Plant Community Composition and Structure Monitoring for Wind Cave National Park

2013 Annual Report

Natural Resource Data Series NPS/NGPN/NRDS—2014/613
ON THE COVER
Photograph by: NGPN
Plant Community Composition and Structure Monitoring for Wind Cave National Park

2013 Annual Report

Natural Resource Data Series NPS/NGPN/NRDS—2014/613

Isabel W. Ashton
Michael Prowatzke

National Park Service
Northern Great Plains Inventory & Monitoring Network
231 East Saint Joseph St.
Rapid City, SD 57701

January 2014

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado
The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available from the Northern Great Plains Inventory & Monitoring Network website (http://science.nature.nps.gov/im/units/ngpn/monitor/plants.cfm) and the Natural Resource Publications Management website (http://www.nature.nps.gov/publications/nrpm/). To receive this report in a format optimized for screen readers, please email irma@nps.gov.

Please cite this publication as:

## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figures</td>
<td>iv</td>
</tr>
<tr>
<td>Tables</td>
<td>iv</td>
</tr>
<tr>
<td>Acknowledgments</td>
<td>v</td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Literature Cited</td>
<td>12</td>
</tr>
<tr>
<td>Appendix A: Field journal for plant community monitoring in WICA for the 2013 season</td>
<td>14</td>
</tr>
<tr>
<td>Appendix B: List of plant species found in 2012 at WICA</td>
<td>15</td>
</tr>
</tbody>
</table>
Figures

**Figure 1.** Map of Wind Cave National Park (WICA) and plant community monitoring plots surveyed in 2013. ................................................................. 2

**Figure 2.** Long-term monitoring plot used for sampling vegetation in Wind Cave National Park. .................................................................................................................. 2

**Figure 3.** Drought conditions in July 2013 in the Northern Great Plains. ......................................................... 6

**Figure 4.** Average cover by lifeform and nativity in 15 plant community monitoring plots in Wind Cave National Park in 2013. .................................................................................. 6

**Figure 5.** The average absolute cover of the 10 most common native (green) and exotic (red) plants recorded at Wind Cave National Park in 2013. ........................................................................ 8

**Figure 6.** Two long-term monitoring sites in Wind Cave national Park, PCM_0014 and PCM_0018, with high native plant diversity. ................................................................. 9

**Figure 7.** Long-term monitoring plot PCM_0013 in Wind Cave National Park. ......................... 10

Tables

**Table 1.** Exotic species surveyed for at Wind Cave National Park as part of the early detection and rapid response program within the Northern Great Plains Network. ......................... 3

**Table 2.** Rare species that were surveyed for during the 2013 field season at Wind Cave National Park. .......................................................................................................................... 3

**Table 3.** Key to the symbols used in the Natural Resource Condition Table. ........................................ 5

**Table 4.** Natural resource condition summary table for upland plant communities in Wind Cave National Monument (WICA). ........................................................................................................ 7

**Table 5.** Average plant species richness in 15 plots at Wind Cave National Park in 2013................................................................................................................................. 9

**Table 6.** Characteristics of the plant community in 15 plots at Wind Cave National Park in 2013................................................................................................................................. 11

**Table 7.** Seedling, pole, and tree densities at 6 plots in Wind Cave National Park in 2013................................................................................................................................. 11
Acknowledgments

We thank all the authors of the NGPN Plant Community Monitoring Protocol, particularly A. Symstad, for outstanding guidance on data collection and reporting. Thank you to the staff at WICA for providing logistical support. We thank M. Bynum, A. Fund, J. Wendt, B. Burkhart, and K. Paintner-Green for assistance in the field. With the assistance of the above people, the 2013 NGPN vegetation field crew of I. Ashton, M. Prowatzke, E. Moore, M. Owen, J. Ladd, J. Moran, C. Traft, and S. Rockwood collected all the data included in this report. We thank S. Wilson for invaluable support and instruction on managing data in the FFI database and for assistance with the GIS data.
Introduction

The Black Hills is a 1.5 million ha refuge of ponderosa pine (Pinus ponderosa) forest surrounded by the mixed-grass prairies of western South Dakota and eastern Wyoming. The Black Hills is a unique ecosystem composed of species from the western Rocky Mountains, eastern deciduous forests, northern boreal forests, and the surrounding Great Plains (Larson and Johnson 2007). The National Park Service (NPS) plays an important role in preserving and restoring ponderosa woodlands and mixed-grass prairies within its boundaries. The stewardship goal of the NPS is to “preserve ecological integrity and cultural and historical authenticity” (NPS 2012); however, resource managers struggle with the reality that there have been fundamental changes in the disturbance regimes, such as climate, fire, and large ungulate grazing, that have historically maintained ponderosa woodlands and native prairies, and there is the continual pressure of exotic invasive species. In recent years, mountain pine beetle (Dendroctonus ponderosae) outbreaks have been of particular concern because they are increasing throughout the Black Hills and have caused 100% mortality of ponderosa pines in some areas (Hocking et al. 2010). Long-term monitoring in national parks is essential to sound management because it can provide information on environmental quality and condition, benchmarks of ecological integrity, and early warning of declines in ecosystem health.

Wind Cave National Park (WICA) is located in the southern Black Hills with a purpose to protect the unique Wind Cave resources and preserve and enhance the mixed-grass prairie and native wildlife, while providing for the enjoyment of the public. The 33,851 acres of WICA is a mosaic of ponderosa forest and mixed-grass prairie, with approximately 30% covered by ponderosa pine forests. While some areas have high exotic species cover, the native plant communities within the upland areas of WICA are considered to be in good condition (Komp et al. 2011). The Northern Great Plains Inventory & Monitoring Program (NGPN) began vegetation monitoring efforts in WICA in 2011 (Ashton et al. 2012). Vegetation monitoring protocols and plot locations were chosen to represent the entire park (based on the 2010 boundary) and to coordinate efforts with the Northern Great Plains Fire Ecology Program (FireEP). There is a separate effort to monitor streambank condition because riparian communities are an important resource for the park (Burkhart and Kovacs 2013). Additional upland plots were added to represent the 2011 Addition. The long-term objectives of the NGPN plant community monitoring effort (Symstad et al. 2012b) in WICA are to:

1. Determine park-wide status and long-term trends in vegetation species composition (e.g., exotic vs. native) and structure (e.g., cover, height) of herbaceous and shrub species.

2. Determine park-wide status (at 5-year intervals) and long-term trends of tree density by species, height class, diameter class, and fuel loads

3. Improve our understanding of the effects of external drivers and management actions on plant community species composition and structure by correlating changes in vegetation composition and structure with changes in climate, landscape patterns, atmospheric chemical composition, fire, and invasive plant control.

This report is intended to provide a timely release of basic data sets and data summaries from our sampling efforts at WICA in 2013. NGPN visited 15 plots (Figure 1). A more thorough
A discussion of forest structure and health was completed in 2012 (Ashton et al. 2013a). We expect to produce reports with more in-depth data analysis and interpretation when we complete 5 years of sampling. In the interim, reports, spatial data, and data summaries can be provided for park management and interpretation upon request.

![Map of Wind Cave National Park (WICA) and plant community monitoring plots surveyed in 2013. Plots in panel 2 (orange) and panel 3 (blue) were surveyed in 2013.](image)

**Figure 1.** Map of Wind Cave National Park (WICA) and plant community monitoring plots surveyed in 2013. Plots in panel 2 (orange) and panel 3 (blue) were surveyed in 2013.
Methods

The NGPN Plant Community Composition and Structure Monitoring Protocol (Symstad et al. 2012b, a) describes in detail the methods used for sampling long-term plots. Below, we briefly describe the general approach. For those interested in more detail please see Symstad et al. 2012, available at http://science.nature.nps.gov/im/units/ngpn/monitor/plants.cfm.

Sample design

We implemented a survey to monitor plant community structure and composition in WICA using a spatially balanced probability design (Generalized Random Tessellation Stratified [GRTS]; Stevens and Olsen 2003, 2004). Using a GRTS design, we selected 35 randomly located sites within WICA. We split these 35 sites into 5 panels with 7 sites each (Figure 1). We visit 2 panels (14 sites) every year, and after 5 years we will have visited all 35 sites twice. In 2013, we visited sites in panel 2 and panel 3 during the first week of July. Data from these randomly selected sites can be used to estimate condition of vegetation communities for the whole park and over time, can be used to discern trends in condition. In 2011, the park acquired new property. We have selected 10 sites (2 per panel) within the addition and will visit these on the same schedule as above when time allows. In 2013, we were able to visit only 1 additional site: PCM_2054.

Plot layout and sampling

At each of the sites we visited, we recorded plant species cover and frequency in a rectangular, 50 m x 20 m (0.1 ha), permanent plot (Figure 2). Data on ground cover, herb-layer height ≤ 2 m, and plant cover were collected on two 50 m transects (the long sides of the plot) using a point-intercept method. Species richness data from the point-intercept method were supplemented with species presence data collected in 5 sets of nested square quadrats (0.01 m², 0.1 m², 1 m², and 10 m²) located systematically along each transect (Figure 2). In 2013, sampling at WICA took a 9-person crew 7 days (see Appendix A for a detail of activities each day).
Figure 2. Long-term monitoring plot used for sampling vegetation in Wind Cave National Park.

When woody species were present, tree regeneration and tall shrub density data were collected within a 10 m radius subplot centered in the larger 50 m x 20 m plot (Figure 2). Trees with diameter at breast height (DBH) > 15 cm, located within the entire 0.1 ha plot, were mapped and tagged. For each tree, the species, DBH, status, and condition (e.g., leaf-discoloration, insect-damaged, etc.) were recorded. Dead and downed woody fuel load data were collected on two perpendicular, 100 ft (30.49 m) transects with midpoints at the center of the plot (Figure 2), following Brown’s Line methods (Brown 1974, Brown et al. 1982).

At all plots, we also surveyed the area for common disturbances and target species of interest to the park. Common disturbances included such things as roads, rodent mounds, animal trails, and fire. For all plots, the type and severity of the disturbances were recorded. We also surveyed the area for exotic species that have the potential to spread into the park and cause significant ecological impacts (Table 1). For each target species that was present at a site, an abundance class was given on a scale from 1-5 where 1 = one individual, 2 = few individuals, 3 = cover of 1-5%, 4 = cover of 5-25%, and 5 = cover > 25% of the plot. The information gathered from this procedure is critical for early detection and rapid response to such threats. In addition, we noted the presence of plant species that are considered rare or vulnerable to loss in South Dakota, and may occur in WICA (Table 2).
Table 1. Exotic species surveyed for at Wind Cave National Park as part of the early detection and rapid response program within the Northern Great Plains Network.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alliaria petiolata</td>
<td>garlic mustard</td>
<td>Riparian</td>
</tr>
<tr>
<td>Polygonum cuspidatum; P. sachalinense; P.x bohemicum</td>
<td>knotweeds</td>
<td>Riparian</td>
</tr>
<tr>
<td>Pueraria montana var. lobata</td>
<td>kudzu</td>
<td>Riparian</td>
</tr>
<tr>
<td>Iris pseudacorus</td>
<td>yellow iris</td>
<td>Riparian</td>
</tr>
<tr>
<td>Ailanthus altissima</td>
<td>tree of heaven</td>
<td>Riparian</td>
</tr>
<tr>
<td>Lepidium latifolium</td>
<td>perennial pepperweed</td>
<td>Riparian</td>
</tr>
<tr>
<td>Arundo donax</td>
<td>giant reed</td>
<td>Riparian</td>
</tr>
<tr>
<td>Rhamnus cathartica</td>
<td>common buckthorn</td>
<td>Riparian</td>
</tr>
<tr>
<td>Heracleum mantegazzianum</td>
<td>giant hogweed</td>
<td>Riparian</td>
</tr>
<tr>
<td>Centaurea solstitialis</td>
<td>yellow star thistle</td>
<td>Upland</td>
</tr>
<tr>
<td>Hieracium aurantiacum; H. caespitosum</td>
<td>orange and meadow hawkweed</td>
<td>Upland</td>
</tr>
<tr>
<td>Isatis tinctoria</td>
<td>Dyer's woad</td>
<td>Upland</td>
</tr>
<tr>
<td>Taeniatherum caput-medusae</td>
<td>medusahead</td>
<td>Upland</td>
</tr>
<tr>
<td>Chondrilla juncea</td>
<td>rush skeletonweed</td>
<td>Upland</td>
</tr>
<tr>
<td>Gypsophila paniculata</td>
<td>baby's breath</td>
<td>Upland</td>
</tr>
<tr>
<td>Centaurea virgata; C.diffusa</td>
<td>knapweeds</td>
<td>Upland</td>
</tr>
<tr>
<td>Linaria dalmatica; L. vulgaris</td>
<td>toadflax</td>
<td>Upland</td>
</tr>
<tr>
<td>Euphorbia myrsinites &amp; E. cyparissias</td>
<td>myrtle spurge</td>
<td>Upland</td>
</tr>
<tr>
<td>Dipsacus fullonum &amp; D. faciniatus</td>
<td>common teasel</td>
<td>Upland</td>
</tr>
<tr>
<td>Salvia aethiopis</td>
<td>Mediterranean sage</td>
<td>Upland</td>
</tr>
<tr>
<td>Ventenata dubia</td>
<td>African wiregrass</td>
<td>Upland</td>
</tr>
</tbody>
</table>

Table 2. Rare species that were surveyed for during the 2013 field season at Wind Cave National Park.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achnatherum robustum</td>
<td>sleepy grass</td>
</tr>
<tr>
<td>Botrychium campestre</td>
<td>prairie moonwort</td>
</tr>
<tr>
<td>Botrychium lineare</td>
<td>narrowleaf grapefern</td>
</tr>
<tr>
<td>Botrychium simplex</td>
<td>little grapefern</td>
</tr>
<tr>
<td>Clematis hirsutissima</td>
<td>hairy clematis</td>
</tr>
<tr>
<td>Cryptantha cana</td>
<td>silver-mounded candleflower</td>
</tr>
<tr>
<td>Cypripedium parviflorum</td>
<td>lesser yellow lady's slipper</td>
</tr>
<tr>
<td>Echinocereus viridiflorus</td>
<td>nylon hedgehog cactus</td>
</tr>
<tr>
<td>Elymus diversiglumis</td>
<td>interrupted wildrye</td>
</tr>
<tr>
<td>Ericameria parryy</td>
<td>Parry's rabbitbrush</td>
</tr>
<tr>
<td>Erigeron acris</td>
<td>bitter fleabane</td>
</tr>
<tr>
<td>Erigeron ochroleucus</td>
<td>buff fleabane</td>
</tr>
<tr>
<td>Ipomopsis spicata</td>
<td>spiked ipomopsis</td>
</tr>
<tr>
<td>Phleum alpinum</td>
<td>alpine timothy</td>
</tr>
<tr>
<td>Physaria arenosa</td>
<td>sidesaddle bladderpod</td>
</tr>
<tr>
<td>Thelesperma megapotamicum</td>
<td>Hopi tea</td>
</tr>
<tr>
<td>Townsendia excapa</td>
<td>Easter daisy</td>
</tr>
<tr>
<td>Townsendia hookeri</td>
<td>Hooker's Townsend daisy</td>
</tr>
<tr>
<td>Viburnum edule</td>
<td>squashberry</td>
</tr>
</tbody>
</table>

Data Management and Analysis

We used FFI (FEAT/FIREMON Integrated; http://frames.gov/ffi/) as the primary software environment for managing our sampling data. FFI is used by a variety of agencies (e.g., NPS, USDA Forest Service, U.S. Fish and Wildlife Service), has a national-level support system, and
generally conforms to the Natural Resource Database Template standards established by the Inventory and Monitoring Program.

Species scientific names, codes, and common names are from the USDA Plants Database (USDA-NRCS 2012). However, nomenclature follows the Integrated Taxonomic Information System (ITIS) (http://www.itis.gov). In the few cases where ITIS recognizes a new name that was not in the USDA PLANTS database, the new name was used and a unique plant code was assigned.

After data for the sites were entered, 100% of records were verified to the original data sheet to minimize transcription errors. A further 10% of records were reviewed a second time. After all data were entered and verified, automated queries were developed to check for errors in the data. When errors were caught by the crew or the automated queries, changes were made to the original datasheets and the FFI database as needed.

Plant life forms (e.g., shrub, forb) were based on definitions from the USDA Plants Database (USDA-NRCS 2012). Warm-season grasses were identified primarily using a guide by Skinner (2010). Summaries were produced using the FFI reporting and query tools, and statistical summaries and graphics were generated using R software (version 2.15.1).

We measured diversity at the plots in 3 ways: species richness, the Shannon Index, and Pielou’s Index of Evenness. Species richness is simply a count of the species recorded in an area. The Shannon Index, H’, is a measure of the number of species in an area and how even abundances are across the community. It typically ranges between 0 (low richness and evenness) to 3.5 (high species richness and evenness). Pielou’s Index of Evenness, J’, measures how even abundances are across taxa. It ranges between 0 and 1; values near 0 indicate dominance by a single species, and values near 1 indicate nearly equal abundance of all species present.

Disturbances were recorded in square meters and ranged from 0 (not present) to 2290 (the whole plot area) for each type of disturbance. We report the sum of all individual disturbances, so the value can be greater than 2290 m².

**Reporting on Natural Resource Condition**

Results were summarized in a Natural Resource Condition Table based on the templates from the State of the Park report series (http://www.nps.gov/stateoftheparks/). The goal is to improve park priority setting and to synthesize and communicate complex park condition information to the public in a clear and simple way. By focusing on specific indicators, such as exotic species cover, it will also be possible and straightforward to revisit the metric in subsequent years. The status and trend of each indicator is scored and assigned a corresponding symbol based on the key found in Table 3.

We chose a set of indicators and specific measures that can describe the condition of vegetation in the Northern Great Plains and the status of exotic plant invasions. The measures include: absolute herb-layer canopy cover, native species richness, evenness, relative cover of exotic species, and annual brome cover. Reference values were based on descriptions of historic condition and variation, past studies, and/or management targets. Current park condition was compared to a reference value, and status was scored as good condition, warrants moderate
caution, or warrants significant concern based on this comparison (Table 3). Good condition was applied to values that fell within the range of the reference value, and significant concern was applied to conditions that fell outside the bounds of the reference value. In some cases, reference conditions can be determined only after we have accumulated more years of data. When this is the case, we refer to these as “To be determined” and estimate condition based on our professional judgment.

Table 3. Key to the symbols used in the Natural Resource Condition Table. The background color represents the current status, the arrow summarizes the trend, and the thickness of the outside line represents the degree of confidence in the assessment. A symbol that does not contain an arrow indicates that there is insufficient information to assess a trend. Based on the State of the Park reports (http://www.nps.gov/stateoftheparks/).

<table>
<thead>
<tr>
<th>Condition Status</th>
<th>Trend in Condition</th>
<th>Confidence in Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource is in Good</td>
<td>Condition is Improving</td>
<td>High</td>
</tr>
<tr>
<td>Condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warrants Moderate</td>
<td>Condition is Unchanging</td>
<td>Medium</td>
</tr>
<tr>
<td>Concern</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warrants Significant</td>
<td>Condition is Deteriorating</td>
<td>Low</td>
</tr>
<tr>
<td>Concern</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results and Discussion

Wind Cave NP experienced severe to extreme drought conditions throughout the winter and into the spring of 2013. When the NGPN visited the park in July, recent wet weather allowed for some green-up, but overall the park was still experiencing abnormally dry to moderate drought conditions (Figure 3). Average canopy cover was 152% (Table 4) in 2013, which was much higher than the 107% seen in the previous year (Ashton et al. 2013b). There was a large amount of standing litter on the ground with ground cover at the sites averaging 87% plant litter.

We found 231 plant species in 2013 at WICA (Appendix B). Graminoids, which includes grasses, sedges, and rushes, accounted for most of the vegetative cover at WICA, but trees, forbs, vines, shrubs and subshrubs (defined as a low-growing shrub usually under 0.5m) were also present (Figure 4). We found 33 exotic species at the park.

There was some variation in species composition across the 15 sites. The most common species in the sites we visited were graminoids, and most were native species (Figure 5). We found one rare plant, nylon hedgehog cactus (*Echinocereus viridiflorus*) at 7 sites within the park.

Figure 3. Drought conditions in July 2013 in the Northern Great Plains. Wind Cave National Park experienced abnormally dry to moderate drought conditions at that time.

Figure 4. Average cover by lifeform and nativity in 15 plant community monitoring plots in Wind Cave National Park in 2013. Native (green) and exotic (red) graminoids were the most abundant lifeform across the plots. Bars represent means ± standard errors.
Table 4. Natural resource condition summary table for upland plant communities in Wind Cave National Monument (WICA).

<table>
<thead>
<tr>
<th>Indicator of Condition</th>
<th>Specific Measures</th>
<th>2013 Value (mean ± SE)</th>
<th>Reference Condition and Data Source</th>
<th>Condition Status/Trend</th>
<th>Rationale for Resource Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upland Plant Community Structure and Composition</td>
<td>Absolute herb-layer canopy cover</td>
<td>152 ± 8 %</td>
<td>TBD (1)</td>
<td></td>
<td>WICA has a high herbaceous canopy cover and a high diversity of native plants. The condition assessment for canopy cover and evenness is based on professional judgment, but as we collect more data and understand the natural range of variability our confidence in these assessments will increase. Future work is needed to determine if the reference condition for native species richness is relevant for Black Hills parks. Forest densities are similar to historic conditions and are characterized by a mosaic of open and closed canopy sites.</td>
</tr>
<tr>
<td></td>
<td>Native species richness (based on average of 10 1m² quadrats per plot)</td>
<td>11 ± 0.8 species</td>
<td>8-18 species (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evenness (based on point-intercept of 2-50m transects per plot)</td>
<td>0.79 ± 0.02</td>
<td>TBD (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forest basal area (m²/ha)</td>
<td>5.1 ± 1.6</td>
<td>15.3 ± 2.7 (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exotic Plant Early Detection and Management</td>
<td>Relative cover of exotic species</td>
<td>19 ± 3.5 %</td>
<td>≤ 10 % cover</td>
<td></td>
<td>In general, the sites in WICA had a high cover of exotic species. Only 3 of 15 sites had &lt;10% exotic cover. Annual brome cover was lower than the management target, but much higher than it was in 2012.</td>
</tr>
<tr>
<td></td>
<td>Annual Brome cover</td>
<td>6.5 ± 2.1 %</td>
<td>≤ 10 % cover</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire and Fuel Dynamics</td>
<td>Total downed fuel loads</td>
<td>4.8 ± 1.3</td>
<td>Between 2 and 10</td>
<td></td>
<td>The current fire ecology program aims to maintain fuel loads of less than 10 tons/acre. In 2013, we measured downed fuel loads at 6 plots and found them to be within the management target.</td>
</tr>
</tbody>
</table>

References, Notes, and Data Sources:

Figure 5. The average absolute cover of the 10 most common native (green) and exotic (red) plants recorded at Wind Cave National Park in 2013. Bars represent means ± standard errors.

Average species richness at each of the 15 plots was measured by point-intercept and in 1 m² and 10 m² quadrats (Table 5). On average, there are about 2 exotic species within the 1 m² quadrat (Table 5). From the point-intersect data, we found average plot diversity, $H'$, to be $2.5 \pm 0.09$. Evenness, $J'$, averaged $0.79 \pm 0.02$ across the plots (Table 4). When including only native species, average diversity and evenness were $2.3 \pm 0.10$ and $0.78 \pm 0.02$, respectively.
Table 5. Average plant species richness in 15 plots at Wind Cave National Park in 2013. Values represent means ± standard errors, n=15.

<table>
<thead>
<tr>
<th></th>
<th>Point-intercept</th>
<th>1 m² quadrats</th>
<th>10 m² quadrats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species richness</td>
<td>24 ± 1.6</td>
<td>13 ± 0.6</td>
<td>24 ± 1.3</td>
</tr>
<tr>
<td>Native species richness</td>
<td>20 ± 1.5</td>
<td>11 ± 0.8</td>
<td>21 ± 1.4</td>
</tr>
<tr>
<td>Exotic species richness</td>
<td>3 ± 0.5</td>
<td>2 ± 0.2</td>
<td>4 ± 0.5</td>
</tr>
<tr>
<td>Graminoid species richness</td>
<td>12 ± 0.8</td>
<td>5 ± 0.3</td>
<td>8 ± 0.4</td>
</tr>
<tr>
<td>Forb species richness</td>
<td>9 ± 0.8</td>
<td>7 ± 0.4</td>
<td>14 ± 0.9</td>
</tr>
</tbody>
</table>

While there was some variation across sites, the plots we visited in WICA tended to have a high diversity of native plants compared to other mixed-grass prairies. Species richness in the mixed-grass prairie is determined by numerous factors including fire regime, grazing, prairie dog disturbance, and weather fluctuations (Symstad and Jonas 2011). While it is difficult to define a reference condition for species richness that can vary so much spatially and temporally, the natural range of variation over long time periods may be a good starting point (Symstad and Jonas in press). Long-term records of species diversity in mixed-grass prairie from a relatively undisturbed site in eastern Montana vary between 8 and 18 species per square meter over the course of 13 years (Symstad and Jonas, in press). Since there are no long-term records of mixed-grass prairie diversity within the Black Hills, we are relying on these data as a reference condition. Future work is needed to develop a robust reference condition for plant communities in the Black Hills. Compared to the nearby mixed-grass prairie, WICA is within the natural range (Table 4, native richness in the 1 m² quadrat and Table 5). The highest diversity was seen in sites PCM_0014 and PCM_0018 (Table 6). Both of these sites contained an element of gravelly soil in addition to the finer soil components common throughout the park. In PCM_0014, this was manifested in a hilltop, whereas PCM_0018 displayed coarse soils in an intermittent streambed (Figure 6).

![Figure 6. Two long-term monitoring sites in Wind Cave national Park, PCM_0014 and PCM_0018, with high native plant diversity.](image)

The average relative cover of exotic species at sites in WICA was fairly high (19 ± 3.5%; Table 4) and higher than the cover seen in 2012 (11 ± 2.7%; Ashton et al. 2013b). However, like species richness, cover of exotic species varied considerably among sites (Table 6). Exotic cover at PCM_0014, PCM_0017, and PCM_0020 was below a proposed management target of 10%, but the other 12 sites surveyed were above this threshold. The highest cover of exotic species was 43%, found at PCM_0013, a site that experienced moderate burn severity during the American Elk prescribed fire in October 2010 (Figure 7; Ashton et al. 2013a). Kentucky bluegrass (Poa pratensis) and Japanese brome (Bromus japonicus) accounted for a majority of the exotic cover in all plots, but other exotics were also abundant (Table 6). Annual bromes increased from 2.1% in 2012 to 6.5% in 2013. Annual bromes are known to
respond strongly to climate (Mack and Pyke 1984) and 2013 was a good year for them. More data is need to determine whether the increase in abundance in annual bromes correlates with expansion into areas of the park that had not previously been invaded. Regardless, reducing the cover of annual bromes remains a major challenge for many of the parks in the region.

Disturbance from grazing, small mammals, fire, and humans affects plant community structure and composition in mixed-grass prairie. For this reason, we measured the approximate area affected by natural and human disturbances at each site we visited. In 2013, the most common disturbance was from grazing, but there was also evidence of fire, bison wallows, prairie dogs, and animal trails.

Trees and/or seedlings were present in 6 of the 15 sites we visited in 2013. A more through assessment of forest structure was completed in 2012 (Ashton et al. 2013a); however, the 2013 data provide a snapshot of condition at a subset of the plots. Ponderosa pine (*Pinus ponderosa*) and chokecherry (*Prunus virginiana*) seedlings were only found in 3 plots (Table 7). The highest density of pine seedlings and saplings was found at PCM_0013 (Figure 7). As discussed above, this site burned during the American Elk prescribed fire and also has a high cover of exotic plants. Overall, basal area at the six sites (5.1 ± 1.6 m²/ha) was less than estimates of historic condition (Table 4) and less than park-wide estimates in 2012 of between 10 and 14 m²/ha (Ashton et al. 2013a). This difference is likely due to the small sample size. We measured dead and downed woody fuels at 6 sites and found fuel loads were within the range that the Fire Ecology Program prescribes (5 tons/acre; Table 4). In 2017, NGPN is scheduled to repeat the thorough assessment of forest structure, fuel loads, and health.
Table 6. Characteristics of the plant community in 15 plots at Wind Cave National Park in 2013 including average native species richness, exotic plant cover, cover of annual bromes, and area of disturbance.

<table>
<thead>
<tr>
<th>Plot</th>
<th>Average native species richness 1 m² plots</th>
<th>Exotic cover (%)</th>
<th>Annual brome cover (%)</th>
<th>Kentucky bluegrass cover (%)</th>
<th>Disturbance within site (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WICA_PCM_0008</td>
<td>11</td>
<td>20</td>
<td>19</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>WICA_PCM_0009</td>
<td>12</td>
<td>19</td>
<td>1</td>
<td>16</td>
<td>2800</td>
</tr>
<tr>
<td>WICA_PCM_0010</td>
<td>9</td>
<td>24</td>
<td>4</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>WICA_PCM_0011</td>
<td>13</td>
<td>12</td>
<td>4</td>
<td>4</td>
<td>2290</td>
</tr>
<tr>
<td>WICA_PCM_0012</td>
<td>7</td>
<td>33</td>
<td>16</td>
<td>1</td>
<td>2290</td>
</tr>
<tr>
<td>WICA_PCM_0013</td>
<td>8</td>
<td>43</td>
<td>1</td>
<td>14</td>
<td>2295</td>
</tr>
<tr>
<td>WICA_PCM_0014</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>WICA_PCM_0015</td>
<td>6</td>
<td>21</td>
<td>0</td>
<td>14</td>
<td>115</td>
</tr>
<tr>
<td>WICA_PCM_0016</td>
<td>8</td>
<td>42</td>
<td>0</td>
<td>30</td>
<td>86</td>
</tr>
<tr>
<td>WICA_PCM_0017</td>
<td>12</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>4580</td>
</tr>
<tr>
<td>WICA_PCM_0018</td>
<td>16</td>
<td>12</td>
<td>10</td>
<td>0</td>
<td>770</td>
</tr>
<tr>
<td>WICA_PCM_0019</td>
<td>11</td>
<td>13</td>
<td>7</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>WICA_PCM_0020</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>WICA_PCM_0021</td>
<td>13</td>
<td>26</td>
<td>25</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>WICA_PCM_2054</td>
<td>9</td>
<td>13</td>
<td>10</td>
<td>2</td>
<td>55</td>
</tr>
<tr>
<td><em>Park Average</em></td>
<td><em>11 ± 0.8 species</em></td>
<td><em>19 ± 3.5%</em></td>
<td><em>6.5 ± 2.1%</em></td>
<td><em>7.0 ± 2.3%</em></td>
<td><em>-</em></td>
</tr>
</tbody>
</table>

Table 7. Seedling, pole, and tree densities at 6 plots in Wind Cave National Park in 2013.

<table>
<thead>
<tr>
<th>Plot</th>
<th>Seedling and Sapling Density (seedlings/hectare)</th>
<th>Tree Density (trees/hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chokecherry</td>
<td>Ponderosa</td>
</tr>
<tr>
<td>WICA_PCM_0008</td>
<td>-</td>
<td>32</td>
</tr>
<tr>
<td>WICA_PCM_0009</td>
<td>32</td>
<td>192</td>
</tr>
<tr>
<td>WICA_PCM_0011</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>WICA_PCM_0012</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>WICA_PCM_0013</td>
<td>-</td>
<td>5347</td>
</tr>
<tr>
<td>WICA_PCM_0016</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Summary

In conclusion, we found that Wind Cave National Park has a high diversity of native plants, and species richness was within the range of natural variability for mixed-grass prairie. Future work is needed to develop reference conditions that are specific to the Black Hills. Exotic plant cover was higher than in past years and was greater than 10% cover at most sites. Kentucky bluegrass and Japanese brome were the most widespread and abundant exotic species. To retain ecological integrity and the high diversity of native plants in WICA, it is important to continue efforts to reduce the cover of invasive plants. Continued monitoring efforts will be critical to track changes in the condition of the vegetation communities in WICA.
Literature Cited


Appendix A: Field journal for plant community monitoring in WICA for the 2013 season

Plant community composition monitoring in WICA was completed using 2 crews of 4 to 6 people working seven 10-hour days.

<table>
<thead>
<tr>
<th>Date</th>
<th>Day of week</th>
<th>Approximate Travel Time (hrs)</th>
<th>Housing</th>
<th>Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 8, 2013</td>
<td>Monday</td>
<td>2.5</td>
<td>N/A</td>
<td>PCM-0010</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PCM-0020 (except quadrats)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PCM-0009</td>
</tr>
<tr>
<td>July 9, 2013</td>
<td>Tuesday</td>
<td>2.5</td>
<td>N/A</td>
<td>PCM-0018</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PCM-0008</td>
</tr>
<tr>
<td>July 10, 2013</td>
<td>Wednesday</td>
<td>2.5</td>
<td>N/A</td>
<td>PCM-0017</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PCM-0014 (except trees)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PCM-0016 (except quadrats)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PCM-0012</td>
</tr>
<tr>
<td>July 11, 2013</td>
<td>Thursday</td>
<td>2.5</td>
<td>N/A</td>
<td>PCM-0016 (quadrats)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PCM-0019</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PCM-0020 (quadrats)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PCM-0015</td>
</tr>
<tr>
<td>July 15, 2013</td>
<td>Monday</td>
<td>2.5</td>
<td>N/A</td>
<td>PCM-0013</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PCM-0011</td>
</tr>
<tr>
<td>July 16, 2013</td>
<td>Tuesday</td>
<td>2.5</td>
<td>N/A</td>
<td>PCM-0021</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PCM-0014 (trees/fuels)</td>
</tr>
<tr>
<td>July 17, 2013</td>
<td>Wednesday</td>
<td>2.5</td>
<td>N/A</td>
<td>PCM-2054</td>
</tr>
</tbody>
</table>
### Appendix B: List of plant species found in 2012 at WICA

<table>
<thead>
<tr>
<th>Family</th>
<th>Code</th>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Exotic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agavaceae</td>
<td>YUGL</td>
<td><em>Yucca glauca</em></td>
<td>soapweed yucca</td>
<td></td>
</tr>
<tr>
<td>Amaranthaceae</td>
<td>AMBL</td>
<td><em>Amaranthus blitoides</em></td>
<td>mat amaranth</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>AMRE</td>
<td><em>Amaranthus retroflexus</em></td>
<td>redroot amaranth</td>
<td></td>
</tr>
<tr>
<td>Anacardiaceae</td>
<td>RHTR</td>
<td><em>Rhus trilobata</em></td>
<td>skunkbush sumac</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TORY</td>
<td><em>Toxicodendron rydbergii</em></td>
<td>western poison ivy</td>
<td></td>
</tr>
<tr>
<td>Apiaceae</td>
<td>LOFO</td>
<td><em>Lomatium foeniculaceum</em></td>
<td>desert biscuitroot</td>
<td></td>
</tr>
<tr>
<td>Apocynaceae</td>
<td>APCA</td>
<td><em>Apocynum cannabinum</em></td>
<td>Indianhemp</td>
<td></td>
</tr>
<tr>
<td>Asclepiadaceae</td>
<td>ASPU</td>
<td><em>Asclepias pumila</em></td>
<td>plains milkweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASSP</td>
<td><em>Asclepias speciosa</em></td>
<td>showy milkweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASST</td>
<td><em>Asclepias stenophylla</em></td>
<td>slimleaf milkweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASVI</td>
<td><em>Asclepias viridiflora</em></td>
<td>green comet milkweed</td>
<td></td>
</tr>
<tr>
<td>Asteraceae</td>
<td>AGGL</td>
<td><em>Agoseris glauca</em></td>
<td>pale agoseris</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AMPS</td>
<td><em>Ambrosia psilostachya</em></td>
<td>Cuman ragweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ANMI3</td>
<td><em>Antennaria microphylla</em></td>
<td>littleleaf pussytoes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ANPA4</td>
<td><em>Antennaria parvifolia</em></td>
<td>small-leaf pussytoes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ARCA12</td>
<td><em>Artemisia campestris</em></td>
<td>field sagewort</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ARDR4</td>
<td><em>Artemisia dracunculus</em></td>
<td>tarragon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ARFR4</td>
<td><em>Artemisia frigida</em></td>
<td>prairie sagewort</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ARLU</td>
<td><em>Artemisia ludoviciana</em></td>
<td>white sagebrush</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BREU</td>
<td><em>Brickellia eupatorioides</em></td>
<td>false boneset</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CIAR4</td>
<td><em>Cirsium arvense</em></td>
<td>Canada thistle</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>CIUN</td>
<td><em>Cirsium undulatum</em></td>
<td>wavyleaf thistle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>COCA5</td>
<td><em>Conyza canadensis</em></td>
<td>Canadian horseweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CORA4</td>
<td><em>Conyza ramosissima</em></td>
<td>dwarf horseweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DYPY</td>
<td><em>Dyssodia papposa</em></td>
<td>fetid marigold</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ECAN2</td>
<td><em>Echinacea angustifolia</em></td>
<td>blacksamson echinacea</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ERCA4</td>
<td><em>Erigeron canus</em></td>
<td>hoary fleabane</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ERFL</td>
<td><em>Erigeron flagellaris</em></td>
<td>trailing fleabane</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ERPU2</td>
<td><em>Erigeron pumilus</em></td>
<td>shaggy fleabane</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GRSQ</td>
<td><em>Grindelia squarrosa</em></td>
<td>curlycup gumweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GUSA2</td>
<td><em>Gutierrezia sarothrae</em></td>
<td>broom snakeweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HELIA3</td>
<td><em>Helianthus species</em></td>
<td>sunflower</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HEAN3</td>
<td><em>Helianthus annuus</em></td>
<td>common sunflower</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HEPA19</td>
<td><em>Helianthus pauciflorus</em></td>
<td>stiff sunflower</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HEVI4</td>
<td><em>Heterotheca villosa</em></td>
<td>hairy false goldenaster</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LASE</td>
<td><em>Lactuca serriola</em></td>
<td>prickly lettuce</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>LIPU</td>
<td><em>Liatris punctata</em></td>
<td>dotted blazing star</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LOAR5</td>
<td><em>Logfia arvensis</em></td>
<td>field cottonrose</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>LYJU</td>
<td><em>Lygodesmia juncea</em></td>
<td>rush skeletonplant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PAPL12</td>
<td><em>Packera plattensis</em></td>
<td>prairie groundsel</td>
<td></td>
</tr>
<tr>
<td>Family</td>
<td>Code</td>
<td>Scientific Name</td>
<td>Common Name</td>
<td>Exotic</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------</td>
<td>---------------------------</td>
<td>------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Asteraceae</td>
<td>RACO3</td>
<td><em>Ratibida columnifera</em></td>
<td>upright prairie coneflower</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SOMI2</td>
<td><em>Solidago missouriensis</em></td>
<td>Missouri goldenrod</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SOMO</td>
<td><em>Solidago mollis</em></td>
<td>velvety goldenrod</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SONE</td>
<td><em>Solidago nemoralis</em></td>
<td>gray goldenrod</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SYER</td>
<td><em>Symphyotrichum ericoides</em></td>
<td>white heath aster</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SYFA</td>
<td><em>Symphyotrichum falcatum</em></td>
<td>white prairie aster</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SYOB</td>
<td><em>Symphyotrichum oblongifolium</em></td>
<td>aromatic aster</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TAOF</td>
<td><em>Taraxacum officinale</em></td>
<td>common dandelion</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>TEAC</td>
<td><em>Tetraneuris acaulis</em></td>
<td>stemless four-nerve daisy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TRDU</td>
<td><em>Tragopogon dubius</em></td>
<td>yellow salsify</td>
<td>*</td>
</tr>
<tr>
<td>Boraginaceae</td>
<td>CRMI5</td>
<td><em>Cryptantha minima</em></td>
<td>little cryptantha</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CRTH</td>
<td><em>Cryptantha thyrsiflora</em></td>
<td>calcareous cryptantha</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CYOF</td>
<td><em>Cynoglossum officinale</em></td>
<td>houndstongue</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>LAOC3</td>
<td><em>Lappula occidentalis</em></td>
<td>flatspine stickseed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIIN2</td>
<td><em>Lithospermum incisum</em></td>
<td>narrowleaf stoneseed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MELA3</td>
<td><em>Mertensia lanceolata</em></td>
<td>prairie bluebells</td>
<td></td>
</tr>
<tr>
<td>Brassicaceae</td>
<td>CAMI2</td>
<td><em>Camelina microcarpa</em></td>
<td>littlepod false flax</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>DEPI</td>
<td><em>Descurainia pinnata</em></td>
<td>western tansymustard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DESO2</td>
<td><em>Descurainia sophia</em></td>
<td>herb sophia</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>DRRE2</td>
<td><em>Draba reptans</em></td>
<td>Carolina draba</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ERYSI</td>
<td><em>Erysimum species</em></td>
<td>wallflower</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>ERCA14</td>
<td><em>Erysimum capitatum</em></td>
<td>sanddune wallflower</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ERCH9</td>
<td><em>Erysimum cheiranthoides</em></td>
<td>wormseed wallflower</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>ERIN7</td>
<td><em>Erysimum inconspicuum</em></td>
<td>shy wallflower</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LEDE</td>
<td><em>Lepidium densiflorum</em></td>
<td>common pepperweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SIAL2</td>
<td><em>Sisymbrium altissimum</em></td>
<td>tall tumblemustard</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>THAR5</td>
<td><em>Thlaspi arvense</em></td>
<td>field pennycress</td>
<td>*</td>
</tr>
<tr>
<td>Cactaceae</td>
<td>ECVI2</td>
<td><em>Echinocereus viridiflorus</em></td>
<td>nylon hedgehog cactus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OPUNT</td>
<td><em>Opuntia species</em></td>
<td>pricklypear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OPFR</td>
<td><em>Opuntia fragilis</em></td>
<td>brittle pricklypear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OPMA2</td>
<td><em>Opuntia macrorhiza</em></td>
<td>twistspine pricklypear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OPPO</td>
<td><em>Opuntia polyacantha</em></td>
<td>plains pricklypear</td>
<td></td>
</tr>
<tr>
<td>Campanulaceae</td>
<td>CARO2</td>
<td><em>Campanula rotundifolia</em></td>
<td>bluebell bellflower</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TRPE4</td>
<td><em>Triodanis perfoliata</em></td>
<td>clasping Venus' looking-glass</td>
<td></td>
</tr>
<tr>
<td>Caprifoliaceae</td>
<td>SYOC</td>
<td><em>Symphoricarpos occidentalis</em></td>
<td>western snowberry</td>
<td></td>
</tr>
<tr>
<td>Caryophyllaceae</td>
<td>PADE4</td>
<td><em>Paronychia depressa</em></td>
<td>spreading nailwort</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SIAN2</td>
<td><em>Silene antirrhina</em></td>
<td>sleepy silene</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SIDR</td>
<td><em>Silene drummondii</em></td>
<td>Drummond's campion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SILA21</td>
<td><em>Silene latifolia</em></td>
<td>bladder campion</td>
<td>*</td>
</tr>
<tr>
<td>Chenopodiaceae</td>
<td>CHNO</td>
<td><em>Chenopodium species</em></td>
<td>goosefoot</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>CHDE</td>
<td><em>Chenopodium desiccatum</em></td>
<td>aridland goosefoot</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHPR5</td>
<td><em>Chenopodium pratericola</em></td>
<td>desert goosefoot</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHSI2</td>
<td><em>Chenopodium simplex</em></td>
<td>mapleleaf goosefoot</td>
<td></td>
</tr>
<tr>
<td>Family</td>
<td>Code</td>
<td>Scientific Name</td>
<td>Common Name</td>
<td>Exotic</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------</td>
<td>------------------------------</td>
<td>------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Chenopodiaceae</td>
<td>MONU</td>
<td><em>Monolepis nuttalliana</em></td>
<td>Nuttall's povertyweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SATR12</td>
<td><em>Salsola tragus</em></td>
<td>prickly Russian thistle</td>
<td></td>
</tr>
<tr>
<td>Commelinaceae</td>
<td>TROC</td>
<td><em>Tradescantia occidentalis</em></td>
<td>prairie spiderwort</td>
<td></td>
</tr>
<tr>
<td>Convolvulaceae</td>
<td>COAR4</td>
<td><em>Convolvulus arvensis</em></td>
<td>field bindweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EVNU</td>
<td><em>Evolvulus nuttallianus</em></td>
<td>shaggy dwarf morning-glory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IPLE</td>
<td><em>Ipomoea leptophylla</em></td>
<td>bush morning-glory</td>
<td></td>
</tr>
<tr>
<td>Cyperaceae</td>
<td>CABA3</td>
<td>Carex backii</td>
<td>Back's sedge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CABR10</td>
<td>Carex brevior</td>
<td>shortbeak sedge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CADU6</td>
<td>Carex duriuscula</td>
<td>needleleaf sedge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CAFI</td>
<td>Carex filifolia</td>
<td>threadleaf sedge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CAIN9</td>
<td>Carex inops</td>
<td>long-stolon sedge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CARI</td>
<td>Carex richardsonii</td>
<td>Richardson's sedge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CARO5</td>
<td>Carex rossii</td>
<td>Ross' sedge</td>
<td></td>
</tr>
<tr>
<td>Dryopteridaceae</td>
<td>WOSC</td>
<td><em>Woodsia scopulina</em></td>
<td>Rocky Mountain woodsia</td>
<td></td>
</tr>
<tr>
<td>Ericaceae</td>
<td>ARUV</td>
<td><em>Arctostaphylos uva-ursi</em></td>
<td>kinnikinnick</td>
<td></td>
</tr>
<tr>
<td>Euphorbiaceae</td>
<td>EUBR</td>
<td><em>Euphorbia brachycera</em></td>
<td>horned spurge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EUDE4</td>
<td><em>Euphorbia dentata</em></td>
<td>toothed spurge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EUMA7</td>
<td><em>Euphorbia maculata</em></td>
<td>spotted sandmat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EUMA8</td>
<td><em>Euphorbia marginata</em></td>
<td>snow on the mountain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EUSP</td>
<td><em>Euphorbia spathulata</em></td>
<td>warty spurge</td>
<td></td>
</tr>
<tr>
<td>Fabaceae</td>
<td>AMCA6</td>
<td><em>Amorpha canescens</em></td>
<td>leadplant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASTRA</td>
<td><em>Astragalus species</em></td>
<td>milkvetch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASAG2</td>
<td><em>Astragalus agrestis</em></td>
<td>purple milkvetch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASCR2</td>
<td><em>Astragalus crassicarpus</em></td>
<td>groundplum milkvetch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASDR3</td>
<td><em>Astragalus drummondii</em></td>
<td>Drummond's milkvetch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASFL2</td>
<td><em>Astragalus flexuosus</em></td>
<td>flexile milkvetch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASGI5</td>
<td><em>Astragalus gilviflorus</em></td>
<td>plains milkvetch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASGR3</td>
<td><em>Astragalus gracilis</em></td>
<td>slender milkvetch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASLA27</td>
<td><em>Astragalus laxmannii</em></td>
<td>Laxmann's milkvetch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASLO4</td>
<td><em>Astragalus lotiflorus</em></td>
<td>lotus milkvetch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASMI10</td>
<td><em>Astragalus missouriensis</em></td>
<td>Missouri milkvetch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASPL2</td>
<td><em>Astragalus plattensis</em></td>
<td>Platte River milkvetch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DACA7</td>
<td><em>Dalea candida</em></td>
<td>white prairie clover</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DAPU5</td>
<td><em>Dalea purpurea</em></td>
<td>purple prairie clover</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GLLE3</td>
<td><em>Glycyrrhiza lepidota</em></td>
<td>American licorice</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LAPO2</td>
<td><em>Lathyrus polymorphus</em></td>
<td>manystem pea</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MELU</td>
<td><em>Medicago lupulina</em></td>
<td>black medick</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MESA</td>
<td><em>Medicago sativa</em></td>
<td>alfalfa</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MEOF</td>
<td><em>Melilotus officinalis</em></td>
<td>yellow sweetclover</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OXSE</td>
<td><em>Oxytropis sericea</em></td>
<td>white locoweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEAR6</td>
<td><em>Pediomelum argophyllum</em></td>
<td>silverleaf Indian breadroot</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEES</td>
<td><em>Pediomelum esculentum</em></td>
<td>large Indian breadroot</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PSTE5</td>
<td><em>Psoralidium tenuiflorum</em></td>
<td>slimflower scurfpea</td>
<td></td>
</tr>
<tr>
<td>Family</td>
<td>Code</td>
<td>Scientific Name</td>
<td>Common Name</td>
<td>Exotic</td>
</tr>
<tr>
<td>-----------------</td>
<td>------</td>
<td>--------------------------</td>
<td>-------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Fabaceae</td>
<td>VIAM</td>
<td>Vicia americana</td>
<td>American vetch</td>
<td></td>
</tr>
<tr>
<td>Grossulariaceae</td>
<td>RICE</td>
<td>Ribes cereum</td>
<td>wax currant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RIOX</td>
<td>Ribes oxyacanthoides</td>
<td>Canadian gooseberry</td>
<td></td>
</tr>
<tr>
<td>Hydrophyllaceae</td>
<td>ELNY</td>
<td>Ellisia nyctelea</td>
<td>Aunt Lucy</td>
<td></td>
</tr>
<tr>
<td>Iridaceae</td>
<td>SIAN3</td>
<td>Sisyrinchium angustifolium</td>
<td>narrowleaf blue-eyed grass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SIMO2</td>
<td>Sisyrinchium montanum</td>
<td>strict blue-eyed grass</td>
<td></td>
</tr>
<tr>
<td>Juncaceae</td>
<td>JUNI2</td>
<td>Juncus interior</td>
<td>inland rush</td>
<td></td>
</tr>
<tr>
<td>Lamiaceae</td>
<td>HEDR</td>
<td>Hedeoma drummondii</td>
<td>Drummond's false pennyroyal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HEHI</td>
<td>Hedeoma hispida</td>
<td>rough false pennyroyal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAVU</td>
<td>Marrubium vulgare</td>
<td>horehound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MOFI</td>
<td>Monarda fistulosa</td>
<td>wild bergamot</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NECA2</td>
<td>Nepeta cataria</td>
<td>catnip</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SARE3</td>
<td>Salvia reflexa</td>
<td>lanceleaf sage</td>
<td></td>
</tr>
<tr>
<td>Liliaceae</td>
<td>ALCE2</td>
<td>Allium cernuum</td>
<td>nodding onion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ALTE</td>
<td>Allium textile</td>
<td>textile onion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CAGU</td>
<td>Calochortus gunnisonii</td>
<td>Gunnison's mariposa lily</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LEMO4</td>
<td>Leucocrinum montanum</td>
<td>common starily</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAST4</td>
<td>Maianthemum stellatum</td>
<td>starry false lily of the valley</td>
<td></td>
</tr>
<tr>
<td>Malvaceae</td>
<td>SPCO</td>
<td>Sphaeralcea coccinea</td>
<td>scarlet globemallow</td>
<td></td>
</tr>
<tr>
<td>Nyctaginaceae</td>
<td>MIHI</td>
<td>Mirabilis hirsuta</td>
<td>hairy four o'clock</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MILI3</td>
<td>Mirabilis linearis</td>
<td>narrowleaf four o'clock</td>
<td></td>
</tr>
<tr>
<td>Onagraceae</td>
<td>OENOT</td>
<td>Oenothera species</td>
<td>evening-primrose</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OEBI</td>
<td>Oenothera biennis</td>
<td>common evening-primrose</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OECO2</td>
<td>Oenothera coronopifolia</td>
<td>crownleaf evening-primrose</td>
<td></td>
</tr>
<tr>
<td>Oxalidaceae</td>
<td>OXST</td>
<td>Oxalis stricta</td>
<td>common yellow oxalis</td>
<td></td>
</tr>
<tr>
<td>Papaveraceae</td>
<td>ARPO2</td>
<td>Argemone polyanthemos</td>
<td>crested pricklypoppy</td>
<td></td>
</tr>
<tr>
<td>Pinaceae</td>
<td>PIPO</td>
<td>Pinus ponderosa</td>
<td>ponderosa pine</td>
<td></td>
</tr>
<tr>
<td>Plantaginaceae</td>
<td>PLPA2</td>
<td>Plantago patagonica</td>
<td>woolly plantain</td>
<td></td>
</tr>
<tr>
<td>Poaceae</td>
<td>ACHY</td>
<td>Achnatherum hymenoides</td>
<td>Indian ricegrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AGSC5</td>
<td>Agrostis scabra</td>
<td>rough bentgrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ANGE</td>
<td>Andropogon gerardii</td>
<td>big bluestem</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ARPM9</td>
<td>Aristida purpurea</td>
<td>purple threeawn</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BOCU</td>
<td>Bouteloua curtipendula</td>
<td>sideoats grama</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BOGR2</td>
<td>Bouteloua gracilis</td>
<td>blue grama</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BOHI2</td>
<td>Bouteloua hirsuta</td>
<td>hairy grama</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRIN2</td>
<td>Bromus inermis</td>
<td>smooth brome</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRTE</td>
<td>Bromus tectorum</td>
<td>cheatgrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CALO</td>
<td>Calamovilfa longifolia</td>
<td>prairie sandreed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DASP2</td>
<td>Danthonia spicata</td>
<td>poverty oatgrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DILI2</td>
<td>Dichanthelium linearifolium</td>
<td>slimleaf panicgrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DIOL</td>
<td>Dichanthelium oligosanthes</td>
<td>Heller's rosette grass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DIWI5</td>
<td>Dichanthelium wilcoxiangum</td>
<td>fall rosette grass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ECMU2</td>
<td>Echinochloa muricata</td>
<td>rough barnyardgrass</td>
<td></td>
</tr>
<tr>
<td>Family</td>
<td>Code</td>
<td>Scientific Name</td>
<td>Common Name</td>
<td>Exotic</td>
</tr>
<tr>
<td>----------</td>
<td>------</td>
<td>-----------------------</td>
<td>-------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Poaceae</td>
<td>ELEL5</td>
<td>Elymus elymoides</td>
<td>squirreltail</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ELRE4</td>
<td>Elymus repens</td>
<td>quackgrass</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>ELTR7</td>
<td>Elymus trachycaulus</td>
<td>slender wheatgrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ELV13</td>
<td>Elymus virginicus</td>
<td>Virginia wildrye</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HECO26</td>
<td>Hesperostipa comata</td>
<td>needle and thread</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HESP11</td>
<td>Hesperostipa spartea</td>
<td>porcupinegrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HOJU</td>
<td>Hordeum jubatum</td>
<td>foxtail barley</td>
<td></td>
</tr>
<tr>
<td></td>
<td>KOMA</td>
<td>Koeleria macrantha</td>
<td>prairie Junegrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MUAS</td>
<td>Muhlenbergia asperifolia</td>
<td>scratchgrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MUCU3</td>
<td>Muhlenbergia cspidata</td>
<td>plains muhy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MURA</td>
<td>Muhlenbergia racemosa</td>
<td>marsh muhy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NAVI4</td>
<td>Nassella viridula</td>
<td>green needlegrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PACA6</td>
<td>Panicum capillare</td>
<td>switchgrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PAVI2</td>
<td>Panicum virgatum</td>
<td>switchgrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PASM</td>
<td>Pascopyrum smithii</td>
<td>western wheatgrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PIMI7</td>
<td>Piptatherum micranthum</td>
<td>littleseed ricegr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>POCO</td>
<td>Poa compressa</td>
<td>Canada bluegrass</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>POPR</td>
<td>Poa pratensis</td>
<td>Kentucky bluegrass</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>SCSC</td>
<td>Schizachyrium scoparium</td>
<td>little bluestem</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SONU2</td>
<td>Sorghastrum nutans</td>
<td>Indiangrass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SPCR</td>
<td>Sporobolus cryptandrus</td>
<td>sand dropseed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SPHE</td>
<td>Sporobolus heterolepis</td>
<td>prairie dropseed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>THIN6</td>
<td>Thinopyrum intermedium</td>
<td>intermediate wheatgr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VUOC</td>
<td>Vulpia octoflora</td>
<td>sixweeks fescue</td>
<td></td>
</tr>
<tr>
<td>Polemoniaceae</td>
<td>COL12</td>
<td>Collomia linearis</td>
<td>tiny trumpet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHAL3</td>
<td>Phlox alyssifolia</td>
<td>alyssumleaf phlox</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHAN4</td>
<td>Phlox andicola</td>
<td>prairie phlox</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHHO</td>
<td>Phlox hoodii</td>
<td>spiny phlox</td>
<td></td>
</tr>
<tr>
<td>Polygaleaceae</td>
<td>POAL4</td>
<td>Polygala alba</td>
<td>white milkwort</td>
<td></td>
</tr>
<tr>
<td></td>
<td>POVE</td>
<td>Polygala verticillata</td>
<td>whorled milkwort</td>
<td></td>
</tr>
<tr>
<td>Polygonaceae</td>
<td>POAV</td>
<td>Polygonum aviculare</td>
<td>prostrate knotweed</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>PODO4</td>
<td>Polygonum douglasii</td>
<td>Douglas' knotweed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PORA3</td>
<td>Polygonum ramosissimum</td>
<td>bushy knotweed</td>
<td></td>
</tr>
<tr>
<td>Portulacaceae</td>
<td>POOL</td>
<td>Portulaca oleracea</td>
<td>little hogweed</td>
<td>*</td>
</tr>
<tr>
<td>Primulaceae</td>
<td>ANAR</td>
<td>Anagallis arvensis</td>
<td>scarlet pimpermel</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>ANSE4</td>
<td>Androsace septentrionalis</td>
<td>pygmyflower rockjasmine</td>
<td></td>
</tr>
<tr>
<td>Ranunculaceae</td>
<td>ANCY</td>
<td>Anemone cylindrica</td>
<td>candle anemone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MYMI2</td>
<td>Myosurus minimus</td>
<td>tiny mousetail</td>
<td></td>
</tr>
<tr>
<td>Rosaceae</td>
<td>CEM02</td>
<td>Cercocarpus montanus</td>
<td>alderleaf mountain mahogany</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DRFI3</td>
<td>Drymocallis fissa</td>
<td>bigflower cinquefoil</td>
<td></td>
</tr>
<tr>
<td></td>
<td>POHI6</td>
<td>Potentilla hippiana</td>
<td>woolly cinquefoil</td>
<td></td>
</tr>
<tr>
<td></td>
<td>POPE8</td>
<td>Potentilla pensylvanica</td>
<td>Pennsylvania cinquefoil</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRAM</td>
<td>Prunus americana</td>
<td>American plum</td>
<td></td>
</tr>
<tr>
<td>Family</td>
<td>Code</td>
<td>Scientific Name</td>
<td>Common Name</td>
<td>Exotic</td>
</tr>
<tr>
<td>-------------</td>
<td>-------</td>
<td>------------------------</td>
<td>--------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Rosaceae</td>
<td>PRPU3</td>
<td><em>Prunus pumila</em></td>
<td>sandcherry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRVI</td>
<td><em>Prunus virginiana</em></td>
<td>chokecherry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ROSA5</td>
<td><em>Rosa species</em></td>
<td>rose</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ROAC</td>
<td><em>Rosa acicularis</em></td>
<td>prickly rose</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ROAR3</td>
<td><em>Rosa arkansana</em></td>
<td>prairie rose</td>
<td></td>
</tr>
<tr>
<td>Rubiaceae</td>
<td>GAAP2</td>
<td><em>Galium aparine</em></td>
<td>stickywilly</td>
<td></td>
</tr>
<tr>
<td>Santalaceae</td>
<td>COUM</td>
<td><em>Comandra umbellata</em></td>
<td>bastard toadflax</td>
<td></td>
</tr>
<tr>
<td>Scrophulariaceae</td>
<td>CASE5</td>
<td><em>Castilleja sessiliflora</em></td>
<td>downy paintedcup</td>
<td></td>
</tr>
<tr>
<td></td>
<td>COPA3</td>
<td><em>Collinsia parviflora</em></td>
<td>maiden blue eyed Mary</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ORLU2</td>
<td><em>Orthocarpus luteus</em></td>
<td>yellow owl's-clover</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEAL2</td>
<td><em>Penstemon albidus</em></td>
<td>white penstemon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEGR5</td>
<td><em>Penstemon gracilis</em></td>
<td>lilac penstemon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEGR7</td>
<td><em>Penstemon grandiflorus</em></td>
<td>large beartongue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VETH</td>
<td><em>Verbascum thapsus</em></td>
<td>common mullein</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>VEPE2</td>
<td><em>Veronica peregrina</em></td>
<td>neckweed</td>
<td></td>
</tr>
<tr>
<td>Selaginellaceae</td>
<td>SEDE2</td>
<td><em>Selaginella densa</em></td>
<td>lesser spikemoss</td>
<td></td>
</tr>
<tr>
<td>Solanaceae</td>
<td>PHLO4</td>
<td><em>Physalis longifolia</em></td>
<td>longleaf groundcherry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHVI5</td>
<td><em>Physalis virginiana</em></td>
<td>Virginia groundcherry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SORO</td>
<td><em>Solanum rostratum</em></td>
<td>buffalobur nightshade</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SOTR</td>
<td><em>Solanum triflorum</em></td>
<td>cutleaf nightshade</td>
<td></td>
</tr>
<tr>
<td>Urticaceae</td>
<td>PAPE5</td>
<td><em>Parietaria pensylvanica</em></td>
<td>Pennsylvania pellitory</td>
<td></td>
</tr>
<tr>
<td>Verbenaceae</td>
<td>VEBR</td>
<td><em>Verbena bracteata</em></td>
<td>bigbract verbena</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VEST</td>
<td><em>Verbena stricta</em></td>
<td>hoary verbena</td>
<td></td>
</tr>
<tr>
<td>Violaceae</td>
<td>VIOLA</td>
<td><em>Viola species</em></td>
<td>violet</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>VIAD</td>
<td><em>Viola adunca</em></td>
<td>hookedspur violet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VINU2</td>
<td><em>Viola nuttallii</em></td>
<td>Nuttall's violet</td>
<td></td>
</tr>
</tbody>
</table>