

# USGS-NPS VEGETATION MAPPING PROGRAM

## Classification of the Vegetation of Jewel Cave National Monument

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## VEGETATION SAMPLING AND CLASSIFICATION

### Introduction

This report presents the results of the vegetation classification portion of the USGS-NPS Vegetation Mapping Program at Jewel Cave National Monument. The major goal of this portion of the project was to classify and describe all plant communities found within the study area. In addition, vegetation data were used by the photointerpreter to determine relationships between signatures on aerial photos and vegetation types on the ground, and in some cases, to correlate habitat characteristics and vegetation types for predictive modeling.

Sampling strategy and field methods are described for vegetation sampling. The vegetation classification, field key to the vegetation types, and descriptions of each type are also included. As a supplement to this report, the raw plot data are included as original field forms and in electronic form in the PLOTS database (a Microsoft Access database).

### Methods

The methods used for the sampling and analysis of vegetation data and the development of the classification generally followed the standards outlined in the Field Methods for Vegetation Mapping document produced for this project. This process began with the development of a preliminary list of vegetation types from the National Vegetation Classification System (NVCS) that were thought to have a high likelihood of being in the mapping area. The list was prepared by literature review, including previous vegetation classifications of the Monument, and contacting knowledgeable experts. Due to the small size of the mapping area, sampling occurred across the entire mapping area.

Twenty-eight plots were collected in late July and August of 1996. The field team attempted to place plots in each of the vegetation types on the preliminary list. In addition, vegetation types that were encountered in the field which appeared distinct from any on the preliminary list were sampled. Plots were subjectively placed, generally in vegetation that was representative of an area of relatively homogeneous vegetation which covered more than 1/2 ha (the minimum mapping unit). Thus, ecotones and small patches were avoided. However, in cases where several vegetation types regularly occurred in mosaics of small stands, it was necessary to use multiple plots and sample smaller patches.

Number of plots and plot size varied by community. The number of plots depended on the aerial extent of the community on Jewel Cave NM, i.e., more widespread communities had more plots than rarer ones. Forest and woodland communities were sampled with 20 x 20 meter plots while shrubland and herbaceous communities were sampled with 10 x 10 meter plots. In some

instances rectangular plots of the same area were used (i.e. 10 x 40 m or 5 x 20 m) in linear or narrow polygons.

In late May and June of 1997, after a preliminary vegetation map had been prepared by the photointerpreter, a map validation step was performed in which further data were collected to obtain more information on the vegetation types and to better correlate the vegetation with the signatures on the aerial photographs. Sampling was conducted at points selected by the photointerpreter based on stratified random design in which more extensive vegetation types were allocated more points. This resulted in the collection of 36 observation points. At each point, the dominant species in each vegetation stratum were recorded with an estimated cover class. These extra points gave a better understanding of the variation within vegetation types and allowed sampling of three types that had not been found in the previous field season.

The final vegetation classification and descriptions were produced using plots, observation points, and the experience of the field team. Field personnel organized the plots and observation points into groups based on vegetation structure and composition. The number of plots ranged from 0-6 per type and the number of observation points ranged from 0-11 per type. Every community was sampled with a plot, observation point, or both. Quantitative analyses were performed to compare to the subjective classification. Average cover of each species and vegetation stratum were computed. Only the plots were used for quantitative analysis because of the more detailed information collected for them. They were analyzed using an ordination technique, Detrended Correspondence Analysis (DCA), and a clustering algorithm, Unweighted Pair-Group Method Using Arithmetic Means (UPGMA). Because there were few plots per type and the locations of the plots were chosen to emphasize the variation within a vegetation type, there was substantial variation within each type. These factors lessened the utility of the numerical analyses. Thus, the results of the numerical analyses were not used to derive the classification, but were compared to the subjective classification and any discrepancies in plot placement were examined.

## **Results**

The classification of the vegetation of Jewel Cave NM resulted in 13 types being defined, including four forest types, three woodland types, one shrubland type, and five herbaceous types. Two of the herbaceous type do not have rangewide descriptions. One because it was newly described from Jewel Cave NM and it is heavily dominated by exotics. The other type was sampled once but was observed to be extremely heterogeneous throughout the mapping area. The name of these types end with "Community" to signify that they have not been fully placed within the NVCS.

The vegetation types described in this report do not necessarily correspond to units on the final vegetation map, for several reasons. In some cases, two or more plant communities distinguishable on the ground could not be distinguished in aerial photographs, nor predicted based on habitat characteristics. In this type of situation, the photointerpreter lumped multiple plant communities into a single map unit, labeled as a complex. In other cases, multiple communities occur as mosaics of small distinct stands which vary over too fine a scale to be

mapped individually. These are mapped as mosaics.

In classifying vegetation, we attempt to recognize distinctive assemblages of plant species that occur repeatedly in appropriate habitat conditions. These plant communities become the basic mapping units in preparing vegetation maps. In some cases, the concept of a discrete assemblage of plants characteristic of a given habitat works very well. For example, in the Black Hills it is easy to correctly predict associated species and habitat characteristics for stands of paper birch and beaked hazel. In other cases, it can be very difficult to subdivide vegetation into consistent, repeating assemblages of species. Much of the ponderosa pine vegetation in the Black Hills presents this problem to some degree. Understory composition often is too variable or varies over too fine a scale to easily define discrete communities, especially using remotely sensed data. Boundaries are not easily recognized. Types grade into other types. The extensive disturbance history of ponderosa pine stands in the Black Hills makes this picture even more difficult to interpret.

In the Black Hills, many investigators have reported difficulties in classifying ponderosa pine vegetation. In our study, we encountered the same problems. Pine stands at environmental extremes (most xeric, most mesic) tended to be fairly consistent in species composition. *Pinus ponderosa* / *Schizachyrium scoparium* Wooded Herbaceous Vegetation (dry slopes, often south-facing) and *Pinus ponderosa* / *Physocarpus monogynus* Forest (northerly slopes) are two good examples. In contrast, stands found on intermediate sites were often problematic due to variable understory composition.

The classification of Jewel Cave NM follows. A field key and descriptions for each of the types are included in later sections of this report.

1. Forest
  - I.A Evergreen forest
    - I.A.8 Temperate or subpolar needle-leaved evergreen forest
      - I.A.8.N Natural/semi-natural
        - I.A.8.N.b Rounded-crowned temperate or subpolar needle-leaved evergreen forest

**PINUS PONDEROSA FOREST ALLIANCE**  
*Pinus ponderosa* / *Physocarpus monogymus* Forest  
*Pinus ponderosa* / *Symphoricarpos albus* Forest
  - I.B Deciduous forest
    - I.B.2 Cold-deciduous forest
      - I.B.2.N Natural/semi-natural
        - I.B.2.N.b Montane or boreal cold-deciduous forest

**POPULUS TREMULOIDES FOREST ALLIANCE**  
*Populus tremuloides* / *Prunus virginiana* Forest
        - I.B.2.N.d Temporarily flooded cold-deciduous forest

**ACER NEGUNDO TEMPORARILY FLOODED FOREST ALLIANCE**  
*Acer negundo* / *Prunus virginiana* Forest

- II. Woodland
    - II.A. Evergreen woodland
      - II.A.4. Temperate or subpolar needle-leaved evergreen woodland
        - II.A.4.N Natural/semi-natural
          - II.A.4.N.a. Rounded-crowned temperate or subpolar needle-leaved evergreen woodland
            - PINUS PONDEROSA WOODLAND ALLIANCE**
            - Pinus ponderosa* / *Arctostaphylos uva-ursi* Woodland
            - Pinus ponderosa* / *Carex inops* ssp. *heliophila*
            - Pinus ponderosa* / *Juniperus communis* Woodland
- III. Shrubland
  - III.B. Deciduous evergreen
    - III.B.2. Cold-deciduous shrubland
      - III.B.2.N Natural/semi-natural
        - III.B.2.N.d Temporarily flooded cold-deciduous shrubland
          - SYMPHORICARPOS OCCIDENTALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE**
          - Symphoricarpos occidentalis* Shrubland [Provisional]
- V. Herbaceous vegetation
  - V.A. Perennial graminoid vegetation
    - V.A.5. Temperate or subpolar grassland
      - V.A.5.N Natural/semi-natural
        - V.A.5.N.c. Medium-tall sod temperate or subpolar grassland
          - PASCOPYRUM SMITHII HERBACEOUS ALLIANCE**
          - Pascopyrum smithii* - *Bouteloua gracilis* - *Carex filifolia*
          - Herbaceous Vegetation
  
          - ALLIANCE UNDEFINED**
          - Poa pratensis* Disturbed Community
  
          - SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE**
          - Schizachyrium scoparium* - *Bouteloua* (*curtipendula*, *gracilis*) - *Carex filifolia* Herbaceous Vegetation
        - V.A.5.N.j. Temporarily flooded temperate or subpolar grassland
          - ALLIANCE UNDEFINED**
          - Carex* spp. Dominated Wetland Community
- V. Herbaceous vegetation
  - V.A. Perennial graminoid vegetation
    - V.A.6. Temperate or subpolar grassland with a sparse tree layer
      - V.A.6.N Natural/semi-natural
        - V.A.6.N.f. Medium-tall temperate or subpolar grassland with a sparse needle-leaved evergreen or mixed layer

**PINUS PONDEROSA WOODED MEDIUM-TALL  
HERBACEOUS ALLIANCE**

*Pinus ponderosa* / *Schizachyrium scoparium* Wooded  
Herbaceous Vegetation

## **Conclusion**

The vegetation of Jewel Cave NM was classified using the techniques established for the NPS/BRD Vegetation Mapping Program. Most of the vegetation types fit within existing associations in the NVCS. Due to extensive disturbance and regional variation, some of the vegetation at Jewel Cave NM did not closely match the more general, national description of the community into which it was placed. In addition, two types did not fit within the current NVCS and retained park-specific names and descriptions. It is expected that these will be fully placed within a national hierarchy and given rangewide descriptions as the NVCS is further developed.

Several recommendations for future mapping projects have flowed from the experience gained mapping Jewel Cave NM. It is recommended that future mapping projects begin fieldwork with a reconnaissance step involving observation point data collection from a large number of points. This type of sampling goes relatively fast and would allow the project investigators to identify plant communities within the study area and to get some feel for variation within each type. After a preliminary classification is in hand, representative stands could be selected for more detailed vegetation plots. Data collected for observation points would also supplement vegetation plot data in preparing community descriptions. This approach is most suited to small parks where regaining access to an area is not especially time-consuming or difficult. In larger parks or those with remote areas, it would still be beneficial to collect observation points from the same area and at the same time as plots are being collected.

Communication between the field ecologists and the photointerpreters/mappers is vital for a successful project. One step that can help this is to begin field work with aerial photos with preliminary vegetation polygons delineated. This helps the ecologists direct their sampling and the process of polygon delineation often generates questions relating to vegetation classification which the field team can investigate during vegetation sampling instead of after the field season.

## **Contributors**

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## 2. FIELD KEY TO THE PLANT COMMUNITIES OF JEWEL CAVE NATIONAL MONUMENT

1. > 10% vegetated
  2. trees present, > 10% cover
    3. broadleaf trees cover > 10% (canopy and/or subcanopy)
      4. *Acer negundo* with cover > 30%  
***Acer negundo* / *Prunus virginiana* Forest**
        4. *Populus tremuloides* and *Prunus virginiana* present  
***Populus tremuloides* / *Prunus virginiana* Forest**
      3. broadleaf trees absent or < 10% cover in canopy/subcanopy
        4. *Physocarpus monogynous* cover > 5%; *Amelanchier alnifolia* usually present  
***Pinus ponderosa* / *Physocarpus monogynous* Forest**
          5. *Schizachyrium scoparium* cover > 10%; *Bouteloua .....curtipendula* and *Koeleria macrocarpa* usually present; pine .....cover can be less than 25%, but greater than 10%  
***Pinus ponderosa* / *Schizachyrium scoparium* Wooded Herbaceous Vegetation**
            5. not as above
              6. shrub/herbaceous cover < 50%; *Juniperus communis* present  
***Pinus ponderosa* / *Juniperus communis* Woodland**
                6. not as above
                  7. *Arctostaphylos uva-ursi* cover > 4%  
***Pinus ponderosa* / *Arctostaphylos uva-ursi* Woodland**
                    8. *Carex inops* ssp. *heliophila* cover >5% or *C. inops* ssp. *heliophila* dominate in the understory  
***Pinus ponderosa* / *Carex inops* ssp. *heliophila* Woodland**

8. not as above; *Symphoricarpos albus* present

***Pinus ponderosa* / *Symphoricarpos albus* Forest**

2. trees absent, or cover < 10%

9. *Symphoricarpos occidentalis* cover > 25%

***Symphoricarpos occidentalis* Shrubland**

9. shrubs occasional or absent

10. *Schizachyrium scoparium* cover > 10%; *Bouteloua curtipendula* and .... *Koeleria macrocarpa* usually present

***Schizachyrium scoparium* - *Bouteloua* (*curtipendula*, *gracilis*) - *Carex filifolia*  
Herbaceous Vegetation**

10. not as above

11. *Poa pratensis* cover > 25%

***Poa pratensis* Disturbed Community**

11. not as above

12. upland; graminoids dominant

***Pascopyrum smithii* - *Bouteloua gracilis* - *Carex filifolia* Herbaceous  
Vegetation**

12. wetland

***Carex* spp. Dominated Wetland Community**

## VEGETATION DESCRIPTION FOR JEWEL CAVE NATIONAL MONUMENT

NOTE: "\*" Indicates a new formation to the National Vegetation Classification System

### Pinus ponderosa / Physocarpus monogynus Forest

COMMON NAME	Ponderosa Pine / Mountain Ninebark Forest
SYNONYM	Ponderosa Pine / Mountain Ninebark Forest
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Evergreen forest (I.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen forest (I.A.8)
PHYSIOGNOMIC SUBGROUP	Natural/semi-natural (I.A.8.N)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)
ALLIANCE	<i>Pinus ponderosa</i> Forest Alliance

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Upland

#### RANGE

##### *Globally*

This community is found in the Black Hills of South Dakota and Wyoming and in other areas of northeastern Wyoming. It has also been reported in northeastern Colorado (Johnston 1987), but this has not been well documented.

##### *Jewel Cave National Monument*

This community occurs throughout the Jewel Cave area. It is best developed on the south sides of drainages such as Lithograph Canyon and the drainage traversed by Highway 16 west of the park entrance.

#### ENVIRONMENTAL DESCRIPTION

##### *Globally*

This community is one of the more mesic of the ponderosa pine forests. It is found on north facing slopes (Johnston 1987). On three stands in eastern Wyoming the slopes ranged from 27-46% (Hoffman and Alexander 1976, 1987). It has been observed at elevations of 1400-1800 m (4300-5900 ft, Jones 1992) but may occur elsewhere. The soils are loam.

##### *Jewel Cave National Monument*

This community was found on slopes ranging from 10 to 20 degrees. Aspect usually is northerly.

#### MOST ABUNDANT SPECIES

##### *Globally*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Pinus ponderosa</i>
Short shrub	<i>Physocarpus monogynus</i>
Herbaceous	<i>Galium boreale</i> , <i>Pulsatilla patens</i>

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*Jewel Cave National Monument*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Pinus ponderosa</i>
Subcanopy	<i>Pinus ponderosa</i>
Short shrub	<i>Physocarpus monogynous</i>

DIAGNOSTIC SPECIES

*Globally*

*Pinus ponderosa, Physocarpus monogynous*

*Jewel Cave National Monument*

*Pinus ponderosa, Physocarpus monogynous*

VEGETATION DESCRIPTION

*Globally*

The overstory of this forest community is usually exclusively *Pinus ponderosa*. The canopy can be moderately closed to closed. Sufficient light penetrates the canopy to allow the growth of a vigorous shrub layer. *Physocarpus monogynous*, which grows to approximately 1 meter, is the dominant shrub. In three stands in the Black Hills of Wyoming this species had an average cover of 42% (Hoffman and Alexander 1987). Other shrubs that occur in this community are *Mahonia repens*, *Arctostaphylos uva-ursi*, and *Symphoricarpos albus*. The herbaceous layer is dominated by forbs and non-vascular plants. *Antennaria rosea*, *Cerastium arvense*, *Galium boreale*, *Pulsatilla patens*, and mosses and lichens are typically found in this community.

*Jewel Cave National Monument*

This community is dominated by *Pinus ponderosa* in both the canopy and subcanopy. Coverage in each stratum typically ranges from 10 to 25%. Short shrub coverage typically is between 10 and 50%. *Physocarpus monogynous* consistently dominates the short shrub stratum, with other species often present, including *Shepherdia canadensis*, *Juniperus communis*, *Arctostaphylos uva-ursi*, *Symphoricarpos albus*, and *Amelanchier alnifolia*.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK G3

RANK JUSTIFICATION

DATABASE CODE CEGL000190

COMMENTS

*Globally*

Lack of natural disturbance (e.g., fire) over the last 100 years has led to increased densities and coverage in the subcanopy.

The stands used to document the *Pinus ponderosa / Physocarpus monogynous* Habitat Type described by Hoffman and Alexander (1976, 1987) had very high basal area and densities, possibly due to their sampling procedure. The dense structure may have affected the floristic makeup of the stands. Additionally, there is some ambiguity between this type as a forest or woodland; in increasingly dense stands, this type has >60% canopy closure.

REFERENCES

Hoffman, G. R. and R. R. Alexander. 1987. Forest vegetation of the Black Hills National Forest of South Dakota and Wyoming: A habitat type classification. Research Paper RM-276. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 48 p.

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## Pinus ponderosa / Symphoricarpos albus Forest

COMMON NAME	Ponderosa Pine / Common Snowberry Forest
SYNONYM	Ponderosa Pine / Snowberry Forest
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Evergreen forest (I.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen forest (I.A.8)
PHYSIOGNOMIC SUBGROUP	Natural/semi-natural (I.A.8.N)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)
ALLIANCE	<i>Pinus ponderosa</i> Forest Alliance

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Upland

### RANGE

#### *Globally*

This community is in eastern Washington, northeastern Oregon, central and northern Idaho, western, central, and southeastern Montana, northern and eastern Wyoming, and western South Dakota. Johnston (1987) reports that this community is also in Nebraska but its presence there needs to be verified.

#### *Jewel Cave National Monument*

This community occurs throughout the Jewel Cave area.

### ENVIRONMENTAL DESCRIPTION

#### *Globally*

This community is found on moderate slopes (Johnston 1987). The soils are usually loams with a high water holding capacity, but they can be stony or sandy. If they are the latter they tend to occur on north facing slopes with more mesic microclimates (Daubenmire 1952).

#### *Jewel Cave National Monument*

This community occurs on gentle to moderate slopes (0 to 15 degrees) of all aspects.

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**MOST ABUNDANT SPECIES**

*Globally*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Pinus ponderosa</i>
Short shrub	<i>Amelanchier alnifolia</i> , <i>Mahonia repens</i> , <i>Symphoricarpos albus</i>
Herbaceous	<i>Campanula rotundifolia</i> , <i>Galium</i> spp.

*Jewel Cave National Monument*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Pinus ponderosa</i>
Subcanopy	<i>Pinus ponderosa</i>
Short shrub	<i>Symphoricarpos albus</i>

**DIAGNOSTIC SPECIES**

*Globally*

*Pinus ponderosa*, *Symphoricarpos albus*, *Balsamorhiza sagittata*

*Jewel Cave National Monument*

*Pinus ponderosa*, *Symphoricarpos albus*

**VEGETATION DESCRIPTION**

*Globally*

The overstory of this community is dominated by successfully reproducing *Pinus ponderosa*. There are lesser amounts of *Populus tremuloides*, *Betula papyrifera*, *Quercus macrocarpa*, *Juniperus scopulorum*, *Picea glauca*, *Pinus flexilis*, and *Pseudotsuga menziesii*. Hoffman and Alexander (1987) sampled 12 stands of this type that averaged 35.8 m<sup>2</sup>/ha basal area. The shrub layer is prominent, with cover approaching 100% in some stands (Daubenmire 1952). The common shrubs in this community are *Amelanchier alnifolia*, *Symphoricarpos albus*, *Shepherdia canadensis*, *Mahonia repens*, *Spiraea betulifolia*, *Juniperus communis*, and *Prunus virginiana*. The herbaceous layer is also well developed. Typical species found in this layer are *Achillea millefolium*, *Campanula rotundifolia*, *Galium species*, and *Solidago occidentalis*. Periodic groundfires move through the lower strata of this community. Regeneration after these events is rapid. Within a few years the signs of a fire may be difficult to detect (Daubenmire 1952).

*Jewel Cave National Monument*

This community is dominated by *Pinus ponderosa* in both the canopy and subcanopy. Coverage for each stratum typically is 10 to 25%, and occasionally as high as 60%. Short shrub coverage typically is less than 10%, with *Symphoricarpos albus* present but not abundant (less than 10% cover). Other shrubs may be present, including *Juniperus communis*, *Spiraea betulifolia*, *Rhus trilobata*, and *Amelanchier alnifolia*. Herbaceous cover is variable, ranging generally between 10 and 60%. This stratum usually is species-rich, with both graminoids and forbs significant. There are no clear dominants. *Symphoricarpos occidentalis* also occurs in the study area. Where it forms dense thickets, it can be identified vegetatively with confidence. However, it also occurs as scattered individuals under pine, and in these situations it is necessary to have flowering material to differentiate between *S. albus* and *S. occidentalis*.

**OTHER NOTEWORTHY SPECIES** Information not available.

**CONSERVATION RANK** G4?

**RANK JUSTIFICATION**

**DATABASE CODE** CEGL000203

**COMMENTS**

Periodic fires are probably important in maintaining the grassland groundlayer and limiting shrub and tree seedling regeneration.

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The stands used to document the *Pinus ponderosa* / *Symphoricarpos albus* Habitat Type described by Hoffman and Alexander (1976, 1987) had very high basal area and densities, possibly due to their sampling procedure. Hoffman and Alexander (1987) described two phases of this type, *Oryzopsis asperifolia* phase which is now identified as *Pinus ponderosa* / *Oryzopsis asperifolia* Woodland and the *Balsamorhiza sagittata* phase which remains part of this type. The dense structure may have affected the floristic makeup of the stands. Additionally, there is some ambiguity between this type as a forest or woodland; in increasingly dense stands, this type has >60% canopy closure.

*Jewel Cave National Monument*

Stands classified as *Pinus ponderosa* / *Symphoricarpos albus* Forest appear to differ significantly from that type as previously described for the Black Hills (Thilenius 1972, Hoffman and Alexander 1987). Canopy cover typically is less than 60% (and therefore is "Woodland" rather than "Forest"), and *Symphoricarpos albus* typically is sparse.

This type often occurs in mosaics with other pine types. At several plot and observation point locations in the Jewel Cave area, *Arctostaphylos uva-ursi* and *Symphoricarpos albus* were equally common and it was difficult to assign community names to the stands.

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- Thilenius, J. F. 1972. Classification of deer habitat in the ponderosa pine forest of the Black Hills, South Dakota. RM-91. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 28p.

## Populus tremuloides / Prunus virginiana Forest

COMMON NAME	Quaking Aspen / Chokecherry Forest
SYNONYM	Aspen / Chokecherry Forest
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Deciduous forest (I.B)
PHYSIOGNOMIC GROUP	Cold-deciduous forest (I.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/semi-natural (I.B.2.N)
FORMATION	Montane or boreal cold-deciduous forest (I.B.2.N.b.)
ALLIANCE	<i>Populus tremuloides</i> Forest Alliance
CLASSIFICATION CONFIDENCE LEVEL	3

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USFWS WETLAND SYSTEM Upland

RANGE

*Globally*

This community is found in Montana, Wyoming, and western South Dakota.

*Jewel Cave National Monument*

This community occurs in Hell Canyon north of the Monument. Small unmapped stands of *Populus tremuloides* are occasional elsewhere in the study area.

ENVIRONMENTAL DESCRIPTION

*Globally*

In the Black Hills, this community is found along mesic valley bottoms. The slopes can vary from steep (at the bottom of the hillslope) to gentle (along the valley bottom).

*Jewel Cave National Monument*

This community occurs in drainage bottoms.

MOST ABUNDANT SPECIES

*Globally*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Populus tremuloides</i>
Short shrub	<i>Prunus virginiana</i>

*Jewel Cave National Monument*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Populus tremuloides</i> , <i>Betula papyrifera</i>
Short shrub	<i>Prunus virginiana</i>

DIAGNOSTIC SPECIES

*Globally*

*Populus tremuloides*, *Prunus virginiana*

*Jewel Cave National Monument*

*Populus tremuloides*, *Prunus virginiana*

VEGETATION DESCRIPTION

*Globally*

This community is dominated by deciduous trees in the canopy, but may have a component of evergreen trees, also. *Populus tremuloides* is the most abundant tree species. *Picea glauca* (in the Black Hills) and *Pinus ponderosa* may also be present. There is a short shrub layer dominated by *Prunus virginiana* and often containing *Amelanchier alnifolia*, *Ribes* spp., and *Symphoricarpos* spp.

*Jewel Cave National Monument*

This community is dominated by *Populus tremuloides* and/or *Betula papyrifera* in both the canopy and subcanopy. Two stands of this type were sampled. Estimated canopy coverage was less than 25% but subcanopy coverage was as high as 60%. Short shrub cover estimates ranged from 10 to 60%, with *Ribes* spp., *Rosa* sp., and *Prunus virginiana* the more common species. *P. virginiana* may form a tall shrub stratum as well. The herbaceous stratum typically is sparse (less than 10%) and variable in species composition; *Oryzopsis asperifolia* and *Fragaria virginiana* were found in both stands. *Betula papyrifera* may be locally codominant or dominant in stands of this type.

OTHER NOTEWORTHY SPECIES Information not available.



**USGS-NPS Vegetation Mapping Program**  
**Jewel Cave National Monument**

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CONSERVATION RANK G3?Q

RANK JUSTIFICATION

DATABASE CODE CEGL000596

COMMENTS

*Globally*

This community is found primarily to the west of the Black Hills. Further rangewide review may alter the global description of the type.

REFERENCES

**Acer negundo / Prunus virginiana Forest**

COMMON NAME Ash Leaf Maple / Choke Cherry Forest  
SYNONYM Box Elder / Chokecherry Forest  
PHYSIOGNOMIC CLASS Forest (I)  
PHYSIOGNOMIC SUBCLASS Deciduous forest (I.B)  
PHYSIOGNOMIC GROUP Cold-deciduous forest (I.B.2)  
PHYSIOGNOMIC SUBGROUP Natural/semi-natural (I.B.2.N)  
FORMATION Temporarily flooded cold-deciduous forest (I.B.2.N.d.)  
ALLIANCE *Acer negundo* Temporarily Flooded Forest Alliance

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Upland

RANGE

*Globally*

This community is found in Montana, Wyoming, and western South Dakota.

*Jewel Cave National Monument*

A single mappable stand of this vegetation type was found in the bottom of Hell Canyon just north of the National Monument.

ENVIRONMENTAL DESCRIPTION

*Globally*

This community is found in mesic situations, usually near streams or rivers.

*Jewel Cave National Monument*

This community occurs in the bottom of Hell Canyon on alluvial soil adjacent to a small stream, and on adjacent lowermost slopes.

MOST ABUNDANT SPECIES

*Globally*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Acer negundo</i>

**USGS-NPS Vegetation Mapping Program**  
**Jewel Cave National Monument**

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Tall shrub                      *Prunus virginiana*

*Jewel Cave National Monument*

Stratum

Species

Tree canopy

*Acer negundo*

Tall shrub

*Prunus virginiana*, *Cornus stolonifera*

Short shrub

*Ribes* spp., *Rubus idaeus*, *Symphoricarpos occidentalis*, *Rosa* sp.

DIAGNOSTIC SPECIES

*Globally*

*Acer negundo*, *Prunus virginiana*

*Jewel Cave National Monument*

*Acer negundo*

VEGETATION DESCRIPTION

*Globally*

This is an early successional community dominated by *Acer negundo*. *Populus tremuloides* may also be found. Tree density may be moderate to high. Shrubs are common and vary from short (<1 m) to tall (>2 m). *Prunus virginiana* and *Cornus stolonifera* are common.

*Jewel Cave National Monument*

This community is dominated by *Acer negundo* in the canopy and subcanopy. In the single mappable stand, both strata had canopy coverages estimated at 10 to 25%. The tall shrub stratum is dominated by *Prunus virginiana* and *Cornus stolonifera*, with coverage estimated at 10 to 25%. There is substantial short shrub cover (estimated at 25 to 50%), with *Ribes* spp., *Rubus idaeus*, *Symphoricarpos occidentalis*, and *Rosa* sp. most common. Herbaceous cover is relatively sparse (less than 5%) but species-rich, with both graminoids and forbs significant.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK G3

RANK JUSTIFICATION

DATABASE CODE CEGL000628

COMMENTS

*Globally*

This is an early successional community that is poorly described across its range.

REFERENCES

## **Pinus ponderosa / Arctostaphylos uva-ursi Woodland**

COMMON NAME

Ponderosa Pine / Bearberry Woodland

SYNONYM

Ponderosa Pine / Kinikinnick Woodland

PHYSIOGNOMIC CLASS

Woodland (II)

PHYSIOGNOMIC SUBCLASS

Evergreen woodland (II.A)

PHYSIOGNOMIC GROUP

Temperate or subpolar needle-leaved evergreen woodland (II.A.4)

PHYSIOGNOMIC SUBGROUP

Natural/semi-natural (II.A.4.N)

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FORMATION Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)

ALLIANCE *Pinus ponderosa* Woodland Alliance

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Upland

RANGE

*Globally*

This community is found in southeastern Montana, eastern Wyoming, and western South Dakota.

*Jewel Cave National Monument*

This community occurs in the northern part of the Monument and in the area to the north.

ENVIRONMENTAL DESCRIPTION

*Globally*

This community is found on flat to gently sloping terrain (3-21%) in the Black Hills (Hoffman and Alexander 1987). It has been found from 1540-3000 m (4250-9100 ft). The slopes are more likely to be facing northward than southward. Soils are sandy loams and clay loams.

*Jewel Cave National Monument*

This community occurs typically on gentle to moderate slopes (5 to 15 degrees), and occasionally on steeper slopes. It was found on all aspects but south.

MOST ABUNDANT SPECIES

*Globally*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Pinus ponderosa</i>
Short shrub	<i>Arctostaphylos uva-ursi</i> , <i>Juniperus communis</i> , <i>Symphoricarpos albus</i>
Herbaceous	<i>Oryzopsis asperifolia</i>

*Jewel Cave National Monument*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Pinus ponderosa</i>
Subcanopy	<i>Pinus ponderosa</i>
Short shrub	<i>Arctostaphylos uva-ursi</i>

DIAGNOSTIC SPECIES

*Globally*

*Pinus ponderosa*, *Arctostaphylos uva-ursi*, *Shepherdia canadensis*

*Jewel Cave National Monument*

*Pinus ponderosa*, *Arctostaphylos uva-ursi*

VEGETATION DESCRIPTION

*Globally*

*Pinus ponderosa* is the dominant tree in this woodland community. *P. ponderosa* reproduces successfully in this community and is found as seedlings and saplings as well as mature trees. There may be seedlings of *Populus tremuloides* and *Quercus macrocarpa*. In northern New Mexico and southern Colorado, *Pseudotsuga menziesii* may also be present, but elsewhere rarely do any species except *Pinus ponderosa* grow larger than saplings. Shrubs are prominent in this community. Hoffman and Alexander (1987) found that in 10 stands in the Black Hills, shrubs averaged 43.9% cover while the herbaceous stratum averaged 19.3% cover. The most abundant shrub was *Arctostaphylos uva-ursi*, which covered an average of 33% (range of 10-85%) of the surface. Other shrubs that are likely to be present are *Spiraea betulifolia*, *Juniperus communis*, and *Symphoricarpos albus*. Typical herbaceous

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species are *Achillea millefolium*, *Fragaria virginiana*, *Lathyrus ochroleucus*, and *Oryzopsis asperifolia*.

*Jewel Cave National Monument*

This community is dominated by *Pinus ponderosa* in both the canopy and subcanopy. Coverage in each stratum typically is less than 25% and often less than 10%. Subcanopy coverage is often greater than canopy coverage. Short shrub coverage typically is between 10 and 50%. *Arctostaphylos uva-ursi* occurs consistently with other species often present, including *Shepherdia canadensis*, *Juniperus communis*, *Physocarpus monogynous*, and *Symphoricarpos* sp. Herbaceous cover usually is sparse (less than 10%) and variable in species composition.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK G4

RANK JUSTIFICATION

DATABASE CODE CEGL000844

COMMENTS

*Globally*

Fire was likely an important factor in the regulation of stand structure historically.

The stands used to document the *Pinus ponderosa* / *Arctostaphylos uva-ursi* Habitat Type described by Hoffman and Alexander (1987) had very high basal area and densities for a woodland, possibly due to their sampling procedure. The dense structure may have affected the floristic makeup of the stands and made the list of dominant species a poor reflection of the community as a whole.

*Jewel Cave National Monument*

This type often occurs in mosaics with other pine types. At several plot and observation point locations, *Arctostaphylos uva-ursi* and *Symphoricarpos albus* were equally common, and it was difficult to assign community names to the stands.

REFERENCES

Alexander, R. R. 1988. Forest vegetation on national forests in the Rocky Mountain and Intermountain region: habitat types and community types. General Technical Report RM-162. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 47 p.

Hoffman, G. R. and R. R. Alexander. 1987. Forest vegetation of the Black Hills National Forest of South Dakota and Wyoming: A habitat type classification. Research Paper RM-276. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 48 p.

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McAdams, A. G., D. A. Stutzman, and D. Faber-Langendoen. 1998. Black Hills Community Inventory, unpublished data. The Nature Conservancy, Midwest Regional Office, Minneapolis, MN.

## Pinus ponderosa / Carex inops ssp. heliophila Woodland

COMMON NAME	Ponderosa Pine / Sun Sedge Woodland
SYNONYM	Ponderosa Pine / Long-Stolon Sedge Woodland
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/semi-natural (II.A.4.N)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	<i>Pinus ponderosa</i> Woodland Alliance

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Upland

### RANGE

*Globally*

This community is found in Colorado, Wyoming, western South Dakota, and Montana.

### *Jewel Cave National Monument*

In the study area, this community occurs most commonly west of the Monument and east of the Monument west of the Pass Creek Road. It is found at scattered sites elsewhere.

### ENVIRONMENTAL DESCRIPTION

*Globally*

This community is often found on gentle and moderate south to west facing slopes (Hansen and Hoffman 1988, Hoffman and Alexander 1987).

### *Jewel Cave National Monument*

This community occurs on gentle slopes (less than 10 degrees) often with southerly aspects.

### MOST ABUNDANT SPECIES

*Globally*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Pinus ponderosa</i>
Herbaceous	<i>Carex inops</i> ssp. <i>heliophila</i> , <i>Danthonia spicata</i>

### *Jewel Cave National Monument*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Pinus ponderosa</i>
Subcanopy	<i>Pinus ponderosa</i>
Herbaceous	<i>Carex inops</i> ssp. <i>heliophila</i>

### DIAGNOSTIC SPECIES

*Globally*

*Pinus ponderosa*, *Carex inops* ssp. *heliophila*

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**Jewel Cave National Monument**

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*Jewel Cave National Monument*

*Pinus ponderosa*, *Carex inops* ssp. *heliophila*

**VEGETATION DESCRIPTION**

*Globally*

The tree canopy and subcanopy are dominated by *Pinus ponderosa*. *Juniperus scopulorum* and *Quercus macrocarpa* are occasionally found in the subcanopy. Shrubs are infrequent in this type. The herbaceous layer is dominated by *Carex inops* ssp. *heliophila* with inclusions of *Schizachyrium scoparium* and *Pseudoroegneria spicata* -- generally in areas with more open canopies.

*Jewel Cave National Monument*

Stands of this vegetation type are dominated by *Pinus ponderosa*. Both canopy and subcanopy coverages typically are less than 25%. Short shrub canopy also typically is less than 25%, and commonly consists of one or more of the following species: *Physocarpus monogynous*, *Arctostaphylos uva-ursi*, *Symphoricarpos albus*, and *Amelanchier alnifolia*. Herbaceous cover usually is less than 25%. *Carex inops* ssp. *heliophila* occurs consistently but is not abundant.

**OTHER NOTEWORTHY SPECIES** Information not available.

**CONSERVATION RANK** G3

**RANK JUSTIFICATION**

**DATABASE CODE** CEGL000849

**COMMENTS**

*Globally*

The canopy in this type is usually moderately open but can become nearly closed in undisturbed stands (i.e., where the natural disturbance regime has been disrupted).

The stands used to document the *Pinus ponderosa* / *Carex inops* ssp. *heliophila* Habitat Type described by Hoffman and Alexander (1987) and Hansen and Hoffman (1988) had very high basal area and densities for a woodland, possibly due to their sampling procedure. The dense structure may have affected the floristic makeup of the stands. This type, however, is a woodland (not forest) type in its typically high-quality state.

*Jewel Cave National Monument*

This type often occurs in mosaics with other pine types, especially *Pinus ponderosa* / *Schizachyrium scoparium* Wooded Herbaceous Vegetation.

**REFERENCES**

Hansen, P. L. and G. R. Hoffman. 1988. The vegetation of the Grand River/Cedar River, Sioux, and Ashland Districts of the Custer National Forest: A habitat type classification. General Technical Report RM-157. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 68 p.

Hoffman, G. R. and R. R. Alexander. 1976. Forest vegetation of the Bighorn Mountains, Wyoming: A habitat type classification. Research Paper RM-170. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 38 p.

Hoffman, G. R. and R. R. Alexander. 1987. Forest vegetation of the Black Hills National Forest of South Dakota and Wyoming: A habitat type classification. Research Paper RM-276. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 48 p.

McAdams, A. G., D. A. Stutzman, and D. Faber-Langendoen. 1998. Black Hills Community Inventory, unpublished data. The Nature Conservancy, Midwest Regional Office, Minneapolis, MN.

## Pinus ponderosa / Juniperus communis Woodland

COMMON NAME	Ponderosa Pine / Common Juniper Woodland
SYNONYM	Ponderosa Pine / Common Juniper Woodland
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/semi-natural (II.A.4.N)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	<i>Pinus ponderosa</i> Woodland Alliance

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Upland

### RANGE

#### *Globally*

This community is found in eastern Montana, the Bighorn Mountains in northern Wyoming and the Black Hills of western South Dakota and eastern Wyoming.

#### *Jewel Cave National Monument*

This community occurs throughout most of the Jewel Cave area. In the study area, it was not found east of the Monument nor in the eastern portion of the park.

### ENVIRONMENTAL DESCRIPTION

#### *Globally*

This community is most often found on moderate north and west facing slopes (Hansen and Hoffman 1987, Hoffman and Alexander 1987, Hoffman and Alexander 1976). The soils are shallow and loamy.

#### *Jewel Cave National Monument*

This community commonly occurs on moderate to steep slopes (20 - 30 degrees), although it occasionally is found on slopes as gentle as 5 degrees. It was found on all aspects.

### MOST ABUNDANT SPECIES

#### *Globally*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Pinus ponderosa</i>
Short shrub	<i>Juniperus communis</i>
Herbaceous	<i>Carex inops</i> ssp. <i>heliophila</i> , <i>Schizachyrium scoparium</i>

#### *Jewel Cave National Monument*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Pinus ponderosa</i>
Subcanopy	<i>Pinus ponderosa</i>
Short shrub	<i>Juniperus communis</i>

### DIAGNOSTIC SPECIES

#### *Globally*

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*Pinus ponderosa.*, *Juniperus communis*, *Mahonia repens*, *Achillea millefolium*.

*Jewel Cave National Monument*

*Pinus ponderosa*, *Juniperus communis*

**VEGETATION DESCRIPTION**

*Globally*

This community is dominated by *Pinus ponderosa* in the overstory. Other tree species that may be present are *Picea glauca* and *Populus tremuloides*. The canopy is usually moderately closed but can become nearly closed in stands that are not disturbed for long periods. There is a prominent low shrub layer whose most abundant component is *Juniperus communis*. This species covered an average of 25% (range of 4-42%) in 7 stands in the Black Hills of South Dakota and Wyoming (Hoffman and Alexander 1987). Total average cover by the shrub layer was 51% and by the herb layer was 8%. Other shrub species found in this community across its range are *Arctostaphylos uva-ursi*, *Mahonia repens*, *Spiraea betulifolia*, and *Symphoricarpos albus*. Typical herbaceous species are *Achillea millefolium*, *Carex inops* ssp. *heliophila*, *Schizachyrium scoparium*, *Fragaria* spp., and *Lathyrus ochroleucus* (McAdams et al. 1998).

*Jewel Cave National Monument*

Stands of this type are dominated by *Pinus ponderosa* in both the canopy and subcanopy. Subcanopy coverage often is greater than canopy coverage, and stands of doghair are common. Short shrub coverage typically is less than 10%, with *Juniperus communis* present but not abundant. Other shrub species may be present, including *Physocarpus monogynous*, *Arctostaphylos uva-ursi*, and *Symphoricarpos albus*. Herbaceous cover is relatively sparse, rarely exceeding 10%.

**OTHER NOTEWORTHY SPECIES**

**CONSERVATION RANK** G4?

**RANK JUSTIFICATION**

**DATABASE CODE** CEGL000859

**COMMENTS**

*Globally*

The canopy in this type is usually moderately closed but can become nearly closed in undisturbed stands (i.e., where the natural disturbance regime has been disrupted).

The stands used to document the *Pinus ponderosa* / *Juniperus communis* Habitat Type described by Hoffman and Alexander (1987) and Hansen and Hoffman (1988) had very high basal area and densities for a woodland, possibly due to their sampling procedure. The dense structure may have affected the floristic makeup of the stands. Additionally, there is some ambiguity between this type as a forest or woodland; in increasingly dense stands, this type has >60% canopy closure.

**REFERENCES**

Hansen, P. L. and G. R. Hoffman. 1988. The vegetation of the Grand River/ Cedar River, Sioux, and Ashland Districts of the Custer National Forest: A habitat type classification. General Technical Report RM-157. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 68 p.

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Thilenius, J. F. 1970. An isolated occurrence of limber pine (*Pinus flexilis* James) in the Black Hills of South Dakota. *American Midland Naturalist* 84(2):411-417.

## Symphoricarpos occidentalis Shrubland [Provisional]

COMMON NAME	Western Snowberry Shrubland
SYNONYM	Wolfberry Shrubland
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/semi-natural (III.B.2.N)
FORMATION	Temporarily flooded cold-deciduous shrubland (III.B.2.N.d.)
ALLIANCE	<i>Symphoricarpos occidentalis</i> Temporarily Flooded Shrubland Alliance
CLASSIFICATION CONFIDENCE LEVEL	1
USFWS WETLAND SYSTEM	Upland

### RANGE

#### *Globally*

This community is widespread in western Montana, North Dakota, and South Dakota. It is also present in Nebraska, Wyoming, and Saskatchewan.

#### *Jewel Cave National Monument*

This community is found throughout the Jewel Cave area. It occurs as mappable stands and as inclusions in other vegetation types.

### ENVIRONMENTAL DESCRIPTION

#### *Globally*

This community is found in mesic swales, depressions, ravines and floodplains. Some examples of this community experience intermittent and brief flooding. The soils are fertile and well drained to imperfectly drained silts and loams. The upper soil horizon is usually deep, although a thin layer of sand may be present if the site has been recently flooded (Jones 1995).

#### *Jewel Cave National Monument*

This community occurs in relatively broad, level canyon bottoms.

### MOST ABUNDANT SPECIES

#### *Globally*

<u>Stratum</u>	<u>Species</u>
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Short shrub                      *Symphoricarpos occidentalis, Rhus aromatica, Prunus virginiana*  
Herbaceous                      *Pascopyrum smithii, Poa pratensis, Galium boreale*  
*Jewel Cave National Monument*  
Stratum                      Species  
Short shrub                      *Symphoricarpos occidentalis*

**DIAGNOSTIC SPECIES**

*Globally*

*Symphoricarpos occidentalis, Rosa woodsii, Poa pratensis, Artemisia ludoviciana*

*Jewel Cave National Monument*

*Symphoricarpos occidentalis*

**VEGETATION DESCRIPTION**

*Globally*

Throughout its range this community is dominated by shrubs approximately 1 m tall. Shrub cover is typically greater than 50%. In places it can approach 100%. These shrubs form dense clumps that exclude most other species. *Symphoricarpos occidentalis* is the most common shrub, but *Rhus aromatica* and *Prunus virginiana* can be locally abundant. *R. aromatica* and *P. virginiana* can grow to 2-3 meters in places. Herbaceous species and smaller shrubs are most abundant at the edge of this community and in gaps between the clumps of taller shrubs where the shading is less complete. *Rosa woodsii* is a typical smaller shrub. *Achillea millefolium, Artemisia ludoviciana, Galium boreale, and Pascopyrum smithii* are common herbaceous species of this community. Woody vines sometimes occur. *Parthenocissus vitacea* is the most common vine.

*Jewel Cave National Monument*

Mappable stands of this community type are composed of thickets of *Symphoricarpos occidentalis* without significant tree cover, although scattered trees may be present. Smaller stands occur under both hardwoods and pine and in grasslands. Short shrub cover typically is high (60 to 100%). Other shrub species may be present, including *Ribes* spp., *Amelanchier alnifolia*, and *Rosa* sp. Herbaceous cover is less than 10%; *Monarda fistulosa* and *Cynoglossum officinale* appear to be the more common components.

**OTHER NOTEWORTHY SPECIES** Information not available.

**CONSERVATION RANK** G4G5

**RANK JUSTIFICATION**

**DATABASE CODE** CEGL001131

**COMMENTS**

*Globally*

This community seems to thrive in disturbed areas (Hansen and Hoffman 1988), especially those subject to disturbance by fire and cattle grazing.

This type often occurs in heavily disturbed areas in conjunction with exotic species such as *Poa pratensis* and *Cirsium arvense*.

**REFERENCES**

Hansen, P. L. and G. R. Hoffman. 1988. The vegetation of the Grand River/ Cedar River, Sioux, and Ashland Districts of the Custer National Forest: A habitat type classification. General Technical Report RM-157. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 88 pp.

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## Pascopyrum smithii - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation

COMMON NAME Western-Wheat Grass - Blue Grama - Threadleaf Sedge Herbaceous Vegetation

SYNONYM Western Wheatgrass - Blue Grama - Thread-Leaved Sedge Prairie

PHYSIOGNOMIC CLASS Herbaceous vegetation (V)

PHYSIOGNOMIC SUBCLASS Perennial graminoid vegetation (V.A)

PHYSIOGNOMIC GROUP Temperate or subpolar grassland (V.A.5)

PHYSIOGNOMIC SUBGROUP Natural/semi-natural (V.A.5.N)

FORMATION Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)

ALLIANCE *Pascopyrum smithii* Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Upland

### RANGE

#### *Globally*

This community is found in Colorado, Wyoming, Montana, North Dakota, South Dakota, and Saskatchewan. Details of its distribution within these states are not available.

#### *Jewel Cave National Monument*

This community is best developed in the bottom of Hell Canyon, on the ridgecrest in the southeast part of the Monument, and in the vicinity of the Pass Creek Road. Smaller stands occur elsewhere.

### ENVIRONMENTAL DESCRIPTION

#### *Globally*

This community is found on flat or gently sloping terrain. Many stands are on floodplains or gentle valley slopes, others are on uplands (Hanson and Whitman 1938, Hansen and Hoffman 1988). The soils are clay loam, silt loam, or loam and usually deep and fertile. This community appears to be only in basins or other broad lowlands. It does not appear to be found in mountain valleys (Hanson and Dahl 1956, Jones 1992).

#### *Jewel Cave National Monument*

This community is best developed on flat to gentle slopes. Smaller stands occur elsewhere, most commonly in openings on wooded southerly slopes.

### MOST ABUNDANT SPECIES

**USGS-NPS Vegetation Mapping Program**  
**Jewel Cave National Monument**

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*Globally*

Stratum

Herbaceous

Species

*Bouteloua gracilis*, *Carex filifolia*, *Pascopyrum smithii*, *Schizachyrium scoparium*, *Stipa comata*

*Jewel Cave National Monument*

Stratum

Herbaceous

Species

*Pascopyrum smithii*, *Poa pratensis*, *Psoralea argophylla*

DIAGNOSTIC SPECIES

*Globally*

*Pascopyrum smithii*, *Carex filifolia*, *Bouteloua gracilis*, *Buchloe dactyloides*

*Jewel Cave National Monument*

*Pascopyrum smithii*

VEGETATION DESCRIPTION

*Globally*

This community is dominated by medium and short graminoids. Total vegetation cover is usually high (Hanson and Dahl 1956, Hansen et al. 1984.) The midgrass stratum is dominated by *Pascopyrum smithii*. Common associates include *Koeleria macrantha*, *Stipa comata*, and *Nassella viridula*. *Stipa comata* is more common on the upper slopes and drier upland sites while *Nassella viridula* is more common on the lower slopes and floodplains. Short graminoids are very abundant in this community. The most common are *Bouteloua gracilis* and *Carex filifolia*. Other upland sedges, such as *C. inops* ssp. *heliophila*, *C. eleocharis*, and *C. pensylvanica* are usually found with these. Forbs do not contribute much of the canopy cover but they are scattered throughout this community. Typical forbs are *Astragalus* spp., *Tragopogon dubius*, *Gaura coccinea*, *Hedeoma hispida*, *Lappula occidentalis*, and *Sphaeralcea coccinea*. Shrubs are a very minor component of the vegetation. The half-shrub *Artemisia frigida* is often present and some stands contain *Artemisia cana*, *Opuntia* spp., or *Symphoricarpos occidentalis*.

*Jewel Cave National Monument*

Herbaceous cover for this community was estimated between 25 and 75%. *Pascopyrum smithii* was found consistently. Other consistently-present graminoids include *Nassella viridula* and *Poa pratensis*. *Bouteloua gracilis* was a significant component in one stand but absent from another. Small stands of *Symphoricarpos occidentalis* are often present.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK G4

RANK JUSTIFICATION

DATABASE CODE CEGL001579

COMMENTS

*Globally*

Fire was likely a common event in this type historically.

This type was described from communities named as *Pascopyrum smithii* - *Bouteloua gracilis* or *Pascopyrum smithii* - *Carex filifolia*. It is unclear whether the *Pascopyrum smithii* - *Bouteloua gracilis* Herbaceous Vegetation overlaps with these descriptions.

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**Jewel Cave National Monument**

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## Poa pratensis Disturbed Community

COMMON NAME	Kentucky Bluegrass Disturbed Community
SYNONYM	Bluegrass Prairie
PHYSIOGNOMIC CLASS	Herbaceous vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/semi-natural (V.A.5.N)
FORMATION	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
ALLIANCE	Undefined
CLASSIFICATION CONFIDENCE LEVEL	3
USFWS WETLAND SYSTEM	Upland
RANGE	
<i>Globally</i>	Information not available.

### *Jewel Cave National Monument*

Mappable stands of this community are common throughout. Smaller patches occur in stands of *Pascopyrum smithii* - *Bouteloua* (curtipendula, gracilis) - *Carex flifolia* Herbaceous Vegetation or form mosaics with that type. *Poa pratensis* is present in many other vegetation types, but not dominant.

**USGS-NPS Vegetation Mapping Program**  
**Jewel Cave National Monument**

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ENVIRONMENTAL DESCRIPTION

*Globally*

Information not available.

*Jewel Cave National Monument*

This community was found on gentle slopes in valley bottoms and on slopes. It was found on all aspects.

MOST ABUNDANT SPECIES

*Globally*

Stratum                      Species

Information not available.

*Jewel Cave National Monument*

Stratum                      Species

Herbaceous                      Poa pratensis

DIAGNOSTIC SPECIES

*Globally*

Information not available.

*Jewel Cave National Monument*

*Poa pratensis*, strongly dominant

VEGETATION DESCRIPTION

*Globally*

Information not available.

*Jewel Cave National Monument*

This community is strongly dominated by *Poa pratensis*. Other graminoids may be present, including *Pascopyrum smithii* and *Nassella viridula*. Small stands of *Symphoricarpos occidentalis* often are present.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK GW

RANK JUSTIFICATION

The dominant species in this community is an invasive exotic. Thus, it falls under the definition of a GW ranking.

DATABASE CODE Information not available.

COMMENTS

REFERENCES

## Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Herbaceous Vegetation

COMMON NAME	Little Bluestem - Grama (Side-oats, Blue) - Threadleaf Sedge
SYNONYM	Northern Great Plains Little Bluestem Prairie
PHYSIOGNOMIC CLASS	Herbaceous vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/semi-natural (V.A.5.N)
FORMATION	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
ALLIANCE	<i>Schizachyrium scoparium - Bouteloua curtipendula</i> Herbaceous Alliance
CLASSIFICATION CONFIDENCE LEVEL	2
USFWS WETLAND SYSTEM	Upland

### RANGE

#### *Globally*

This community is found in western North Dakota, western South Dakota, eastern and northern Wyoming, central and eastern Montana, southern Saskatchewan, and southern Manitoba.

#### *Jewel Cave National Monument*

This community is best developed on the ridgecrest in the southwest part of the Monument, and in the area of the Pass Creek Road. Smaller stands occur throughout the study area, especially in openings in *Pinus ponderosa* / *Schizachyrium scoparium* Wooded Herbaceous Vegetation.

### ENVIRONMENTAL DESCRIPTION

#### *Globally*

This community is usually found on gentle to steep slopes with variable aspects (Thilenius 1972, Hansen et al. 1984, Johnston 1987, Hansen and Hoffman 1988). The soil may be loamy sand, sandy loam, loam, or clay loam. There may be a substantial component of gravel. Hansen et al. (1984) found 7-36% gravel by weight in 16 stands in western North Dakota. The soils are typically shallow and occur over sandstone or limestone (Johnston 1987, Thilenius et al. 1995).

#### *Jewel Cave National Monument*

Mappable stands of this vegetation type were found on gentle slopes with southerly exposures.

### MOST ABUNDANT SPECIES

#### *Globally*

<u>Stratum</u>	<u>Species</u>
Herbaceous	<i>Bouteloua curtipendula</i> , <i>Bouteloua gracilis</i> , <i>Carex filifolia</i> , <i>Schizachyrium scoparium</i>

#### *Jewel Cave National Monument*

<u>Stratum</u>	<u>Species</u>
Herbaceous	<i>Schizachyrium scoparium</i> , <i>Psoralea argophylla</i> , <i>Echinacea angustifolia</i>

### DIAGNOSTIC SPECIES

#### *Globally*

*Schizachyrium scoparium*, *Carex filifolia*, *Bouteloua gracilis*, *Andropogon gerardii*

**USGS-NPS Vegetation Mapping Program**  
**Jewel Cave National Monument**

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*Jewel Cave National Monument*  
*Schizachyrium scoparium*

**VEGETATION DESCRIPTION**

*Globally*

This community is predominantly composed of graminoid species less than 1 m tall. Occasional *Pinus ponderosa* are scattered throughout the type. The vegetation cover is moderate to high. Thilenius et al. (1995) found that vegetation cover was 44% in Wyoming and Hansen and Hoffman (1988) found 75% cover in North Dakota. The dominant species is *Schizachyrium scoparium* with *Bouteloua curtipendula*, *B. gracilis*, and *Carex filifolia* as associates or co-dominants. *Andropogon gerardii*, *Carex inops* ssp. *heliophila*, *C. eleocharis*, *Koeleria macrantha* and *Calamovilfa longifolia* are often present. *C. longifolia* may be abundant on sandier soils. *Muhlenbergia cuspidata*, *Stipa comata*, *Pascopyrum smithii*, and *Nassella viridula* may also be present. *Pseudoroegneria spicata* may be found in the western portions of this community (Jones 1992). In Manitoba, the graminoids *Festuca ovina* and *Elymus trachycaulus* and the lichen *Selaginella densa* are more abundant (Greenall 1995). Forbs do not contribute greatly to the canopy, but many species may be found in this community (Hanson and Whitman 1938). Among the forbs that may be found are *Echinacea angustifolia*, *Aster oblongifolius*, *A. ericoides*, *Gaura coccinea*, *Lygodesmia juncea*, *Helianthus pauciflorus* ssp. *pauciflorus*, *Rosa arkansana*, *Liatris punctata*, *Psoralea argophylla*, *Dalea purpurea*, *Phlox hoodii*, and *Campanula rotundifolia*. There are very few woody species; those that are present are usually short shrubs such as *Artemisa frigida*, *Juniperus horizontalis*, and *Yucca glauca*. Litter often accumulates and may cover more than 50% of the ground (Hirsch 1985).

*Jewel Cave National Monument*

Two mappable stands of this vegetation type were found. Herbaceous cover estimates were between 25 and 75% with *Schizachyrium scoparium* clearly dominant. This type is relatively species-rich with prairie graminoids and forbs well-represented.

**OTHER NOTEWORTHY SPECIES** Information not available.

**CONSERVATION RANK** G3

**RANK JUSTIFICATION**

**DATABASE CODE** CEGL001681

**COMMENTS**

*Globally*

Fire likely played a major role in this type. Periodic fire likely helped graminoid production and deterred tree growth.

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## **Pinus ponderosa / Schizachyrium scoparium Wooded Herbaceous Vegetation**

COMMON NAME	Ponderosa Pine / Little Bluestem Wooded Herbaceous Vegetation
SYNONYM	Ponderosa Pine / Little Bluestem Savanna
PHYSIOGNOMIC CLASS	Herbaceous vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland with a sparse tree layer (V.A.6)
PHYSIOGNOMIC SUBGROUP	Natural/semi-natural (V.A.6.N)
FORMATION	Medium-tall temperate or subpolar grassland with a sparse needle-leaved evergreen or mixed tree layer (V.A.6.N.f.)
ALLIANCE	<i>Pinus ponderosa</i> Wooded Medium-tall Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Upland

### **RANGE**

#### *Globally*

Currently reported from western Nebraska, South Dakota, and eastern Wyoming; it is unknown if it also occurs in Montana and Colorado.

**USGS-NPS Vegetation Mapping Program**  
**Jewel Cave National Monument**

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*Jewel Cave National Monument*

This community occurs throughout the Jewel Cave area. It is best developed on the north sides of drainages, such as Lithograph Canyon.

ENVIRONMENTAL DESCRIPTION

*Globally*

This community is found on loamy, sandy, or rocky soil. It is usually found on gentle to moderate slopes. Parent material is usually either sandstone or limestone (McAdams et. al 1998).

*Jewel Cave National Monument*

The larger stands of this community were observed on slopes ranging from 4 to 30 degrees, with most between 10 and 20 degrees. Aspect usually is southerly.

MOST ABUNDANT SPECIES

*Globally*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Pinus ponderosa</i> , <i>Juniperus scopulorum</i>
Short shrub	<i>Rhus trilobata</i> , <i>Symphoricarpos occidentalis</i>
Herbaceous	<i>Bouteloua gracilis</i> , <i>Carex filifolia</i> , <i>Schizachyrium scoparium</i>

*Jewel Cave National Monument*

<u>Stratum</u>	<u>Species</u>
Tree canopy	<i>Pinus ponderosa</i>
Subcanopy	<i>Juniperus scopulorum</i>
Short shrub	<i>Rhus trilobata</i>
Herbaceous	<i>Schizachyrium scoparium</i>

DIAGNOSTIC SPECIES

*Globally*

*Pinus ponderosa*, *Schizachyrium scoparium*, *Yucca glauca*, *Opuntia* spp.

*Jewel Cave National Monument*

*Pinus ponderosa*, *Schizachyrium scoparium*

VEGETATION DESCRIPTION

*Globally*

This community has scattered mature trees with a fairly continuous graminoid understory. *Pinus ponderosa* is the most abundant tree species, sometimes with *Juniperus scopulorum* present as small trees or tall shrubs. The most abundant graminoids in the understory are *Schizachyrium scoparium*, *Stipa comata*, *Carex filifolia*, *Bouteloua gracilis*, and *B. curtipendula*. *Calamovilfa longifolia* and *Koeleria macrantha* may be found on sandy soils in the eastern part of this community's range. Forbs that may be present include *Gaura coccinea*, *Psoraleidium lanceolatum*, and *Asclepias pumila*. In addition to the herbaceous species, shrubs such as *Symphoricarpos occidentalis*, *Rhus trilobata*, and *Cercocarpus montanus* are sometimes found in this community.

*Jewel Cave National Monument*

This community is dominated by *Pinus ponderosa* in the canopy, and by dry prairie graminoids in the understory with *Schizachyrium scoparium* consistently most abundant. *Juniperus scopulorum* (subcanopy) and *Rhus trilobata* (short shrub) are consistent components, though not abundant. Canopy cover typically is sparse, with few widely-spaced trees (this is easily seen in aerial photographs). The subcanopy and shrub strata typically are sparse or occasionally absent. Herbaceous cover typically ranges from 25 to 50%.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK G2G3

RANK JUSTIFICATION

**USGS-NPS Vegetation Mapping Program**  
**Jewel Cave National Monument**

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There are probably fewer than 100 occurrences in a restricted range in the northwestern Great Plains. Three occurrences are currently documented, one from South Dakota, and two from Nebraska. Over 8000 acres are currently documented, and at least that much is expected in other occurrences. Two of the currently documented occurrences are in fair condition; it seems likely that occurrences have been degraded by cattle grazing.

DATABASE CODE CEGL002019

COMMENTS

*Globally*

Periodic fires are probably important in maintaining the open grassland understory of this type.

*Jewel Cave National Monument*

In some areas, this community probably is an artifact of fire history, representing post-burn pine encroachment into little bluestem grassland.

This community also occurs in mosaics with the *Pinus ponderosa* / *Carex inops* ssp. *heliophila* Woodland.

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