

Nebraska GAP Land Cover Classes and Associated NVCS Alliances

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- V.A.5.N.k.53 Carex pellita seasonally flooded herbaceous alliance
- V.A.5.N.l.6 Schoenoplectus pungens semipermanently flooded herbaceous alliance
- V.A.5.N.l.9 Typha (angustifolia, latifolia) - (Schoenoplectus spp.) semipermanently flooded herbaceous alliance
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- II.B.2.N.a.29 Fraxinus pennsylvanica - (Ulmus Americana) woodland alliance
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Low Intensity Residential

High Intensity Residential/Commercial/Industrial/Transportation

1. Ponderosa Pine Forests and Woodlands

I.A.8.N.b.10 Pinus ponderosa forest alliance

Forests dominated by *Pinus ponderosa* occur in mountainous regions of the western United States, from the Cascades and Black Hills, throughout the Rocky Mountains, southeast to the mountains of Arizona, New Mexico, and western Texas. This alliance may range into southern British Columbia, and although *Pinus ponderosa* is found in Mexico, it is uncertain whether this alliance ranges into that country. This alliance can be found on slopes of a variety of aspects and pitches, but is most often on gentle to moderate, northeast- to northwest-facing slopes. It can be on slopes of other aspects where the soil is heavier and retains more moisture or if other conditions make the site relatively mesic. Periodic ground fires are important in maintaining *Pinus ponderosa* forests. In the prolonged absence of fires, some stands will succeed to other communities. Throughout its range, *Pinus ponderosa* is found at elevations from sea level to 3050 m (10,000 feet). Within the central Rocky Mountains, *Pinus ponderosa* grows at elevations between 1800-2600 m (6000-8500 feet). In the Black Hills and northeastern Wyoming, it can be found from 1080-2100 m (3600-7000 feet). In the southeastern United States, these forests are restricted to the high elevations (over 1800 m, 6000 feet) of the Guadalupe, Davis, and Chisos mountains in western Texas, where associations are dominated by *Pinus ponderosa* var. *scopulorum*. Associated species vary with elevation and geography, but consistently include *Quercus gambelii*, *Pinus strobiformis*, *Juniperus deppeana*, *Quercus grisea*, *Quercus muehlenbergii*, *Pinus arizonica* var. *stormiae*, *Cupressus arizonica*, *Juniperus flaccida*, *Festuca arizonica*, *Schizachyrium scoparium* var. *scoparium* (= *Schizachyrium scoparium* ssp. *neomexicanum*), *Panicum bulbosum*, and *Piptochaetium pringlei* (= *Stipa pringlei*).

II.A.4.N.a.32 Pinus ponderosa woodland alliance

This alliance is one of the most widespread wooded alliances in the western United States; there are currently over 50 plant associations in this alliance. The alliance is found throughout the western half of the U.S. and southwestern Canada, as well as the Trans-Pecos of Texas and the western portions of the Great Plains, such as in western Oklahoma and the Dakotas. Sites are dry/dry-mesic to xeric, and soils are generally well-drained and coarse-textured. *Pinus ponderosa* often dominates these woodlands, but codominant species may include *Pseudotsuga menziesii*, other *Pinus* species, and species of *Juniperus*, *Abies*, or *Picea*. The understory ranges from dense shrub or graminoid layers to barren rock. The associated plant species vary with changes in geography and environmental conditions. Associated trees include species of *Pinus*, *Quercus*, *Juniperus*, *Abies*, *Pseudotsuga*, *Populus*, and *Picea*. Shrubs can include species of *Arctostaphylos*, *Artemisia*, *Cercocarpus*, *Ceanothus*, *Symphoricarpos*, *Physocarpus*, *Rosa*, *Purshia*, and others. Important graminoids include species of *Carex*, *Elymus*, *Poa*, *Festuca*, *Muhlenbergia*, *Piptochaetium*, and many others.

2. Deciduous Forests and Woodlands

I.B.2.N.a.8 Acer saccharum - Tilia Americana - (Quercus rubra) forest alliance

This alliance, found in the midwestern United States, forms the westernmost portion of the mesic deciduous forests that occupy much of the eastern United States. Stands in this alliance have a moderately dense to dense tree canopy dominated by some combination of *Acer saccharum*, *Quercus rubra*, and *Tilia americana*. The latter two species become more prominent constituents of the forest along the drier western edge of the alliance's range. Other common canopy species include *Acer rubrum*, *Carya* spp., *Celtis occidentalis*, *Fraxinus pennsylvanica*, *Quercus alba*, and *Ulmus* spp. *Carpinus caroliniana* (in the southern half of this alliance's range) and *Ostrya virginiana* are

characteristic subcanopy trees. The dense canopy tends to inhibit the formation of a significant shrub layer. Scattered shrubs of *Acer spicatum* (in the north), *Corylus americana*, *Hamamelis virginiana*, *Ribes* spp., *Sambucus* spp., *Viburnum acerifolium* (in the north), and *Zanthoxylum americanum* may be found in stands of this alliance. Spring ephemerals are a distinctive part of the herbaceous layer, especially in the southern part of this alliance's range. Common herbaceous species include *Anemone quinquefolia*, *Eurybia macrophylla* (= *Aster macrophyllus*) (in the north), *Carex pensylvanica*, *Claytonia* spp., *Dicentra cucullaria*, *Erythronium* spp., *Hepatica nobilis* var. *acuta* (= *Hepatica triloba*), *Laportea canadensis*, *Polygonatum pubescens*, *Sanicula odorata* (= *Sanicula gregaria*), *Trillium grandiflorum*, and *Uvularia grandiflora*.

Stands of this alliance are found on well-drained, nutrient-rich, loamy soils. In the southern part of the alliance's range, stands are often found on ravine slopes where the microclimate is more mesic than the surrounding uplands. This alliance is very intolerant of fire. Thus, along the western edge of its range, stands are found on sites protected from fire, such as the lee side of waterbodies or where topographic features inhibit the spread of fire.

I.B.2.N.a.27 *Quercus alba* - (*Quercus rubra*, *Carya* spp.) forest alliance

This alliance is widely distributed in the eastern United States and portions of adjacent Canada and includes dry mesic to mesic upland oak forests dominated by *Quercus alba* and/or *Quercus rubra*, with or without *Carya* species. Stands are 15-25 m tall, with a closed, deciduous canopy. The shrub and herbaceous strata are typically well-developed. *Quercus alba* usually dominates the stands, either alone or in combination with *Quercus rubra* (especially on moister sites) and sometimes *Quercus velutina* (especially on drier sites). Some associations in this alliance are dominated by *Quercus rubra*, although *Quercus alba* is usually also a canopy component. *Carya* species (particularly *Carya alba*, *Carya glabra* or *Carya ovata*) are typically common either in the canopy or subcanopy. In the southeastern United States, this alliance covers dry-mesic forests of the Piedmont, low Appalachian Mountains, and the Cumberland and Interior Low Plateau, and mesic oak-hickory forests of the Blue Ridge and the interior highlands of the Ozarks and Ouachita Mountains. Associated species in the southeastern United States include *Carya glabra*, *Carya ovata*, *Carya alba*, *Fraxinus americana*, *Acer rubrum*, *Acer leucoderme*, *Cornus florida*, *Nyssa sylvatica*, *Ostrya virginiana*, *Calycanthus floridus*, *Pyrolaria pubera*, *Tilia americana* var. *caroliniana*, *Oxydendrum arboreum*, and others. This alliance is found throughout the midwestern United States on moderately rich, upland sites. Typical associates include *Fraxinus americana*, *Ulmus americana*, *Tilia americana*, *Acer saccharum*, *Acer rubrum*, and more locally, *Quercus macrocarpa* and *Quercus ellipsoidalis*.

Stands are found on gentle to moderately steep slopes on uplands and on steep valley sides. The soils are moderately deep to deep and vary from silts to clays and loams. The parent material ranges from glaciated till to limestone, shale, sandstone and other bedrock types. In the midwestern United States, many stands are succeeding to types dominated by *Acer saccharum*, *Tilia americana*, *Acer rubrum*, and other mesic tree associates. This succession may be delayed by fire and grazing. In the eastern and southeastern United States, *Liriodendron tulipifera*, *Fraxinus americana*, *Acer rubrum*, and other mesic associates often increase after disturbances, such as clearcutting or windstorms, especially in the absence of fire.

I.B.2.N.a.33 *Quercus macrocarpa* forest alliance

This alliance is restricted to the northern Great Plains and the Black Hills. The canopy can be moderately closed to closed but is often relatively open for a forest alliance. The overstory of this alliance is usually dominated by *Quercus macrocarpa*, although in some elements *Tilia americana* is a codominant. Associated trees include *Ulmus americana*, *Fraxinus pennsylvanica*, and *Betula papyrifera* throughout its range, and *Pinus ponderosa* in the Black Hills. There is a subcanopy of *Ostrya virginiana*, *Juniperus virginiana*, and small overstory species. In the eastern portion of its range, *Juglans nigra*, *Populus tremuloides*, and *Celtis* spp. are often found in the canopy and subcanopy. A shrub layer may be present. It is usually made up of species 0.5-2 m tall, such as *Symphoricarpos occidentalis*, *Prunus virginiana*, *Ribes* spp., *Amelanchier alnifolia*, *Corylus cornuta*, and *Corylus americana*. Smaller shrubs like *Mahonia repens* and *Rosa* spp. are also commonly found in this alliance. The herbaceous layer typically contains *Aralia nudicaulis*, *Caulophyllum thalictroides*, *Elymus virginicus*, *Carex* spp., *Maianthemum stellatum*, and *Viola* spp.

Quercus macrocarpa Forest Alliance (A.245) is found on rolling hills, mountain slopes (in the Black Hills), and along watercourses. These topographic positions provided some protection from the fires that regularly occurred in the surrounding grasslands. In the drier parts of its range, this alliance is predominantly found on north-facing slopes or along watercourses where the microclimate is more mesic. The soils of this alliance tend to be deep, loamy, and moderately well-drained to well-drained.

I.B.2.N.b.3 *Betula papyrifera* forest alliance

This alliance is found in the Black Hills, Great Lakes area, and northern New England. The canopy is moderately closed to closed and tree density can be high. The dominant tree, *Betula papyrifera*, does not cast dense shade and thus there is usually a prominent subcanopy or shrub layer. The subcanopy, and most other tree reproduction, is composed largely of more shade-tolerant tree species such as *Abies balsamea* (near the western Great Lakes), *Acer rubrum*, *Acer saccharum*, *Betula alleghaniensis*, *Picea glauca* (near the western Great Lakes), *Pinus banksiana* (in northwestern Ontario), *Pinus ponderosa* (in the western Great Plains), and *Quercus rubra*. These trees may be found in small amounts in the canopy, especially in older stands of this alliance. *Populus tremuloides* and *Populus grandidentata* are common canopy associates, as well, although in the range of *Populus tremuloides* this alliance is restricted to stands where *Betula papyrifera* comprises >90% of the deciduous canopy. *Amelanchier* spp. and *Corylus cornuta* are common shrubs across the range of this alliance. In the western Great Lakes area, *Acer spicatum*, *Diervilla lonicera*, *Rosa acicularis*, and *Vaccinium* spp. are typical shrubs. The herbaceous layer contains species such as *Actaea rubra*, *Aralia nudicaulis*, *Eurybia macrophylla* (= *Aster macrophyllus*), *Clintonia borealis* (in the western Great Lakes area), *Maianthemum canadense*, *Schizachne purpurascens* (in the Great Plains), and *Trientalis borealis* (in the western Great Lakes area).

This alliance is an early successional forest and occurs on a variety of sites. It is most often found on well-drained or rapidly drained, fresh to moist soil. Stands can be found on flat to moderately sloping areas, generally, although they may occur on steep slopes in the Great Plains. The soil texture is usually loam.

II.B.2.N.a.20 *Quercus macrocarpa* woodland alliance

This alliance is widespread in the northern and central Great Plains. All of its associations are found exclusively or primarily in the midwestern United States west of the Mississippi River. The canopy is open to moderately closed and usually dominated by *Quercus macrocarpa*. Common associates in the canopy are *Quercus muehlenbergii* in the

southeast portion, *Fraxinus pennsylvanica*, *Tilia americana*, and *Populus tremuloides* in the northern half, and *Carya* spp. and *Ulmus* spp. in the eastern part of the alliance's range. *Pinus ponderosa* can occur in some stands at the extreme western limit of this alliance's range. A shrub layer 1-2 m tall is often present, especially in the northern half of the range of this alliance. Dominant shrubs include *Amelanchier alnifolia*, *Corylus americana*, *Corylus cornuta*, *Prunus virginiana*, and *Symphoricarpos occidentalis*. The herbaceous layer is dominated by graminoids. These can range from tall grasses, such as *Andropogon gerardii*, *Panicum virgatum*, and *Sorghastrum nutans*, to mid grasses, such as *Schizachyrium scoparium* and *Hesperostipa spartea* (= *Stipa spartea*), to short graminoids, such as *Carex inops* ssp. *heliophila*. This alliance is found in a landscape dominated by prairie communities. The woodland is typically found on rolling hills, lower mountain slopes (in the Black Hills), or along ravines. These topographic positions provided some protection from the fires that regularly occurred on the surrounding prairies in pre-European times. However, some fire was necessary to prevent the woodland physiognomy from closing and becoming a forest. This was especially important in the more mesic eastern portions of this alliance's range. In Nebraska, the soils are fertile, moderately well-drained to well-drained, and deep.

3. Juniper Woodlands

II.A.4.N.a.8 Juniperus scopulorum woodland alliance

This alliance includes woodlands dominated by *Juniperus scopulorum*, occurring in seven states from the northern and central Rocky Mountains, east to the Great Plains. Many associations in this alliance occur in the landscape above dry prairies and below communities dominated by *Pinus ponderosa* or *Pseudotsuga menziesii*. In southwestern North Dakota and western South Dakota, *Juniperus scopulorum* dominates low-stature woodlands, where associated species can include *Pinus ponderosa*, *Pseudotsuga menziesii*, *Artemisia* spp., *Cercocarpus montanus*, *Purshia tridentata*, *Rhus trilobata*, *Bouteloua gracilis*, *Festuca idahoensis*, *Piptatherum micranthum* (= *Oryzopsis micrantha*), *Pseudoroegneria spicata*, and *Hesperostipa comata* (= *Stipa comata*). This alliance is extremely limited in the southeastern United States, occurring in northwestern Texas in the escarpment area between the High Plains and Rolling Plains, where *Juniperus scopulorum* forms nearly pure stands on mesic slopes and in canyons. *Juniperus scopulorum* woodlands are typically found on gentle to steep, north-facing slopes, rock outcrops, and bluffs, and are best developed on calcareous soils. Soils are typically thin, stony, clay or clay loam, commonly with exposed bedrock. The soil parent material varies with community association but may be limestone, gneiss, sandstone, scoria, or shale.

4. Sandsage Shrubland

III.A.4.N.a.4 Artemisia filifolia shrubland alliance

This alliance includes *Artemisia filifolia*-dominated shrublands occurring mostly in the southern Great Plains, but associations are distributed as far north as the Black Hills, south to the Trans-Pecos of western Texas, as well as on the Colorado Plateau. These shrublands typically occur on flat, hummocky, or rolling terrain, as well as on partially stabilized dunes and sand sheets. Soils supporting these communities have low water retention and nutrient availability, and are typically sand or loamy sand, primarily of aeolian origin, but include sand deposits derived from sandstone residuum and cinder deposits. Less xeric sites tend to be more grass-dominated. In western Kansas and eastern Colorado, this alliance is found downwind of major waterways where alluvial sand is blown. In Texas these shrublands occur over sandy soils in the Rolling and High Plains and on gypsum dunes in the Trans-Pecos. On the Colorado Plateau, stands occur on a variety of sites including pockets of sand below sandstone cliffs, dunes and sheets of sand

or cinder, floodplain terraces and alluvial fans. Vegetation cover is sparse to moderately dense, with a shrub stratum approximately 1 m tall, dominated by *Artemisia filifolia*, interspersed with areas of bare substrate and scattered tall or mid grasses. Species composition will vary with geography, precipitation, disturbance, and soil texture. Associated species may include *Andropogon hallii*, *Artemisia frigida*, *Bouteloua curtipendula*, *Bouteloua gracilis*, *Carex duriuscula* (= *Carex eleocharis*), *Calamovilfa gigantea*, *Calamovilfa longifolia*, *Calylophus serrulatus*, *Carex inops* ssp. *heliophila*, *Helianthus petiolaris*, *Hesperostipa comata* (= *Stipa comata*), *Heterotheca villosa* var. *villosa*, *Ipomoea leptophylla*, *Lathyrus polymorphus*, *Lygodesmia juncea*, *Opuntia* spp., *Penstemon buckleyi*, *Prosopis glandulosa*, *Prunus angustifolia*, *Psoralidium lanceolatum*, *Schizachyrium scoparium*, *Sporobolus giganteus*, *Sporobolus cryptandrus*, and *Yucca glauca*. Communities associated with gypsum dunes have many gypsophiles or gypsum endemics. Colorado Plateau shrub associates include *Ericameria nauseosa*, *Ephedra torreyana*, *Ephedra viridis*, *Gutierrezia sarothrae*, *Atriplex canescens*, and the graminoids *Muhlenbergia pungens*, *Sporobolus cryptandrus*, *Bouteloua eriopoda*, and *Achnatherum hymenoides*.

5. Sandhills Upland Prairie

V.A.5.N.a.3 *Andropogon hallii* herbaceous alliance

This alliance includes herbaceous vegetation with *Andropogon hallii*, occurring in the Great Plains from the United States-Canada border south to Texas. It is dominated by tall and midgrass species, with shortgrass species becoming important in the western portion of its range. *Andropogon hallii* is usually dominant or codominant. *Calamovilfa longifolia* is present to codominant in most stands south of the South Dakota-Nebraska border. *Hesperostipa comata* (= *Stipa comata*), *Koeleria macrantha*, *Schizachyrium scoparium*, *Bouteloua gracilis*, *Bouteloua hirsuta*, *Eragrostis trichodes*, *Pascopyrum smithii*, and *Sporobolus cryptandrus* are typical grasses in stands of this alliance. Upland sedges are also very common, especially *Carex filifolia*, *Carex inops* ssp. *heliophila*, and *Carex duriuscula* (= *Carex eleocharis*). Although graminoids are overwhelmingly dominant, several species of forbs can be found in many stands of this alliance. Some of the more common forbs are *Ambrosia psilostachya*, *Psoralidium* spp., *Ipomoea leptophylla*, *Liatriis punctata*, and *Tradescantia occidentalis*. There may be widely scattered low shrubs, including *Rosa woodsii*, *Prunus pumila* var. *besseyi*, and *Yucca glauca*. In west Texas common associates on deep sands include *Panicum havardii*, *Sporobolus giganteus*, and *Calamovilfa gigantea*. Stands of this alliance occur on sand deposits, usually on gentle to steep slopes but sometimes on flat ground. The soils are sand, loamy sand, or sandy loam. They can be poorly to moderately well-developed. There is little runoff or evaporation because moisture quickly sinks into the coarse soil. Soil near the surface is consequently dry throughout much of the year, but moisture is present further down, favoring deep-rooting species such as *Andropogon hallii* and *Calamovilfa longifolia*. Wind sometimes scours sand and vegetation from small areas, creating blowouts. These bare spots are initially colonized by species that are uncommon in this alliance, such as *Muhlenbergia pungens* and *Redfieldia flexuosa*. Eventually, these blowouts succeed to one of the communities in the V.A.5.N.a *Andropogon hallii* Herbaceous Alliance (A.1193). These grasslands occur on semi-stabilized quartz sand dunes in eastern Trans-Pecos Texas, where they form landscape mosaics with *Quercus havardii* shrublands, wetland dune swales, and sparsely vegetated dunes. The rare plant, *Penstemon haydenii*, an endemic to dune blowouts in the sandhills of Nebraska, may be endangered by the decline in habitat because of fire suppression and low to moderate stocking rates (Harrison 1980).

6. Lowland Tallgrass Prairie

V.A.5.N.a.1 *Andropogon gerardii* - (*Calamagrostis canadensis*, *Panicum virgatum*) herbaceous alliance

This alliance, found in central North America, is made up of mesic to wet-mesic tall grasslands. The dominant lifeforms in stands of this alliance are tall grasses, although forbs can be abundant as well. Trees and shrubs can occur as scattered individuals or clumps. Vegetation tends to be dense and between 1.5 and 2 m tall. The dominant species across the range of this alliance is *Andropogon gerardii*. Other species that are common to abundant throughout the alliance's range are *Calamagrostis canadensis*, *Carex* spp., *Panicum virgatum*, *Sorghastrum nutans*, and *Spartina pectinata*. *Muhlenbergia richardsonis* may be diagnostic of this alliance in the northeastern Great Plains, and *Pascopyrum smithii* is common in the western portion of this alliance's range. *Elymus canadensis* is abundant in Wisconsin. *Schizachyrium scoparium* can be found on sites subject to seasonal drought. Forbs are abundant, especially farther east in this alliance's range. Among these forbs are *Asteraceae* spp., *Helianthus grosseserratus*, *Lysimachia quadrifolia*, *Pycnanthemum virginianum*, *Ratibida columnifera*, *Ratibida pinnata*, *Thalictrum dasycarpum*, and *Zizia aurea*.

Stands of this widespread alliance occur most frequently on sand to silt loam soils. Some are found on clay loams or silty clays. The sites are typically level to gently sloping, and those with heavier soils often have standing water present in the spring or after heavy rains. Most stands are in the glaciated Midwest and occur on glacial till, outwash, or drift, or on glacial lakeplains. Fires were a common occurrence in stands of this alliance before effective fire suppression activities. In the prolonged absence of fire, woody species usually invade and can become abundant.

V.A.5.N.j.11 *Spartina pectinata* temporarily flooded herbaceous alliance

This alliance is found primarily in central North America. This description is based on this alliance as it occurs in the Midwest. The vegetation of this alliance is characterized by dense stands of graminoids 1-2 m tall with scattered to very infrequent woody plants. The most abundant species are *Calamagrostis canadensis*, *Carex aquatilis*, *Carex atherodes*, *Carex pellita* (= *Carex lanuginosa*), *Carex sartwellii*, and *Spartina pectinata*. In some stands, *Spartina pectinata* can form virtual monocultures. Other common graminoids include *Andropogon gerardii*, *Muhlenbergia richardsonis*, *Panicum virgatum*, *Poa palustris* (in the western part of this alliance's range), and *Sorghastrum nutans*. Forbs are abundant and include *Symphotrichum ericoides* (= *Aster ericoides*), *Symphotrichum novae-angliae* (= *Aster novae-angliae*), *Helianthus grosseserratus*, *Lythrum alatum*, *Pycnanthemum virginianum*, and *Thalictrum dasycarpum*. Shrubs and small trees are infrequent in the south and west but are often present in the north and east. Among these *Cornus* spp., *Fraxinus pennsylvanica*, and *Salix* spp. are typical.

This alliance occurs in the Southeast only as small disjunct occurrences in Oklahoma, the Upper West Gulf Coastal Plain of Kentucky, and possibly extending a short distance into adjacent Tennessee. Associates in Kentucky and Tennessee occurrences may include *Helianthus angustifolius*, *Viola sagittata*, *Cephalanthus occidentalis*, *Andropogon gerardii*, *Dichanthelium scoparium*, *Schizachyrium scoparium*, *Sorghastrum nutans*, *Tripsacum dactyloides*, *Asclepias tuberosa*, *Baptisia alba* var. *macrophylla* (= *Baptisia leucantha*), *Crotalaria sagittalis*, *Dichanthelium clandestinum*, *Agalinis fasciculata*, *Helianthus grosseserratus*, *Helianthus mollis*, *Heterotheca villosa* (= *Chrysopsis villosa*), *Spiranthes cernua*, *Rhexia mariana*, *Rudbeckia hirta*, *Rudbeckia subtomentosa*, and *Viola sagittata*. In Kentucky, this vegetation is at present probably seasonally saturated; it was

presumably formerly seasonally flooded. In Oklahoma, this alliance contains *Spartina pectinata* with *Eleocharis montevidensis* and *Carex* spp.

Stands of this wide-ranging alliance are found on level to gently sloping sites with sand, loam, or clay soils. They occur near lakes or rivers or in depressions. All sites are typically flooded for part of the winter and spring. In the east, stands can experience droughty conditions in the summer and fall (Comer et al. 1995) while in the south and central portion of this alliance's range they can remain saturated for much of the growing season.

7. Upland Tallgrass Prairie

V.A.5.N.a.2 *Andropogon gerardii* - (*Sorghastrum nutans*) herbaceous alliance

This alliance is a very widespread mesic tallgrass prairie, which occurs in central North America. Most communities have moderately dense to dense vegetation dominated by graminoids 1-2 m tall. *Andropogon gerardii* is dominant across this alliance's range. Other abundant species include *Bouteloua curtipendula*, *Pascopyrum smithii* (in the western portions of this alliance's range), *Schizachyrium scoparium*, *Sorghastrum nutans* (in the center and east), *Sporobolus heterolepis* (in the Great Plains), and *Hesperostipa spartea* (= *Stipa spartea*) (in the northern Great Plains). In Montana, *Festuca idahoensis* (at its eastern range limits) is codominant in an association in this alliance. Forbs are abundant in stands of this alliance, especially in the more humid East. Among these are *Aletris farinosa* (in the East), *Asteraceae* spp., *Echinacea pallida*, *Helianthus grosseserratus*, *Liatris pycnostachya*, *Phlox pilosa*, *Ratibida pinnata*, *Silphium laciniatum* (in the center), and *Solidago* spp. *Galium boreale* and *Oxalis* sp. are more common in northern tallgrass prairies than in southern. Trees and tall shrubs are infrequent in high-quality stands, especially in the Great Plains. Among those that may be found are scattered *Symphoricarpos occidentalis* (in the northern Great Plains), *Rhus* spp., and *Quercus macrocarpa* (in the central and eastern portions of this alliance's range).

Stands of this alliance occur on flat to rolling topography. In the West and South, stands are found on lower slopes and valleys that receive extra moisture. On the western plains, the alliance can be found in areas with gravelly soil where water infiltrates below the surface but is held by an impermeable subsurface layer. Floodplain and toe-slope soils are deep and fine-textured, whereas the foothills soils are coarse-textured, often with cobble-sized rocks. In the northwestern plains, this alliance is found on lower slopes of hills, creeks and creek terraces. Soils are generally finer-textured (clay loams). In other parts of this alliance's range, stands can be found on many topographic positions. Soils are generally fertile, deep, slightly acidic, and moderately to well-drained. In glacial lakeplains near the Great Lakes, soils tend to be more poorly drained. Soils moisture is generally mesic, although it can vary from dry-mesic to wet-mesic. Soil texture can range from clay loams to sands.

In the far western extent, vegetation in this alliance is a relict true prairie found along the eastern foothills and floodplains of the Front Range of the Rocky Mountains. *Andropogon gerardii* is the major diagnostic species, as well as *Sorghastrum nutans*, *Panicum virgatum*, *Schizachyrium scoparium*, *Sporobolus heterolepis*, the other common tallgrass prairie species. *Bouteloua curtipendula* and *Pascopyrum smithii* are also common grasses. The alliance is found in mesic areas along the Colorado Front Range. Landform position and soil texture dictate potential sites, as precipitation is generally not adequate to support stands of this alliance. In localized areas, hydrological processes of the site enhance the soil moisture. Along the Front Range, 'relict' true prairie is found

along the foothills in parks and on slopes below *Pinus ponderosa* woodlands. Soils are coarse-textured, and runoff and seeps enhance soil moisture. The alliance is also found in floodplains adjacent to streams where the water table is within reach for plant roots.

8. Little Bluestem-Gamma Mixedgrass Prairie

V.A.5.N.c.20 *Schizachyrium scoparium* - *Bouteloua curtipendula* herbaceous alliance

This alliance is mainly in the Great Plains but extends eastward to the Mississippi River and even beyond on dry sites. Across its range, the vegetation is dominated by mid grasses. The vegetation cover can be moderately sparse to dense. Tall grasses and short grasses contribute substantially to the vegetation cover in most communities. The proportions of these two lifeforms are typically negatively correlated with each other and vary with the specific community and site. The tall grasses are more prevalent on sandier soils and on moderate or gentle lower slopes. The short grasses tend to be more common on flat uplands or steep slopes with heavier soils. The dominant species are the nominal species, *Schizachyrium scoparium* and *Bouteloua curtipendula*. *Bouteloua gracilis* and *Bouteloua hirsuta* are common associates across this alliance's range. Other graminoids that are present to codominant are *Aristida purpurea*, *Andropogon gerardii*, *Andropogon hallii* (on sandier soils), *Buchloe dactyloides* (in the south and west of this alliance's range), *Calamovilfa longifolia* (on sandier soils), *Carex duriuscula* (= *Carex eleocharis*), *Carex inops* ssp. *heliophila*, and *Carex filifolia* (all three *Carices* in the north), *Koeleria macrantha*, *Muhlenbergia cuspidata*, *Pascopyrum smithii*, *Pseudoroegneria spicata* (in the northwest), *Sporobolus cryptandrus*, *Sporobolus compositus* var. *compositus* (in the south), *Sporobolus heterolepis* (in the east), *Hesperostipa spartea* (= *Stipa spartea*), and *Hesperostipa comata* (= *Stipa comata*) (in the north). There are a great number of forbs that occur in communities of this alliance, although they do not make up a large part of the herbaceous canopy. *Amorpha canescens*, *Symphytotrichum oblongifolium* (= *Aster oblongifolius*), *Symphytotrichum ericoides* (= *Aster ericoides*), *Ambrosia psilostachya*, *Dalea purpurea*, *Echinacea angustifolia*, *Gaura coccinea*, *Liatris punctata*, *Lygodesmia juncea*, *Ratibida columnifera*, and *Sphaeralcea coccinea* are found in many communities in this alliance. Shrubs are not abundant, but *Symphoricarpos occidentalis*, *Yucca glauca*, *Artemisia frigida*, and *Rosa* spp. may be scattered among the herbaceous species.

Communities within this alliance are most commonly found on slopes but can occur on level ground. Loam and silt soils appear to be the most common; however, in the southwest of this alliance's range, some communities are predominantly on sandy soils. Communities in the central and western portions of this alliance's range usually occur on medium to deep soils. Communities in the eastern portion of this alliance's range are found almost exclusively on steep south- or west-facing slopes. These slopes have thinner soils, greater insolation, and greater runoff than surrounding areas. These factors inhibit the growth of taller grasses and woody species and allow the midgrass communities to be maintained. Most of these sites are small.

V.A.5.N.c.29 *Hesperostipa comata* - *Bouteloua gracilis* herbaceous alliance

This alliance is widespread across upland sites in the northern Great Plains. Its communities tend to be the climax communities on fertile dry-mesic sites across much of its range. It is dominated by mid and short grass species; woody species do not regularly achieve prominence. Few of the species exceed 1 m while many, including *Bouteloua gracilis*, do not exceed 50 cm. The most abundant species are *Hesperostipa comata* (= *Stipa comata*) and *Bouteloua gracilis*. On more mesic sites *Hesperostipa comata* is predominant, while on areas that are drier or subject to light grazing *Bouteloua gracilis* takes precedence. Other graminoid species that are commonly found in communities of

this alliance are *Aristida purpurea* var. *longiseta* (= *Aristida longiseta*), *Carex duriuscula* (= *Carex eleocharis*), *Carex filifolia*, *Koeleria macrantha*, *Nassella viridula*, and *Pascopyrum smithii*. Sites in the southern half of the range of this alliance may have significant amounts of *Bouteloua curtipendula*. Forbs are common but not usually abundant. Forb species that are regularly found are *Artemisia frigida*, *Gaura coccinea*, *Gutierrezia sarothrae* (= *Gutierrezia diversifolia*), *Liatrix punctata*, *Sphaeralcea coccinea* (= *Malvastrum coccineum*), *Phlox hoodii*, and *Sphaeralcea coccinea*. The clubmoss *Selaginella densa* is present in many stands in this alliance. Scattered shrubs are sometimes present. These include *Prunus virginiana*, *Rhus aromatica*, and *Symphoricarpos occidentalis*. In the western and southwestern portions of its range, *Cercocarpus montanus* may be found where this alliance occurs on slopes.

Communities in this alliance are found on flat to moderately steep topography. The soils are sandy loam, loam, or sometimes clay loam. They are often well-developed and derived from either glacial deposits or sometimes limestone or sandstone (Hanson and Whitman 1938, Coupland 1950, Hanson 1955).

9. Western Wheatgrass Mixedgrass Prairie

V.A.5.N.c.27 *Pascopyrum smithii* herbaceous alliance

This alliance is common and widespread in the Great Plains, especially the northern portions, and parts of the intermountain western U.S. and possibly Canada. The communities in it range from dry or dry-mesic to wet-mesic. Mid grasses are the dominant vegetation in most communities, although short grasses and sedges can be codominant. The vegetation tends to be denser where the mid grasses are predominant and more open where shorter graminoids are abundant. The mid grasses grow to 0.5-1.0 m on favorable sites, while the short grasses and sedges are less than 0.5 m tall. The most abundant midgrass is *Pascopyrum smithii*. Common associates include *Hesperostipa comata* (= *Stipa comata*), *Nassella viridula*, *Koeleria macrantha*, *Schizachyrium scoparium*, *Hesperostipa spartea* (= *Stipa spartea*), and *Poa* spp. In the drier communities of this alliance *Bouteloua gracilis* is the most common shortgrass. Other short graminoids typically found in the drier communities include *Carex inops* ssp. *heliophila*, *Carex duriuscula* (= *Carex eleocharis*), *Carex filifolia*, and *Bouteloua curtipendula* (in the northern portion of this alliance's range), *Aristida purpurea*, and *Buchloe dactyloides* (in the southern half of this alliance's range). In the wetter communities within this alliance, *Distichlis spicata*, *Hordeum jubatum*, *Elymus trachycaulus*, and *Iva annua* are common. Forbs and shrubs are generally minor components of communities within this alliance. If shrubs are present they are rarely taller than 1 m. Some forbs that are usually scattered about are *Gaura coccinea*, *Sphaeralcea coccinea*, *Amorpha canescens*, *Astragalus* spp., and *Tragopogon dubius*. Shrubs include *Symphoricarpos occidentalis*, *Artemisia cana*, *Artemisia frigida*, and *Opuntia* spp.

Communities within this alliance occur on several different soil types. The soil is most often clay or clay loam, however. it can be loam or sandy loam. In the east and central part of this alliance's range, these communities can be found on flat or rolling uplands, hillslopes, or along streams or depressions. In the western part of this alliance's range, its communities are found where local conditions are wetter than the average. This includes such areas as the base of slopes or along rivers or streams.

10. Western Shortgrass Prairie

V.A.5.N.e.9 *Bouteloua gracilis* herbaceous alliance

This widespread alliance includes grasslands dominated or codominated by *Bouteloua gracilis*, and is found across the Great Plains from near the United States-

Mexico border to southern Canada. The bulk of this alliance occurs in the western Great Plains and southwestern United States, but one extensive and one restricted community occur in the midwestern United States. Stands are found on flat to rolling uplands such as plains, plateaus, foothills, valley bottoms, and sand sheets and dunes with a variety of soil types. Surface soils can range from sandy loam to loamy clay. Subsoils are often finer than the surface soils and may be somewhat impermeable to water. The upland position and heavy soils often result in much of the precipitation running off, and drought conditions prevail for much of the year. This trend is more pronounced in the northern part of this alliance. In the southern portions of its range, the greater temperatures and lack of precipitation allow this shortgrass alliance to occur on coarser soils.

Vegetation within this alliance is dominated by short grasses with mid grasses present to codominant. Mid grasses are more abundant in the eastern portions of this alliance. Coverage by short grasses is moderate to almost complete. The foliage is typically 7-19 cm tall with flowering stalks reaching 45 cm. Midgrass species are usually dwarfed because of dry conditions and may not exceed 0.7 m except in especially wet years. Shrubs are very rare except in the southern parts of this alliance's range where scattered desert shrubs may occur (<10% cover). Typical codominant species are *Buchloe dactyloides* or *Pleuraphis jamesii* (= *Hilaria jamesii*). Other common to codominant graminoids may include *Aristida purpurea*, *Bouteloua curtipendula*, *Bouteloua hirsuta*, *Carex filifolia*, *Carex inops* ssp. *heliophila*, *Carex duriuscula* (= *Carex eleocharis*), *Elymus elymoides*, *Hesperostipa neomexicana* (= *Stipa neomexicana*), *Pascopyrum smithii*, *Sporobolus cryptandrus*, or *Sporobolus airoides*. There are a variety of forbs found in stands of this alliance, although they do not contribute greatly to the total vegetation cover. Common forbs include *Astragalus* spp., *Gaura coccinea*, *Machaeranthera pinnatifida* var. *pinnatifida*, *Opuntia polyacantha*, *Plantago patagonica*, *Psoralidium tenuiflorum*, *Ratibida columnifera*, and *Sphaeralcea coccinea*.

11. Barren/Sand/Outcrop

VII.A.1.N.a.6 Open cliff sparse vegetation alliance

This is technically not an alliance. It is a placeholder for a group of sparsely vegetated associations that do not have adequate vegetation descriptions, but do share certain substrate characteristics.

VII.A.1.N.a.8 Rock outcrop sparse vegetation alliance

This is technically not an alliance. It is a placeholder for a group of sparsely vegetated associations that do not have adequate vegetation descriptions, but do share certain substrate characteristics.

VII.C.3.N.b.7 Large eroding bluffs sparse vegetation alliance

This is technically not an alliance. It is a placeholder for a group of sparsely vegetated associations that do not have adequate vegetation descriptions, but do share certain substrate characteristics.

12. Agricultural Field

13. Open Water

14. Fallow Agricultural Field

15. Aquatic Bed Wetland

V.A.5.N.c.27 *Pascopyrum smithii* - intermittently flooded herbaceous alliance

This alliance, found in the southern Great Plains, occurs on the edges of playa lakebeds. This description is strongly based on the part of the alliance found in the Midwest. Perennial graminoids and forbs under 1 m tall dominate this alliance. *Pascopyrum smithii* is the most abundant and consistent throughout the range of this alliance, though in some places *Agrostis hyemalis*, *Elymus virginicus*, and *Hordeum jubatum* may be abundant. *Buchloe dactyloides* is often common in grazed sites. Early-season ephemeral annuals, such as *Alopecurus carolinianus*, *Elatine rubella*, *Myosurus minimus*, and *Veronica peregrina*, are ubiquitous, and *Limosella aquatica* and *Plagiobothrys scouleri* may be common. Perennial forbs are conspicuous in some places, including *Ambrosia* spp., *Phyla cuneifolia* (= *Lippia cuneifolia*), *Oenothera canescens*, and *Vernonia fasciculata*. Stands of this alliance often occur at the margin of playa and pond marsh communities and grade into upland tallgrass and mixedgrass prairie. The extent and species composition of stands vary with water levels from year to year. Species diversity is low to moderate.

Stands of this alliance occur on nearly level ground and in very shallow depression in uplands. Soils are somewhat poorly drained, silty clay loams underlain by a clay pan. They are usually formed from loess. These areas may be temporarily flooded in winter and early spring but are usually dry by early summer.

V.A.5.N.j.5 *Distichlis spicata* - (*Hordeum jubatum*) temporarily flooded herbaceous alliance

This alliance occurs in the Great Plains and western United States. This description is based on those communities found in the Great Plains. Dominant vegetation is a mixture of short and mid grasses and can have moderately sparse to dense cover. Vegetation height and cover and species diversity tend to vary inversely with salinity. *Distichlis spicata* is the most abundant species in stands across the range of this alliance. Other species found in the Great Plains include *Grindelia squarrosa* (in the northern portion of this alliance's range), *Hordeum jubatum*, *Iva annua*, *Bassia scoparia* (= *Kochia scoparia*), *Pascopyrum smithii* (on less saline stands), *Poa arida*, *Puccinellia nuttalliana* (in the north), *Salicornia rubra* (on more saline stands), *Schoenoplectus maritimus* (= *Scirpus maritimus*), *Sporobolus airoides*, and *Suaeda calceoliformis* (on more saline stands). Widely scattered low shrubs, especially *Atriplex patula* and *Sarcobatus vermiculatus*, can be found on sites in the western and central Great Plains. Trees are not found on stands of this alliance.

Stands of this alliance are found in depressions and along the margins of saline lakes and ponds. Most of the stands are flooded or saturated for a few weeks in the spring and after heavy rains; some have water present for most of the growing season. The soils range from sand to clay and from moderately well-drained to poorly drained. Most are deep and moderately to strongly saline. Stands that have good drainage in the surface soils usually have a deeper impermeable or slowly permeable layer that allows retention of water. Fires which spread from upland prairies may have moved through the more dense stands, but many stands did not have sufficient vegetation to support fires.

V.A.5.N.j.12 *Polygonum* spp. - *Echinochloa* spp. temporarily flooded herbaceous alliance

This alliance, found in the southern Great Plains, occurs in temporarily flooded playa lakebeds. Annual herbaceous graminoids and forbs mostly less than 1 m tall dominate the exposed mud flats of this alliance. Species composition and extent of stands vary from year to year. *Coreopsis tinctoria*, *Echinochloa* spp., *Eleocharis engelmannii*, *Lindernia dubia*, *Polygonum* spp., and *Rumex stenophyllus* are typical species of this alliance. In sites which have been modified to hold water longer, i.e., drainage ditches and re-use

pits, perennials such as *Eleocharis palustris* and *Marsilea vestita* may dominate. The frequent water fluctuations and thick clay pan prevent establishment of most perennial hydrophytes typical of pond marshes.

Stands of this alliance occur in shallow depressions in nearly level ground. Soils are silty clay loam underlain by a clay pan. These areas are temporarily or sometimes seasonally flooded by ponded rainwater and surface runoff. Sites dry out by mid to late summer in all but the wettest years.

V.C.2.N.a.14 Potamogeton spp. - Ceratophyllum spp. - Elodea spp. permanently flooded herbaceous alliance

This broadly defined alliance is found throughout the southeastern and midwestern United States, as well as several Great Plains states and Canadian provinces. The vegetation is generally found in open water less than 2 m deep with emergent cover of floating-leaved aquatics up to 25% and submerged aquatics at least 25%. Individual stands may be dominated by a single species, leading to any number of dominance types, and until the patterns are better understood, these are all grouped together in one alliance. In northern parts of the range, stands may be dominated by *Potamogeton* spp., including *Potamogeton natans*, *Stuckenia pectinata* (= *Potamogeton pectinatus*), *Potamogeton zosteriformis*, and *Potamogeton richardsonii*; *Ceratophyllum* spp., including *Ceratophyllum demersum*; *Elodea* spp., including *Elodea canadensis*; and *Myriophyllum* spp., including *Myriophyllum verticillatum*. Other associated species include emergents such as *Zizania palustris*, *Utricularia macrorhiza*, *Nuphar* spp., *Ranunculus longirostris*, *Chara* spp., *Lemna* spp., *Spirodela polyrrhiza*, and *Vallisneria americana*. *Potamogeton nodosus* and *Ceratophyllum demersum* are reported from stands in Oklahoma. Other associated species in the southern part of the range may include *Potamogeton diversifolius*, *Potamogeton nodosus*, *Ceratophyllum demersum*, *Stuckenia pectinata*, *Elodea canadensis*, *Elodea nuttallii*, *Cabomba caroliniana*, *Heteranthera dubia*, *Hottonia inflata*, *Myriophyllum pinnatum*, and *Proserpinaca* spp. The exotic *Egeria densa* may also be present and may crowd out native components.

Stands are often found in sheltered bays of lakes and streams. Water hardness may play an important role in species patterns within this group.

16. Emergent Wetland

V.A.5.N.j.5 *Distichlis spicata* - (*Hordeum jubatum*) temporarily flooded herbaceous alliance

This alliance occurs in the Great Plains and western United States. This description is based on those communities found in the Great Plains. Dominant vegetation is a mixture of short and mid grasses and can have moderately sparse to dense cover. Vegetation height and cover and species diversity tend to vary inversely with salinity. *Distichlis spicata* is the most abundant species in stands across the range of this alliance. Other species found in the Great Plains include *Grindelia squarrosa* (in the northern portion of this alliance's range), *Hordeum jubatum*, *Iva annua*, *Bassia scoparia* (= *Kochia scoparia*), *Pascopyrum smithii* (on less saline stands), *Poa arida*, *Puccinellia nuttalliana* (in the north), *Salicornia rubra* (on more saline stands), *Schoenoplectus maritimus* (= *Scirpus maritimus*), *Sporobolus airoides*, and *Suaeda calceoliformis* (on more saline stands). Widely scattered low shrubs, especially *Atriplex patula* and *Sarcobatus vermiculatus*, can be found on sites in the western and central Great Plains. Trees are not found on stands of this alliance.

Stands of this alliance are found in depressions and along the margins of saline lakes and ponds. Most of the stands are flooded or saturated for a few weeks in the spring and after heavy rains; some have water present for most of the growing season. The soils range from sand to clay and from moderately well-drained to poorly drained. Most are deep and moderately to strongly saline. Stands that have good drainage in the surface soils usually have a deeper impermeable or slowly permeable layer that allows retention of water. Fires which spread from upland prairies may have moved through the more dense stands, but many stands did not have sufficient vegetation to support fires.

V.A.5.N.k.33 *Typha* spp. - (*Schoenoplectus* spp., *Juncus* spp.) seasonally flooded herbaceous alliance

This alliance, found in the midwestern United States and the central provinces of Canada, is characterized by emergent graminoids and forbs in shallow marshes. Shallow aquatics like *Sparganium eurycarpum* or *Sagittaria latifolia* may be more diagnostic than *Typha* spp. or *Schoenoplectus* spp. (= *Scirpus* spp.). Other species present include *Carex comosa*, *Lemna minor*, and *Rumex orbiculatus*. Further work is needed to characterize this alliance.

Shallow marshes have soils that are saturated to inundated by standing water up to 15 cm in depth throughout much of the growing season.

V.A.5.N.k.53 *Carex pellita* seasonally flooded herbaceous alliance

Vegetation types within this seasonally flooded grassland alliance occur in wet meadows, basins, and sometimes shallow standing water. They are found from the plains (<300 m) and lowlands (1050 m) to moderate (2700 m) elevations in the mountains in low-gradient, trough-shaped, moderately wide valleys with gentle to moderately steep sideslopes. Stands occur in depressions and swales at the saturated edge of stream channels or in standing water. Sites are poorly drained, often flooded during spring runoff, and water levels normally remain in the rooting zone throughout the growing season. Soils are variable, but most commonly mineral with large amounts of organic matter or, more rarely, with thick accumulations of partially decomposed sedges. Streambanks have alluvial soils composed of sand, silt, and clay deposits. This alliance is often characterized by a nearly monotypic cover of 40-90% *Carex pellita* (= *Carex lanuginosa*). Other graminoid cover is minor, but includes *Carex microptera*, *Phalaris arundinacea*, *Calamagrostis stricta*, *Carex nebrascensis*, *Juncus balticus*, *Scirpus microcarpus*, *Schoenoplectus acutus* (= *Scirpus acutus*), and *Schoenoplectus pungens* (= *Scirpus pungens*). Scattered forbs include *Geum macrophyllum*, *Mentha arvensis*, *Prunella vulgaris*, and *Potentilla gracilis*.

V.A.5.N.l.6 *Schoenoplectus pungens* semipermanently flooded herbaceous alliance

This alliance, found in the northern Great Plains, Utah, and Nevada, is made up of graminoid-dominated communities found in saline wetlands. Medium-tall and short graminoids predominate. Woody species are very uncommon. *Schoenoplectus pungens* (= *Scirpus pungens*), *Suaeda calceoliformis*, *Distichlis spicata* (on drier margins), and *Ruppia maritima* are all common species. *Chenopodium incanum*, *Monolepis nuttalliana*, and *Picradeniopsis oppositifolia* are sometimes abundant on less saline portions of the alliance.

This alliance occurs in depressions and river valleys. The loam to sandy loam soils are deep, poorly drained and formed in alluvium (Steinauer 1989). These soils are

slightly to strongly affected by soluble salt. Standing water is at or near the surface for most of the year.

V.A.5.N.1.9 *Typha* (*angustifolia*, *latifolia*) - (*Schoenoplectus* spp.)
semipermanently flooded herbaceous alliance

This alliance, found in virtually every state in the United States and probably most Canadian provinces, contains stands dominated by *Typha angustifolia* and/or *Typha latifolia*, either alone or in combination with other tall emergent marsh species. Associated species vary widely; in the Midwest they include many sedges such as *Carex aquatilis*, *Carex rostrata*, *Carex pellita* (= *Carex lanuginosa*), bulrushes such as *Schoenoplectus americanus* (= *Scirpus americanus*), *Schoenoplectus acutus* (= *Scirpus acutus*), and *Schoenoplectus heterochaetus* (= *Scirpus heterochaetus*), and broad-leaved herbs such as *Thelypteris palustris*, *Asclepias incarnata*, *Impatiens capensis*, *Sagittaria latifolia*, *Scutellaria lateriflora*, *Sparganium eurycarpum*, *Hibiscus moscheutos*, and *Verbena hastata*. Floating aquatics such as *Lemna minor* may predominate in deeper zones.

This alliance is found most commonly along lake margins and in shallow basins, and occasionally in river backwaters. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. *Typha angustifolia* can grow in deeper water compared to *Typha latifolia*, although both species reach maximum growth at a water depth of 50 cm. *Typha* often occurs in pure stands, and can colonize areas recently exposed by either natural or human causes. *Lythrum salicaria*, an exotic species from Europe, has become a common associate of many eastern *Typha* marshes. In the Southeast, this alliance is widespread and currently representative of a wide variety of mixed marshes with no clear dominants. Vegetation in this alliance may be natural or semi-natural and includes mixed stands of the nominal species, as well as essentially monospecific stands of *Typha latifolia*. These monospecific stands occur especially in artificial wetlands, such as borrow pits or ponds. This alliance occurs on hydric soils in wetlands, ditches, ponds, lakes, and rivers, as well as on shorelines and streambanks. Inundation is commonly 3-6 dm (1-2 feet) in depth. These marshes have hydric soils and are flooded with water levels ranging from several centimeters to more than 1 m for a significant part of the growing season. Occurrences may display areas of open water, but emergent vegetation dominates (80% cover). Seasonal flooding during winter and spring or flooding during heavy rains help maintain these marshes by causing water exchange which replenishes freshwater and circulates nutrients and organic debris. Soils which support this community can be mineral or organic but are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Vegetative diversity and density is highly variable in response to water depth, water chemistry, and natural forces.

V.A.5.N.m.19 *Carex* spp. - *Typha* spp. saturated herbaceous alliance

This alliance is dominated by hydrophytic graminoids and found in the central United States near acid or neutral seeps. Vegetation cover is moderate to high and 1 m or less tall. Diagnostic species of this alliance are not well understood. *Typha latifolia* is the most common of the taller species. Among the shorter species, *Carex* spp., *Equisetum hyemale*, *Climacium americanum*, *Eupatorium perfoliatum*, and *Scirpus* spp. are abundant. Shrubs and small trees, such as *Populus deltoides*, *Salix* spp., and *Lindera benzoin* (in the southeast of this alliance's range), are sometimes present.

This alliance forms on the slopes and at the bases of hills, valleys, and bluffs. Soils are shallow to deep and formed from sandstone, glacial till, loess, and colluvium. Moderately minerotrophic groundwater saturates stands for much of the year.

17. Riparian Shrubland

III.B.2.N.d.20 *Symphoricarpos occidentalis* temporarily flooded shrubland alliance

This alliance is found in the northern Great Plains in mesic swales, depressions, ravines and floodplains. Some sites 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. This alliance is dominated by shrubs approximately 1 m tall. Shrub cover is typically greater than 50%, and in places it can approach 100%. These shrubs form dense clumps that exclude most other species. *Symphoricarpos occidentalis* is the most common shrub. *Rhus aromatica* and *Prunus virginiana* can be locally abundant, and both can grow to 2-3 m in places. Rarely, scattered small trees are present. These are most often *Fraxinus americana* or *Populus deltoides*. Herbaceous species and smaller shrubs are most abundant at the edge of stands of this alliance and in gaps between the 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. Woody vines sometimes occur, most commonly *Parthenocissus vitacea*. *Symphoricarpos occidentalis* shrublands often have a significant component of exotic species, especially where grazing has been intense. *Bromus inermis*, *Cirsium arvense*, and *Poa pratensis* are the most abundant of these exotics. Overgrazing of prairies can lead to the expansion of degraded forms of this alliance.

V.A.5.N.m.20 *Carex pellita* - (*Carex nebrascensis*) - *Schoenoplectus* spp. saturated herbaceous alliance

This alliance, found in the central Great Plains, occurs where groundwater seeps to the surface. The vegetation of these seepage fens is predominantly hydrophytic graminoids which typically forms dense cover. Common herbaceous species include *Carex hystericina*, *Carex pellita* (= *Carex lanuginosa*), *Carex nebrascensis*, *Eleocharis* spp., *Eupatorium maculatum*, *Leersia oryzoides*, *Scirpus* spp., *Thelypteris palustris*, and *Typha latifolia*. Shrubs, primarily *Salix* spp., may occasionally occur. Ferns may be locally common. Species composition is variable between sites and is probably related to factors such as depth and composition of organic soils, water chemistry, and level of disturbance. Vegetation zonation is often conspicuous and related to hydrologic regime.

Stands of this alliance are found on mid to lower slopes of hillsides and terraces in canyons and stream valleys. In eastern Nebraska, stands are associated with sandstone outcrops or loess and glacial till slopes. Soils are deep and consist of peat or muck, often mixed with sands. Peat layers range from 0.5-1.5 m deep. Fens are constantly saturated by groundwater. Mounded groundwater discharge zones are common features of these fens. Groundwater pH typically ranges from 6.0-7.5 and is not calcium-rich. The water table is usually near the soil surface.

VII.C.2.N.c.1 Sand flats temporarily flooded sparse vegetation alliance

This is technically not an alliance. It is a placeholder for a group of sparsely vegetated associations that do not have adequate vegetation descriptions, but do share certain substrate characteristics.

18. Riparian Woodland

I.B.2.N.d.15 *Populus deltoides* temporarily flooded forest alliance

This alliance, found throughout the central midwestern and southeastern United States, contains riverfront floodplain forests. The tree canopy is tall (to 30 m) and dominated by *Populus deltoides* and *Salix nigra*, although *Fraxinus pennsylvanica*, *Acer negundo*, *Acer rubrum*, *Acer saccharinum*, *Platanus occidentalis*, and *Ulmus americana* are also commonly encountered in various parts of this alliance's range. Tree diversity is limited due to the dynamics of flooding and deposition/scouring of sediments. The shrub layer is often sparse, but species such as *Salix exigua*, *Carpinus caroliniana*, *Lindera benzoin*, *Cornus drummondii* and, in the Southeast, *Ilex vomitoria*, *Ilex opaca* var. *opaca*, and *Forestiera acuminata* can be found. Herbaceous growth can be thick and lush but is often patchy and sparse due to frequent inundation. Herbaceous species found throughout the range of this alliance are not well known, but in parts of the range, species can include *Carex* spp., *Leersia oryzoides*, *Bidens* spp., Asteraceae spp., *Eragrostis hypnoides*, *Lipocarpa micrantha*, *Rumex maritimus*, *Potentilla paradoxa*, and, more commonly in the Southeast, *Leptochloa panicea* ssp. *mucronata* (= *Leptochloa mucronata*) and *Mikania scandens*.

Stands are found primarily along riverfronts, where they develop on bare, moist soil on newly made sand bars, front-land ridges, and well-drained flats. Soils are formed in alluvium, are deep, medium-textured, and with adequate or excessive moisture available for vegetation during the growing season. This alliance can also be found on abandoned fields and well-drained ridges in the first bottoms.

II.B.2.N.a.20 *Quercus macrocarpa* woodland alliance

This alliance is widespread in the northern and central Great Plains. All of its associations are found exclusively or primarily in the midwestern United States west of the Mississippi River. The canopy is open to moderately closed and usually dominated by *Quercus macrocarpa*. Common associates in the canopy are *Quercus muehlenbergii* in the southeast portion, *Fraxinus pennsylvanica*, *Tilia americana*, and *Populus tremuloides* in the northern half, and *Carya* spp. and *Ulmus* spp. in the eastern part of the alliance's range. *Pinus ponderosa* can occur in some stands at the extreme western limit of this alliance's range. A shrub layer 1-2 m tall is often present, especially in the northern half of the range of this alliance. Dominant shrubs include *Amelanchier alnifolia*, *Corylus americana*, *Corylus cornuta*, *Prunus virginiana*, and *Symphoricarpos occidentalis*. The herbaceous layer is dominated by graminoids. These can range from tall grasses, such as *Andropogon gerardii*, *Panicum virgatum*, and *Sorghastrum nutans*, to mid grasses, such as *Schizachyrium scoparium* and *Hesperostipa spartea* (= *Stipa spartea*), to short graminoids, such as *Carex inops* ssp. *heliophila*. This alliance is found in a landscape dominated by prairie communities. The woodland is typically found on rolling hills, lower mountain slopes (in the Black Hills), or along ravines. These topographic positions provided some protection from the fires that regularly occurred on the surrounding prairies in pre-European times. However, some fire was necessary to prevent the woodland physiognomy from closing and becoming a forest. This was especially important in the more mesic eastern portions of this alliance's range. In Nebraska, the soils are fertile, moderately well-drained to well-drained, and deep.

II.B.2.N.a.29 *Fraxinus pennsylvanica* - (*Ulmus Americana*) woodland alliance

This alliance is found along streams and rivers and in draws and canyons across much of the northern Great Plains. Stands often have an overstory that is more dense than typical woodland physiognomy. The canopy can be moderately closed to closed. Most of the canopy trees are 6-10 m tall, and they allow significant light to penetrate to the understory. The shrub layer is usually well-developed while the herbaceous layer is

moderately to well-developed. The canopy is dominated by *Fraxinus pennsylvanica* and sometimes *Ulmus americana*. Individuals of *Populus deltoides* and *Acer negundo* are often scattered throughout. The shrub layer is typically dominated by *Prunus virginiana*, *Symphoricarpos occidentalis*, *Symphoricarpos albus*, and *Ribes* spp. The herbaceous layer often contains *Maianthemum stellatum*, *Galium aparine*, and *Elymus canadensis*.

Stands of this alliance are usually on flat to moderately steep slopes near permanent or ephemeral streams. Rarely, it can be found on steep north-facing escarpments. These sites create more mesic microclimates in which the woodland can develop in landscapes otherwise dominated by grasslands. The soils are typically deep and loamy, but in places they can be rocky. Stands are common along riparian areas but are usually distant enough from larger streams that they do not flood or do so for very short periods.

II.B.2.N.b.4 *Populus deltoides* temporarily flooded woodland alliance

This alliance occurs throughout the Great Plains near rivers and large streams. It is dominated by *Populus deltoides* throughout its range. Secondary canopy species include *Acer negundo* throughout, *Salix nigra* (in the eastern part of its range), *Fraxinus pennsylvanica* and *Ulmus americana* (central and eastern), and *Salix amygdaloides* (central and western). *Fraxinus pennsylvanica* and *Ulmus americana* often increase in abundance and dominance as stands of this alliance age. *Populus deltoides* does not reproduce well in established stands. The understory composition and structure are variable. A shrub layer may be present, with species such as *Salix* spp., *Symphoricarpos occidentalis*, and *Prunus virginiana* predominating. Sites experience seasonal floods, which, after receding, leave areas available for colonization. This process often favors the establishment of aggressive native and exotic plants. Among the species that are common in this alliance are *Carex* spp., *Juncus* spp., *Spartina pectinata* (in the east), *Pascopyrum smithii* (in the west), *Elymus* spp., *Cenchrus longispinus*, *Melilotus officinalis*, and *Equisetum* spp. Typical exotics found in this alliance are *Poa pratensis* and *Bromus* spp.

Stands of this alliance are found on level to gently sloping topography near rivers, streams, lakes, and ponds. The areas may have been very recently deposited by water action, or they may have been deposited earlier and occupied by other communities. The water table fluctuates with the level of the adjacent water body. This can lead to periods of flooding and soil saturation in the spring and after heavy rains and also to periods of drought when the water level falls in the summer and fall. The soils are silts, loams, and sands, and are derived from alluvial material.

19. Low Intensity Residential

20. High Intensity Residential/Commercial/Industrial/Transportation

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