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A CLASSIFICATION OF THE NATURAL VEGETATION OF KANSAS

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ABSTRACT—We present the first hierarchical classification system of the existing natural vegetation of Kansas. Sixty vegetation community types are recognized in classes of forest, woodland, shrubland, and herbaceous vegetation, with most of the types classified as herbaceous plant communities. One community type, chalkflat mixed prairie, is unique to Kansas and 11 other types are known to occur in only one other state. The purpose of the vegetation classification system is to support the efforts of the Kansas Natural Heritage Inventory of the Kansas Biological Survey and the Kansas Gap Analysis Project to identify and describe current native plant communities. Its use is recommended for those working on land management and conservation efforts in Kansas and the central Great Plains.

RESUMEN—Presentamos el primer sistema jerárquico de clasificación de la vegetación natural actual en el estado de Kansas, USA. Son reconocidos sesenta tipos de comunidades de vegetación en clases de bosque, arboleda, matorral, y vegetación herbácea, con la mayoría de los tipos clasificados como comunidades de plantas herbáceas. Un tipo de comunidad, llanura mixta de piedra caliza, es único de Kansas y otros 11 tipos son conocidos solamente en otro estado. El propósito del sistema de clasificación de la vegetación es de apoyar los esfuerzos del “Kansas Natural Heritage Inventory,” del “Kansas Biological Survey,” y del “Kansas Gap Analysis Project” a identificar y describir comunidades de plantas nativas actuales. Su uso es recomendado para los que esté trabajando en el manejo de la tierra y los esfuerzos de conservación en Kansas y en las Grandes Planicies centrales.

The vegetation of an area is an integration of the physical environment and the biological elements at that site. Vegetation classification systems aim to define similar groups of plants found on sites that share similar environmental factors. This can be done directly by grouping plants on the basis of composition or morphological characteristics, or indirectly by classifying physical features (e.g., climate or landform). A primary purpose for developing vegetation classifications is to provide information on plant communities useful for resource management (Hall, 1989) and land conservation (Grossman et al., 1994).

A vegetation classification system for Kansas is needed to support statewide ecological surveys and ecosystem protection initiatives. In 1989, the Kansas Natural Heritage Inventory (KSNHI) of the Kansas Biological Survey developed a preliminary vegetation classification to “identify and plan protection for exemplary occurrences of Kansas’ ecological communi-

ties” (Lauver, 1989:1). The classification was developed by examining Kùchler’s (1974) potential natural vegetation map in relation to the geology (Kansas Geological Survey, 1964), soils (United States Department of Agriculture, Soil Conservation Service, 1986), and physiographic provinces (Wilson, 1978) of Kansas. Vegetation types were based on variations in physical features (e.g., climate, soils, and topography) that contributed to differences in species composition. For example, although sharing the same dominant species, a northeastern tallgrass prairie and southeastern tallgrass prairie were distinguished because of known differences in soil development (i.e., glaciation) and the floristic composition of communities in these areas.

The present classification is a conversion of the previous version into the vegetation classification system developed by The Nature Conservancy (TNC) in cooperation with state, federal, and academic partners (Grossman et al.,

1998). Development of the Kansas classification is coordinated by the Midwest Conservation Science Department of TNC. The Nature Conservancy modified the United Nations Educational, Scientific, and Cultural Organization (UNESCO, 1973) vegetation classification system to develop a consistent national and international classification for the purpose of conserving and managing biological diversity, and recently has published the United States National Vegetation Classification System (Anderson et al., 1998; Grossman et al., 1998). The modified UNESCO/TNC system has been adopted by the Federal Geographic Data Committee (FGDC) in establishing a national standard for classification of existing vegetation of the United States (FGDC, 1997). Standards to support the on-going development of the national classification, particularly using a quantitative, plot-sampling approach, are being developed by an inter-organizational committee overseen by the Ecological Society of America (Glenn-Lewin, 1999).

The Nature Conservancy uses a coarse filter/fine filter approach to conserve natural diversity (Jenkins, 1976). Identifying and protecting ecological communities (e.g., vegetation types) provides the coarse filter of diversity for most species, with protection of rare species representing the fine filter. An objective of both TNC and state Natural Heritage Programs is to identify and protect representative examples of each vegetation type. In this way, most of the natural diversity of an area and the ecological processes operating at the community level will be preserved. Species that fall through the community filter are generally rare species, which are managed as individual species. The classification of natural vegetation presented herein represents the coarse filter that KSNHI uses for local, state, and regional conservation planning.

Another conservation initiative employing the KSNHI vegetation classification system is the Kansas Gap Analysis Project (Lauer et al., 1996). This effort is coordinated by the Kansas Cooperative Fish and Wildlife Research Unit in cooperation with several academic institutions, and state and federal agencies. Gap Analysis is a state-oriented approach that assesses the degree of protection afforded to wildlife species and natural vegetation types (Scott et al., 1993). An example of a state vegetation classi-

fication designed for Gap Analysis that uses the UNESCO system was developed for Arkansas by Foti et al. (1994). The national Gap Analysis Program and other federal agencies are now supporting modifications to the UNESCO system proposed by TNC and its partners through the FGDC (FGDC, 1997). As in Arkansas, the Kansas Gap Analysis Project will produce a statewide map of existing vegetation types by classifying digital satellite imagery (Jennings, 1993). Because Gap Analysis is a nationwide project, it is desirable to relate the Kansas classification to the national vegetation classification system. The objective of this paper is to provide a current vegetation classification for Kansas that supports these state and national conservation efforts.

METHODS—The Kansas Classification—Natural vegetation can be classified by similarities and differences in appearance (physiognomy) and species composition (floristics). The proposed classification system for Kansas is hierarchical and combines physiognomy at the highest levels with a floristic approach at the lower levels. Physiognomic classifications use structural and other morphological characteristics of predominant vegetation to delineate plant formations. The floristic approach uses more detailed data on species composition (at the site level) to classify plant communities. Diagnostic species are identified through analyses of the floristic composition of plant communities to characterize different units within the classification. To achieve a finer level of resolution, the floristic approach was used by KSNHI to assess the range and variation of community types throughout the state.

The purpose of the classification is to identify plant communities consisting of natural and near-natural vegetation. Natural vegetation includes vegetation that approximates natural conditions prior to European settlement. Near-natural vegetation includes vegetation that has been influenced by human disturbance and contains a species composition similar to presettlement vegetation. The classification does not include vegetation that has been significantly modified (e.g., grasslands dominated by exotic, naturalized species such as *Bromus inermis*), nor cultural landcover, such as agricultural (cultivated fields) and urban areas, although these landcover types can be incorporated into the TNC/FGDC system.

Several guiding principles were established in adopting and developing the KSNHI vegetation classification. First, the system must describe actual or existing vegetation rather than potential natural vegetation. Because of persistent, widespread distur-

bances (e.g., livestock grazing, removal of woody vegetation), determination of climax vegetation types in Kansas is problematic. Judgements must be made as to the degree to which stands of vegetation appear to be functioning under natural ecologic processes. Second, the basic element of the classification, the plant association or community type, is an abstraction based on grouping individual vegetation stands with similar plant species composition (and observation of ecotones or transitions between types in the field—Pfister, 1989). Third, the system must be flexible so that new community types can be added to the classification.

The basic unit and the lowest level of the classification is the community type, which is defined as a plant association of definite floristic composition with uniform physiognomy and habitat (Flahault and Schroter, 1910, cited in Grossman et al., 1998). The plant association is a group of co-occurring species that persist under similar environmental conditions. Because of environmental gradients, the individual distribution of species may vary, and thus the community type expresses this variation as well. Given specified criteria for homogeneity, repeating plant associations can be identified on the ground, but individual occurrences of a particular community type will have variable species composition.

The highest level of the classification (system) separates vegetated communities (terrestrial system) from unvegetated deepwater habitats (aquatic system) and unvegetated subterranean habitats (subterranean system). Classification of the terrestrial system is presented in Appendix 1, and includes upland vegetation, and emergent and rooted wetland and aquatic vegetation, thus integrating the wetland classification system of Cowardin et al. (1979).

Classification Hierarchy—The classification system follows UNESCO (1973) format with some significant modifications (Grossman et al., 1998). There are seven levels in the classification hierarchy: class, subclass, group, subgroup, formation, alliance, and community type. The first five levels are broadly physiognomic, and the latter two are floristically based. Definitions for each level are largely from the national Gap Analysis Program (Jennings, 1993) and Grossman et al. (1998).

There are seven primary classes. Six are for areas with at least 10% vegetation cover. These six classes are separated on the basis of height and relative percentage of cover of the dominant life-form. The seventh class represents bare ground with little to no vegetation: 1) Forest—areas dominated by trees >5 m tall with their crowns overlapping, generally forming 60 to 100% cover; 2) Woodland—areas dominated by open stands of trees >5 m tall with crowns not usually touching, generally forming 25 to 60% cover; a shrub or herbaceous understory (or both) is usually present; 3) Shrubland—areas dominated

by shrubs generally >0.5 m tall with individuals or clumps not touching to overlapping, generally forming >25% canopy cover (tree cover generally <25%); 4) Dwarf-Shrubland—areas dominated by low growing shrubs usually <0.5 m tall with individuals or clumps not touching to overlapping; dwarf-shrubs generally form >25% cover; trees and shrubs generally <25% cover (this type probably does not occur in Kansas); 5) Herbaceous Vegetation—areas dominated by herbs (graminoids, forbs, and ferns), generally forming at least 25% cover; trees, shrubs, and dwarf-shrubs generally with <25% cover; 6) Nonvascular Vegetation—areas dominated by nonvascular cover (bryophytes, lichen, and algae), generally forming at least 25% cover; 7) Sparse Vegetation—areas where vegetation is scattered or nearly absent; total vegetation cover is <25%, and generally 1 to 10%; includes bluffs and rock outcrops, sandy areas, and mud flats.

Subclasses are divisions within each class determined by the predominant leaf phenology (for wooded classes), or by the persistence and growth form (for the herbaceous class) of the main vegetation. For the forest, woodland, and shrubland classes, similarities are based on three factors: evergreen, deciduous, and mixed evergreen and deciduous. For the herbaceous class, similarities are based on perennial graminoid, perennial forb, hydromorphic rooted vegetation, and annual graminoid or forb.

The group level in the hierarchy is defined by a combination of climate, leaf morphology, and leaf phenology. Categories within each subclass may be based on climate (e.g., tropical, temperate, subpolar) for all types. For forests, woodlands, and shrublands it may be based on leaf type (e.g., broad-leaved, sclerophyllous, needle-leaved). For the herbaceous class it may be based on presence or absence of a tree, shrub, or dwarf-shrub with a canopy coverage of 11 to 25%.

Subgroups represent a binary division within each group to separate naturally-occurring vegetation from cultural vegetation: natural vegetation (natural, near-natural, and some modified vegetation); cultural vegetation (planted or cultivated).

Formations are categories within each subgroup in which vegetation similarities are based on any of the following criteria: Crown shape (e.g., rounded, conical, cylindrical) and height (e.g., tall, medium-tall, short); elevational zone (temperate lowland, montane, alpine); moisture or hydrologic regime (e.g., saturated, seasonally flooded, intermittently flooded—after Cowardin et al., 1979); and kinds of associated vegetation (e.g., broad-leaved forest with or without evergreen needle-leaved trees, or with or without succulents).

An alliance is a group of plant community types having the same primary dominant (i.e., in terms of

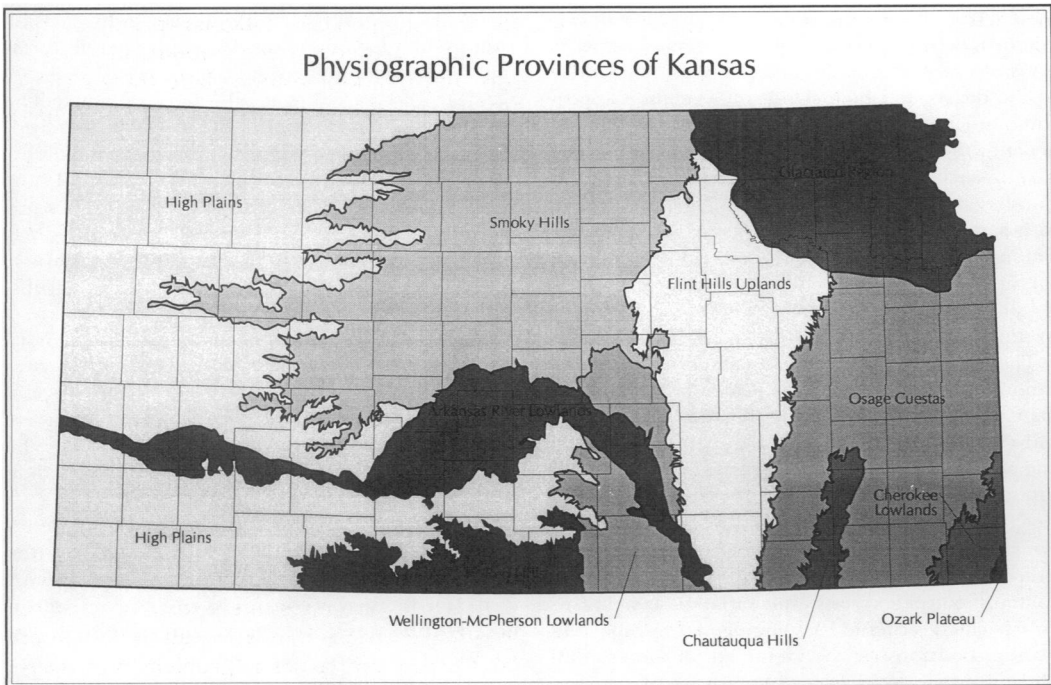


FIG. 1.—The physiographic provinces of Kansas (adapted from Wilson, 1978).

abundance or cover) species and similar physiognomy; an aggregation of plant community types. The alliance level is equivalent to the "cover type" level of Jennings (1993), and is the level used by the national Gap Analysis Program to standardize mapping efforts. Alliances are named using the scientific names of the species that dominate the canopy layer(s). Descriptions for alliances in the midwestern United States are available in Drake and Faber-Langendoen (1997).

The community type is an assemblage of plant species that potentially interact at the same time and place, and have defined species composition and physiognomy, regardless of seral stage. Types are usually named using dominant and characteristic species from one to several canopy layers.

The natural vegetation classification system for Kansas is presented in Appendix 1. The first step in developing the new system was to compare the preliminary Kansas classification to the modified UNESCO system. This process was facilitated by comparisons with the Midwest regional classification developed by TNC. In this way, several new community types were identified and incorporated into the Kansas classification. The classification shown in Appendix 1 was further enhanced through meetings and discussions with state Natural Heritage program ecologists and academic partners.

To facilitate interpretation of the classification, community types are listed followed by a series of descriptive features for each type. These include a common name for the type and the distribution or region within Kansas where each community type is expected to occur. The distribution of most types is presented as a listing of physiographic provinces, and a map of the Kansas provinces is shown in Fig. 1. A list of other states (abbreviated) in which the type is known to occur is shown next, followed by the type's pattern. For the purposes of this paper, community pattern (i.e., small-patch, large-patch, or matrix) refers to the size and landscape position of potential and existing stands of a particular type (M. Anderson, pers. comm.). Small-patch communities are those on specialized landforms or microhabitats, and generally range from less than 1 ha to 8 ha. Large-patch communities generally occur on sub-dominant landform features and form large but interrupted cover, usually from 8 to 400 ha. Matrix communities occur on the dominant landform types forming extensive and often contiguous cover, usually exceeding 400 ha (M. Anderson, pers. comm.). Following the pattern, brief descriptions are included of the habitat, soils, and other associated common or characteristic plant species for each community type. This series of descriptive features is not

included for community types listed under the sparse vegetation class because of lack of data.

Plant species nomenclature follows the Great Plains Flora Association (1986), except in a few cases where the genus name has recently been changed. For example, *Andropogon scoparius* has changed to *Schizachyrium scoparium*, and *Agropyron smithii* has been changed to *Pascopyrum smithii* (Kartesz, 1994). Species occurring in the same stratum are separated by “-”, whereas species occurring in different strata are separated by the “/” symbol. Species listed in parentheses are typical of a majority of stands, but are not found consistently in the type. In cases where diagnostic species are unknown, geographic and geologic modifiers (e.g., Flint Hills, unglaciated) are used until diagnostic species can be determined, and to denote observed differences in plant species composition among community types. Further descriptions of each of these types, including references, are being developed.

RESULTS AND DISCUSSION—The vegetation classification system of Kansas contains 60 vegetated community types in 38 alliances and eight sparse vegetation community types (Appendix 1). Half of the vegetated community types are classified as upland vegetation, with the remainder occurring on lowlands and subjected to some degree of flooding. Because Kansas is located in the Great Plains, it was anticipated that most of the community types would belong to the herbaceous class. Two-thirds of the community types (38) are classified as herbaceous, with types split evenly between upland and floodplain habitats. The classification contains a modest number of woody plant communities (22), with 10 wetland community types and 12 located on uplands. Given that most of the land in Kansas is upland, this distribution of community types suggests that lowland areas contain a greater diversity of plant communities than the associated upland habitat.

Because of its central location in the Great Plains, most of the community types of Kansas also occur in adjoining and other nearby states (Appendix 1). One type, chalkflat mixed prairie, currently is reported only in Kansas. Unique soil and topographic conditions along the Smoky Hill River in western Kansas prompted K uchler (1974) to classify this prairie as a separate potential natural vegetation type. Thirteen community types are known or believed to occur in only one other state, in-

cluding Flint Hills tallgrass prairie (Oklahoma), mixed oak ravine woodland (Nebraska), and Ozark limestone glade (Missouri).

The classification is supported by a database that contains example stands for some of the community types; these data are maintained by the Kansas Biological Survey (KBS). The Midwest Regional Office of The Nature Conservancy (TNC) also maintains a similar database for community occurrences throughout the midwestern United States. A major shortcoming of the databases is the lack of information and examples for many community types, particularly for wetland communities. Because of recent and historical agricultural development in Kansas, nearly half of the original wetland habitat has been destroyed or degraded (Dahl, 1990). Consequently, example stands for some wetland community types (e.g., oak floodplain woodland, cottonwood-switchgrass floodplain woodland) may no longer exist. In addition, locating example stands for all of the woodland community types is problematic because of the lack of periodic fire necessary to maintain the open woodland character.

Regardless of these problems, KBS will continue its effort to locate and document example stands for all Kansas community types using a variety of survey techniques. The flexible and open system of the Kansas vegetation classification lends itself to this endeavor, and is amenable to both land cover mapping using remotely sensed data and ground-based surveys. The classification also has utility for state-wide, regional, and national conservation efforts: it’s fully integrated into the United States National Vegetation Classification System and is used by KBS, TNC, and other partners to conduct ecoregional conservation planning in the central Great Plains (e.g., Central Shortgrass Prairie Ecoregional Planning Team, 1998). For these reasons we believe the classification will be useful in future vegetation studies in Kansas.

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APPENDIX 1

Classification of the natural vegetation of Kansas. Community types are followed by a unique TNC code (Anderson et al., 1998). Types marked with an asterisk (*) are wetlands. Plant species occurring in the same stratum are separated by “—”, and species occurring in different strata are separated by the “/” symbol. Species listed in parentheses are typical of a majority of stands, but are not found consistently in the type. Species listed within the [] symbols are regionally significant but are not generally found in Kansas.

United States National Vegetation Classification	Kansas community types
I.	FOREST (61 to 100% tree cover; trees >5 m tall)
I.B.	Deciduous forest (deciduous species contribute >75% of total tree cover)
I.B.2.	Cold-deciduous forest
I.B.2.N.a.	Lowland and submontane cold-deciduous forest
I.B.2.N.a.	ACER SACCHARUM—TILIA AMERICANA—(QUERCUS RUBRA) FOREST ALLIANCE
I.B.2.N.a.	<i>Acer saccharum</i> —[<i>Acer nigrum</i>] <i>—Tilia americana—Quercus rubra/Ostrya virginiana</i> Forest (2061) Common name: maple—basswood forest Distribution: Glaciated Region (restricted to the eastern third of this region) Other states: IA, MO, NE Pattern: small-patch Habitat: moderate to steep slopes on uplands and valley sides Soils: well drained silts and loams, formed in loess or glacial till Other species: <i>Asimina triloba</i> , <i>Carya cordiformis</i> , <i>Celtis occidentalis</i> , <i>Fraxinus americana</i> , <i>Gymnocladus dioica</i> , <i>Juglans nigra</i> , <i>Prunus serotina</i> , <i>Quercus macrocarpa</i> , <i>Staphylea trifolia</i> , <i>Ulmus americana</i> , <i>Viburnum prunifolium</i> Note: In general, <i>Acer nigrum</i> is not part of the Kansas community type but is a regional co-dominant.
I.B.2.N.a.	QUERCUS ALBA—(QUERCUS RUBRA, CARYA SP.) FOREST ALLIANCE
I.B.2.N.a.	<i>Quercus alba/Cornus florida</i> Unglaciated Forest (2066) Common names: oak—dogwood forest, Ozark forest Distribution: Ozark Plateau Other states: IL, IN, MO Pattern: large-patch Habitat: level to steep uplands Soils: cherty, silty well drained soils, formed from cherty limestone Other species: <i>Carya cordiformis</i> , <i>C. ovata</i> , <i>Danthonia spicata</i> , <i>Euonymus atropurpureus</i> , <i>Ostrya virginiana</i> , <i>Sassafras albidum</i> , <i>Staphylea trifolia</i> , <i>Vaccinium arboreum</i>
I.B.2.N.a.	<i>Quercus alba</i> —(<i>Quercus velutina</i>)— <i>Carya ovata/Ostrya virginiana</i> Forest (2011) Common name: oak—hickory forest Distribution: Glaciated Region, Osage Cuestas Other states: IA, MO, NE, OK Pattern: large-patch Habitat: gentle to moderately steep slopes on uplands and valley sides Soils: poorly drained to well drained silts and loams, formed in loess, glacial till, or from shale or limestone Other species: <i>Carya cordiformis</i> , <i>Cercis canadensis</i> , <i>Fraxinus americana</i> , <i>Prunus serotina</i> , <i>Quercus rubra</i> , <i>Ulmus americana</i> , <i>Viburnum rufidulum</i>

APPENDIX 1
Continued.

United States National Vegetation Classification	Kansas community types
I.B.2.N.a.	QUERCUS STELLATA–QUERCUS MARILANDICA FOREST ALLIANCE
I.B.2.N.a.	<i>Quercus stellata</i> – <i>Quercus marilandica</i> –[(<i>Carya texana</i>)] Forest (2074) Common names: post oak–blackjack oak forest, Cross Timbers forest Distribution: Chautauqua Hills, Osage Cuestas Other states: OK, TX Pattern: large-patch Habitat: ridgetops and nearly level to steep hillsides Soils: shallow to moderately deep, sandy and loamy soils from sandstone Other species: <i>Carya cordiformis</i> , <i>Quercus prinoides</i> , <i>Q. velutina</i> , <i>Rhus copallina</i> , <i>R. glabra</i> , <i>Schizachyrium scoparium</i>
I.B.2.N.d.	Temporarily flooded cold-deciduous forest
I.B.2.N.d.	CARYA ILLINOINENSIS–(CELTIS LAEVI-GATA) TEMPORARILY FLOODED FOREST ALLIANCE
I.B.2.N.d.	* <i>Carya illinoensis</i> – <i>Celtis occidentalis</i> Forest (2087) Common name: pecan–hackberry floodplain forest Distribution: Cherokee Lowlands, Glaciated Region, Osage Cuestas Other states: AR, MO (possible), OK, TX Pattern: small-patch Habitat: nearly level floodplains along major streams and rivers Soils: deep, poorly drained to well drained, formed in silty and clayey recent alluvium Other species: <i>Acer negundo</i> , <i>Carex grayi</i> , <i>Fraxinus pennsylvanica</i> , <i>Juglans nigra</i> , <i>Parthenocissus quinquefolia</i> , <i>Platanus occidentalis</i> , <i>Toxicodendron radicans</i> , <i>Ulmus americana</i>
I.B.2.N.d.	FRAXINUS PENNSYLVANICA–ULMUS AMERICANA–CELTIS (OCCIDENTALIS, LAEVI-GATA) TEMPORARILY FLOODED FOREST ALLIANCE
I.B.2.N.d.	* <i>Fraxinus pennsylvanica</i> – <i>Ulmus</i> sp.– <i>Celtis occidentalis</i> Forest (2014) Common name: ash–elm–hackberry floodplain forest Distribution: eastern half of Kansas Other states: IA, IL, IN, MI, NE, OH Pattern: large-patch Habitat: nearly level bottoms and terraces along major streams and rivers Soils: deep, poorly drained to well drained, formed in silty and clayey recent alluvium Other species: <i>Juglans nigra</i> , <i>Parthenocissus quinquefolia</i> , <i>Populus deltoides</i> , <i>Quercus palustris</i> , <i>Q. shumardii</i> , <i>Toxicodendron radicans</i> , <i>Ulmus americana</i> , <i>U. rubra</i>
I.B.2.N.d.	POPULUS DELTOIDES TEMPORARILY FLOODED FOREST ALLIANCE
I.B.2.N.d.	* <i>Populus deltoides</i> – <i>Platanus occidentalis</i> Forest (2095) Common name: cottonwood–sycamore floodplain forest Distribution: Cherokee Lowlands, Flint Hills Uplands, Glaciated Region, Osage Cuestas Other states: MO (possible) Pattern: large-patch Habitat: nearly level and undulating soils on floodplains along major rivers and streams Soils: deep, poorly drained to well drained, formed in silty and clayey recent alluvium Other species: <i>Acer negundo</i> , <i>Carya illinoensis</i> , <i>Celtis occidentalis</i> , <i>Salix nigra</i>

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United States National Vegetation Classification	Kansas community types
I.B.2.N.d.	<p>*<i>Populus deltoides</i>–<i>Salix nigra</i> Forest (2018) Common name: cottonwood–black willow floodplain forest Distribution: statewide Other states: AR, IA, IL, KY, MN, MO, NE, OH, OK, TN, WI Pattern: small-patch Habitat: nearly level to undulating floodplains along the fronts and banks of most major rivers and streams throughout the central and southern U.S. Soils: deep, medium-textured, formed in alluvium Other species: <i>Acer negundo</i>, <i>A. saccharinum</i>, <i>Aster simplex</i>, <i>Bidens</i> sp., <i>Carex</i> sp., <i>Fraxinus pennsylvanica</i>, <i>Leersia oryzoides</i>, <i>Platanus occidentalis</i>, <i>Salix eri- ocephala</i>, <i>Ulmus americana</i></p>
I.B.2.N.d.	<p>QUERCUS MACROCARPA–QUERCUS BICOLOR–(CARYA LACINIOSA) TEMPORARILY FLOODED FOREST ALLIANCE</p>
I.B.2.N.d.	<p>*<i>Quercus macrocarpa</i>–<i>Quercus shumardii</i>–<i>Carya cordiformis</i>/ <i>Chasmanthium lati- folium</i> Forest (4544) Common name: mixed oak floodplain forest Distribution: Glaciated Region, Osage Cuestas Other states: AR, MO, OK Pattern: small-patch Habitat: nearly level to undulating floodplains Soils: deep, medium-textured, formed in alluvium Other species: <i>Acer negundo</i>, <i>A. saccharinum</i>, <i>Carex</i> sp., <i>Fraxinus pennsylvani- ca</i>, <i>Leersia oryzoides</i>, <i>Platanus occidentalis</i>, <i>Ulmus americana</i></p>
II.	<p>WOODLAND (26 to 60% tree cover; trees >5 m tall)</p>
II.B.	<p>Deciduous woodland (deciduous species contribute >75% of total tree cover)</p>
II.B.2.	<p>Cold-deciduous woodland</p>
II.B.2.N.a.	<p>Cold-deciduous woodland</p>
II.B.2.N.a.	<p>QUERCUS MACROCARPA WOODLAND ALLIANCE</p>
II.B.2.N.a.	<p><i>Quercus macrocarpa</i>/ <i>Andropogon gerardii</i>–<i>Panicum virgatum</i> Woodland (2052) Common name: mixed oak floodplain woodland Distribution: Glaciated Region, Osage Cuestas Other states: NE, OK Pattern: small-patch Habitat: nearly level to gently sloping soils on floodplains along major riv- ers and streams Soils: deep, somewhat poorly drained, formed in silty and clayey recent al- luvium Other species: <i>Carya illinoensis</i>, <i>Fraxinus</i> sp., <i>Salix nigra</i>, <i>Spartina pectinata</i></p>
II.B.2.N.a.	<p><i>Quercus macrocarpa</i>/ <i>Andropogon gerardii</i>–<i>Stipa spartea</i> Woodland (2053) Common name: oak floodplain woodland Distribution: Glaciated Region, north half of Osage Cuestas Other states: IA, MO, NE, SD (possible) Pattern: small-patch Habitat: floodplains of rivers and streams with gentle to steep slopes Soils: silts or loams, formed from loess or glacial till Other species: <i>Fraxinus</i> sp., <i>Panicum virgatum</i>, <i>Quercus rubra</i>, <i>Schizachyrium scoparium</i>, <i>Sorghastrum nutans</i></p>

APPENDIX I
Continued.

United States National Vegetation Classification	Kansas community types
II.B.2.N.a.	QUERCUS MUEHLENBERGII WOODLAND ALLIANCE
II.B.2.N.a.	<p><i>Quercus muehlenbergii</i>–<i>Quercus macrocarpa</i>/<i>Andropogon gerardii</i> Ravine Woodland (2145)</p> <p>Common name: mixed oak ravine woodland</p> <p>Distribution: Flint Hills Uplands, Glaciated Region, Osage Cuestas</p> <p>Other states: NE (possible)</p> <p>Pattern: small-patch</p> <p>Habitat: ravines and valleys of rivers and major streams</p> <p>Soils: shallow to moderately deep, silty clay loams and cherty silt loams, formed from shale and limestone</p> <p>Other species: <i>Cercis canadensis</i>, <i>Panicum virgatum</i>, <i>Schizachyrium scoparium</i>, <i>Ulmus</i> sp.</p>
II.B.2.N.a.	QUERCUS STELLATA–QUERCUS MARILANDICA WOODLAND ALLIANCE
II.B.2.N.a.	<p><i>Quercus stellata</i>–<i>Quercus marilandica</i>/<i>Schizachyrium scoparium</i> Woodland (2147)</p> <p>Common names: post oak–blackjack oak woodland, Cross Timbers woodland</p> <p>Distribution: Chautauqua Hills, Osage Cuestas</p> <p>Other states: OK, TX</p> <p>Pattern: large-patch</p> <p>Habitat: ridgetops and gently sloping to steep hillsides</p> <p>Soils: shallow to moderately deep, sandy and loamy, somewhat poorly drained to well drained, from sandstone</p> <p>Other species: <i>Andropogon gerardii</i>, <i>Celtis tenuifolia</i>, <i>Quercus prinoides</i>, <i>Sorghastrum nutans</i></p>
II.B.2.N.b.	Temporarily flooded cold-deciduous woodland
II.B.2.N.b.	POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE
II.B.2.N.b.	<p>*<i>Populus deltoides</i>–(<i>Salix amygdaloides</i>)/<i>Salix exigua</i> Woodland (0659)</p> <p>Common name: cottonwood–willow floodplain woodland</p> <p>Distribution: Arkansas River Lowlands, High Plains, Red Hills, Smoky Hills, Wellington-McPherson Lowlands</p> <p>Other states: CO, ND, NE, NM, OK, SD, TX</p> <p>Pattern: small-patch</p> <p>Habitat: nearly level floodplains along major rivers and streams</p> <p>Soils: deep loams, silts, and sands, somewhat poorly drained to well drained, formed in sandy recent alluvium or in calcareous silty or loamy recent alluvium</p> <p>Other species: <i>Amorpha fruticosa</i>, <i>Elymus virginicus</i>, <i>Muhlenbergia</i> sp.</p>
II.B.2.N.b.	<p>*<i>Populus deltoides</i>–(<i>Salix nigra</i>)/<i>Spartina pectinata</i>–<i>Carex</i> sp. Woodland (2017)</p> <p>Common name: cottonwood floodplain woodland</p> <p>Distribution: eastern third of Kansas</p> <p>Other states: MO, NE, SD</p> <p>Pattern: small-patch</p> <p>Habitat: floodplains near the lower Missouri River and its tributaries</p>

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United States National Vegetation Classification	Kansas community types
II.B.2.N.b.	<p>Soils: deep sandy loam to sand, somewhat poorly drained, formed from alluvium</p> <p>Other species: <i>Acer negundo</i>, <i>Andropogon gerardii</i>, <i>Fraxinus pennsylvanica</i>, <i>Panicum virgatum</i>, <i>Quercus macrocarpa</i></p> <p>*<i>Populus deltoides</i>/<i>Panicum virgatum</i>–<i>Schizachyrium scoparium</i> Woodland (1454)</p> <p>Common name: cottonwood–switchgrass floodplain woodland</p> <p>Distribution: High Plains</p> <p>Other states: CO, NE, OK, SD, TX</p> <p>Pattern: small-patch</p> <p>Habitat: swales and depressions along streams</p> <p>Soils: poorly drained sands and clays</p> <p>Other species: <i>Chrysothamnus nauseosus</i>, <i>Pascopyrum smithii</i></p>
III.	SHRUBLAND (shrubs or trees 0.5 to 5 m tall forming >25% canopy cover)
III.A.	Evergreen shrubland (evergreen species contribute >75% of total shrub and/or tree cover)
III.A.4.	Microphyllous evergreen shrubland
III.A.4.N.a.	Microphyllous evergreen shrubland
III.A.4.N.a.	ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE
III.A.4.N.a.	<p><i>Artemisia filifolia</i>/<i>Andropogon hallii</i> Shrubland (1459)</p> <p>Common name: sandsage–sand bluestem shrubland</p> <p>Distribution: Arkansas River Lowlands, High Plains, Red Hills, Smoky Hills</p> <p>Other states: CO, NE, NM, OK, TX, WY</p> <p>Pattern: matrix</p> <p>Habitat: gentle to moderately sloping loamy soils and rolling to hummocky sandy soils on uplands</p> <p>Soils: deep, well drained to excessively drained, formed in loamy or sandy eolian sediments</p> <p>Other species: <i>Asclepias arenaria</i>, <i>Calamovilfa gigantea</i>, <i>Cyperus schweinitzii</i>, <i>Eragrostis secundiflora</i>, <i>Eriogonum annuum</i>, <i>Paspalum setaceum</i>, <i>Prionopsis ciliata</i></p>
III.A.4.N.a.	<p><i>Artemisia filifolia</i>/<i>Schizachyrium scoparium</i>–<i>Andropogon hallii</i> Shrubland (2178)</p> <p>Common name: sandsage–little bluestem shrubland</p> <p>Distribution: Arkansas River Lowlands, High Plains, Red Hills, Smoky Hills (primarily located in the southern half of these regions)</p> <p>Other states: OK, TX</p> <p>Pattern: large-patch</p> <p>Habitat: sandy, rolling hills</p> <p>Soils: loamy fine sand to sandy soils, excessively drained, formed in loamy or sandy eolian sediments</p> <p>Other species: <i>Bouteloua curtipendula</i>, <i>Calamovilfa gigantea</i>, <i>Cyperus schweinitzii</i>, <i>Eriogonum annuum</i>, <i>Helianthus petiolaris</i>, <i>Paspalum setaceum</i>, <i>Prionopsis ciliata</i>, <i>Yucca glauca</i></p>
III.A.4.N.a.	<p><i>Artemisia filifolia</i>/<i>Bouteloua (curtipendula, gracilis)</i> Shrubland (2176)</p> <p>Common name: sandsage–grama shrubland</p> <p>Distribution: Arkansas River Lowlands, High Plains, Red Hills, Smoky Hills (primarily located in the southern half of these regions)</p> <p>Other states: OK, TX</p>

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United States National Vegetation Classification	Kansas community types
	<p>Pattern: large-patch Habitat: sandy, rolling hills Soils: loamy fine sand to sandy soils, excessively drained, formed in loamy or sandy eolian sediments Other species: <i>Andropogon hallii</i>, <i>Cyperus schweinitzii</i>, <i>Eriogonum annuum</i>, <i>Helianthus petiolaris</i>, <i>Paspalum setaceum</i>, <i>Prionopsis ciliata</i>, <i>Schizachyrium scoparium</i></p>
III.A.5.	Extremely xeromorphic evergreen shrubland
III.A.5.N.b.	Facultatively deciduous extremely xeromorphic subdesert shrubland
III.A.5.N.b.	ATRIPLEX CANESCENS SHRUBLAND ALLIANCE
III.A.5.N.b.	<p><i>Atriplex canescens</i>/<i>Bouteloua gracilis</i> Shrubland (1283) Common name: saltbush-grama shrubland Distribution: High Plains Other states: AZ, CO, NM, TX Pattern: small-patch Habitat: dry barren flats, slopes, and bluffs Soils: shallow, rocky, alkaline Other species: <i>Bouteloua curtipendula</i>, <i>B. hirsuta</i>, <i>Rhus aromatica</i>, <i>Toxicodendron rydbergii</i>, <i>Yucca glauca</i></p>
III.B.	Deciduous shrubland (deciduous species contribute >75% of total shrub and/or tree cover)
III.B.2.	Cold-deciduous shrubland
III.B.2.N.d.	Temporarily flooded cold-deciduous shrubland
III.B.2.N.d.	SALIX EXIGUA TEMPORARILY FLOODED SHRUBLAND ALLIANCE
III.B.2.N.d.	<p>*<i>Salix exigua</i>/Mesic Graminoids Shrubland (1203) Common name: willow-grass shrubland Distribution: High Plains, Red Hills, Smoky Hills Other states: CO, NE, OK, UT, WY Pattern: small-patch Habitat: sandbars, islands, and shorelines of streams and rivers Soils: poorly developed, composed of sand, clay, silt, or gravel, formed in alluvium Other species: <i>Andropogon gerardii</i>, <i>Eleocharis</i> sp., <i>Scirpus</i> sp.</p>
III.B.2.N.f.	Semipermanently flooded cold-deciduous shrubland
III.B.2.N.f.	CEPHALANTHUS OCCIDENTALIS SEMIPERMANENTLY FLOODED SHRUBLAND ALLIANCE
III.B.2.N.f.	<p>*<i>Cephalanthus occidentalis</i>/<i>Carex</i> sp. Southern Shrubland (2191) Common name: buttonbush swamp Distribution: Cherokee Lowlands, Osage Cuestas Other states: AR, IL, IN, KY, MO, OK, SC, TN, TX Pattern: small-patch Habitat: inundated depressions, oxbow ponds, and sloughs of stream and river floodplains Soils: deep, very poorly drained soils of peat or muck, formed in alluvium Other species: <i>Eleocharis</i> sp., <i>Leersia</i> sp., <i>Salix amygdaloides</i>, <i>S. nigra</i>, <i>Scirpus</i> sp.</p>
V.	HERBACEOUS (graminoids and/or forbs form >25% cover; woody cover <25%)
V.A.	Perennial vegetation graminoid
V.A.5.	Temperate or subpolar grassland

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United States National Vegetation Classification	Kansas community types
V.A.5.N.a.	Tall sod temperate grassland (includes mixed sod and bunch graminoids)
V.A.5.N.a.	ANDROPOGON GERARDII-(SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE
V.A.5.N.a.	<p><i>Andropogon gerardii</i>-<i>Panicum virgatum</i>-<i>Schizachyrium scoparium</i> Dakota Sandstone Herbaceous Vegetation (5231)</p> <p>Common name: Dakota Hills tallgrass prairie</p> <p>Distribution: Smoky Hills</p> <p>Other states: NE</p> <p>Pattern: large-patch</p> <p>Habitat: moderately sloping to steep side slopes and ridgetops on uplands; hills and mounds with numerous sandstone outcrops are common</p> <p>Soils: shallow, somewhat excessively drained to moderately deep, well drained loamy soils, formed in material weathered from sandstone and sandy shale</p> <p>Other species: <i>Bouteloua curtipendula</i>, <i>Clematis fremontii</i>, <i>Schizachyrium scoparium</i>, <i>Sorghastrum nutans</i>, <i>Tradescantia occidentalis</i>, <i>T. tharpii</i></p> <p>Comments: In Kansas, this type is limited to soils underlain by the Dakota (sandstone) Formation in the north-central part of the state.</p>
V.A.5.N.a.	<p><i>Andropogon gerardii</i>-<i>Sorghastrum nutans</i>-<i>Schizachyrium scoparium</i> Flint Hills Herbaceous Vegetation (2201)</p> <p>Common name: Flint Hills tallgrass prairie</p> <p>Distribution: Flint Hills Uplands</p> <p>Other states: OK</p> <p>Pattern: matrix</p> <p>Habitat: nearly level to steep slopes on uplands</p> <p>Soils: shallow to deep, somewhat poorly to somewhat excessively drained, loams, clays, and silts, formed in shale or limestone, or interbedded limestone and clayey shale</p> <p>Other species: <i>Amorpha canescens</i>, <i>Aster ericoides</i>, <i>Bouteloua curtipendula</i>, <i>Panicum virgatum</i>, <i>Psoralidium tenuiflorum</i>, <i>Sporobolus asper</i></p>
V.A.5.N.a.	<p><i>Andropogon gerardii</i>-<i>Sorghastrum nutans</i>-(<i>Sporobolus heterolepis</i>)-<i>Liatris</i> sp.-<i>Ratibida pinnata</i> Herbaceous Vegetation (2203)</p> <p>Common names: glaciated tallgrass prairie, northeastern (KS) tallgrass prairie</p> <p>Distribution: Glaciated Region</p> <p>Other states: IA, IL, IN, MI, MN, MO, NE, OH, WI</p> <p>Pattern: matrix</p> <p>Habitat: nearly level to steep slopes on uplands</p> <p>Soils: deep, somewhat poorly drained to well drained, silty and loamy soils from loess, glacial till, or clayey colluvium</p> <p>Other species: <i>Amorpha canescens</i>, <i>Dalea candida</i>, <i>D. purpurea</i>, <i>Salix humilis</i></p>
V.A.5.N.a.	<p><i>Andropogon gerardii</i>-<i>Sorghastrum nutans</i> Unglaciated Herbaceous Vegetation (2204)</p> <p>Common names: unglaciated tallgrass prairie, southeastern (KS) tallgrass prairie</p> <p>Distribution: Chautauqua Hills, Cherokee Lowlands, Osage Cuestas, Smoky Hills (eastern quarter), Wellington-McPherson Lowlands</p> <p>Other states: AR, MO, OK</p> <p>Pattern: matrix</p>

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Continued.

United States National Vegetation Classification	Kansas community types
V.A.5.N.a.	<p>Habitat: nearly level to moderately steep slopes on uplands Soils: moderately deep to deep, somewhat poorly drained to well drained silts and loams, formed in clayey, old alluvium or from shale, limestone, or sandstone Other species: <i>Amorpha canescens</i>, <i>Dalea candida</i>, <i>D. purpurea</i>, <i>Psoralidium tenuiflorum</i>, <i>Schizachyrium scoparium</i>, <i>Scleria triglomerata</i></p> <p><i>Andropogon gerardii</i>-<i>Sorghastrum nutans</i>-<i>Stipa spartea</i> Loess Hills Herbaceous Vegetation (2025) Common names: loess hills tallgrass prairie, hill prairie Distribution: Glaciated Region (primarily in the eastern third of this region) Other states: IA, MO, NE, SD Pattern: small-patch Habitat: bluff tops along larger streams or rivers and moderately steep to very steep exposed slopes, typically with S- or W-facing aspects, of dissected hills or plains Soils: deep, well drained silty loams, formed in loess or glacial till Other species: <i>Amorpha canescens</i>, <i>Bouteloua curtipendula</i>, <i>Dalea candida</i>, <i>Psoralidium tenuiflorum</i>, <i>Schizachyrium scoparium</i> Comments: In Kansas, this type is limited to the loess hills along the bluffs of the Missouri and Kansas rivers and the glacial drift/till hills in the northeast.</p>
V.A.5.N.a.	<p><i>Andropogon gerardii</i>-<i>Sorghastrum nutans</i> Western Great Plains Herbaceous Vegetation (1464) Common names: western tallgrass prairie, subirrigated tallgrass prairie Distribution: High Plains Other states: CO, OK Pattern: small-patch Habitat: valley bottoms and terraces along larger streams or rivers Soils: deep, somewhat poorly drained loam to sandy loam, formed in loamy and sandy alluvium Other species: <i>Desmanthus illinoensis</i>, <i>Glycyrrhiza lepidota</i>, <i>Panicum virgatum</i>, <i>Pascopyrum smithii</i>, <i>Schoenoplectus pungens</i>, <i>Sporobolus cryptandrus</i></p>
V.A.5.N.a.	ANDROPOGON HALLII HERBACEOUS ALLIANCE
V.A.5.N.a.	<p><i>Andropogon hallii</i>-<i>Calamovilfa longifolia</i> Herbaceous Vegetation (1467) Common name: sand prairie Distribution: Arkansas River Lowlands, Red Hills, Smoky Hills, Wellington-McPherson Lowlands Other states: MT, ND, NE, SD Pattern: matrix Habitat: undulating to hummocky sandy soils; nearly level to moderately sloping loamy soils Soils: deep, well drained to excessively drained, sand, loamy sand and sandy loams formed in sandy eolian sediments or in loamy alluvium Other species: <i>Calamovilfa gigantea</i> (southern part of range), <i>Helianthus petiolaris</i>, <i>Monarda punctata</i>, <i>Oenothera rhombipetala</i>, <i>Panicum virgatum</i>, <i>Prunus angustifolia</i>, <i>Schizachyrium scoparium</i></p>
V.A.5.N.a.	SCHIZACHYRIUM SCOPARIUM-SORGHASTRUM NUTANS HERBACEOUS ALLIANCE

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United States National Vegetation Classification	Kansas community types
V.A.5.N.a.	<p><i>Schizachyrium scoparium</i>–<i>Sorghastrum nutans</i>–<i>Andropogon ternarius</i>–<i>Coreopsis grandiflora</i> Sandstone–Shale Herbaceous Vegetation (2212) Common name: sandstone prairie Distribution: Chautauqua Hills, Osage Cuestas Other states: MO Pattern: small-patch Habitat: level to nearly level plains and terraces on uplands Soils: impermeable to semi-permeable clay and loamy soils, from shale or sandstone Other species: <i>Bouteloua curtipendula</i>, <i>Liatris pycnostachya</i>, <i>Panicum virgatum</i>, <i>Sabatia campestris</i>, <i>Viola sagittata</i></p>
V.A.5.N.c.	Medium-tall sod temperate or subpolar grassland (includes mixed sod and bunch graminoids)
V.A.5.N.c.	PASCOPIRUM (AGROPYRON) SMITHII HERBACEOUS ALLIANCE
V.A.5.N.c.	<p><i>Pascopyrum smithii</i>–<i>Bouteloua gracilis</i> Herbaceous Vegetation (1578) Common name: wheatgrass–grama prairie Distribution: High Plains Other states: CO, NM Pattern: small-patch Habitat: nearly level ground or shallow depressions on uplands Soils: silty clay loam with an impermeable or slowly permeable clay pan subsoil layer Other species: <i>Bouteloua curtipendula</i>, <i>Buchloë dactyloides</i>, <i>Ratibida columnifera</i></p>
V.A.5.N.c.	SCHIZACHYRIUM SCOPARIUM–BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE
V.A.5.N.c.	<p><i>Schizachyrium scoparium</i>–<i>Bouteloua curtipendula</i>–<i>Bouteloua gracilis</i> Central Plains Herbaceous Vegetation (2246) Common name: mixed prairie Distribution: High Plains, Smoky Hills Other states: OK Pattern: matrix Habitat: level to moderately sloping uplands and steep ravine slopes Soils: shallow to moderately deep, well drained loam, clay loam, silty loam, or silt formed from limestone Other species: <i>Ambrosia psilostachya</i>, <i>Andropogon gerardii</i>, <i>Astragalus crassicaerpus</i> var. <i>crassicaerpus</i>, <i>Bouteloua hirsuta</i>, <i>Buchloë dactyloides</i>, <i>Calylophus serrulatus</i>, <i>Dalea enneandra</i>, <i>Liatris punctata</i>, <i>Sorghastrum nutans</i></p>
V.A.5.N.c.	<p><i>Schizachyrium scoparium</i>–<i>Bouteloua curtipendula</i> Chalkflat Herbaceous Vegetation (2247) Common name: chalkflat mixed prairie Distribution: Smoky Hills (restricted to the valleys of Hackberry Creek and the Smoky Hill River) Pattern: large-patch Habitat: nearly level to gently sloping terraces below chalk or limestone outcrops Soils: strongly calcareous silt or loam, moderately deep to deep, well drained, formed from chalky shale and soft limestone</p>

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Continued.

United States National Vegetation Classification	Kansas community types
V.A.5.N.c.	<p>Other species: <i>Andropogon gerardii</i>, <i>Bouteloua gracilis</i>, <i>B. hirsuta</i>, <i>Buchloë dactyloides</i>, <i>Distichlis spicata</i>, <i>Eriogonum effusum</i>, <i>Gutierrezia sarothrae</i>, <i>Oenothera macrocarpa</i>, <i>Stanleya pinnata</i></p> <p><i>Schizachyrium scoparium</i>–<i>Bouteloua curtipendula</i> Red Hills Herbaceous Vegetation (2248)</p> <p>Common name: Red Hills mixed prairie</p> <p>Distribution: Red Hills</p> <p>Other states: OK</p> <p>Pattern: large-patch</p> <p>Habitat: gently sloping to strongly dissected steep hills and escarpments on uplands</p> <p>Soils: shallow to deep, well drained, silty, loamy and clayey soils formed from red silty shale, red silty sandstone, red sandstone, or clayey shale</p> <p>Other species: <i>Andropogon gerardii</i>, <i>Aster ericoides</i>, <i>Bouteloua gracilis</i>, <i>B. hirsuta</i>, <i>Callirhoe involucrata</i>, <i>Gutierrezia sarothrae</i>, <i>Sporobolus cryptandrus</i></p> <p>Comments: Woody vegetation is scattered across the landscape, including <i>Juniperus virginiana</i> and groves of small deciduous trees and shrubs (<i>Celtis occidentalis</i>, <i>Prunus angustifolia</i>, <i>Rhus glabra</i>, <i>Sapindus saponaria</i>, <i>Symphoricarpos occidentalis</i>) on north-facing slopes and in valleys.</p>
V.A.5.N.c.	<p><i>Schizachyrium scoparium</i>–<i>Bouteloua curtipendula</i> Loess Mixedgrass Herbaceous Vegetation (2036)</p> <p>Common name: loess mixed prairie</p> <p>Distribution: High Plains (primarily in the northern third of this region)</p> <p>Other states: CO, ND, NE, SD</p> <p>Pattern: large-patch</p> <p>Habitat: loess deposits on level to steep uplands</p> <p>Soils: deep loam or silt loam formed in loess material</p> <p>Other species: <i>Andropogon gerardii</i>, <i>Artemisia dracunculus</i>, <i>Asclepias pumila</i>, <i>Bouteloua gracilis</i>, <i>Lygodesmia juncea</i>, <i>Panicum virgatum</i>, <i>Pascopyrum smithii</i>, <i>Ratibida columnifera</i>, <i>Solidago missouriensis</i></p>
V.A.5.N.c.	<p><i>Schizachyrium scoparium</i>–<i>Bouteloua curtipendula</i>–<i>Agrostis hyemalis</i>–<i>Eleocharis</i> sp. Hardpan Herbaceous Vegetation (2249)</p> <p>Common name: hardpan prairie</p> <p>Distribution: Cherokee Lowlands, Osage Cuestas</p> <p>Other states: MO</p> <p>Pattern: small-patch</p> <p>Habitat: level to gently sloping ground on upland plains, ridges, and terraces</p> <p>Soils: silty loam, with an impermeable or slowly permeable silty clay subsoil layer</p> <p>Other species: <i>Andropogon gerardii</i>, <i>Camassia scilloides</i>, <i>Carex</i> sp., <i>Cicuta maculata</i>, <i>Desmanthus illinoensis</i>, <i>Panicum virgatum</i>, <i>Polygala verticillata</i>, <i>Sporobolus vaginiflorus</i></p>
V.A.5.N.c.	<p>STIPA COMATA–BOUTELOUA GRACILIS HERBACEOUS ALLIANCE</p> <p><i>Stipa comata</i>–<i>Bouteloua gracilis</i>–[<i>Carex filifolia</i>] Herbaceous Vegetation (2037)</p> <p>Common name: northern mixed prairie</p> <p>Distribution: High Plains, Smoky Hills (northern half of these regions)</p> <p>Other states: CO, MT, ND, NE, SD, WY</p>

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Continued.

United States National Vegetation Classification	Kansas community types
	<p>Pattern: large-patch Habitat: rolling hills and plains Soils: deep loess, well drained Other species: <i>Buchloë dactyloides</i>, <i>Pascopyrum smithii</i>, <i>Psoralea argophylla</i>, <i>Ratibida columnifera</i>, <i>Yucca glauca</i></p>
V.A.5.N.d.	Medium-tall bunch temperate or subpolar grassland
V.A.5.N.d.	SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE
V.A.5.N.d.	<p><i>Sporobolus airoides</i> Herbaceous Vegetation (1685) Common name: alkali sacaton lowland prairie Distribution: High Plains, Smoky Hills (restricted to salty flats) Other states: CO, MT, NM, TX Pattern: small-patch Habitat: nearly level bottomland and terraces Soils: shallow, moderately-well to poorly drained silty clays, formed in alluvium Other species: <i>Aster subulatus</i>, <i>Buchloë dactyloides</i>, <i>Distichlis spicata</i>, <i>Hordeum jubatum</i>, <i>Pascopyrum smithii</i></p>
V.A.5.N.e.	Short sod temperate or subpolar grassland
V.A.5.N.e.	BOUPELOUA GRACILIS HERBACEOUS ALLIANCE
V.A.5.N.e.	<p><i>Bouteloua gracilis</i>–<i>Buchloë dactyloides</i> Herbaceous Vegetation (1756) Common name: shortgrass prairie Distribution: High Plains Other states: CO, NE, NM, OK, TX, WY Pattern: matrix Habitat: nearly level to moderately steep slopes on rolling plains and uplands Soils: deep loams and silts, well drained, formed in loess or in loamy, eolian sediments Other species: <i>Aristida purpurea</i>, <i>Gutierrezia sarothrae</i>, <i>Psoralidium tenuiflorum</i>, <i>Ratibida columnifera</i></p>
V.A.5.N.i.	Intermittently flooded temperate grassland
V.A.5.N.i.	PASCOPYRUM SMITHII INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE
V.A.5.N.i.	<p><i>Pascopyrum smithii</i>–<i>Buchloë dactyloides</i>–(<i>Phyla cuneifolia</i>, <i>Oenothera canescens</i>) Herbaceous Vegetation (2038) Common name: grass playa lake Distribution: High Plains (restricted to upland depressional basins) Other states: NE, OK, TX Pattern: small-patch Habitat: depressional features in plains (playas) Soils: dense clays, poorly drained Other species: <i>Ambrosia grayi</i>, <i>Eleocharis macrostachya</i>, <i>Hordeum jubatum</i>, <i>Rorippa sinuata</i></p>
V.A.5.N.j.	Temporarily flooded temperate or subpolar grassland
V.A.5.N.j.	DISTICHLIS SPICATA–(HORDEUM JUBATUM) TEMPORARILY FLOODED HERBACEOUS ALLIANCE
V.A.5.N.j.	<p>*<i>Distichlis spicata</i>–(<i>Hordeum jubatum</i>, <i>Poa arida</i>, <i>Sporobolus airoides</i>) Herbaceous Vegetation (2042) Common names: saltflat mixed prairie, saline playa lake</p>

APPENDIX 1
Continued.

United States National Vegetation Classification	Kansas community types
	<p>Distribution: High Plains (restricted to the shallow Scott-Finney depression, Scott and Finney counties) Other states: NE, OK, TX Pattern: large-patch Habitat: nearly level to gently sloping areas on uplands in or adjacent to broad depressions Soils: deep, somewhat poorly to well drained, saline and saline-alkali loams and silts, formed in loess or alluvium Other species: <i>Bouteloua curtipendula</i>, <i>Pascopyrum smithii</i></p>
V.A.5.N.j.	<p>*<i>Distichlis spicata</i>-<i>Scirpus maritimus</i>-<i>Salicornia rubra</i> Herbaceous Vegetation (2043) Common name: salt marsh Distribution: Arkansas River Lowlands, Smoky Hills Other states: MO, NE, OK Pattern: small-patch Habitat: swales and depressions of floodplains and their terraces, and valley basins Soils: deep, very poorly drained, consisting of peat, muck, or mineral materials, formed in alluvium or loess Other species: <i>Scirpus</i> sp., <i>Suaeda depressa</i> Comments: Distinguished from the freshwater marsh community by its restriction to salty seepage areas that often contain brackish or stagnant water.</p>
V.A.5.N.j.	<p>ELEOCHARIS MACROSTACHYA TEMPORARILY FLOODED HERBACEOUS ALLIANCE</p>
V.A.5.N.j.	<p>*<i>Eleocharis macrostachya</i>-(<i>Eleocharis compressa</i>)-<i>Leptochloa fascicularis</i> Herbaceous Vegetation (2259) Common name: spikerush playa lake Distribution: High Plains, Smoky Hills (restricted to upland depressional basins) Other states: OK Pattern: small-patch Habitat: depressional features in plains (playas) Soils: dense clays, poorly drained Other species: <i>Ambrosia grayi</i>, <i>Aster subulatus</i>, <i>Hordeum jubatum</i>, <i>Polygonum bicorne</i></p>
V.A.5.N.j.	<p>POLYGONUM SP.-ECHINOCHLOA SP. TEMPORARILY FLOODED HERBACEOUS ALLIANCE</p>
V.A.5.N.j.	<p>*<i>Polygonum</i> sp.-<i>Echinochloa</i> sp.-<i>Distichlis spicata</i> Playa Lake Herbaceous Vegetation (2039) Common name: playa lake Distribution: High Plains, Smoky Hills (restricted to upland depressional basins) Other states: NE, OK Pattern: small-patch Habitat: nearly level to gently sloping shallow depressions or saucer-shaped basins Soils: deep to moderately deep loams and clay loams, usually containing a dense clay subsoil layer</p>

APPENDIX 1
Continued.

United States National Vegetation Classification	Kansas community types
	<p>Other species: <i>Ambrosia grayi</i>, <i>Aster subulatus</i>, <i>Chenopodium berlandieri</i>, <i>Hordeum jubatum</i></p> <p>Comments: For all playa lake communities, shallow ponds often form after large rainfall events due to poor drainage and are subject to natural drawdown and replenishment cycles during the year.</p>
V.A.5.N.j.	SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE
V.A.5.N.j.	<p>*<i>Spartina pectinata</i>–<i>Eleocharis</i> sp.–<i>Carex</i> sp. Herbaceous Vegetation (2223)</p> <p>Common names: low prairie, wet prairie</p> <p>Distribution: eastern third of Kansas</p> <p>Other states: OK</p> <p>Pattern: small-patch</p> <p>Habitat: nearly level soils on floodplains along rivers, streams, and creeks</p> <p>Soils: deep, poorly drained, formed in alluvium</p> <p>Other species: <i>Asclepias incarnata</i>, <i>Aster lanceolatus</i>, <i>Baptisia lactea</i>, <i>Helianthus grosseserratus</i>, <i>Scirpus atrovirens</i></p> <p>Comments: These communities are nearly always saturated with water, or are temporarily inundated with surface water during the winter and/or spring seasons. Short-term flooding of 1 to 3 days at depths less than 0.6 m occurs periodically (2 to 12 times) through the year.</p>
V.A.5.N.j.	<p>*<i>Calamagrostis canadensis</i>–<i>Juncus</i> sp.–<i>Carex</i> sp. Sandhills Herbaceous Vegetation (2028)</p> <p>Common name: sandhills wet prairie</p> <p>Distribution: Arkansas River Lowlands, High Plains</p> <p>Other states: ND, NE</p> <p>Pattern: small-patch</p> <p>Habitat: interdunal sandhill valleys on terraces and floodplains</p> <p>Soils: poorly drained silty loams and sandy soils</p> <p>Other species: <i>Amorpha fruticosa</i>, <i>Eleocharis atropurpurea</i>, <i>Panicum virgatum</i>, <i>Salix exigua</i></p>
V.A.5.N.k.	Seasonally flooded temperate or subpolar grassland
V.A.5.N.k.	TYPHA SP.–(SCIRPUS SP., JUNCUS SP.) SEASONALLY FLOODED HERBACEOUS ALLIANCE
V.A.5.N.k.	<p>*<i>Scirpus validus</i>–<i>Typha</i> sp.–(<i>Sparganium</i> sp., <i>Juncus</i> sp.) Herbaceous Vegetation (2026)</p> <p>Common names: freshwater marsh, bulrush–cattail marsh</p> <p>Distribution: Chautauqua Hills, Cherokee Lowlands, Flint Hills Uplands, Glaciated Region, Osage Cuestas</p> <p>Other states: IA, IL, IN, MO, ND, NE, OH, OK, SD, WI</p> <p>Pattern: small-patch</p> <p>Habitat: swales and depressions associated with river systems</p> <p>Soils: deep, very poorly drained, consisting of peat, muck, or mineral materials, formed in alluvium</p> <p>Other species: <i>Carex</i> sp., <i>Typha latifolia</i></p>
V.A.5.N.l.	Semipermanently flooded temperate or subpolar grassland
V.A.5.N.l.	SCIRPUS PUNGENS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE
V.A.5.N.l.	<p>*<i>Scirpus pungens</i>–<i>Suaeda depressa</i> Alkaline Herbaceous Vegetation (2040)</p> <p>Common name: alkaline marsh</p>

APPENDIX 1
Continued.

United States National Vegetation Classification	Kansas community types
	<p>Distribution: Arkansas River Lowlands, High Plains, Smoky Hills Other states: NE Pattern: small-patch Habitat: depressional basins on uplands and along stream terraces Soils: poorly drained clays to loams Other species: <i>Coreopsis tinctoria</i>, <i>Polygonum bicorne</i>, <i>Sagittaria longiloba</i>, <i>Schoenoplectus acutus</i>, <i>S. tabernaemontani</i>, <i>Typha angustifolia</i></p>
V.A.5.N.1.	<p>*<i>Scirpus pungens</i>–(<i>Eleocharis</i> sp.) Herbaceous Vegetation (1587) Common name: bulrush–spikerush marsh Distribution: statewide Other states: MT, NV, UT Pattern: small-patch Habitat: basins, oxbows, and lowlands along stream courses Soils: silty clays, poorly drained Other species: <i>Bolboschoenus maritimus</i>, <i>Lemna minor</i>, <i>Sagittaria latifolia</i>, <i>Typha</i> sp.</p>
V.A.5.N.1.	<p>TYPHA (ANGUSTIFOLIA, LATIFOLIA)–(SCIRPUS SP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE</p>
V.A.5.N.1.	<p>*<i>Typha</i> (<i>angustifolia</i>, <i>domingensis</i>, <i>latifolia</i>)–[<i>Scirpus americanus</i>] Herbaceous Vegetation (2032) Common name: cattail–bulrush marsh Distribution: eastern half of Kansas Other states: OK, TX Pattern: small-patch Habitat: oxbows and low areas along creeks and streams Soils: poorly drained clays and silty clays Other species: <i>Carex hyalinolepis</i>, <i>Eleocharis</i> sp., <i>Lemna minor</i>, <i>Sagittaria latifolia</i> Note: <i>Scirpus americanus</i> is very rare in Kansas, but is a regional codominant.</p>
V.A.5.N.1.	<p>*<i>Typha</i> sp. Great Plains Herbaceous Vegetation (2389) Common name: western cattail marsh Distribution: western two-thirds of Kansas Other states: ND, NE, OK, SD Pattern: small-patch Habitat: oxbows and low areas along creeks and streams Soils: poorly drained clays and silty clays Other species: <i>Eleocharis</i> sp., <i>Sagittaria latifolia</i></p>
V.A.5.N.1.	<p>*<i>Typha</i> sp. Midwest Herbaceous Vegetation (2233) Common name: eastern cattail marsh Distribution: eastern third of Kansas Other states: IA, IL, IN, MI, MN, MO, ND, NE, OH, SD, WI Pattern: small-patch Habitat: basins and low areas Soils: poorly drained clays and silty clays Other species: <i>Eleocharis</i> sp., <i>Scirpus pungens</i></p>
V.A.5.N.m.	<p>Saturated temperate or subpolar grassland</p>
V.A.5.N.m.	<p>CAREX LANUGINOSA–(CAREX NEBRASCENSIS)–SCIRPUS SP. SATURATED HERBACEOUS ALLIANCE</p>

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United States National Vegetation Classification	Kansas community types
V.A.5.N.m.	<p>*<i>Carex lanuginosa</i>–<i>Carex</i> sp.–<i>Scirpus</i> sp. Plains Fen Herbaceous Vegetation (2041) Common name: fen Distribution: Glaciated Region Other states: IA, MO, NE Pattern: small-patch Habitat: moderately sloping to steep hillsides in narrow valleys, bases of river bluffs, and floodplain terraces Soils: deep, saturated mucky peat, formed in gravelly alluvium or colluvium over limestone bedrock Other species: <i>Eleocharis</i> sp., <i>Eupatorium maculatum</i>, <i>Scirpus validus</i>, <i>Typha latifolia</i> Comments: A calcareous groundwater seepage community where subsurface recharge may occur through localized artesian conditions. Note: <i>Carex nebrascensis</i> is very rare in Kansas, but is a regional codominant.</p>
V.A.5.N.m.	CAREX SP.–TYPHA SP. SATURATED HERBACEOUS ALLIANCE
V.A.5.N.m.	<p>*<i>Typha</i> sp.–<i>Equisetum hyemale</i>–<i>Carex</i> sp. Seep Herbaceous Vegetation (2033) Common name: neutral seep Distribution: Glaciated Region, Osage Cuestas Other states: IA, MO, NE, SD Pattern: small-patch Habitat: hillsides and bluffs in river valleys Soils: shallow to deep (varying with degree of slope), formed from loess or shale Other species: <i>Equisetum</i> sp., <i>Typha angustifolia</i>, <i>T. latifolia</i> Comments: A circumneutral community where the pH of the groundwater and its mineral content are caused by rainwater permeating loess or glacial till and contacting an impervious shale layer. Groundwater flows outward where the loess-shale interface is exposed on hillsides and bluffs.</p>
V.A.5.N.m.	<p>*<i>Typha</i> sp.–<i>Carex</i> sp. Acid Seep Herbaceous Vegetation (2235) Common name: acid seep Distribution: Cherokee Lowlands, Osage Cuestas, Ozark Plateau Other states: MO Pattern: small-patch Habitat: bases of gentle to moderately steep slopes in river valleys and canyons Soils: shallow to deep with deposits of peat or muck, formed in sandstone or sandy colluvium Other species: <i>Lindera benzoin</i>, <i>Sassafras albidum</i>, <i>Sphagnum</i> sp., <i>Vaccinium arboreum</i> Comments: The soils are constantly saturated by acidic groundwater that flows from gravelly or sandy substrates.</p>
V.A.6.	Temperate or subpolar grassland with a sparse tree layer
V.A.6.N.q.	Bedrock temperate or subpolar grassland with a sparse tree layer
V.A.6.N.q.	(QUERCUS STELLATA–QUERCUS MARILANDICA)/SCHIZACHYRIUM SCOPARIUM WOODED HERBACEOUS ALLIANCE
V.A.6.N.q.	<p><i>Schizachyrium scoparium</i>–<i>Aristida dichotoma</i>–<i>Croton willdenowii</i>/Lichens Wooded Herbaceous Vegetation (2242) Common name: Ozark sandstone glade/prairie</p>

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Continued.

United States National Vegetation Classification	Kansas community types
	<p>Distribution: Chautauqua Hills, Cherokee Lowlands, Osage Cuestas, Ozark Plateau</p> <p>Other states: AR, MO</p> <p>Pattern: small-patch</p> <p>Habitat: gently rolling plains, gentle to moderately-sloping hills and knobs, and steep upper slopes of south-facing escarpments</p> <p>Soils: shallow, sandy, rapidly drained with vernal inundated depressions, formed from sandstone</p> <p>Other species: <i>Chaetopappa asteroides</i>, <i>Isoetes butleri</i>, <i>Saxifraga texana</i>, <i>Sedum nuttallianum</i>, <i>S. pulchellum</i>, <i>Talinum parviflorum</i></p> <p>Comments: Often contains large areas of exposed bedrock with stunted xerophytic trees and shrubs.</p>
V.A.6.N.q.	(JUNIPERUS VIRGINIANA)/SCHIZACHYRIUM SCOPARIUM-(BOUTELLOUA CURTIPENDULA) WOODED HERBACEOUS ALLIANCE
V.A.6.N.q.	<p><i>Schizachyrium scoparium</i>-<i>Bouteloua curtispindula</i>-[<i>Rudbeckia missouriensis</i>]-<i>Mentzelia oligosperma</i> Wooded Herbaceous Vegetation (2251)</p> <p>Common name: Ozark limestone glade</p> <p>Distribution: Cherokee Lowlands, Osage Cuestas, Ozark Plateau</p> <p>Other states: MO</p> <p>Pattern: small-patch</p> <p>Habitat: nearly level to steep upland south- or west-facing slopes and bluffs of dissected hills and valleys</p> <p>Soils: shallow, rocky, well drained and usually clayey, formed from limestone</p> <p>Other species: <i>Heliotropium tenellum</i>, <i>Isoetes butleri</i>, <i>Ophioglossum engelmannii</i>, <i>Sedum pulchellum</i>, <i>Talinum parviflorum</i></p> <p>Comments: In general, <i>Rudbeckia missouriensis</i> is not part of the Kansas community type but is a co-dominant in Missouri. Exposed horizontal layers of limestone (outcrops) are common to abundant.</p>
V.A.8.	Temperate or subpolar grassland with a sparse dwarf-shrub layer
V.A.8.N.a.	Short temperate or subpolar lowland grassland with a sparse needle-leaved or microphyllous dwarf-shrub layer
V.A.8.N.a.	KRASCHENINNIKOVIA (CERATOIDES) LANATA DWARF-SHRUB HERBACEOUS ALLIANCE
V.A.8.N.a.	<p><i>Krascheninnikovia lanata</i>/<i>Bouteloua gracilis</i> Dwarf-Shrub Herbaceous Vegetation (1321)</p> <p>Common name: winterfat-blue grama prairie</p> <p>Distribution: High Plains (primarily in the north half of this region)</p> <p>Other states: AZ, CO, NM</p> <p>Pattern: small-patch</p> <p>Habitat: areas with sparse vegetation on uplands and flats</p> <p>Soils: shallow, rocky, alkaline</p> <p>Other species: <i>Buchloë dactyloides</i>, <i>Echinacea angustifolia</i>, <i>Liatris punctata</i>, <i>Stanleya pinnata</i></p>
V.C.	Hydromorphic rooted vegetation (non-emergent graminoids and forbs structurally supported by water and rooted in substrate)
V.C.2.	Temperate or subpolar hydromorphic rooted vegetation

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United States National Vegetation Classification	Kansas community types
V.C.2.N.a.	Permanently flooded temperate or subpolar hydromorphic rooted vegetation
V.C.2.N.a.	HETERANTHERA LIMOSA PERMANENTLY FLOODED HERBACEOUS ALLIANCE
V.C.2.N.a.	* <i>Heteranthera limosa</i> – <i>Bacopa rotundifolia</i> – <i>Sagittaria latifolia</i> Herbaceous Vegetation (2279) Common name: forb playa lake Distribution: High Plains (restricted to upland depressional basins) Other states: OK, TX Pattern: small-patch Habitat: depressional features in plains (playas) Soils: dense clays, poorly drained Other species: <i>Eleocharis macrostachya</i> , <i>Hordeum jubatum</i> , <i>Polygonum bicorne</i> , <i>Rorippa sinuata</i>
V.C.2.N.a.	POTAMOGETON SP.–CERATOPHYLLUM SP.–ELODEA SP. PERMANENTLY FLOODED HERBACEOUS ALLIANCE
V.C.2.N.a.	* <i>Potamogeton</i> sp.– <i>Ceratophyllum demersum</i> Great Plains Herbaceous Vegetation (2044) Common name: pondweed aquatic wetland Distribution: Arkansas River Lowlands, Smoky Hills, Wellington-McPherson Lowlands Other states: ND, NE, SD Pattern: small-patch Habitat: interdunal swales and depressions along streams Soils: poorly drained sands and clays Other species: <i>Schoenoplectus</i> sp., <i>Scirpus</i> sp., <i>Typha</i> sp.
VII.	SPARSE VEGETATION (vegetation scattered or nearly absent; total vegetation cover less than 10%)
VII.A.	Consolidated rock sparse vegetation
VII.A.1.	Sparsely vegetated cliffs
VII.A.1.N.a.	Cliffs with sparse vascular vegetation
VII.A.1.N.a.	OPEN BLUFF/CLIFF SPARSELY VEGETATED ALLIANCE
VII.A.1.N.a.	Chert Ozark Moist Cliff Sparse Vegetation (2288)
VII.A.1.N.a.	Limestone/Dolostone Midwest Dry Cliff Sparse Vegetation (2291)
VII.A.1.N.a.	Limestone/Dolostone Midwest Moist Cliff Sparse Vegetation (2292)
VII.A.1.N.a.	Sandstone Dry Cliff Sparse Vegetation (2045)
VII.A.1.N.a.	Sandstone Moist Cliff Sparse Vegetation (2287)
VII.A.1.N.a.	ROCK OUTCROP/BUTTE SPARSELY VEGETATED ALLIANCE
VII.A.1.N.a.	Limestone Caprock Butte Sparse Vegetation (2296)
VII.A.1.N.a.	Sandstone Caprock Butte Sparse Vegetation (2297)
VII.C.	Unconsolidated material sparse vegetation
VII.C.2.	Sparsely vegetated sand flats
VII.C.2.N.c.	Temporarily flooded sand flats
VII.C.2.N.c.	SAND FLATS TEMPORARILY FLOODED SPARSELY VEGETATED ALLIANCE
VII.C.2.N.c.	Riverine Sand Flats—Bars Sparse Vegetation (2049)