1)** VA; 2350–2440'; Wpw

### **Cornaceae**

*Cornus canadensis* L. **(5)** PH; 3920–4830'; Flp, Fmr  
*Cornus sericea* L. var. *sericea* **(22)** PH, VA; 2130–4830'; Fmr, Ftw

### **Crassulaceae**

*Sedum lanceolatum* Torr. **(9)** PH; 4160–5700'; Flp, Fmc, Fmr, Fpp, Gmm, Voc

### **Cyperaceae**

- Bolboschoenus fluviatilis* (Torr.) Soják **(2)** VA; 2580–2940'; Wpw  
*Bolboschoenus maritimus* (L.) Palla ssp. *paludosus* (A. Nelson) T. Koyama **(16)** PH,  
 VA; 2200–3050'; Frc, Wal, Wpw  
*Carex atherodes* Spreng. **(1)** VA; 2620–2630'; Wpw  
*Carex aurea* Nutt. **(2)** PH, VA; 3030–4220'; Fmr, Wcb  
*Carex bebbii* (L. H. Bailey) Olney ex Fernald **(2)** PH, VA; 3030–4430'; Fmr, Wcb  
*Carex brevior* (Dewey) Mack. ex Lunell **(29)** PH, VA; 2200–3070'; Ftw, Wcb, Wpw  
*Carex deweyana* Schwein. var. *deweyana* **(2)** PH; 4180–4830'; Fmr  
*Carex disperma* Dewey **(1)** PH; 4180–4430'; Fmr  
*Carex douglasii* Boott **(1)** VA; 2200–2210'; Gmg  
*Carex duriuscula* C. A. Mey. **(26)** PH, VA; 2040–3760'; Fpj, Gmg, Sss  
*Carex filifolia* Nutt. **(41)** PH, VA; 2040–3760'; Fpj, Gmg, Gup, Sjj, Sss  
*Carex hoodii* Boott **(6)** PH; 4160–5530'; Fmc, Fmr, Gmm  
*Carex inops* L. H. Bailey ssp. *heliophila* (Mack.) Crins **(20)** PH, VA; 2040–4480';  
 Fpj, Gmg, Sss  
*Carex laeviconica* Dewey **(1)** PH; 2300–2320'; Wpw

- Carex lanuginosa* Michx. (5) PH, VA; 2225–3760'; Wal, Wcb, Wpw  
*Carex lasiocarpa* Ehrh. (1) PH; 2650–2660'; Wcb  
*Carex obtusata* Lilj. (1) VA; 3030–3150'; Gmg  
*Carex praegracilis* W. Boott (24) PH, VA; 2220–3760'; Wcb, Wpw  
*Carex rossii* Boott (3) PH, VA; 2620–5700'; Gmm, Gup
- ◆ *Carex scoparia* Schkuhr ex Willd. var. *scoparia* (2) PH; 3090–5700'; Ftw, Gmm  
*Carex sprengelii* Dewey ex Spreng. (2) PH, VA; 3120–4040'; Fmr, Ftw  
*Carex stipata* Muhl. ex Willd. var. *stipata* (1) PH; 3920–4040'; Fmr  
*Carex vulpinoidea* Michx. (2) PH; 2520–2560'; Wcb, Wpw  
*Cyperus squarrosus* L. (1) PH; 2600–2610'; Wpw  
*Eleocharis acicularis* (L.) Roem. & Schult. (11) PH, VA; 2250–3010'; Wal, Wcb, Wpw  
*Eleocharis palustris* (L.) Roem. & Schult. (44) PH, VA; 2140–3070'; Wcb, Wpw  
*Schoenoplectus acutus* (Muhl. ex Bigelow) Á. Löve & D. Löve var. *acutus* (9) PH, VA; 2190–2970'; Wpw  
*Schoenoplectus acutus* (Muhl. ex Bigelow) Á. Löve & D. Löve var. *occidentalis* (S. Watson) S. G. Sm. (8) PH, VA; 2240–3070'; Wal, Wpw  
*Schoenoplectus pungens* (Vahl) Palla var. *pungens* (24) PH, VA; 2220–3050'; Frc, Wal, Wcb, Wpw  
*Schoenoplectus tabernaemontani* (K. C. Gmel.) Palla (11) PH, VA; 2130–2880'; Frc, Wcb, Wpw  
*Scirpus pallidus* (Britton) Fernald (1) VA; 2720–2920'; Wcb
- Elaeagnaceae**
- \* *Elaeagnus angustifolia* L. (18) PH, VA; 2080–2740'; D, Frc, Ftw, Gmg, Wcb, Wpw  
*Elaeagnus commutata* Bernh. ex Rydb. (4) VA; 2300–3250'; Ftw, Gmg, Wcb  
*Shepherdia argentea* (Pursh) Nutt. (35) PH, VA; 2080–3100'; Ftw, Wcb, Wpw  
*Shepherdia canadensis* (L.) Nutt. (23) PH, VA; 3120–5400'; Flp, Fmc, Fmr, Fpp, Gmm
- Elatinaceae**
- Elatine rubella* Rydb. (3) PH, VA; 2440–2700'; Wpw
- Ericaceae**
- Arctostaphylos uva-ursi* (L.) Spreng. (24) PH, VA; 2900–5700'; Flp, Fmc, Fmr, Fpp, Gmm  
*Chimaphila umbellata* (L.) W. P. C. Barton var. *occidentalis* (Rydb.) S. F. Blake (2) PH; 4180–4900'; Flp  
*Moneses uniflora* (L.) A. Gray (2) PH; 4180–4830'; Flp, Fmr  
*Orthilia secunda* (L.) House (10) PH; 4070–5700'; Flp, Fmc, Fmr, Gmm  
*Pterospora andromedea* Nutt. (15) PH; 3920–5700'; Flp, Fmc, Fmr, Fpp  
*Pyrola asarifolia* Michx. var. *asarifolia* (7) PH; 4000–4830'; Fmc, Fmr  
*Pyrola chlorantha* Sw. (4) PH; 4160–5700'; Flp, Fmr
- Euphorbiaceae**
- Chamaesyce glyptosperma* (Engelm.) Small (24) PH, VA; 2140–3050'; D, Frc  
*Chamaesyce serpens* (Kunth) Small (5) PH, VA; 2140–2700'; D  
*Chamaesyce serpyllifolia* (Pers.) Small (16) PH, VA; 2200–2910'; D, Sss, Vbl
- \*■ *Euphorbia esula* L. var. *esula* (7) PH, VA; 2140–2680'; Frc, Sjjw, Sss, Wcb, Wpw



- \*■ *Euphorbia esula* L. var. *uralensis* (Fisch. ex Link) Dorn (13) PH, VA; 2040–3010’;  
D, Frc, Ftw, Gmg, Wcb, Wpw
- Euphorbia spathulata* Lam. (15) PH, VA; 2260–3760’; Fpj, Gmg, Sgs, Wcb

### Fabaceae

- Astragalus adsurgens* Pall. var. *robustior* Hook. (53) PH, VA; 2210–5160’; Fpj, Ftw, Gmg, Gup, Sju, Sss
- Astragalus agrestis* Douglas ex G. Don (64) PH, VA; 2180–4480’; Fpj, Ftw, Gmg, Sss, Wcb
- Astragalus americanus* (Hook.) M. E. Jones (3) PH; 4160–4830’; Fmr
- Astragalus bisulcatus* (Hook.) A. Gray var. *bisulcatus* (47) PH, VA; 2225–3440’; D, Fpj, Gmg, Gup, Sgs, Sss, Vbl, Wcb
- Astragalus canadensis* L. var. *canadensis* (2) PH; 4330–4760’; Fmc, Fpp
- Astragalus cibarius* E. Sheld. (2) PH, VA; 2350–3800’; Sss
- \* *Astragalus cicer* L. (4) PH; 4130–5720’; D, Flp, Fmc, Fmr
- Astragalus crassicaarpus* Nutt. var. *crassicaarpus* (4) PH, VA; 2310–2890’; Gmg, Gup
- Astragalus crassicaarpus* Nutt. var. *paysonii* (E. H. Kelso) Barneby (16) PH, VA; 2280–4725’; Gmg, Gmm, Gup, Sss
- Astragalus drummondii* Douglas ex Hook. (39) PH, VA; 2210–4725’; Gmg, Gmm, Gup, Sss
- Astragalus flexuosus* (Hook.) Douglas ex G. Don var. *flexuosus* (5) VA; 2550–3250’; Gmg, Gup
- Astragalus gilviflorus* E. Sheld. var. *gilviflorus* (38) PH, VA; 2150–4760’; Fpj, Gmg, Gup, Sss
- Astragalus kentrophyta* A. Gray var. *kentrophyta* (1) VA; 2620–2750’; Gup
- Astragalus lotiflorus* Hook. (7) PH, VA; 2500–3440’; Fpj, Gmg, Sss
- Astragalus missouriensis* Nutt. var. *missouriensis* (74) PH, VA; 2150–4500’; Gmg, Gup, Sgs, Sss
- Astragalus pectinatus* (Hook.) Douglas ex G. Don (38) PH, VA; 2320–3150’; Gmg, Gup, Wcb
- Astragalus purshii* Douglas ex Hook. var. *purshii* (11) PH, VA; 2280–2820’; Gmg, Sss
- Astragalus spatulatus* E. Sheld. (9) PH, VA; 2500–3040’; Gmg, Gup
- Astragalus tenellus* Pursh (9) PH, VA; 2440–3250’; Ftw, Gmg, Gup
- \* *Caragana arborescens* Lam. (3) PH, VA; 2240–2740’; D
- Dalea candida* Michx. var. *oligophylla* (Torr.) Shinnars (35) PH, VA; 2190–3440’; Fpj, Gmg, Gup, Sss
- Dalea purpurea* Vent. var. *purpurea* (63) PH, VA; 2080–4880’; Fpj, Fpp, Gmg, Gup, Sju, Sss
- Glycyrrhiza lepidota* Pursh (66) PH, VA; 2080–4500’; Fmr, Frc, Ftw, Gmg, Gup, Wcb, Wpw
- Hedysarum alpinum* L. var. *philoscia* (A. Nelson) Rollins (2) PH; 4180–4900’; Flp, Gmm
- Hedysarum boreale* Nutt. var. *boreale* (4) PH, VA; 2300–3760’; Ftw, Gmg, Gup
- Hedysarum boreale* Nutt. var. *pabulare* (A. Nelson) Dorn (6) PH, VA; 2400–3440’; Fpj, Ftw, Gup
- Hedysarum sulphurescens* Rydb. (6) PH; 4190–5700’; Flp, Fmc, Fmr

- Lathyrus ochroleucus* Hook. **(4)** PH; 4180–4830'; Fmc, Fmr
- \* *Lotus corniculatus* L. **(3)** PH; 4130–5720'; D, Fmr
- Lotus unifoliolatus* (Hook.) Benth. var. *unifoliolatus* **(3)** VA; 2130–2740'; Gmg, Wcb, Wpw
- Lupinus pusillus* Pursh var. *pusillus* **(16)** PH, VA; 2200–3100'; Gmg, Gup
- \* *Medicago lupulina* L. **(46)** PH, VA; 2040–5530'; D, Fmc, Fmr, Fpj, Wcb, Wpw
- \* *Medicago sativa* L. **(52)** PH, VA; 2080–4480'; D, Fpj, Ftw, Gmg, Sgs, Sss, Wcb, Wpw
- \* *Melilotus albus* Medik. **(7)** PH, VA; 2160–4400'; D, Fmr, Gmg
- \* *Melilotus officinalis* (L.) Pall. **(110)** PH, VA; 2040–4430'; D, Fpj, Gmg, Gup, Sgs, Sjlw, Sss
- Oxytropis besseyi* (Rydb.) Blank. var. *argophylla* (Rydb.) Barneby **(1)** VA; 3030–3150'; Gmg
- Oxytropis besseyi* (Rydb.) Blank. var. *besseyi* **(3)** PH, VA; 2440–3130'; Gup
- Oxytropis campestris* (L.) DC. var. *spicata* Hook. **(25)** PH, VA; 2440–3250'; Gmg
- Oxytropis lambertii* Pursh var. *lambertii* **(30)** PH, VA; 2100–3760'; Gmg, Gup, Sss
- × *Oxytropis lambertii* Pursh × *Oxytropis sericea* Nutt. **(3)** PH, VA; 2390–2700'; Gmg, Sss
- Oxytropis sericea* Nutt. var. *sericea* **(3)** PH; 2500–3200'; Fpj, Gup
- Oxytropis sericea* Nutt. var. *speciosa* (Torr. & A. Gray) S. L. Welsh **(30)** PH, VA; 2270–4725'; Gmg, Gup, Sss
- Oxytropis splendens* Douglas ex Hook. **(8)** PH; 4000–5160'; Flp, Fmc, Fmr, Fpp, Gmm
- Pedimelum argophyllum* (Pursh) J. W. Grimes **(93)** PH, VA; 2080–4480'; Fpj, Gmg, Gup, Sss, Wcb
- Pedimelum esculentum* (Pursh) Rydb. **(42)** PH, VA; 2100–4760'; Fpj, Gmg, Gup, Sss
- Psoralidium lanceolatum* (Pursh) Rydb. **(5)** VA; 2400–2880'; Fpj, Ftw, Gup
- Thermopsis rhombifolia* (Nutt. ex Pursh) Nutt. ex Richardson var. *annulocarpa* (A. Nelson) L. O. Williams **(6)** PH, VA; 2390–3800'; Gmg, Sss
- Thermopsis rhombifolia* (Nutt. ex Pursh) Nutt. ex Richardson var. *rhombifolia* **(86)** PH, VA; 2040–5700'; Flp, Fpj, Ftw, Gmg, Gup, Sjlw, Sss, Wcb
- \* *Trifolium aureum* Pollich **(1)** PH; 4840–4900'; Gmm
- \* *Trifolium fragiferum* L. **(1)** VA; 2160–2170'; D
- \* *Trifolium hybridum* L. **(3)** PH; 2190–4430'; Fmr, Fpp, Wpw
- \* *Trifolium pratense* L. **(2)** PH; 4180–4900'; D, Gmm
- \* *Trifolium repens* L. **(8)** PH, VA; 2160–4890'; D, Fmc, Fmr
- Vicia americana* Muhl. ex Willd. var. *americana* **(8)** PH, VA; 2180–4830'; Fmr, Fpj
- Vicia americana* Muhl. ex Willd. var. *minor* Hook. **(122)** PH, VA; 2040–5160'; Fpj, Gmg, Gmm, Sgs, Sjlw, Sss, Wcb

### Gentianaceae

- Gentiana affinis* Griseb. **(1)** PH; 2540–2560'; Wpw
- Gentianella amarella* (L.) Börner var. *acuta* (Michx.) Herder **(2)** PH; 3920–4220'; Fmr

## Geraniaceae

- Geranium bicknellii* Britton var. *longipes* (S. Watson) Fernald (4) PH; 4070–5400';  
Flp, Fmc, Fmr  
*Geranium carolinianum* L. (1) PH; 4380–4500'; Wpw  
*Geranium richardsonii* Fisch. & Trautv. (8) PH; 3920–4890'; Flp, Fmr  
*Geranium viscosissimum* Fisch. & C. A. Mey. ex C. A. Mey. var. *viscosissimum* (1)  
VA; 3030–3150'; Wcb

## Grossulariaceae

- Ribes americanum* Mill. (1) PH; 4080'; Fmr  
*Ribes aureum* Pursh var. *aureum* (3) PH; 2330–4480'; Fmr, Ftw, Wpw  
*Ribes aureum* Pursh var. *villosum* DC. (20) PH, VA; 2240–4500'; Ftw, Gmg, Gup,  
Wcb, Wpw  
*Ribes cereum* Douglas (27) PH, VA; 2380–5700'; Fpj, Gup, Sju, Voc  
*Ribes lacustre* (Pers.) Poir. (1) PH; 4180–4430'; Fmr  
*Ribes oxycanthoides* L. var. *irriguum* (Douglas) Jancz. (1) PH; 4580–4830'; Fmr  
*Ribes oxycanthoides* L. var. *oxycanthoides* (16) PH, VA; 2230–5530'; Fmr, Ftw,  
Sju, Voc, Wcb

## Haloragaceae

- Myriophyllum sibiricum* Kom. (1) PH; 3050–3070'; Wpw  
*Myriophyllum verticillatum* L. (1) VA; 3030–3150'; Wpw

## Hydrocharitaceae

- ◆ *Elodea bifoliata* H. St. John (3) PH; 2540–3070'; Wpw

## Iridaceae

- Sisyrinchium montanum* Greene var. *montanum* (16) PH, VA; 2270–5530'; Ftw,  
Gmg, Gmm, Wcb

## Juncaceae

- Juncus arcticus* Willd. var. *balticus* (Willd.) Trautv. (24) PH, VA; 2240–3760'; Wal,  
Wcb, Wpw  
*Juncus bufonius* L. (7) PH, VA; 2100–2880'; Ftw, Wal, Wcb, Wpw  
*Juncus dudleyi* Wiegand (2) PH, VA; 2700–3150'; Wcb  
*Juncus interior* Wiegand (14) PH, VA; 2410–2990'; Wcb, Wpw  
*Juncus longistylis* Torr. (3) PH, VA; 2550–3100'; Wal, Wcb

## Juncaginaceae

- Triglochin maritima* L. (8) PH, VA; 2240–3760'; Wal, Wcb, Wpw

## Lamiaceae

- Dracocephalum parviflorum* Nutt. (2) PH; 4240–5160'; Fmr, Gmm  
*Hedeoma drummondii* Benth. (2) PH, VA; 2720–3760'; Fmr, Fpj  
*Hedeoma hispidum* Pursh (55) PH, VA; 2040–3440'; Fpj, Gmg, Sss, Wcb  
*Lycopus americanus* Muhl. ex W. P. C. Barton (1) VA; 2720–2920'; Wal  
*Lycopus asper* Greene (12) PH, VA; 2130–3070'; Wpw  
*Mentha arvensis* L. (24) PH, VA; 2240–4330'; Fmr, Frc, Wpw  
*Monarda fistulosa* L. var. *mentifolia* (Graham) Fernald (20) PH, VA; 2560–5490';  
Flp, Fmc, Fmr, Fpp, Ftw, Wcb  
\* *Nepeta cataria* L. (1) PH; 2240–2250'; Ftw  
*Salvia reflexa* Hornem. (1) VA; 2130'; Wpw  
*Stachys palustris* L. var. *pilosa* (Nutt.) Fernald (5) PH, VA; 2240–3010'; Wcb, Wpw

## Liliaceae

- Calochortus nuttallii* Torr. & A. Gray (15) PH, VA; 2260–3760'; Fpj, Gmg, Gup, Sss  
*Fritillaria pudica* (Pursh) Spreng. (5) PH; 2360–4480'; Fpj, Gmg, Gmm, Wcb  
*Prosartes trachycarpa* S. Watson (16) PH, VA; 2780–4890'; Fmc, Fmr, Ftw  
*Streptopus amplexifolius* (L.) DC. (2) PH; 3920–4430'; Fmr

## Linaceae

- Linum australe* A. Heller var. *australe* (23) PH, VA; 2180–3250'; Gmg, Gup, Sss  
*Linum compactum* A. Nelson (10) PH, VA; 2170–2720'; Gmg, Gup, Sss  
*Linum lewisii* Pursh var. *lewisii* (32) PH, VA; 2210–4725'; D, Ftw, Gmg, Gup, Wcb  
*Linum rigidum* Pursh var. *rigidum* (5) PH, VA; 2210–3440'; Fpj, Gup, Sss

## Loasaceae

- Mentzelia albicaulis* (Douglas ex Hook.) Douglas ex Torr. & A. Gray (4) PH, VA;  
2300–3200'; Fpj, Gmg, Vbl  
*Mentzelia decapetala* (Pursh ex Sims) Urb. & Gilg ex Gilg (2) PH; 2800–2850'; D,  
Vbl  
*Mentzelia dispersa* S. Watson (9) PH, VA; 2250–2900'; Fpj, Gmg, Sjl, Vbl

## Lythraceae

- ◆ *Ammannia robusta* Heer & Regel (1) VA; 2430–2450'; Wpw

## Malvaceae

- Sphaeralcea coccinea* (Nutt.) Rydb. (74) PH, VA; 2100–3760'; D, Fpj, Gmg, Gup,  
Sgs, Sss

## Melanthiaceae

- Zigadenus venenosus* S. Watson var. *gramineus* (Rydb.) O. S. Walsh ex M. Peck (50)  
PH, VA; 2240–5160'; Gmg, Sss, Wcb

## Myrsinaceae

- ◆ *Anagallis minima* (L.) E. H. L. Krause (2) PH, VA; 2560–2990'; Wcb, Wpw  
*Glaux maritima* L. (3) PH, VA; 2530–3760'; Wal, Wcb  
*Lysimachia ciliata* L. (3) PH; 4070–4890'; Flp, Fmc, Fmr

## Nyctaginaceae

- Mirabilis linearis* (Pursh) Heimerl var. *linearis* (10) PH, VA; 2190–3100'; Fpj, Gmg,  
Gup, Sgs, Sjl, Sss

## Oleaceae

- Fraxinus pennsylvanica* Marshall (15) PH, VA; 2080–2700'; Frc, Ftw, Wcb, Wpw

## Onagraceae

- Chamerion angustifolium* (L.) Holub var. *angustifolium* (1) PH; 4880–5700'; Gmm  
*Chamerion angustifolium* (L.) Holub var. *canescens* (A. W. Wood) N. H. Holmgren  
& P. K. Holmgren (9) PH; 4160–5720'; Fmr, Fpp, Gmm  
*Circaea alpina* L. var. *alpina* (1) PH; 4180–4430'; Fmr  
*Epilobium brachycarpum* C. Presl (24) PH, VA; 2220–5700'; D, Fpp, Ftw, Gmg,  
Wcb, Wpw  
*Epilobium campestre* (Jeps.) Hoch & W. L. Wagner (8) PH, VA; 2210–3010'; Wcb,  
Wpw  
*Epilobium ciliatum* Raf. var. *ciliatum* (13) PH, VA; 2520–4430'; Fmr, Wcb, Wpw  
*Epilobium ciliatum* Raf. var. *glandulosum* (Lehm.) Dorn (2) PH; 4070–4330'; Fmr  
*Epilobium glaberrimum* Barbey var. *fastigiatum* (Nutt.) Trel. ex Jeps. (1) VA; 2720–  
2920'; Wcb

*Epilobium leptophyllum* Raf. (3) PH, VA; 2240–2740'; Wcb, Wpw  
*Gayophytum diffusum* Torr. & A. Gray var. *strictipes* (Hook.) Dorn (1) PH; 5650–5720'; D  
*Oenothera albicaulis* Pursh (6) PH, VA; 2330–2780'; Ftw, Gmg, Gup, Sss  
*Oenothera cespitosa* Nutt. var. *cespitosa* (41) PH, VA; 2040–3240'; Fpj, Gmg, Gup, Sgs, Sss, Vbl  
*Oenothera nuttallii* Sweet (2) VA; 2230–2460'; Ftw, Gmg  
*Oenothera serrulata* Nutt. (6) PH, VA; 2230–3100'; Fpj, Ftw, Gmg, Sss, Wcb  
*Oenothera suffrutescens* (Ser.) W. L. Wagner & Hoch (79) PH, VA; 2040–4400'; Fpj, Gmg, Gup, Sss, Vbl, Wcb  
*Oenothera villosa* Thunb. var. *strigosa* (Rydb.) Dorn (9) PH, VA; 2160–5720'; D, Fmr, Frc, Wpw

### Orchidaceae

*Calypso bulbosa* (L.) Oakes var. *americana* (R. Br.) Luer (1) PH; 4250–4340'; Fmc  
*Coeloglossum viride* (L.) Hartm. (2) PH; 4130–4760'; Fmc, Fmr  
*Corallorhiza maculata* (Raf.) Raf. var. *occidentalis* (Lindl.) Ames (4) PH; 4380–5700'; Flp, Fmr  
*Corallorhiza striata* Lindl. var. *striata* (4) PH; 3920–4730'; Fmr, Fpp  
*Corallorhiza wisteriana* Conrad (3) PH; 3920–4725'; Fmr, Fpp  
*Cypripedium montanum* Douglas ex Lindl. (4) PH; 4000–4500'; Fmc, Fmr, Fpp  
*Goodyera oblongifolia* Raf. (1) PH; 4180–4430'; Flp  
*Platanthera aquilonis* Sheviak (3) PH; 4080–4500'; Fmr

### Orobanchaceae

*Castilleja miniata* Douglas ex Hook. var. *miniata* (6) PH; 4070–4900'; Fmr, Gmm  
*Castilleja sessiliflora* Pursh (12) PH, VA; 2180–3760'; Fpj, Gmg, Sss  
*Orobanche fasciculata* Nutt. (32) PH, VA; 2040–3250'; Fpj, Gmg, Gup, Sss  
*Orthocarpus luteus* Nutt. (49) PH, VA; 2210–4480'; Fpj, Ftw, Gmg, Sss, Wcb

### Oxalidaceae

*Oxalis dillenii* Jacq. (2) VA; 2890–2990'; Wcb, Wpw

### Papaveraceae

*Corydalis aurea* Willd. var. *aurea* (3) PH; 3800–5700'; D, Wpw  
 \* *Fumaria vaillantii* Loisel. (1) VA; 2210–2370'; Ftw

### Phrymaceae

*Mimulus guttatus* DC. (5) PH; 3920–4570'; Fmr

### Plantaginaceae

◆ *Bacopa rotundifolia* (Michx.) Wettst. (1) PH; 2680–2700'; Wpw  
*Besseyia wyomingensis* (A. Nelson) Rydb. (2) PH; 3130–4480'; Fpp  
*Callitriche heterophylla* Pursh var. *heterophylla* (3) VA; 2630–2990'; Wpw  
*Callitriche palustris* L. (1) PH; 2520–2600'; Wpw  
*Collinsia parviflora* Lindl. (2) PH; 4250–4725'; Gmm  
*Gratiola neglecta* Torr. (5) PH; 2410–2600'; Wpw  
*Limosella aquatica* L. (11) PH, VA; 2430–3070'; Wpw  
*Penstemon albidus* Nutt. (68) PH, VA; 2040–3800'; Gmg, Gup, Sss, Wcb  
*Penstemon gracilis* Nutt. (12) PH, VA; 2260–3250'; Gmg, Wcb  
*Penstemon nitidus* Douglas ex Benth. var. *nitidus* (62) PH, VA; 2040–5490'; Fpj, Gmg, Gmm, Gup, Sgs, Sjj, Sss, Vbl

- Penstemon procerus* Douglas ex Graham var. *procerus* **(13)** PH, VA; 2600–5700';  
Fmr, Gmg, Gmm, Wcb
- Plantago elongata* Pursh var. *elongata* **(46)** PH, VA; 2040–3220'; D, Gmg, Sgs, Sss,  
Wcb
- \* *Plantago major* L. **(11)** PH, VA; 2240–4430'; D, Fmr, Wpw
- Plantago patagonica* Jacq. **(83)** PH, VA; 2080–3760'; D, Fpj, Gmg, Gup, Sgs, Sss
- Veronica americana* Schwein. ex Benth. **(2)** PH; 3920–4330'; Fmr
- \* *Veronica catenata* Pennell **(1)** VA; 2130'; Wpw
- Veronica peregrina* L. var. *xalapensis* (Kunth) H. St. John & F. W. Warren **(32)** PH,  
VA; 2100–3070'; Gmg, Wcb, Wpw

## Poaceae

- Achnatherum hymenoides* (Roem. & Schult.) Barkworth **(36)** PH, VA; 2200–3760';  
Fpj, Gmg, Gup, Sss
- Achnatherum nelsonii* (Scribn.) Barkworth ssp. *nelsonii* **(2)** PH, VA; 3030–4400'; D,  
Wcb
- \* *Agropyron cristatum* (L.) Gaertn. var. *cristatum* **(45)** PH, VA; 2080–4020'; D, Ftw,  
Gmg, Sss
- \* *Agropyron cristatum* (L.) Gaertn. var. *desertorum* (Fisch. ex Link) Dorn **(54)** PH,  
VA; 2200–3250'; D, Gmg, Sgs, Sss
- \* *Agropyron cristatum* (L.) Gaertn. var. *fragile* (Roth) Dorn **(2)** PH, VA; 2300–2710';  
D
- \* *Agropyron triticeum* Gaertn. **(1)** VA; 2180–2260'; Gmg
- Agrostis exarata* Trin. **(3)** PH; 3920–4080'; Fmr
- Agrostis scabra* Willd. **(17)** PH, VA; 2430–5720'; D, Flp, Wcb, Wpw
- \* *Agrostis stolonifera* L. **(6)** PH, VA; 2240–4330'; Fmr, Wcb, Wpw
- Alopecurus aequalis* Sobol. var. *aequalis* **(1)** VA; 2400–2650'; Wpw
- \* *Alopecurus arundinaceus* Poir. **(11)** PH, VA; 2080–3040'; D, Wal, Wcb, Wpw
- Alopecurus carolinianus* Walter **(14)** PH, VA; 2360–2970'; D, Wal, Wcb, Wpw
- \* *Alopecurus geniculatus* L. **(10)** PH, VA; 2430–3050'; Wcb, Wpw
- Aristida purpurea* Nutt. var. *longiseta* (Steud.) Vasey **(9)** PH, VA; 2430–3060'; Gmg,  
Gup, Sss
- \* *Avena fatua* L. **(2)** PH; 2590–4020'; D
- Avenula hookeri* (Scribn.) Holub **(3)** PH, VA; 3030–3760'; Fpp, Gmg
- Beckmannia syzigachne* (Steud.) Fernald **(38)** PH, VA; 2080–3070'; Frc, Wcb, Wpw
- Bouteloua gracilis* (Kunth) Lag. ex Griffiths **(80)** PH, VA; 2080–3440'; Fpj, Gmg,  
Gup, Sgs, Sjjw, Sss
- Bromus ciliatus* L. **(2)** PH; 4160–4570'; Flp, Fmr
- \* *Bromus commutatus* Schrad. **(3)** PH, VA; 2260–2970'; D, Sss
- \* *Bromus inermis* Leyss. **(47)** PH, VA; 2080–4890'; D, Fmr, Frc, Ftw, Gmg, Wcb,  
Wpw
- \* *Bromus japonicus* Thunb. ex Murray **(82)** PH, VA; 2040–5160'; D, Fpj, Gmg, Sgs,  
Sjjw, Sss, Wcb
- Bromus porteri* (J. M. Coult.) Nash **(3)** PH; 4330–5700'; Fpp, Gmm
- Bromus pumpellianus* Scribn. **(3)** PH, VA; 2160–5530'; D, Fmc
- Bromus richardsonii* Link **(5)** PH; 3920–5720'; D, Fmr
- \* *Bromus squarrosus* L. **(7)** PH, VA; 2100–2970'; D, Gmg, Sss

- \* *Bromus tectorum* L. **(37)** PH, VA; 2160–5700'; D, Ftw, Gmg, Gmm, Gup, Sss  
*Calamagrostis canadensis* (Michx.) P. Beauv. var. *canadensis* **(3)** PH; 4160–4830';  
Fmr  
*Calamagrostis inexpansa* A. Gray **(1)** VA; 2730–2740'; Wpw  
*Calamagrostis montanensis* (Scribn.) Scribn. **(11)** PH, VA; 2170–3760'; Fpj, Fpp,  
Gmg, Sjw, Sss  
*Calamagrostis purpurascens* R. Br. **(4)** PH; 4450–5700'; Flp, Fmc, Gmm  
*Calamovilfa longifolia* (Hook.) Scribn. var. *longifolia* **(31)** PH, VA; 2240–3200'; Fpj,  
Gmg, Gup, Sgs, Sss  
*Cinna latifolia* (Trevir. ex Göpp.) Griseb. **(1)** PH; 3920–4040'; Fmr
- \* *Crypsis alopecuroides* (Piller & Mitterp.) Schrad. **(1)** PH; 2270'; Frc  
*Danthonia spicata* (L.) P. Beauv. ex Roem. & Schult. **(6)** PH; 4160–5490'; Flp, Fmc,  
Fmr, Fpp  
*Danthonia unispicata* (Thurb.) Munro ex Macoun **(4)** PH, VA; 2600–3050'; Gmg,  
Wcb  
*Deschampsia cespitosa* (L.) P. Beauv. var. *cespitosa* **(7)** PH, VA; 2550–3150'; Wcb,  
Wpw  
*Distichlis spicata* (L.) Greene **(25)** PH, VA; 2210–3440'; Sgs, Sss, Wal, Wpw  
*Echinochloa muricata* (P. Beauv.) Fernald var. *microstachya* Wiegand **(23)** PH, VA;  
2130–3070'; D, Frc, Wpw  
*Elymus albicans* (Scribn. & J. G. Sm.) Á. Löve **(5)** PH, VA; 2480–4760'; Fpj, Fpp,  
Gup  
*Elymus canadensis* L. var. *canadensis* **(16)** PH, VA; 2240–3760'; Ftw, Wcb, Wpw  
*Elymus cinereus* Scribn. & Merr. **(1)** PH; 2310–2390'; D
- \* *Elymus elongatus* (Host) Runemark var. *ponticus* (Podp.) Dorn **(1)** VA; 2080–2150';  
Gmg  
*Elymus elymoides* (Raf.) Swezey var. *brevifolius* (J. G. Sm.) Dorn **(4)** PH; 2430–  
2690'; Gmg, Gup, Sss  
*Elymus elymoides* (Raf.) Swezey var. *elymoides* **(26)** PH, VA; 2100–3130'; Gmg,  
Gup, Sgs, Sss  
*Elymus glaucus* Buckley var. *glaucus* **(3)** PH; 4380–4900'; Fmr, Gmm
- \* *Elymus hispidus* (Opiz) Melderis var. *hispidus* **(4)** PH; 2600–5720'; D, Fmc
- \* *Elymus hispidus* (Opiz) Melderis var. *ruthenicus* (Griseb.) Dorn **(2)** PH; 2210–2240';  
D, Frc  
*Elymus lanceolatus* (Scribn. & J. G. Sm.) Gould var. *lanceolatus* **(19)** PH, VA; 2400–  
5400'; D, Gmg, Vbl  
*Elymus lanceolatus* (Scribn. & J. G. Sm.) Gould var. *riparius* (Scribn. & J. G. Sm.)  
Dorn **(17)** PH, VA; 2230–4760'; D, Gmg  
*Elymus* ×*macounii* Vasey **(1)** PH; 2830–2850'; Gmg
- \* *Elymus repens* (L.) Gould **(19)** PH, VA; 2240–4830'; Fmc, Fmr, Ftw, Sgs, Wcb,  
Wpw  
*Elymus* ×*saundersii* Vasey **(2)** PH, VA; 2640–2740'; D, Sgs  
*Elymus smithii* (Rydb.) Gould **(121)** PH, VA; 2040–3760'; D, Fpj, Gmg, Sgs, Sjw,  
Sss, Vbl  
*Elymus spicatus* (Pursh) Gould **(38)** PH, VA; 2040–5700'; Fmc, Fpj, Gmg, Gup, Sss

- Elymus trachycaulus* (Link) Gould ex Shinnars ssp. *subsecundus* (Link) Á. Löve & D. Löve **(9)** PH, VA; 2300–5700'; Fmc, Fmr, Ftw, Gmg, Gmm, Gup, Wcb, Wpw
- Elymus trachycaulus* (Link) Gould ex Shinnars var. *trachycaulus* **(42)** PH, VA; 2220–5530'; D, Fpj, Fpp, Ftw, Gmg, Sgs, Vbl, Wcb, Wpw
- \* *Eragrostis cilianensis* (All.) Vignolo ex Janch. **(13)** PH, VA; 2160–2720'; D, Frc
- Eragrostis hypnoides* (Lam.) Britton, Sterns, & Poggenb. **(1)** PH; 2270'; Frc
- Festuca campestris* Rydb. **(1)** PH; 4530–4725'; Gmm
- Festuca hallii* (Vasey) Piper **(1)** VA; 3030–3150'; Gmg
- Festuca saximontana* Rydb. var. *saximontana* **(9)** PH, VA; 2650–5700'; Flp, Fpp, Gmg, Gmm
- Glyceria striata* (Lam.) Hitchc. **(2)** PH; 3920–4330'; Fmr
- Hesperostipa comata* (Trin. & Rupr.) Barkworth var. *comata* **(86)** PH, VA; 2040–3760'; Fpj, Gmg, Gup, Sgs, Sjl, Sss
- Hesperostipa curtisetata* (Hitchc.) Barkworth **(8)** PH, VA; 2550–3250'; Ftw, Gmg
- Hordeum jubatum* L. ssp. *intermedium* Bowden **(59)** PH, VA; 2080–3760'; D, Gmg, Sgs, Sss, Vbl, Wal, Wcb, Wpw
- Hordeum jubatum* L. ssp. *jubatum* **(66)** PH, VA; 2040–5720'; D, Gmg, Sss, Wal, Wcb, Wpw
- Hordeum pusillum* Nutt. **(4)** PH; 2310–2600'; D, Sgs, Sss
- \* *Hordeum vulgare* L. var. *vulgare* **(1)** VA; 2440–2640'; Ftw
- Koeleria macrantha* (Ledeb.) Schult. **(110)** PH, VA; 2040–5700'; Fpj, Gmg, Gmm, Gup, Sss, Wcb
- Muhlenbergia asperifolia* (Nees & Meyen ex Trin.) Parodi **(1)** PH; 2430–2460'; Wcb
- Muhlenbergia cuspidata* (Torr. ex Hook.) Rydb. **(2)** PH, VA; 2190–2400'; Ftw, Gmg
- Muhlenbergia richardsonis* (Trin.) Rydb. **(3)** PH, VA; 2730–2990'; Wcb, Wpw
- Munroa squarrosa* (Nutt.) Torr. **(10)** PH, VA; 2190–2700'; D
- Nassella viridula* (Trin.) Barkworth **(100)** PH, VA; 2040–5700'; Fpj, Ftw, Gmg, Gmm, Gup, Sgs, Sjl, Sss, Wcb
- Oryzopsis asperifolia* Michx. **(4)** PH; 4160–4830'; Flp, Fmc, Fmr
- Panicum capillare* L. ssp. *capillare* **(7)** PH, VA; 2160–2650'; D, Frc, Wcb, Wpw
- Phalaris arundinacea* L. **(3)** PH, VA; 2080–2300'; Frc, Wpw
- Phleum alpinum* L. var. *alpinum* **(1)** PH; 4580–4830'; Fmr
- \* *Phleum pratense* L. var. *pratense* **(18)** PH; 2520–5530'; D, Fmc, Fmr, Wcb, Wpw
- Phragmites australis* (Cav.) Trin. ex Steud. **(2)** PH, VA; 2140–2200'; Frc, Wpw
- Piptatherum micranthum* (Trin. & Rupr.) Barkworth **(9)** PH, VA; 2230–3200'; Fpj, Ftw, Sjl, Wcb
- Poa arida* Vasey **(27)** PH, VA; 2170–3240'; Gmg, Sgs, Sss, Wcb, Wpw
- \* *Poa compressa* L. **(20)** PH, VA; 2240–5720'; D, Flp, Fmr, Fpp, Wcb, Wpw
- Poa cusickii* Vasey var. *pallida* (Soreng) Dorn **(10)** PH, VA; 2330–3300'; Gmg, Sss, Wcb
- Poa fendleriana* (Steud.) Vasey ssp. *fendleriana* **(1)** VA; 2890–3025'; Gmg
- Poa glauca* ssp. *glauca* **(1)** PH; 4880–5700'; Voc
- Poa interior* Rydb. **(9)** PH; 3130–5700'; Flp, Fmc, Fmr, Fpp, Gmm
- Poa nervosa* var. *wheeleri* **(3)** PH; 3920–5400'; Fmc, Fmr, Fpp
- Poa palustris* L. **(33)** PH, VA; 2080–5400'; Fmr, Ftw, Wcb, Wpw
- \* *Poa pratensis* L. **(92)** PH, VA; 2040–5700'; D, Fmr, Ftw, Gmg, Gmm, Wcb, Wpw



- Poa secunda* J. Presl ssp. *juncifolia* (Scribn.) Soreng **(60)** PH, VA; 2040–5530'; Fpj, Gmg, Sgs, Sjw, Sss, Wcb, Wpw
- Poa secunda* J. Presl ssp. *secunda* **(67)** PH, VA; 2040–3240'; Fpj, Gmg, Sgs, Sss, Wcb
- \* *Polypogon monspeliensis* (L.) Desf. **(12)** PH, VA; 2080–3070'; Frc, Wpw
- Puccinellia distans* (L.) Parl. **(1)** VA; 2160–2170'; D
- Puccinellia nuttalliana* (Schult.) Hitchc. **(34)** PH, VA; 2100–3760'; Gmg, Sgs, Sss, Vbl, Wal, Wcb, Wpw
- Schedonnardus paniculatus* (Nutt.) Trel. **(14)** PH, VA; 2100–3180'; D, Gmg, Sss
- \* *Schedonorus arundinaceus* (Schreb.) Dumort. **(1)** PH; 4380–4500'; Wpw
- \* *Schedonorus pratensis* (Huds.) P. Beauv. **(1)** PH; 4070–4330'; Fmr
- Schizachne purpurascens* (Torr.) Swall. **(2)** PH; 4180–4830'; Flp, Fmr
- Schizachyrium scoparium* (Michx.) Nash var. *scoparium* **(17)** PH, VA; 2250–4480'; Ftw, Gup, Sjw, Sss
- \* *Setaria viridis* (L.) P. Beauv. **(7)** PH, VA; 2140–2850'; D, Frc
- Spartina gracilis* Trin. **(15)** PH, VA; 2230–3100'; Frc, Ftw, Sgs, Wal, Wcb, Wpw
- Spartina pectinata* Link **(11)** PH, VA; 2270–3760'; Wal, Wcb, Wpw
- ◆ *Sphenopholis intermedia* (Rydb.) Rydb. **(1)** PH; 4450–4560'; Fmc
- Sphenopholis obtusata* (Michx.) Scribn. **(1)** PH; 2600–2610'; Wpw
- Sporobolus airoides* (Torr.) Torr. **(1)** PH; 3130–3760'; Wal
- Sporobolus cryptandrus* (Torr.) A. Gray **(5)** PH, VA; 2160–2700'; D, Gmg
- \* *Triticum aestivum* L. **(3)** PH, VA; 2440–2740'; D, Vbl
- Vulpia octoflora* (Walter) Rydb. var. *glauca* (Nutt.) Fernald **(7)** PH, VA; 2200–2750'; Gmg, Gup, Sss
- Vulpia octoflora* (Walter) Rydb. var. *octoflora* **(22)** PH, VA; 2160–2800'; Gmg, Sss
- Polemoniaceae**
- Collomia linearis* Nutt. **(88)** PH, VA; 2040–5720'; D, Fpj, Gmg, Gup, Sgs, Sjw, Sss, Wcb
- Leptosiphon septentrionalis* (H. Mason) J. M. Porter & L. A. Johnson **(2)** PH, VA; 2540–2840'; Gmg, Sss
- Navarretia intertexta* (Benth.) Hook. var. *propinqua* (Suksd.) Brand **(8)** PH, VA; 2140–2990'; Wcb, Wpw
- Phlox alyssifolia* Greene **(9)** PH, VA; 2190–4730'; Fmc, Fpp, Ftw, Gmg, Gup, Sjw
- ◆ *Phlox andicola* E. E. Nelson **(1)** PH; 3080–3220'; Sss
- Phlox hoodii* Richardson **(43)** PH, VA; 2150–4730'; Gmg, Gup, Sgs, Sss
- Polygalaceae**
- Polygala alba* Nutt. **(10)** PH, VA; 2170–2920'; Gmg, Wcb
- Polygala verticillata* L. **(2)** PH, VA; 2400–2680'; Fpj
- Polygonaceae**
- Eriogonum cernuum* Nutt. **(2)** VA; 2400–2880'; Gup
- Eriogonum flavum* Nutt. var. *flavum* **(50)** PH, VA; 2100–3760'; Gmg, Gup, Sss
- Eriogonum ovalifolium* Nutt. var. *ochroleucum* (Small ex Rydb.) M. Peck **(5)** PH; 2790–3760'; Fpj, Gmg, Gup
- Eriogonum ovalifolium* Nutt. var. *purpureum* (Nutt.) T. Durand **(1)** PH; 4880–5700'; Voc

- Eriogonum pauciflorum* Pursh (**55**) PH, VA; 2200–3440'; Fpj, Gmg, Gup, Sgs, Sss, Vbl
- \* *Fallopia convolvulus* (L.) Á. Löve (**25**) PH, VA; 2140–3760'; D, Frc, Ftw, Gmg, Wcb, Wpw
- Persicaria amphibia* (L.) Gray (**27**) PH, VA; 2080–3070'; Wcb, Wpw
- Persicaria lapathifolia* (L.) Gray (**11**) PH, VA; 2130–3070'; Frc
- \* *Persicaria maculosa* Gray (**1**) PH; 2220–2230'; Ftw
- Polygonum achoreum* S. F. Blake (**21**) PH, VA; 2140–2970'; D
- \* *Polygonum aviculare* L. (**96**) PH, VA; 2040–5720'; D, Gmg, Sgs, Sju, Sss, Vbl, Wal, Wcb, Wpw
- Polygonum douglasii* Greene (**16**) PH, VA; 2210–5160'; Ftw, Gmg, Wcb
- Polygonum erectum* L. (**2**) PH, VA; 2310–3200'; D, Sgs
- Polygonum ramosissimum* Michx. var. *ramosissimum* (**13**) PH, VA; 2080–3060'; Fpj, Gmg, Wcb
- \* *Rumex crispus* L. (**12**) PH, VA; 2430–4330'; Fmr, Wcb, Wpw
- Rumex fueginus* Phil. (**4**) PH, VA; 2080–2700'; Wpw
- Rumex occidentalis* S. Watson (**2**) VA; 2720–2970'; Wcb, Wpw
- \* *Rumex patientia* L. (**4**) PH, VA; 2140–2850'; Wcb, Wpw
- \* *Rumex stenophyllus* Ledeb. (**25**) PH, VA; 2080–2970'; Wal, Wcb, Wpw
- Rumex triangulivalvis* (Danser) Rech. f. (**28**) PH, VA; 2200–5720'; Wcb, Wpw
- Rumex utahensis* Rech. f. (**20**) PH, VA; 2140–2990'; Ftw, Wcb, Wpw
- Rumex venosus* Pursh (**1**) VA; 2180–2260'; Gmg

#### Portulacaceae

- Lewisia rediviva* Pursh (**1**) PH; 2580'; Gmg
- \* *Portulaca oleracea* L. (**3**) PH, VA; 2210–2700'; D

#### Potamogetonaceae

- Potamogeton diversifolius* Raf. (**1**) PH; 2680–2700'; Wpw
- Potamogeton pusillus* L. var. *pusillus* (**1**) VA; 2720–2920'; Wpw
- Potamogeton richardsonii* (A. Benn.) Rydb. (**7**) PH, VA; 2540–3150'; Wpw
- Potamogeton zosteriformis* Fernald (**1**) PH; 2660'; Wpw
- Stuckenia pectinata* (L.) Börner (**8**) PH, VA; 2210–3070'; Wpw
- Zannichellia palustris* L. (**1**) PH; 2270–2290'; Wpw

#### Primulaceae

- Androsace occidentalis* Pursh (**31**) PH, VA; 2040–4480'; Gmg, Sss, Wcb
- Androsace septentrionalis* L. (**15**) PH, VA; 2415–3040'; Gmg, Wcb
- Primula conjugens* (Greene) A. R. Mast & Reveal var. *conjugens* (**2**) PH; 3920–4500'; Fpp, Gmm
- Primula pauciflora* (Greene) A. R. Mast & Reveal var. *pauciflora* (**1**) VA; 3030–3150'; Wcb

#### Ranunculaceae

- Actaea rubra* (Aiton) Willd. (**8**) PH; 3920–4890'; Fmc, Fmr
- Anemone cylindrica* A. Gray (**5**) PH; 3920–4880'; Flp, Fmc, Fmr
- Anemone multifida* Poir. var. *multifida* (**12**) PH, VA; 2230–5700'; Fmc, Fmr, Fpp, Ftw, Gmm
- Anemone patens* L. var. *multifida* Pritz. (**16**) PH, VA; 2190–4730'; Fpp, Gmg, Gmm, Wcb

- Clematis columbiana* (Nutt.) Torr. & A. Gray var. *tenuiloba* (A. Gray) J. S. Pringle (1) PH; 4120–4730'; Fpp
- Clematis ligusticifolia* Nutt. (4) PH, VA; 2140–2460'; Frc, Ftw
- Clematis occidentalis* (Hornem.) DC. var. *grosseserrata* (Rydb.) J. S. Pringle (13) PH; 3920–4890'; Flp, Fmc, Fmr
- Delphinium bicolor* Nutt. ssp. *bicolor* (5) PH, VA; 2890–4725'; Fmr, Gmg, Gmm
- Myosurus minimus* L. (8) PH, VA; 2270–2730'; Wcb, Wpw
- Ranunculus abortivus* L. (2) PH; 3920–4330'; Fmr
- Ranunculus aquatilis* L. var. *diffusus* With. (7) PH, VA; 2520–4330'; Fmr, Wpw
- Ranunculus cymbalaria* Pursh (12) PH, VA; 2130–3150'; Wal, Wcb, Wpw
- Ranunculus glaberrimus* Hook. var. *ellipticus* (Greene) Greene (3) VA; 2690–3040'; Wcb
- ◆ *Ranunculus hyperboreus* Rottb. (1) VA; 2730–2740'; Wpw
- Ranunculus macounii* Britton (5) PH, VA; 2730–4430'; Fmr, Wpw
- \* *Ranunculus testiculatus* Crantz (1) VA; 2380'; D
- Thalictrum occidentale* A. Gray (5) PH, VA; 2560–4830'; Fmr, Ftw
- Thalictrum venulosum* Trel. (2) PH; 2630–4220'; Fmr, Ftw
- Rhamnaceae**
- Ceanothus velutinus* Douglas ex Hook. var. *velutinus* (4) PH; 4100–5700'; Flp, Fmc
- Rosaceae**
- Agrimonia striata* Michx. (6) PH; 2900–4570'; Fmr, Ftw
- Amelanchier alnifolia* (Nutt.) Nutt. ex M. Roem. var. *alnifolia* (19) PH, VA; 2240–5160'; Fmr, Fpp, Ftw
- Chamaerhodos erecta* (L.) Bunge var. *parviflora* (Nutt.) C. L. Hitchc. (10) PH, VA; 2100–4760'; Gmg, Gup, Sss, Voc
- \* *Cotoneaster lucidus* Schldl. (1) VA; 2720–2740'; D *Crataegus chrysocarpa* Ashe var. *chrysocarpa* (4) PH; 2940–4725'; Fmr, Ftw
- Crataegus macracantha* Lodd. ex Loudon var. *occidentalis* (Britton) Eggl. (1) PH; 4250–4340'; Fmr
- Dasiphora fruticosa* (L.) Rydb. (19) PH, VA; 2780–5720'; Flp, Fmc, Fmr, Fpp, Ftw, Gmg, Gmm, Voc, Wcb
- Drymocallis arguta* (Pursh) Rydb. (20) PH, VA; 2040–5160'; Fmc, Ftw, Gmg, Sss, Wcb
- Drymocallis glabrata* Rydb. (11) PH; 2640–5700'; Flp, Fmc, Fmr, Fpp, Gmm
- Fragaria vesca* L. (1) VA; 2860–2990'; Wcb
- Fragaria virginiana* Mill. (9) PH; 3920–5160'; Flp, Fmc, Fmr, Fpp
- Geum aleppicum* Jacq. (10) PH, VA; 2550–4570'; Fmr, Ftw, Wcb
- Geum macrophyllum* Willd. var. *perincisum* (Rydb.) Raup (3) PH; 4000–4430'; Flp, Fmr
- Geum triflorum* Pursh var. *triflorum* (61) PH, VA; 2170–5160'; Fpj, Fpp, Ftw, Gmg, Gmm, Sss, Wcb
- \* *Malus pumila* Mill. (1) PH; 2240–2260'; D
- Potentilla anserina* L. (8) PH, VA; 2130–3150'; Wcb, Wpw
- Potentilla bipinnatifida* Douglas ex Hook. var. *bipinnatifida* (37) PH, VA; 2100–3180'; Gmg, Gup, Wcb
- Potentilla concinna* Richardson var. *concinna* (15) PH, VA; 2280–4730'; Gmg, Wcb

- Potentilla gracilis* Douglas ex Hook. var. *elmeri* (Rydb.) Jeps. **(2)** VA; 2240–3150'; Wcb
- Potentilla gracilis* Douglas ex Hook. var. *fastigiata* (Nutt.) S. Watson **(6)** PH, VA; 2260–3250'; Ftw, Gmg, Wcb, Wpw
- Potentilla gracilis* Douglas ex Hook. var. *pulcherrima* (Lehm.) Fernald **(18)** PH, VA; 2430–4900'; Fmr, Ftw, Gmm
- Potentilla hippiana* Lehm. var. *effusa* (Douglas ex Lehm.) Dorn **(6)** PH; 3130–5700'; Flp, Fmc, Gmm, Gup, Voc
- Potentilla hippiana* Lehm. var. *hippiana* **(15)** PH, VA; 2470–3150'; Gmg, Sss, Wcb, Wpw
- Potentilla norvegica* L. ssp. *monspeliensis* (L.) Asch. & Graebn. **(9)** PH, VA; 2520–5400'; D, Fmc, Fmr, Wcb, Wpw
- Potentilla pensylvanica* L. var. *pensylvanica* **(11)** PH, VA; 2380–3760'; Gmg, Gup, Sss, Wcb, Wpw
- Potentilla rivalis* Nutt. var. *millegrana* (Engelm. ex Lehm.) S. Watson **(3)** PH, VA; 2080–2840'; Wpw
- Prunus americana* Marshall **(1)** VA; 2720–2740'; Wcb
- Prunus pensylvanica* L. f. **(10)** PH; 2780–5530'; Fmc, Fmr, Ftw
- Prunus virginiana* L. var. *melanocarpa* (A. Nelson) Sarg. **(62)** PH, VA; 2080–5700'; Fmr, Fpp, Frc, Ftw, Wcb
- Rosa arkansana* Porter var. *arkansana* **(10)** PH, VA; 2210–3130'; Fpj, Ftw, Gmg, Gup
- Rosa arkansana* Porter var. *suffulta* (Greene) Cockerell **(33)** PH, VA; 2240–4760'; Fmc, Fpj, Fpp, Ftw, Gmg, Sss, Wcb, Wpw
- Rosa nutkana* C. Presl var. *hispida* Fernald **(10)** PH, VA; 2730–5700'; Flp, Fmr, Fpj, Ftw
- Rosa sayi* Schwein. **(41)** PH, VA; 2040–5160'; Fmr, Gmg, Gup, Sjj, Sss
- Rosa woodsii* Lindl. var. *woodsii* **(83)** PH, VA; 2140–5490'; D, Fpj, Frc, Ftw, Gmg, Gup, Wcb, Wpw
- Rubus idaeus* L. var. *aculeatissimus* Regel & Tiling **(17)** PH, VA; 2780–5720'; Fmc, Fmr, Ftw
- Rubus parviflorus* Nutt. var. *parviflorus* **(1)** PH; 4160–4570'; Flp
- Spiraea betulifolia* Pall. var. *lucida* (Douglas ex Hook.) C. L. Hitchc. **(15)** PH; 3920–5720'; Flp, Fmc, Fmr, Fpp

### Rubiaceae

- Galium aparine* L. **(9)** PH, VA; 2250–3760'; Ftw, Wcb
- Galium boreale* L. **(27)** PH, VA; 2520–5700'; Flp, Fmc, Fmr, Fpp, Ftw, Gmg, Gmm
- Galium triflorum* Michx. **(12)** PH, VA; 2480–5700'; Fmc, Fmr, Ftw

### Salicaceae

- Populus angustifolia* E. James **(1)** PH; 4240–4400'; Fmr
- Populus balsamifera* L. var. *balsamifera* **(3)** PH; 2240–4400'; Fmr
- Populus* × *brayshawii* B. Boivin **(2)** PH; 4080–4725'; Fmr
- Populus deltoides* W. Bartram ex Marshall var. *occidentalis* Rydb. **(45)** PH, VA; 2080–4500'; Frc, Ftw, Wcb, Wpw
- Populus tremuloides* Michx. **(26)** PH, VA; 2780–5530'; Fmc, Fmr, Fpp, Ftw
- Salix amygdaloides* Andersson **(35)** PH, VA; 2080–3150'; Frc, Wpw

- Salix bebbiana* Sarg. (7) PH; 3920–4730'; Fmr  
*Salix eriocephala* Michx. var. *famelica* (C. R. Ball) Dorn (6) PH, VA; 2130–2920';  
 Frc, Ftw, Wpw  
*Salix eriocephala* Michx. var. *watsonii* (Bebb) Dorn (2) VA; 2225–2840'; Wcb  
*Salix exigua* Nutt. ssp. *interior* (Rowlee) Cronquist (26) PH, VA; 2130–3150'; Frc,  
 Wpw  
 \* *Salix fragilis* L. (1) VA; 2720–2740'; Wcb  
*Salix scouleriana* Barratt ex Hook. (9) PH; 4080–5700'; Flp, Fmc, Fmr
- Santalaceae**  
*Comandra umbellata* (L.) Nutt. var. *pallida* (A. DC.) M. E. Jones (79) PH, VA;  
 2040–4725'; Fpj, Gmg, Gup, Sjw, Sss
- Sapindaceae**  
*Acer negundo* L. var. *interius* (Britton) Sarg. (11) PH, VA; 2080–3180'; Frc, Ftw,  
 Wpw  
*Acer negundo* L. var. *violaceum* (Kirchn.) Jacq. (1) PH; 2210–2240'; Frc
- Sarcobataceae**  
*Sarcobatus vermiculatus* (Hook.) Torr. (69) PH, VA; 2040–3300'; Fpj, Sgs, Sss, Vbl
- Saxifragaceae**  
*Heuchera parvifolia* Nutt. ex Torr. & A. Gray (4) PH; 3130–5700'; Fmr, Fpp, Voc  
*Heuchera richardsonii* R. Br. (7) VA; 2520–3250'; Ftw, Gmg, Wcb  
*Lithophragma parviflorum* (Hook.) Nutt. ex Torr. & A. Gray (1) PH; 4080–4500';  
 Fmr  
*Saxifraga occidentalis* S. Watson (1) PH; 5200–5400'; Fmr
- Scrophulariaceae**  
 \* *Verbascum thapsus* L. (5) PH; 4020–5720'; D, Fmr
- Solanaceae**  
*Solanum triflorum* Nutt. (9) PH, VA; 2140–3050'; D, Ftw, Gmg
- Tamaricaceae**  
 \*■ *Tamarix chinensis* Lour. (3) VA; 2250–2570'; Wcb, Wpw
- Typhaceae**  
*Typha angustifolia* L. (4) PH, VA; 2220–2740'; Wpw  
*Typha latifolia* L. (12) PH, VA; 2200–3050'; Frc, Wpw
- Ulmaceae**  
*Ulmus americana* L. (1) PH; 2240–2260'; D  
 \* *Ulmus pumila* L. (2) VA; 2160–2740'; D
- Urticaceae**  
*Parietaria pensylvanica* Muhl. ex Willd. (30) PH, VA; 2210–3760'; Fmr, Fpj, Ftw,  
 Sgs  
*Urtica dioica* L. var. *procera* (Muhl. ex Willd.) Wedd. (16) PH, VA; 2140–4190';  
 Frc, Ftw, Wcb, Wpw
- Verbenaceae**  
*Verbena bracteata* Lag. & Rodr. (14) PH, VA; 2140–3070'; D
- Violaceae**  
*Viola adunca* Sm. var. *adunca* (5) PH; 3920–4730'; Flp, Fmc, Fmr, Fpp  
*Viola canadensis* L. (10) PH, VA; 3120–4830'; Fmr, Ftw, Gmm  
*Viola nephrophylla* Greene (1) VA; 3030–3150'; Wcb

*Viola nuttallii* Pursh (**35**) PH, VA; 2040–4730'; Fpj, Gmg, Gup, Sjl, Sss, Wcb  
*Viola vallicola* A. Nelson (**15**) PH, VA; 2330–4725'; Gmg, Gmm, Wcb

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