USGS-NPS VEGETATION MAPPING PROGRAM

Classification of the Vegetation of Agate Fossil Beds National Monument

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1. VEGETATION SAMPLING AND CLASSIFICATION

Introduction

This report presents the results of the vegetation classification portion of the USGS-NPS Vegetation Mapping Program at Agate Fossil Beds National Monument. Sampling strategy and field methods are described for both plot and accuracy assessment 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 and accuracy assessment points are included as original field forms and in electronic form in the PLOTS database (a Microsoft Access database).

Methods

In general, the field methods used for developing the classification followed the standards outlined in the Field Methods for Vegetation Mapping document produced for this project. This began with the development of a preliminary vegetation classification based on literature review and an initial visit to the site. Names from the preliminary classification were used to identify polygons delineated from aerial photos. Due to the small size of the mapping area it was not deemed necessary to limit sampling to subsets of the whole area or to stratify it based on environmental or other factors. Although environmental information was not used to stratify the mapping area, data were collected from across a range of conditions on the mapping area to capture as much of the variation in the vegetation as possible. The field team performed a reconnaissance of the mapping area and the preliminary classification was refined before sampling began. Plot data were collected from across the entire mapping area, not just within the boundaries of Agate Fossil Beds NM. However, data collection outside the borders of the Monument was kept to a minimum to limit any possible complications with private landowners.

Within polygons, plots were subjectively placed in vegetation that was judged to be representative of the whole polygon. In some polygons this was difficult because dominant species were distributed in patches. In these cases, the patchiness was noted on the field forms. Total number of plots per vegetation type was related to areal coverage of each vegetation type, widespread types had more plots than those with limited distribution. The number of plots (39) varied from 0-5 per type, with an average of 3 per type. Plot size also varied with vegetation type. Woodland communities were sampled with 20 x 20 m plots while shrub and herbaceous dominated communities were sampled with 10 x 10 m plots.

Plots and observations by the field team were used to produce the final classification of Agate Fossil Beds NM. Field personnel organized the plots into groups based on vegetation structure and composition. Average cover of each species and vegetation stratum were computed. The plots 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 represent the variation of a type at Agate Fossil Beds NM, there was substantial variation within each type. In addition, the history of disturbance, especially in the floodplain of the Niobrara, has allowed invasive species to become established with the natural vegetation. 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.

Accuracy assessment data were collected following the procedures outlined in the Field Methods for Vegetation Mapping document produced for this project. The amount of data collected for each polygon was the same as that collected for observation points. 301 accuracy assessment points were collected from Aug. 26-Sept. 5, 1997. Points were placed along one of 30 transects crossing the mapping area.

Results

The classification of the vegetation at Agate Fossil Beds NM resulted in 13 types being defined, including one woodland type, two shrubland types, and 10 herbaceous types. Four of the herbaceous types are not placed within the National Vegetation Classification System (NVCS). Areas classified as these types are heavily dominated by exotic and/or invasive species. They are so disturbed that they cannot be accurately placed within the natural vegetation subgroup of the NVCS. Many types intergraded to some extent. Three were especially difficult to classify at times. *Calamovilfa longifolia - Andropogon gerardii* Herbaceous Vegetation and *Stipa comata - Bouteloua gracilis - Carex filifolia* were very similar in places. *Stipa comata - Bouteloua gracilis - Carex filifolia* Herbaceous Vegetation and *Schizachyrium scoparium - Bouteloua* (*curtipendula, gracilis*) - *Carex filifolia* Herbaceous Vegetation were also very difficult to distinguish in some places.

The classification of Agate Fossil Beds NM, placed within the NVCS, follows. A field key and descriptions for each of the types are included in later sections of this report.

II Woodland
- II.B Deciduous woodland
  - III.B.2 Cold-deciduous woodland
    - III.B.2.N Natural/semi-natural
      - III.B.2.N.b Temporarily flooded cold-deciduous woodland
        POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE
        Populus deltoides - (*Salix amygdaloides*) / *Salix exigua* Woodland

III Shrubland
- III.B Deciduous shrubland
  - III.B.2 Cold-deciduous shrubland
    - III.B.2.N Natural/semi-natural
      - III.B.2.N.d Temporarily flooded cold-deciduous shrubland
        SALIX EXIGUA TEMPORARILY FLOODED SHRUBLAND ALLIANCE
        Salix exigua Shrubland [Provisional]

        SYMPHORICARPOS OCCIDENTALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE
        Symphoricarpos occidentalis Shrubland [Provisional]

V Herbaceous
V.A Perennial graminoid vegetation
V.A.5 Temperate or subpolar grassland
V.A.5.N Natural/semi-natural
V.A.5.N.a Tall sod temperate grassland
CALAMOVILFA LONGIFOLIA HERBACEOUS ALLIANCE
Calamovilfa longifolia - Andropogon hallii Herbaceous Alliance

V.A.5.N.c Medium-tall sod temperate or subpolar grassland
PASCOPYRUM SMITHII HERBACEOUS ALLIANCE
Pascopyrum smithii Herbaceous Vegetation [Provisional]

SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE
Schizachyrium scoparium - Bouteloua (*curtipendula, gracilis*) - *Carex filifolia* Herbaceous Vegetation

STIPA COMATA - BOUTELOUA GRACILIS HERBACEOUS ALLIANCE
Stipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation

Stipa comata - Bouteloua gracilis Gravel Herbaceous Vegetation

V.A.5.N.k Seasonally flooded temperate or subpolar grassland
JUNCUS BALTICUS SEASONALLY FLOODED HERBACEOUS ALLIANCE
Juncus balticus Herbaceous Vegetation

V.A.5.N.l Semipermanently flooded temperate or subpolar grassland
TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCIRPUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE
Typha latifolia Western Herbaceous Vegetation

V.A.5.C Cultural
Formation undefined
ALLIANCE UNDEFINED
Seeded Grassland Community

ALLIANCE UNDEFINED
Upland Disturbance Community

V.D Annual graminoid or forb vegetation
V.D.2 Temperate or subpolar annual grasslands or forb vegetation
V.D.2.C Cultural
Formation undefined
ALLIANCE UNDEFINED
Annual-dominated Floodplain Disturbance Community

Conclusions

The vegetation of Agate Fossil Beds NM was classified using the techniques established for the USGS-NPS Vegetation Mapping Program. Most of the vegetation types were placed in the NVCS. Due to disturbance in some areas, some of the vegetation at Agate Fossil Beds NM did not closely match the more general, national description of the community into which it was placed. In addition, a few types did not fit within the current NVCS and retained park-specific names and descriptions. It is expected that these will be placed within a national hierarchy as the NVCS is further developed.

The general methods outlined for the USGS-NPS Vegetation Mapping Program worked well in this project. There were several factors which contributed to this. The first was that the field team had aerial photographs with preliminary polygons already delineated when they began fieldwork. This made choosing plot and observation point locations much more efficient than would otherwise have been the case, especially given the limited environmental data available. The second was that the field personnel had been involved in mapping other parks for this project. This eliminated the need for training and made for more efficient use of field time. Finally, the small size and relatively gentle terrain of the mapping area made many aspects of the field effort easier.

Contributors

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2. FIELD KEY TO THE PLANT COMMUNITIES OF AGATE FOSSIL BEDS NATIONAL MONUMENT

This key may not apply in grazed portions of the mapping area outside the monument

1. Site >25% vegetated by woody plants >0.5 m tall

    2. Dominant woody plant stratum >3 m tall.....**Populus deltoides - (Salix amygdaloides) / Salix exigua Woodland**

    2. Dominant woody plant stratum <3 m tall

        3. Willows (*Salix exigua, S. lutea*) dominant.....**Salix exigua Shrubland**

        3. Willows uncommon or absent

            4. Tallest stratum dominated by *Symphoricarpos occidentalis* .....**Symphoricarpos occidentalis Shrubland**

            4. Tallest stratum dominated by herbaceous plants or a mixture of herbaceous plants and shrubs.....**Juncus balticus Herbaceous Vegetation**

1. Site <25% vegetated by woody plants >0.5 m tall

    5. Site dominated by forbs (or nearly equal amounts of forbs and graminoids)

        6. Site dominated by annual forbs (*Atriplex heterosperma, Iva xanthifolia, Lactuca serriola, Helianthus* spp.)

            7. Site located in floodplain; *Atriplex heterosperma* or *Iva xanthifolia* usually abundant.....**Annual-dominated Floodplain Disturbance Community**

            7. Site located in uplands (usually valley bottoms); *Helianthus annuus, Lactuca serriola, Salsola* spp. usually abundant.....**Upland Disturbance Community**

        6. Site dominated or co-dominated by perennial forbs (or subshrubs <0.5 m tall), including *Artemisia frigida, Cirsium arvense, Glycyrrhiza lepidota, Gutierrezia sarothrae,* or *Solidago* spp.

            8. Slope of site >15%

                9. Forb density obviously > graminoid density. Unvegetated surface predominately of exposed rock .....**Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Herbaceous Vegetation**

                9. Forb density ≈ graminoid density

10. *Carex filifolia* and *Stipa comata* among the most common graminoids, overall vegetative cover usually >50%
Stipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation / Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Herbaceous Vegetation Mosaic

10. *Schizachyrium scoparium* and *Muhlenbergia pungens* generally more common than either *Carex filifolia* or *Stipa comata*, overall vegetative cover usually <50%..... **Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Herbaceous Vegetation**

8. Site nearly level (slope <10%)

11. Site densely vegetated (>90%), located in floodplain.....**Juncus balticus Herbaceous Vegetation**

11. Site sparsely to moderately vegetated (<70%), located in uplands

12. Site located in valley bottom.....**Stipa comata - Bouteloua gracilis Gravel Herbaceous Vegetation**

12. Site located on crest of hill

13. Forb density much > graminoid density, vegetative cover <50%**Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Herbaceous Vegetation**

13. Forb density ≤ graminoid density..... **Stipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation / Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Herbaceous Vegetation Mosaic**

5. Site dominated by graminoids

14. Site dominated by coarse aquatic graminoids >1.5 m tall (*Typha latifolia, Sparganium eurycarpum*), restricted to low places in floodplain.....**Typha latifolia Western Herbaceous Vegetation**

14. Site dominated by slender graminoids <1.5 m tall (grasses, sedges, rushes)

15. Site dominated by annual grasses (usually *Bromus tectorum*)..**Upland Disturbance Community**

15. Site dominated by perennial graminoids

16. *Carex filifolia* cover >10%, sites usually on hilltops and upper or middle slopes (sometimes low slopes and valley bottoms).....**Stipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation**

16. *Carex filifolia* cover <10%; sites on middle and lower slopes, valley bottoms, and floodplain

17. Sites dominated by non-native grasses (*Agropyron cristatum* or *Bromus inermis*).....**Seeded Grassland Community**

17. Sites dominated by native grasses

18. Sites present in uplands (including upper floodplain terraces which do not flood), usually dominated by grasses

19. *Calamovilfa longifolia* and/or *Stipa comata* dominant, mostly slopes and valley bottoms **Calamovilfa longifolia - Andropogon hallii Herbaceous Vegetation**

19. *Pascopyrum smithii* and/or *Poa pratensis* dominant, *Equisetum laevigatum* and *Cirsium floodmanii* commonly present, mostly upper floodplain terraces.....**Pascopyrum smithii Herbaceous Vegetation**

18. Sites restricted to floodplain and old river channels, sedges and/or rushes usually co-dominant .....**Juncus balticus Herbaceous Vegetation**

3. VEGETATION DESCRIPTIONS OF AGATE FOSSIL BEDS NATIONAL MONUMENT

Populus deltoides - (Salix amygdaloides) / Salix exigua Woodland

COMMON NAME	Eastern Cottonwood - Peach-Leaf Willow / Narrow-Leaf Willow Woodland
SYNONYM	Cottonwood - Peach-Leaf Willow Floodplain Woodland
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Deciduous woodland (II.B)
PHYSIOGNOMIC GROUP	Cold-deciduous woodland (II.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/semi-natural (II.B.2.N)
FORMATION	Temporarily flooded cold-deciduous woodland (II.B.2.N.b.)
ALLIANCE	*Populus deltoides* Temporarily Flooded Woodland Alliance

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Palustrine

RANGE
Globally
This community is found in southern Manitoba, North Dakota, South Dakota, central and western Nebraska, western Kansas, eastern Colorado, and Oklahoma. It may occur in Texas and New Mexico.

Agate Fossil Beds National Monument
This community is found in the floodplain of the Niobrara River in the western half of the Agate Fossil Beds National Monument.

ENVIRONMENTAL DESCRIPTION
Globally
This community is found along the banks of streams and rivers. It develops on newly deposited alluvium. The soils are predominantly sand, although silt, clay, or loam may be present. Soils are poorly developed (Steinauer 1989). The water table fluctuates with the level of the river or stream and flooding is common, especially in the spring.

Agate Fossil Beds National Monument
The community occurs on level or sloping ground on the banks or in old channels in the primary floodplain. Soils are fine sands and sandy loams that are somewhat poorly drained.

MOST ABUNDANT SPECIES
Globally

Stratum	Species
Tree canopy	*Populus deltoides*, *Salix amygdaloides*
Shrub	*Salix exigua*, *Symphoricarpos occidentalis*
Herbaceous	*Ambrosia psilostachya*, *Carex emoryi*, *Carex pellita*, *Equisetum arvense*, *Glycyrrhiza lepidota*, *Helianthus petiolaris*, *Pascopyrum smithii*, *Poa pratensis*, *Spartina pectinata*, *Sporobolus cryptandrus*

Agate Fossil Beds National Monument

Stratum	Species
Tree canopy	*Populus deltoides, Salix amygdaloides, S. fragilis*
Shrub	*Ribes aureum* var. *villosum, Symphoricarpos occidentalis*
Herbaceous	*Atriplex heterosperma, Bromus inermis, Carex pellita, Cirsium arvense, Iva xanthifolia, Poa pratensis*

DIAGNOSTIC SPECIES
Globally
Populus deltoides, Salix amygdaloides, Salix exigua

Agate Fossil Beds National Monument
Populus deltoides, Salix amygdaloides

VEGETATION DESCRIPTION
Globally
This community has an open tree canopy dominated by *Populus deltoides* and *Salix amygdaloides* which reach 6-12 m. *Salix amygdaloides* is absent to common in examples of this community. *Fraxinus pennsylvanica* may be present, especially on the upland side of this community, and *Elaeagnus angustifolia* or *Juniperus* spp. may invade some sites (Currier 1982). This woodland community typically has closely spaced shrubs and small trees. *Salix exigua* is usually more abundant along the streamside margins of this community and where the canopy of taller trees is most open. This shrub grows to 2-5 m tall. Other shorter shrubs that can be found are *Symphoricarpos occidentalis* and *Toxicodendron rydbergii*. Graminoids adapted to mesic sites dominate the understory of most sites, the most common species including *Carex emoryi, C. pellita, Elymus canadensis, Hordeum jubatum, Muhlenbergia racemosa, Pascopyrum smithii, Poa pratensis*, and *Spartina pectinata*. Forbs that are frequently abundant in relatively undisturbed sites include *Equisetum arvense* and *Glycyrrhiza lepidota*. Flooding often creates open patches in the herbaceous layer which are available for colonization by nearby species. The floristic composition of these patches is greatly affected by the species that are near and can invade the disturbed areas. Because of the high permeability of the sandy floodplain soils, species typical of upland prairie may invade in addition to annual forbs typical of disturbed sites. Widely distributed species that are adapted to these sites include *Ambrosia psilostachya, Artemisia campestris* ssp. *caudata, A. ludoviciana, Calamovilfa longifolia, Cenchrus longispinus, Euphorbia serpyllifolia, Grindelia squarrosa, Helianthus petiolaris, Heterotheca villosa, Lippia lanceolata, Opuntia macrorhiza*, and *Sporobolus cryptandrus*. These sites are prone to invasion by exotic grasses and forbs, the most widely established being *Agrostis stolonifera, Bromus tectorum, Cirsium arvense, Kochia scoparia, Melilotus* spp., *Taraxacum officinale,* and *Tragopogon dubius* (Hefley 1937, Jones and Walford 1992).

Agate Fossil Beds National Monument
Locally, this community consists of open stands of large willows (*Salix amygdaloides* or *S. fragilis*) 10-20 m tall with occasional cottonwoods (*Populus deltoides*) interspersed. There is no regeneration of these species, nor recruitment of other arboreal species in this community on the Monument. The shrub layer is sparse and contains species typical of *Pascopyrum smithii* Herbaceous Vegetation, such as *Ribes aureum* var. *villosum* and *Symphoricarpos occidentalis*. Herbaceous understory is variable and contains species typical of Annual-dominated Floodplain Disturbance Community, *Pascopyrum smithii* Herbaceous Vegetation, and *Juncus balticus* Herbaceous Vegetation. The most common graminoids are *Carex pellita, Pascopyrum smithii,* and *Poa pratensis.* In some places these species dominate the herbaceous layer, while in others they serve as understory beneath a layer of tall annual and perennial forbs including *Atriplex micrantha, Cirsium arvense, Iva xanthifolia, Glycyrrhiza lepidota,* and *Lactuca serriola.* Species diversity is moderate to relatively high.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK G2G3

RANK JUSTIFICATION Although the habitat for this community is relatively abundant, in the absence of regular flooding many sites undergo succession to later seral stages. Other sites are overgrazed and invaded by exotic woody and herbaceous species.

DATABASE CODE CEGL000659

COMMENTS
Globally
Restoring natural flooding regimes in areas where water levels have been lowered will help maintain this community type (Burgess *et al*. 1973, Bellah and Hulbert 1974). Occasional spring burning to control exotic species may also prove beneficial.

Agate Fossil Beds National Monument
Sites of this community occurring along the west boundary of the Monument are an extension of the plantings made at the Agate Springs Ranch around the turn of the century. The cottonwoods there are certainly planted, but *Salix fragilis* may be present there as an escape. The woodland on the east side of the grazed inholding is certainly naturally occurring, and is dominated almost entirely by *Salix amygdaloides*. Other naturally-occurring woodlands are present in the survey area east of the Monument boundary.

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Salix exigua Shrubland [Provisional]

COMMON NAME	Narrow-Leaf Willow Shrubland
SYNONYM	Sandbar Willow 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 *Salix exigua* Temporarily Flooded Shrubland Alliance

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Palustrine

RANGE
Globally
This community is found along rivers and streams in Oregon, Washington, Idaho, Montana, southern Manitoba, Wyoming, Colorado, Oklahoma, Nebraska, South Dakota. It probably extends into North Dakota.

Agate Fossil Beds National Monument
This community occurs along the Niobrara River primarily in the eastern half of the Monument.

ENVIRONMENTAL DESCRIPTION
Globally
This community is found near lakes and streams on recently deposited or disturbed alluvial material. The parent material is alluvial sand, although silt, clay, or gravel may be present. Soil development is poor to absent (Steinauer 1989).

Agate Fossil Beds National Monument
This community occurs on lower floodplain terraces, usually bordering the river. Soils are sandy loams overlying sand and are poorly to somewhat poorly drained.

MOST ABUNDANT SPECIES
Globally

Stratum	Species
Shrub	*Salix exigua*
Herbaceous	*Carex pellita, Scirpus americanus*

Agate Fossil Beds National Monument

Stratum	Species
Shrub	*Salix exigua* var. *interior, Salix lutea* var. *famelica, Ribes americanum*
Herbaceous	*Agrostis stolonifera, Carex pellita, Juncus balticus*

DIAGNOSTIC SPECIES
Globally
Salix exigua

Agate Fossil Beds National Monument
Echinocystis lobata, Ribes americanum, Salix exigua var. *interior, S. lutea* var. *famelica*

VEGETATION DESCRIPTION

Globally
The dominant vegetation in this community is short shrubs, usually not more than 4 meters tall. The most common of these is *Salix exigua*. *Salix irrorata* and saplings of *Populus deltoides* or *S. amygdaloides* are also frequently found in the shrub layer. This stratum can have moderate to high stem density in the community as a whole (Bellah and Hulbert 1974). The species in the shrub layer do not form a closed canopy, allowing significant light to reach the groundlayer. There are often patches where the shrub layer is absent. The herbaceous cover is sparse to moderate. Older stands and places with less competition from the shrubs have greater herbaceous cover (Wilson 1970). The composition of the herbaceous layer can vary greatly. Species that are often found in this community are *Carex pellita*, *Cenchrus longispinus*, *Polygonatum lapathifolium*, *Scirpus americanus*, *Triglochin maritimum*, and *Xanthium strumarium*.

Agate Fossil Beds National Monument
This community is dominated by a dense to usually slightly open stand of *Salix exigua* 1-2 m tall, with *Salix lutea* sometimes present in older stands. A sparse short-shrub underlayer of *Ribes americanum* is sometimes additionally present in these older stands. The herbaceous understory is often fairly dense and consists primarily of graminoids common to *Juncus balticus* Herbaceous Vegetation, including *Agrostis stolonifera, Carex pellita, Juncus balticus, Leersia oryzoides, Muhlenbergia mexicana*, and *Scirpus pungens*. Forb species frequently present include *Bidens frondosa, Cicuta maculata, Epilobium leptophyllum, Lycopus americanus*, and *Mentha arvensis*. Species diversity is relatively high.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK G5Q

RANK JUSTIFICATION

DATABASE CODE CEGL001197

COMMENTS
Agate Fossil Beds National Monument
This community is best developed near the eastern end of the Monument. No occurrences were seen on grazed lands bordering the Monument.

REFERENCES
Bellah, R. G. and L. C. Hulbert. 1974. Forest succession on the Republican River floodplain in Clay County, Kansas. The Southwestern Naturalist 19(2):155-166.

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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 *Symphoricarpos occidentalis* Temporarily Flooded Shrubland Alliance

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Upland

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

Agate Fossil Beds National Monument
The only mapped occurrence of this community is found in the grazed inholding in the western half of the Monument. Small, poorly-developed examples are scattered throughout higher portions of the *Juncus balticus* Herbaceous Vegetation but are most common in the western half of the Monument.

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).

Agate Fossil Beds National Monument
This community occurs on better-drained portions of the lower floodplain terraces. Soils are fine sands or sandy loams that are somewhat poorly drained.

MOST ABUNDANT SPECIES
Globally

Stratum	Species
Shrub	*Symphoricarpos occidentalis, Rhus aromatica, Prunus virginiana*
Herbaceous	*Pascopyrum smithii, Poa pratensis, Galium boreale*

Agate Fossil Beds National Monument

Stratum	Species
Shrub	*Ribes aureum* var. *villosum, Symphoricarpos occidentalis*
Herbaceous	*Parietaria pensylvanica, Poa pratensis, Urtica dioica* ssp. *gracilis*

DIAGNOSTIC SPECIES
Globally
Symphoricarpos occidentalis, Pascopyrum smithii

Agate Fossil Beds National Monument
Ribes aureum var. *villosum, 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 (Hansen *et al.* 1984, Hanson and Hoffman 1987).

Agate Fossil Beds National Monument
This community is densely vegetated by *Symphoricarpos occidentalis*, with a few plants of *Ribes aureum* var. *villosum* often also scattered among them. The understory is often relatively sparse and dominated by *Poa pratensis*, with a few annual species such as *Parietaria pensylvanica*. Species diversity is relatively low.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK G4G5

RANK JUSTIFICATION

DATABASE CODE CEGL001131

COMMENTS
Agate Fossil Beds National Monument
The only area in the survey boundary that is large enough to map is located in a grazed area. In ungrazed areas, *Symphoricarpos occidentalis* occurs among tall weedy forbs such as *Cirsium arvense* and *Iva xanthifolia*, making them difficult to distinguish as shrubland on aerial photographs.

REFERENCES
Hansen, P. L. and G. R. Hoffman. 1987. 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.

Hansen, P. L., G. R. Hoffman, and A. J. Bjugstad. 1984. The vegetation of Theodore Roosevelt National Park, North Dakota: A habitat type classification. General Technical Report RM-113, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins CO. 35 pp.

Jones, G. P. 1995. Major riparian vegetation types of eastern Wyoming. A Report Submitted to the Wyoming Department of Environmental Quality, Water Quality Division. Grant no. 9-01136. 244 pp.

Calamovilfa longifolia - Andropogon hallii Herbaceous Vegetation

COMMON NAME	Prairie Sandreed - Sand Bluestem Herbaceous Vegetation
SYNONYM	Prairie Sandreed - Sand 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 Tall sod temperate grassland (V.A.5.N.a.)

ALLIANCE *Calamovilfa longifolia* Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Upland

RANGE
Globally
This community is found in eastern Montana, western Nebraska, South Dakota, North Dakota, southern Saskatchewan, and southern Manitoba.

Agate Fossil Beds National Monument
This community occurs throughout the Monument.

ENVIRONMENTAL DESCRIPTION
Globally
This community is found on sandy deposits, usually on gentle to moderate slopes (Johnston 1987). The soil is sand, loamy sand, or sandy loam and often erodible. Hirsch (1985) reported that stands of this type in southwestern North Dakota were small, generally less than 400 m^2.

Agate Fossil Beds National Monument
This community occurs primarily on lower slopes and in valley bottoms. Soils are mostly fine sands and loamy fine sands.

MOST ABUNDANT SPECIES
Globally

Stratum	Species
Herbaceous	*Andropogon hallii, Bouteloua gracilis, Calamovilfa longifolia, Stipa comata*

Agate Fossil Beds National Monument

Stratum	Species
Herbaceous	*Andropogon hallii, Artemisia frigida, Bouteloua gracilis, Calamovilfa longifolia, Helianthus petiolaris, Sporobolus cryptandrus, Stipa comata*

DIAGNOSTIC SPECIES
Globally
Calamovilfa longifolia, Andropogon hallii

Agate Fossil Beds National Monument
Calamovilfa longifolia, Erigeron bellidiastrum, Mirabilis hirsuta, M. linearis, Stipa comata, Tradescantia occidentalis

VEGETATION DESCRIPTION
Globally

This community is dominated by moderately widely spaced midgrasses. Hirsch (1985) found that bare ground and litter covered 84-93% of the ground in 4 stands in southwestern North Dakota. The most abundant species is *Calamovilfa longifolia*. *Andropogon hallii* is common to co-dominant. Other graminoids that may be found in this community include *Schizachyrium scoparium, Carex eleocharis, C. filifolia, C. inops* ssp. *heliophila, Stipa comata, Koeleria macrantha, Muhlenbergia pungens,* and *Bouteloua gracilis*. Forbs and shrubs are a minor component of the total vegetation. *Psoralidium lanceolatum, Liatris punctata, Lithospermum incisum, Lappula occidentalis* var. *occidentalis*, and *Lygodesmia juncea* may occur in this community. *Artemisia frigida* and *Yucca glauca* are the most common shrubs.

Agate Fossil Beds National Monument
This community is dominated by mid and tall grasses 0.5-1.5 m tall, the most common being *Calamovilfa longifolia* and *Stipa comata*. In level valley bottoms and on floodplain terraces, *Pascopyrum smithii* may also be common. Small inclusions of upland disturbance (primarily gopher mounds) are common throughout ungrazed portions of this community and include *Artemisia frigida* and *Helianthus petiolaris*. Forb density and diversity is often fairly low in undisturbed examples of this community, among the more commonly encountered species are *Lactuca serriola, Lithospermum incisum, Lupinus plattensis, Lygodesmia juncea, Mirabilis hirsuta*, and *Tradescantia occidentalis*.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK G3

RANK JUSTIFICATION

DATABASE CODE CEGL001469

COMMENTS
Agate Fossil Beds National Monument
On upper floodplain terraces, this community may intergrade with *Pascopyrum smithii* Herbaceous Vegetation. Heavily grazed examples of this community are often dominated by *Bouteloua gracilis* and are difficult to distinguished from similarly-grazed *Stipa comata - Bouteloua gracilis - Carex filifolia* Herbaceous Vegetation. The presence of large patches of *Calamovilfa longifolia* among the *Bouteloua gracilis* will distinguish this community from others.

REFERENCES
Hirsch, K. J. 1985. Habitat type classification of grasslands and shrublands of southwestern North Dakota. Ph. D. Thesis, North Dakota State University, Fargo. 281 p.

Johnston, B. C. 1987. Plant associations of regions two. R2-ECOL-87-2. USDA Forest Service, Rocky Mountain Region, Lakewood, CO. 429 p.

Pascopyrum smithii Herbaceous Vegetation [Provisional]

COMMON NAME	Western Wheatgrass Herbaceous Vegetation [Provisional]
SYNONYM	Western Wheatgrass Mixedgrass 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 (includes sod or mixed sod-bunch graminoids) (V.A.5.N.c.)

ALLIANCE *Pascopyrum smithii* Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Upland

RANGE
Globally
This community is found in Montana, Wyoming, Colorado, Idaho, Utah, Nebraska, Saskatchewan, and possibly North Dakota.

Agate Fossil Beds National Monument
This community occurs on higher terraces throughout the length of the Monument.

ENVIRONMENTAL DESCRIPTION
Globally
This community occurs on flat to gently sloping topography. Soils are clay, clay loam, and silt loam. It is sometimes found on alluvial fans of small streams. The soils are deep (40-100 cm) and well developed (Godfread 1994).

Agate Fossil Beds National Monument
This community occurs on fairly level ground on high terraces on either side of the river. Soils are fine sands and loamy fine sands.

MOST ABUNDANT SPECIES
Globally

Stratum	Species
Herbaceous	*Pascopyrum smithii*,

Agate Fossil Beds National Monument

Stratum	Species
Herbaceous	*Artemisia frigida, Cirsium flodmanii, Equisetum laevigatum, Pascopyrum*

DIAGNOSTIC SPECIES
Globally
Pascopyrum smithii

Agate Fossil Beds National Monument
Cirsium flodmanii, Equisetum laevigatum, Pascopyrum smithii

VEGETATION DESCRIPTION
Globally
This is a midgrass community. Shrubs are rare. The dominant species grow to approximately 1 meter. *Pascopyrum smithii* is the only constant dominant species and may have 50% cover. Other species such as *Koeleria macrantha* and *Poa* spp. may be locally abundant. Many other species common in midgrass prairies are also found in this community. These include *Artemisia ludoviciana*, *Bouteloua gracilis*, *Nassella viridula*, and *Stipa comata* (Aldous 1924)

Agate Fossil Beds National Monument
This community is dominated by a relatively dense layer of graminoids ca 1 m tall. The dominant graminoids are *Pascopyrum smithii* and *Poa pratensis*, though sometimes species from bordering *Calamovilfa longifolia - Andropogon gerardii* Herbaceous Vegetation (*Calamovilfa longifolia, Stipa comata*) and *Juncus balticus* Herbaceous Vegetation (*Juncus balticus, Panicum virgatum*) are well-represented. *Equisetum laevigatum*, the only pteridophyte present on the Monument, is often abundant. *Cirsium flodmanii* is the most conspicuous forb and is mostly restricted to this community on the Monument. Other forb species include exotic annual weeds and species typical of surrounding communities. Species diversity is moderate.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK G3G5Q

RANK JUSTIFICATION

DATABASE CODE CEGL001577

COMMENTS
Globally
This community is similar to several others that are dominated or co-dominated by *Pascopyrum smithii*. Further work needs to be done to refine the differences in composition and environmental characteristics.

Agate Fossil Beds National Monument
In grazed areas, this community is usually very heavily impacted by cattle. In these sites, the forb component increases greatly. Grazed *Pascopyrum smithii* Herbaceous Vegetation surrounding the Monument often has high densities of *Artemisia frigida*, *Cirsium flodmanii*, and *Senecio riddellii*.

REFERENCES
Aldous, A. E. 1924. Types of vegetation in the semiarid portion of the United States and their economic significance. Journal of Agricultural Research 28(2):99-123.

Godfread, C. 1994. The vegetation of the Little Missouri Badlands of North Dakota. Pp. 17-24 In C. H. Schmidt (ed.) Proceedings of the Leafy Spurge Strategic Planning Workshop, Dickinson, ND.

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

COMMON NAME	Little Bluestem - Grama (Side-oats, Blue) - Threadleaf Sedge Herbaceous
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 (includes sod or mixed sod-bunch graminoids) (V.A.5.N.c.)
ALLIANCE	*Schizachyrium scoparium - Bouteloua curtipendula* Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Upland

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

Agate Fossil Beds National Monument
This community occurs in uplands throughout the Monument.

ENVIRONMENTAL DESCRIPTION
Globally
This community is usually found on moderate to steep slopes with variable aspects (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).

Agate Fossil Beds National Monument
This community occurs on shoulders of flat-topped hills and on eroding sandstone slopes on the sides of hills. Hilltop outcrops are nearly level and consist predominately of small rock fragments, whereas those on eroded hillsides consist primarily of bedrock and small rock fragments. Soils are poorly developed or absent.

MOST ABUNDANT SPECIES
Globally

Stratum	Species
Herbaceous	*Schizachyrium scoparium, Bouteloua gracilis, Bouteloua curtipendula, Carex filifolia*

Agate Fossil Beds National Monument

Stratum	Species
Herbaceous	*Arenaria hookeri, Cryptantha cana, Erigeron ochroleucus* var. *scribneri, Muhlenbergia pungens, Musineon tenuifolium, Paronychia depressa, Schizachyrium scoparium, Tetraneuris acaulis*

DIAGNOSTIC SPECIES
Globally
Schizachyrium scoparium, Bouteloua gracilis, Bouteloua curtipendula, Carex filifolia

Agate Fossil Beds National Monument
Arenaria hookeri, Cryptantha cana, Erigeron ochroleucus var. *scribneri, Lesquerella alpina, Musineon tenuifolium, Paronychia sessiliflora, Stenotus armerioides*

VEGETATION DESCRIPTION
Globally

This community is predominantly composed of graminoid species less than 1 m tall. 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. *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, Psoralidium argophyllum, 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).

Agate Fossil Beds National Monument
Most areas are relatively sparsely vegetated, with vegetative cover ranging from ca 25-50%. Level outcrops with no soil developed are dominated by dwarf, cespitose perennial forbs including *Arenaria hookeri, Erigeron ochroleucus, Paronychia depressa, P. sessiliflora, Phlox hoodii* ssp. *muscoides,* and *Stenotus armerioides*. The only common graminoid in these sites is *Muhlenbergia cuspidata*. Where shallow soils have developed, *Stipa comata - Bouteloua gracilis - Carex filifolia* Herbaceous Vegetation occurs as mosaic patches. On eroding slopes, graminoids are far more common, including *Bouteloua gracilis, Muhlenbergia pungens,* and *Schizachyrium scoparium*. These sites typically have more soil development Species diversity is moderate.

OTHER NOTEWORTHY SPECIES
Agate Fossil Beds National Monument
Several species occurring in this community are of biogeographic interest, since they are common in similar habitats in the vicinity of the southwest corner of the Nebraska Panhandle, and are evidently disjunct northward at the Monument. These include *Lesquerella alpina, Paronychia sessiliflora, Phlox hoodii* ssp *muscoides,* and *Stenotus armerioides*.

CONSERVATION RANK G3

RANK JUSTIFICATION

DATABASE CODE CEGL001681

COMMENTS
Agate Fossil Beds National Monument
This community has less vegetation cover at the Monument than is typical throughout its range. It may be desirable to separate the irregular rock outcrops from the level rock outcrops, but more sampling is needed to specifically address this problem.

REFERENCES
Greenall, J. A. 1995. Draft element descriptions for natural communities of southern Manitoba (prairie and parkland regions). Manitoba Conservation Data Centre, Winnipeg. 17 p.

Hansen, P. L., G. R. Hoffman, and A. J. Bjugstad. 1984. The vegetation of Theodore Roosevelt National Park, North Dakota: A habitat type classification. General Technical Report RM-113. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 35 p.

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.

Hanson, H. C. and W. Whitman. 1938. Characteristics of major grassland types in western North Dakota. Ecological Monographs 8(1):58-114.

Hirsch, K. J. 1985. Habitat type classification of grasslands and shrublands of southwestern North Dakota. Ph. D. Thesis, North Dakota State University, Fargo. 281 p.

Johnston, B. C. 1987. Plant associations of region two. R2-ECOL-87-2. USDA Forest Service, Rocky Mountain Region, Lakewood, CO. 429 p.

Jones, G. 1992. Wyoming plant community classification. Unpublished draft. Wyoming Natural Diversity Database, The Nature Conservancy, Laramie, WY.

Thilenius, J. F., G. R. Brown, and A. L. Medina. 1995. Vegetation on semi-arid rangelands, Cheyenne River basin, Wyoming. General Technical Report RM-GTR-263. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 60 p.

Stipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation

COMMON NAME	Needle-and-Thread - Blue Grama - Threadleaf Sedge Herbaceous Vegetation
SYNONYM	Needle-And-Thread - Blue Grama Mixedgrass 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 (includes sod or mixed sod-bunch graminoids) (V.A.5.N.c.)
ALLIANCE	*Stipa comata - Bouteloua gracilis* Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Upland

RANGE
Globally
This community is common in Montana, Wyoming, and is in Nebraska, North Dakota, South Dakota, southern Saskatchewan, and southern Manitoba.

Agate Fossil Beds National Monument
This community is found away from the floodplain throughout the Monument.

ENVIRONMENTAL DESCRIPTION

Globally

This community is found on flat to gently sloping sites, predominantly with sandy loam or loam soil. The soil is typically 40-100 cm deep (Hanson and Whitman 1938, Hansen *et al*. 1984).

Agate Fossil Beds National Monument

This community occurs primarily on upper slopes and flat summits of hills, but in some areas also on lower slopes and in valley bottoms. Soils are fine sands and fine loamy sands and are often shallow and rocky.

MOST ABUNDANT SPECIES

Globally

Stratum	Species
Herbaceous	*Stipa comata, Bouteloua gracilis, Carex filifolia*

Agate Fossil Beds National Monument

Stratum	Species
Herbaceous	*Bouteloua gracilis, Calamovilfa longifolia, Carex filifolia, Gutierrezia sarothrae, Stipa*

DIAGNOSTIC SPECIES

Globally

Herbaceous	*Stipa comata, Bouteloua gracilis, Carex filifolia*

Agate Fossil Beds National Monument

Astragalus missouriensis, Carex filifolia, Heterotheca villosa var. villosa, Phlox andicola, Stipa comata

VEGETATION DESCRIPTION

Globally

This midgrass prairie community is dominated by graminoids that are usually between 0.5 and 1 m tall. The vegetation cover is moderate. The dominant species are *Bouteloua gracilis*, *Carex filifolia*, and *Stipa comata*. *S. comata* usually has the most coverage of any single species. *Carex duriuscula* is not always present but is abundant at some sites. Forbs that are typical of this community are *Heterotheca villosa* var. *villosa*, *Guara coccinea*, *Liatris punctata*, and *Phlox hoodii*. Sandier areas often have *Calamovilfa longifolia* present. Shrubs rarely grow taller than the grasses, but *Artemisia frigida* is very common in this community. Other grasses that are likely to be present are *Aristida purpurea* var. *longiseta*, *Koeleria macrantha*, and *Sporobolus cryptandrus*. On 19 stands in west-central Montana the cover by the different strata was as follows: shrubs - 6%, graminoids - 67%, forbs - 11%, bryophytes - 14%, litter - 55%, rock 4%, bare soil - 9% (Mueggler and Stewart 1978). Thilenius *et al*. (1995) found that the average cover on 14 stands in eastern Wyoming was 42%. Tolstead (1942) described this community as the climax on the level lands of the northern part of Cherry County, Nebraska.

Agate Fossil Beds National Monument

This is a midgrass prairie community dominated by graminoids < 1 m tall. *Carex filifolia* dominates, with *Stipa comata* often common. *Calamovilfa longifolia* and *Schizachyrium scoparium* are locally common on steeper slopes. Frequently this community occurs on detrital upper slopes of hills where a sparse short shrub layer of *Rhus trilobata* and *Yucca glauca* are often present. Common forbs include *Astragalus* spp., *Heterotheca villosa* var. *villosa*, *Psoralidium lanceolatum*, *P. tenuiflorum*, and *Senecio riddellii*. The subshrubs *Artemisia frigida* and *Gutierrezia sarothrae* may be common in disturbed and heavily-grazed sites.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK G3G4

RANK JUSTIFICATION

DATABASE CODE CEGL002037

COMMENTS
Agate Fossil Beds National Monument
In heavily grazed sites, *Bouteloua gracilis* may displace *Carex filifolia* and *Stipa comata*. *Gutierrezia sarothrae* is an indicator of overgrazing in this community.

REFERENCES
Hansen, P. L., G. R. Hoffman, and A. J. Bjugstad. 1984. The vegetation of Theodore Roosevelt National Park, North Dakota: A habitat type classification. General Technical Report RM-113. USDA Forest Service, Rocky Mountains Forest and Range Experiment Station, Fort Collins, CO. 35 p.

Hanson, H. C. and W. Whitman. 1938. Characteristics of major grassland types in western North Dakota. Ecological Monographs 8(1):58-114.

Mueggler, W. F. and W. L. Stewart. 1978. Grassland and shrubland habitat types of western Montana. USDA Forest Service General Technical Report INT-66. Intermountain Forest and Range Experiment Station, Ogden, UT. 154 pp.

Thilenius, J. F., G. R. Brown, and A. L. Medina. 1995. Vegetation on semi-arid rangelands, Cheyenne River basin, Wyoming. General Technical Report RM-263. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 60 p.

Tolstead, W. L. 1942. Vegetation of the northern part of Cherry County, Nebraska. Ecological Monographs 12(3):256-292.

Stipa comata - Bouteloua gracilis Gravel Herbaceous Vegetation

COMMON NAME	Needle-and-thread Grass - Blue Grama Gravel Herbaceous Vegetation
SYNONYM	Gravel Wash
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 (includes sod or mixed sod-bunch graminoids) (V.A.5.N.c.)
ALLIANCE	*Stipa comata - Bouteloua gracilis* Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Upland

RANGE
Globally
This community has only been identified at Agate Fossil Beds National Monument. It is likely to occur elsewhere, but needs further review.

Agate Fossil Beds National Monument
This community occurs primarily in draws among the south hills and is scattered throughout the length of the Monument.

ENVIRONMENTAL DESCRIPTION
Globally Information not available.

Agate Fossil Beds National Monument
This community occurs in the bottoms of narrow draws and is made up of small rock fragments and sand presumably washed in following heavy rains. Soils are shallow and poorly developed.

MOST ABUNDANT SPECIES
Globally
Information not available.

Agate Fossil Beds National Monument

Stratum	Species
Herbaceous	*Artemisia frigida, Bouteloua gracilis, Gutierrezia sarothrae, Heterotheca villosa* var.

DIAGNOSTIC SPECIES
Globally
Information not available.

Agate Fossil Beds National Monument
Aristida purpurea var. *longiseta, Artemisia frigida, Gutierrezia sarothrae*

VEGETATION DESCRIPTION
Globally Information not available.

Agate Fossil Beds National Monument
This community is mostly 30-60% vegetated and dominated by a combination of grasses and forbs typical of upland prairie slopes. *Artemisia frigida* and *Gutierrezia sarothrae* are the most conspicuous components of this community. Other frequently-encountered species include *Calamovilfa longifolia, Calylophus serrulatus, Dalea candida* var. *oligophylla, Elymus elymoides, Paronychia depressa, Phacelia hastata* var. *hastata,* and *Psoralidium tenuiflorum.*

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE

COMMENTS
Agate Fossil Beds National Monument
This community appears similar to *Stipa comata - Bouteloua gracilis - Carex filifolia* Herbaceous Vegetation, but the topographic position, composition, and soil type are all somewhat different from most stands of that type. Further work needs to be done on the classification of this community. The stands assigned to it at Agate Fossil Beds NM do not fit well with any existing community. Thus, they have been placed in a new community, but they need to be compared to other community descriptions as those are developed to establish their distinctiveness or that they fall within the normal range of variation of an existing community.

Because of the narrow, linear nature of this community, it is underrepresented on the vegetation map.

REFERENCES

Juncus balticus Herbaceous Vegetation

COMMON NAME	Baltic Rush Herbaceous Vegetation
SYNONYM	Baltic Rush Wet Meadow
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	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)
ALLIANCE	*Juncus balticus* Seasonally Flooded Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Palustrine

RANGE
Globally
This community is found in Montana, Idaho, Oregon, Washington, Nevada, Utah, New Mexico, Colorado, Wyoming, extreme western Nebraska, and maybe California.

Agate Fossil Beds National Monument
This community is found along the Niobrara River throughout the length of the Monument.

ENVIRONMENTAL DESCRIPTION
Globally
This community has been described in eastern Wyoming as found at low elevations (<8000 ft) on flat to gently sloping ground near seeps or meandering streams. Soils are usually sandy clay loam or fine sands and mottled or gleyed (Jones and Walford 1995).

Agate Fossil Beds National Monument
This community occurs on both lower and higher portions of the lower terraces along the river and in abandoned river channels throughout the floodplain. Soils are fine sands and fine sandy loams, and may contain muck in the lowest, mostly saturated portions. Soils may range from not noticeably alkaline to moderately alkaline, and are somewhat poorly to very poorly drained.

MOST ABUNDANT SPECIES
Globally

Stratum	Species
Herbaceous	*Juncus balticus*, *Carex praegracilis*, *Carex nebrascensis*

Agate Fossil Beds National Monument

Stratum	Species
Herbaceous	*Agrostis stolonifera, Calamagrostis stricta, Carex nebrascensis, C. pellita, C.*

DIAGNOSTIC SPECIES
Globally
Juncus balticus, Carex praegracilis, Carex nebrascensis

Agate Fossil Beds National Monument
Carex nebrascensis, C. pellita, Cicuta maculata, Hordeum jubatum, Juncus balticus, Muhlenbergia asperifolia, Panicum virgatum

VEGETATION DESCRIPTION
Globally
This community is dominated by a heavy cover of herbaceous vegetation approximately 0.5 m tall. *Juncus balticus* is the most abundant of these, but *Carex praegracilis, C. nebrascensis, Hordeum jubatum,* and *Agrostis stolonifera* can be common. *Salix* spp. are the most common woody species found, but are not abundant.

Agate Fossil Beds National Monument
This community is by far the most heterogeneous of any recorded on the Monument. It is generally dominated by graminoids 0.5-1 m tall, though numerous places are dominated by perennial forbs. Species composition varies with soil moisture and alkalinity. Areas along the river which are mostly saturated are dominated by *Carex nebrascensis, Eleocharis erythropoda,* and *Leersia oryzoides* and usually occupy narrow bands along the river margin (or at the margin of marshes). The area surrounding these sites, which are not saturated but which have a very high water table are dominated by *Carex pellita* and *Juncus balticus*, the former often producing near monocultures in wet swales. Slightly drier areas within the community are often slightly alkaline as well, and are dominated by various combinations of *Carex pellita, C. praegracilis, Elymus trachycaulus, Hordeum jubatum, Juncus balticus, Muhlenbergia asperifolia, Panicum virgatum,* and *Spartina gracilis*. The most noticeably alkaline areas occur at the margin of the floodplain meadow community and contain *Distichlis spicata* in addition to *Muhlenbergia asperifolia, Carex praegracilis,* and *Spartina gracilis*. Salt crusts are seldom present.

Forb species may dominate in higher portions of this community. In the western half of the Monument, open shrubby patches of *Symphoricarpos occidentalis* may be present among coarse forbs such as *Cirsium arvense, Glycyrrhiza lepidota, Solidago canadensis,* and *Sonchus arvensis* ssp. *uliginosus*. In other places these forbs occur as dense stands with, or sometimes to the near exclusion of the graminoid layer. Species diversity is moderate to high.

OTHER NOTEWORTHY SPECIES
Agate Fossil Beds National Monument
Spiranthes diluvialis occurs in this community upstream from the Monument. Other unusual, disjunct species occurring in this community in the immediate vicinity of the Monument include *Glaux maritima* and *Argentina anserina*.

CONSERVATION RANK G5

RANK JUSTIFICATION

DATABASE CODE CEGL001838

COMMENTS
Agate Fossil Beds National Monument

It is likely that this community might be split up into two or more communities, but more work is needed. Ungrazed portions of this community are often overrun with annual and perennial forbs. Invasion by *Cirsium arvense* represents a potentially serious threat to this community on the Monument.

REFERENCES

Jones, G. and G. Walford. 1995. Major riparian vegetation types of eastern Wyoming. A report submitted to the Wyoming Department of Environmental Quality, Water Quality Division. 245 pp.

Typha latifolia Western Herbaceous Vegetation

COMMON NAME	Broad-Leaf Cattail Herbaceous Vegetation
SYNONYM	Broad-Leaved Cattail Marsh
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	Semipermanently flooded temperate or subpolar grassland (V.A.5.N.l.)
ALLIANCE	*Typha* (*angustifolia, latifolia*) - (*Scirpus* spp.) Semipermanently Flooded Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Palustrine

RANGE

Globally

This community occurs in Montana, Colorado, New Mexico, Wyoming, and Nebraska.

Agate Fossil Beds National Monument

This community occurs along the Niobrara River throughout the length of the Monument.

ENVIRONMENTAL DESCRIPTION

Globally

This community is found along streams, rivers, and the banks of ponds. The soil is saturated or flooded for much of the year (Ramaley 1939, Tolstead 1942). It usually has a high organic content.

Agate Fossil Beds National Monument

This community occurs in wet ground along the banks and in the bottoms of abandoned channels in the primary floodplain of the river. Soils range from fine sand with little organic matter to muck overlying sand, and are poorly to very poorly drained.

MOST ABUNDANT SPECIES

Globally

Stratum	Species
Herbaceous	*Typha latifolia*

Agate Fossil Beds National Monument

Stratum	Species
Herbaceous	*Iris pseudacorus, Scirpus tabernaemontani, Sparganium eurycarpum, Typha latifolia*

DIAGNOSTIC SPECIES
Globally
Typha latifolia

Agate Fossil Beds National Monument
Sparganium eurycarpum, Typha latifolia

VEGETATION DESCRIPTION
Globally
This community is dominated by hydrophytic macrophytes, especially *Typha latifolia*, which grow to approximately 2 meters. *T. latifolia* can form dense stands in places, almost to the exclusion of other species. Other species typical of wetlands are found in lesser amounts in this community. Among these are *Carex* spp. and *Scirpus* spp.

Agate Fossil Beds National Monument
This community is dominated by tall graminoids 1-2 m tall. *Typha latifolia* is usually the most common species, and often nearly the only species present, though in some places *Sparganium eurycarpum* may form a wide band along the periphery of the cat-tails. *Iris pseudacorus* and *Scirpus tabernaemontani* are frequently found along the margins of this community, bordering *Juncus balticus* Herbaceous Vegetation. Shorter graminoids of *Juncus balticus* Herbaceous Vegetation such as *Carex nebrascensis, C. pellita, Eleocharis erythropoda*, and *Leersia oryzoides* may sometimes invade along the margins of this community. Forbs are widely scattered among the dominants, some of the more frequently encountered species being wet meadow species such as *Lycopus asper*, *Mentha arvensis*, and *Scutellaria lateriflora*. Marshes which remain saturated through most of the season are dominated almost exclusively by *Typha latifolia* and have very little understory, save for a few aquatic forbs such as *Lemna minor* and *Veronica anagallis-aquatica.*

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK G5

RANK JUSTIFICATION

DATABASE CODE CEGL002010

COMMENTS
Globally
This community is a common element found in many wetland systems but has received little attention. Consequently, the diagnostic features and species of this community are not well known.

Agate Fossil Beds National Monument
Marshes dominated by *Scirpus tabernaemontani* are found in grazed areas east of the Monument boundary. It is unknown whether the species composition is an artifact of grazing, or due to some other factor.

REFERENCES
Ramaley, F. 1939. Sand-hill vegetation of northeastern Colorado. Ecological Monographs 9(1):1-51.

Tolstead, W. L. 1942. Vegetation of the northern part of Cherry County, Nebraska. Ecological Monographs 12(3):256-292.

Seeded Grassland Community

COMMON NAME

SYNONYM Seeded Grassland

PHYSIOGNOMIC CLASS Herbaceous vegetation (V)

PHYSIOGNOMIC SUBCLASS Perennial graminoid vegetation (V.A)

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

PHYSIOGNOMIC SUBGROUP Planted/cultivated (V.A.5.C)

FORMATION Undefined

ALLIANCE Undefined

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Upland

RANGE
Globally
Information not available.

Agate Fossil Beds National Monument
This community is of very limited occurrence. Only one site is known within the Monument boundary, along the periphery of an abandoned cropfield. Size of the occurrence is <1 ha.

ENVIRONMENTAL DESCRIPTION
Globally
Information not available.

Agate Fossil Beds National Monument
This community occurs on a low slope at the margin of a valley bottom. Soils are fine sand.

MOST ABUNDANT SPECIES
Globally
Information not available.

Agate Fossil Beds National Monument

Stratum	Species
Herbaceous	*Agropyron cristatum, Bromus inermis*

DIAGNOSTIC SPECIES
Globally
Information not available.

Agate Fossil Beds National Monument
Agropyron cristatum, Bromus inermis

VEGETATION DESCRIPTION
Globally
Information not available.

Agate Fossil Beds National Monument
This sites consist of small patches seeded to the exotic perennial grasses *Agropyron cristatum* and *Bromus inermis*. Species diversity is low.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE Not applicable

COMMENTS
Agate Fossil Beds National Monument
This community is a result of extensive disturbance with subsequent invasion by weedy exotic or native species. Thus, it is not placed within the National Vegetation Classification System. This community is included for possible future management considerations and represents a relatively insignificant entity within the flora. An area directly north of the visitors center has been seeded to native species.

REFERENCES

Upland Disturbance Community

COMMON NAME

SYNONYM	Upland Disturbance
PHYSIOGNOMIC CLASS	Herbaceous vegetation (V)
PHYSIOGNOMIC SUBCLASS	Annual graminoid or forb vegetation (V.D)
PHYSIOGNOMIC GROUP	Temperate or subpolar annual grassland or forb vegetation (V.D.2)
PHYSIOGNOMIC SUBGROUP	Planted/cultivated (V.D.2.C)
FORMATION	Undefined
ALLIANCE	Undefined

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Upland

RANGE
Globally
Information not available.

Agate Fossil Beds National Monument
This community is found in uplands throughout the Monument.

ENVIRONMENTAL DESCRIPTION
Globally
Information not available.

Agate Fossil Beds National Monument
This community occurs primarily in bottoms of valleys and draws in uplands throughout the Monument. Soils are fine sands and loamy fine sands.

MOST ABUNDANT SPECIES
Globally
Information not available.

Agate Fossil Beds National Monument

Stratum	Species
Shrub	*Krascheninnikovia lanata*
Herbaceous	*Bromus tectorum, Helianthus annuus, Kochia scoparia, Lactuca serriola, Pascopyrum smithii, Salsola collina, Sisymbrium altissimum*

DIAGNOSTIC SPECIES
Globally
Information not available.

Agate Fossil Beds National Monument
Bromus tectorum, Helianthus annuus, Krascheninnikovia lanata, Sisymbrium altissimum

VEGETATION DESCRIPTION
Globally
Information not available.

Agate Fossil Beds National Monument
This community is dominated either by tall annual forbs 1-2 m tall including *Helianthus annuus, Lactuca serriola, Salsola collina*, and *Sisymbrium altissimum*, or by *Bromus tectorum* with scattered annual forbs. A shrub layer dominated by *Krascheninnikovia lanata* is conspicuous in some larger occurrences and the perennial grasses *Pascopyrum smithii* and *Stipa comata* are frequently present.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE Not applicable

COMMENTS
Agate Fossil Beds National Monument
This community is a result of extensive disturbance with subsequent invasion by weedy exotic or native species. Thus, it is not placed within the National Vegetation Classification System.

Two very large occurrences representing abandoned cropfields are found in broad valley bottoms south of the bone cabin and north-west of the fishing access at the Monument. Smaller occurrences are frequently present within *Calamovilfa longifolia - Andropogon hallii* Herbaceous Vegetation and at times may form a mosaic with that community. Upland disturbance represents a highly degraded form of *Calamovilfa longifolia - Andropogon hallii* Herbaceous Vegetation.

REFERENCES

Annual-dominated Floodplain Disturbance Community

COMMON NAME

SYNONYM	Floodplain Disturbance Meadow
PHYSIOGNOMIC CLASS	Herbaceous vegetation (V)
PHYSIOGNOMIC SUBCLASS	Annual graminoid or forb vegetation (V.D)
PHYSIOGNOMIC GROUP	Temperate or subpolar annual grasslands or forb vegetation (V.D.2)
PHYSIOGNOMIC SUBGROUP	Planted/cultivated (V.D.2.C)
FORMATION	Undefined
ALLIANCE	Undefined

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Palustrine

RANGE
Globally
Information not available.

Agate Fossil Beds National Monument
This community occurs throughout the Monument in ungrazed areas within the floodplain of the Niobrara River.

ENVIRONMENTAL DESCRIPTION
Globally
Information not available.

Agate Fossil Beds National Monument
This community occurs in level ground on lower floodplain terraces, usually along the boundary of *Pascopyrum smithii* Herbaceous Vegetation and *Juncus balticus* Herbaceous Vegetation. Soils are fine sands and loamy fine sands and are probably slightly alkaline.

MOST ABUNDANT SPECIES
Globally
Information not available.

Agate Fossil Beds National Monument

Stratum	Species

Herbaceous *Atriplex heterosperma, Cyclachaena xanthifolia, Helianthus annuus*

DIAGNOSTIC SPECIES
Globally
Information not available.

Agate Fossil Beds National Monument
Atriplex heterosperma, Cyclachaena xanthifolia

VEGETATION DESCRIPTION
Globally
Information not available.

Agate Fossil Beds National Monument
In most occurrences, this community is dominated by a dense near-monoculture stand of *Cyclachaena xanthifolia* 1-2 m tall, occasionally co-occurring with *Atriplex heterosperma* and other coarse annuals such as *Helianthus annuus*. More open stands also contain perennial forbs and grasses typical of the community bordering the disturbance. Species common in more open floodplain disturbance stands include *Cirsium flodmanii, Hordeum jubatum, Juncus balticus, Melilotus alba, Pascopyrum smithii,* and *Poa pratensis*.

OTHER NOTEWORTHY SPECIES Information not available.

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE Not applicable

COMMENTS
Agate Fossil Beds National Monument
This community is a result of extensive disturbance with subsequent invasion by weedy exotic or native species. Thus, it is not placed within the National Vegetation Classification System. This community appears to be a degraded condition of the higher, slightly-alkaline portions of the wet meadow community, though it may also occur in *Pascopyrum smithii* Herbaceous Vegetation, as well. The two most common species (*Atriplex micrantha* and *Iva xanthifolia*) are tolerant of slightly alkaline soils. This community is not found in grazed areas surrounding the Monument, and may occur as a result of excessive thatch accumulation smothering the graminoids in the ungrazed areas.

REFERENCES