

Key to Vegetation Communities at Big Muddy National Fish and Wildlife Refuge

Supplement to:

Struckhoff, M.A., Grabner, K.W., and Stroh E.D, 2010, Vegetation communities at Big Muddy National Fish and Wildlife Refuge, Missouri: U.S. Geological Survey Open-File Report 2011-1038, 29 p. with Appendix. <http://pubs.usgs.gov/of/2011/1038/>

Between 2006 and 2009, vegetation communities at Big Muddy National Fish and Wildlife Refuge were identified, described and mapped on five units in the eastern half of Missouri. This key is intended to allow identification of vegetation communities encountered during that study, as well as other communities known to occur or potentially occurring on the Missouri River flood plain within Missouri. Also included are a few upland types encountered during the project. The key is informed by 1) data and observations made during the project, and 2) information exchanges with refuge biologists (W. Watkins, oral comms., and M. Gallagher, unpub. data) and Timothy A. Nigh, an ecologist familiar with the Missouri River system and the vegetation communities found therein (Resource Scientist, Missouri Department of Conservation, oral and written communs., 2006-07).

Most communities included here have been identified and described by the National Vegetation Classification System (NVCS; The Nature Conservancy, 2004). Global descriptions for these types have been developed and are maintained by NatureServe (2011). An appendix to the report cited above (Struckhoff and others, 2011) combines these global descriptions with local descriptions based on field data and observations made during the vegetation mapping project. Where possible, the diagnostic features included here are based on field observations made during the same project (Struckhoff and others, 2011). For communities that were not encountered during the study (see report), diagnostic features are culled from the descriptions maintained by NatureServe (2011).

Selections within the key will lead users to a single community, designated by its common name and code (in the format CEGL00####) as recognized within the NVCS descriptions maintained by NatureServe (2011). Communities not recognized by the NVCS are indicated as such. Species names follow the U.S. Department of Agriculture, Natural Resource Conservation Service PLANTS database (2011).

The key begins with six broad categories—forests, woodlands, shrublands, herbaceous communities, sparse herbaceous communities, and marshes—based largely on the physiognomic characteristics of the community. Forests have a canopy generally providing foliar cover above 60 percent, while woodlands have canopy cover generally from below 60 percent down to about 15 percent. Shrublands lack significant tree cover, but have copious foliar cover provided by woody shrubs and smaller trees below 5 meters height. Herbaceous communities are defined by their lack of foliar cover provided by woody species. Sparse herbaceous communities generally have foliar cover of less than 20 percent, this often patchily distributed. Marshes are defined by standing water throughout most of the growing season.

I. FOREST COMMUNITIES

Tree canopy cover > 60% with crowns touching or overlapping. Tree and shrub layer generally discreet.

1. Upland forests not associated with the floodplain, but including floodplains of upland drainages

2. Mixed evergreen-deciduous forests with eastern redcedar (*Juniperus virginiana*) abundant, usually in excess of 15 percent. Dominant species may include white oak (*Quercus alba*), black oak (*Quercus velutina*), post oak (*Quercus stellata*), chinkapin oak (*Quercus muehlenbergii*), northern red oak (*Quercus rubra*) and black hickory (*Carya texana*).

2. Deciduous forest with little or no eastern redcedar (*Juniperus virginianus*)

3. White oak (*Quercus alba*) dominated forests in mesic to dry mesic slope positions

4. Sugar maple (*Acer saccharum*) dominates with white oak (*Quercus alba*) and northern red oak (*Quercus rubra*). Chinkapin oak (*Quercus muehlenbergii*) and white ash (*Fraxinus americana*) may be abundant where base saturation is higher, usually in association with limestone or dolomite bedrock at or near the surface.

4. White oak (*Quercus alba*) and northern red oak (*Quercus rubra*) dominate, while sugar maple (*Acer saccharum*) is relatively sparse, in the canopy. It may be abundant in lower vegetative strata.

5. Forests dominated by white oak (*Quercus alba*), but canopy lacking significant amounts of chinkapin oak (*Quercus muehlenbergii*) and white ash (*Fraxinus americana*). These may be abundant in lower strata. Other species likely include northern red oak (*Quercus rubra*), pignut hickory (*Carya glabra*), mockernut hickory (*Carya alba*) and shagbark hickory (*Carya ovata*). Dogwoods (*Cornus* spp.) are abundant in the lower canopy and shrub layers.

5. Forests with all strata abundant with chinkapin oak (*Quercus muehlenbergii*), green ash (*Fraxinus americana*) and northern red oak (*Quercus rubra*). Sugar maple (*Acer saccharum*) and white oak (*Quercus alba*) also are abundant. Shrubs include northern spicebush (*Lindera benzoin*) and pawpaw (*Asimina triloba*).

3. Mixed oak (*Quercus* spp.) forests where white oak is at most co-dominant with black oak (*Quercus velutina*), post oak (*Quercus stellata*) and hickories, most likely black hickory (*Carya texana*). These communities are limited to dry to dry-mesic upper slope positions.

Ozark Red-cedar-Hardwood Forest (CEGL004803)

White Oak–Northern Red Oak–Sugar Maple Mesic Forest (CEGL002058)

White Oak / Dogwood Dry–Mesic Forest (CEGL002066)

White Oak–Mixed Oak Dry–Mesic Alkaline Forest (CEGL002070)

6. Dry forests dominated by post oak (*Quercus stellata*) and black hickory (*Carya texana*), with lesser amounts of white oak (*Quercus alba*), black oak (*Quercus velutina*), and other hickory (*Carya* spp.). Eastern redcedar (*Juniperus virginiana*) may be abundant and indicative of past disturbance, especially grazing.
6. Dry-mesic forests dominated by black oak (*Quercus velutina*), white oak (*Quercus alba*), pignut hickory (*Carya glabra*) and shagbark hickory (*Carya ovata*). Drier expressions may have abundant black hickory (*Carya texana*) and less commonly blackjack oak (*Quercus marilandica*).
1. Bottomland forests associated with the flood plain of the Missouri River, its major tributaries and, less commonly, the mouth of upland drains.
7. Forests with little or no oak (*Quercus* spp.) component. Forests occur adjacent to river or secondary river channel, or in frequently flooded low, wet depressions. Soils are poorly drained clayey alluvium, saturated and wet for significant periods of the year (especially fall, winter, and spring).
8. Upper most strata is comprised of eastern cottonwood (*Populus deltoides*) and/or Willow (*Salix* spp.; > 50% basal area and/or density). Other trees found in the uppermost strata may include: American sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), silver maple (*Acer saccharinum*), and boxelder (*Acer negundo*).
8. Upper most strata is dominated by maples (*Acer* spp.), ash (*Fraxinus* spp.), sycamore (*Platanus occidentalis*), or sugarberry (*Celtis laevigata*). Eastern cottonwood (*Populus deltoides*) can be a component of the overstory but is not dominant.
9. Canopy closure varies from open to complete or nearly so. Canopy is dominated by maples (*Acer* spp.) or elms (*Ulmus* spp.).
10. Upper most strata is more-or-less closed and dominated by silver maple (*Acer saccharinum*). Silver maple may dominate an emergent or dominant overstory layer with a very dense sub-canopy to shrub layer. Other trees that may be found in upper most and lower strata include: cottonwood (*Populus deltoides*), sycamore (*Platanus occidentalis*), American elm (*Ulmus americana*), willow (*Salix* spp.), box-elder (*Acer negundo*), sugarberry (*Celtis laevigata*), and green ash (*Fraxinus pennsylvanica*)
10. Upper most strata dominated by box-elder (*Acer negundo*), sycamore (*Platanus occidentalis*), sugarberry (*Celtis laevigata*), elm (*Ulmus* spp.), mulberry (*Morus* spp.), maple (*Acer* spp.), and eastern cottonwood (*Populus deltoides*).

**Midwest Post Oak–Blackjack Oak Forest
(CEGL002075)**

**Black Oak–White Oak–Hickory Forest
(CEGL002076)**

**Midwest Cottonwood–Willow Forest
(CEGL002018)**

**Silver Maple–Elm Forest
(CEGL002586)**

Box-elder Floodplain Forest (CEGL005033)

7. Forests with moderate (20 percent or more) to significant oak (*Quercus* spp.) cover. Forests occur in swales adjacent to or succeeding from old oxbows, backwaters, low ridges, and flats on both lower and elevated, very gently sloping (0-3%) river bottoms. Areas are seasonally flooded and/or saturated in fall, winter, and spring. Ephemeral ponding often occurs during heavy rainfall. Soils are very deep silty and loamy alluvium. Soils are moderately well to somewhat poorly drained.

11. Canopy is dominated by hackberry (*Celtis occidentalis*), ash (*Fraxinus* spp.), and American sycamore (*Platanus occidentalis*). Burr oak (*Quercus macrocarpa*), more rarely white oak (*Quercus alba*) occasionally found in overstory. Soils are moderately well-drained and moist throughout the year, but only wet in the spring

11. Canopy dominated by oaks (*Quercus* spp.)

12. Upper most strata partially open to closed. Oaks (*Quercus* spp.) should comprise at least 25% of upper most strata. Other canopy associates that may dominate include: sugarberry (*Celtis laevigata*), silver maple (*Acer saccharinum*), and black walnut (*Juglans nigra*). Common oaks include: pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), burr oak (*Quercus macrocarpa*), Shumard's oak (*Quercus shumardii*), and northern red oak (*Quercus rubra*).

12. Upper strata partially open to closed. Upper strata dominated by burr oak (*Quercus macrocarpa*), swamp white oak (*Quercus bicolor*), and shellbark hickory (*Carya laciniosa*). Other associated tree species include: Shumard's oak (*Quercus shumardii*), pecan (*Carya illinoiensis*), green ash (*Fraxinus pennsylvanica*), and American elm (*Ulmus americana*).

**Central Green Ash–
Elm–Hackberry Forest
(CEGL002014)**

**Pin Oak Mixed
Hardwood Depression
Forest (CEGL002432)**

**Bur Oak - Swamp White
Oak Mixed Bottomland
Forest (CEGL002098)**

II. WOODLAND COMMUNITIES

Tree canopy cover between 15-60%. Canopy composed of widely spaced trees with a poorly developed shrub layer and vigorous herbaceous layer

1. Scattered ruderal woody species above mixed annual and perennial, ruderal forbs—old field communities. In uplands, likely dominants include honeylocust (*Gleditsia triacanthos*) and eastern redcedar (*Juniperus virginiana*). Bottomland old fields are dominated by sugarberry (*Celtis laevigata*), green ash (*Fraxinus americana*), boxelder (*Acer negundo*), and mulberry (*Morus spp.*)

2. Old fields of uplands.

2. Old fields of bottomlands

1. Oak (*Quercus spp.*) or more likely eastern cottonwood (*Populus deltoides*) dominated woodlands of the bottoms.

3. Overstory composed of medium to tall trees. Overstory cover is ≤ 50% and trees have crowns that nearly touch the ground. Overstory is dominated by either singularly or in combination: eastern cottonwood (*Populus deltoides*), willow (*Salix spp.*), green ash (*Fraxinus pennsylvanica*), pecan (*Carya illinoiensis*), pin oak (*Quercus palustris*), and/or elms (*Ulmus spp.*). Community occurs on floodplains where water table is near the surface and in lower sites; standing water may be present in fall, winter, or spring. Soils are deep sandy loam to sand and somewhat poorly drained.

3. Upper most canopy position dominated by oaks (*Quercus spp.*) Overstory is dominated by burr oak (*Quercus macrocarpa*), swamp white oak (*Quercus bicolor*), and sugarberry (*Celtis laevigata*) dominates the smaller size classes. Other associated tree species include: honeylocust (*Gleditsia triacanthos*), sycamore (*Platanus occidentalis*), elm (*Ulmus spp.*), and black walnut (*Juglans nigra*). Community occurs on floodplain terraces or elevated floodplains. Soils associated with this community are silt loam that is high in organic matter and has a moderate permeability with a high water holding capacity.

Upland Woody Old Field (Not recognized by NVCS)

Bottomland Woody Old Field (Not recognized by NVCS)

Cottonwood Floodplain Woodland (CEGL002017)

Bur Oak Bottomland Woodland (CEGL002140)

III. SHRUBLAND COMMUNITIES

Uppermost strata composed of shrubs >0.5m tall with tree cover <15%.

1. Scattered ruderal woody species above mixed annual and perennial, ruderal forbs—old field communities—usually on landforms that are drier and experience less frequent inundation, or have not been inundated frequently since the cessation of agricultural production. In uplands, likely dominants include honey locust (*Gleditsia triacanthos*) and eastern redcedar (*Juniperus virginiana*). Bottomland old fields are dominated by sugarberry (*Celtis laevigata*), green ash (*Fraxinus americana*), boxelder (*Acer negundo*), and mulberry (*Morus* spp.).

2. Old fields of uplands.

2. Old fields of bottomlands

1. Communities dominated by willow (*Salix* spp.) or buttonbush, usually on landforms that experience frequent or prolonged inundation.
2. Sandbar willow (*Salix interior*) dominated shrubland. Canopy coverage ranges from dense to partially open. Willows range in size from 2 to 4 meters tall. Other species associated with community include: eastern cottonwood (*Populus deltoides*) and/or sycamore (*Platanus occidentalis*).
2. Shrub layer can vary from open to closed (20-80%). Common buttonbush (*Cephalanthus occidentalis*) typically comprises nearly 90% of shrub layer in waters 1-2 meter deep. Other shrubs commonly encountered include: swamp loosestrife (*Decodon verticillatus*), common winterberry (*Ilex verticillata*), swamp rose (*Rosa palustris*), and black willow (*Salix nigra*). A scattered tree canopy may occur including the following species: silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), and American elm (*Ulmus americana*).

Upland Woody Old Field (Not recognized by NVCS)

Bottomland Woody Old Field (Not recognized by NVCS)

Sandbar Willow Shrubland (CEGL8562)

Northern Buttonbush Shrubland (CEGL002190)

IV HERBACEOUS COMMUNITIES

Community is dominated by herbaceous vegetation or woody vines, vegetation cover >25%. Community may or may not flood. If the community floods it is inundated for short periods of time.

1. Community is dominated by graminoids
 2. Community is dominated by grasses, not sedges and rushes
 3. Community is dominated by native grasses
 4. Prairie cordgrass (*Spartina pectinata*) and bluejoint (*Calamagrostis canadensis*) are the two most abundant species. Other common species include sedges (*Carex* spp.), rushes (*Juncus* spp.), flatsedge (*Cyperus* spp.), big bluestem (*Andropogon gerardii*), mat muhly (*Muhlenbergia richardsonis*), switchgrass (*Panicum virgatum*), and rice cutgrass (*Leersia oryzoides*) are found in this community. Forbs encountered in this community include: New England aster (*Symphyotrichum novae-angliae*), prairie blazing star (*Liatris pycnostachya*), and giant goldenrod (*Solidago gigantea*). This community is found in lowland areas that are flooded in spring and saturated for much of the growing season.
 4. Big bluestem (*Andropogon gerardii*), prairie cordgrass (*Spartina pectinata*), and switchgrass (*Panicum virgatum*) dominate and are greater than 1m tall. Other common species encountered within this community are: inland rush (*Juncus interior*), eastern gamagrass (*Tripsacum dactyloides*), sawtooth sunflower (*Helianthus grosseserratus*), common cinquefoil (*Potentilla simplex*), and button eryngo (*Eryngium yuccifolium*). This community is found in the floodplains of larger streams and rivers.
 3. Community is dominated by non-native grasses and forbs
 5. Community is dominated by Johnsongrass (*Sorghum halepense*) with ticktrefolies (*Desmodium* spp.). Other common species include honeyvine (*Cynanchum leavे*), trumpet creeper (*Campsis radicans*), and eastern cottonwood (*Populus deltoides*).
 5. Community dominated by non-native grasses
 6. Bottomland community dominated by weedy native or exotic grasses such as witchgrass (*Panicum capillare*), whitegrass (*Leersia virginica*), smooth crabgrass (*Digitaria ischaemum*), and green bristlegrass (*Setaria viridis*). Other commonly encountered species include: panicleleaf ticktrefoli (*Desmodium paniculatum*), calico aster (*Symphyotrichum lateriflorus*), rough cocklebur (*Xanthium strumarium*), field bindweed (*Convolvulus arvensis*), and lateflowering thoroughwort (*Eupatorium serotinum*).
 6. Upland old field dominated by tall fescue (*Festuca arundinacea*) mixed with ruderal annuals and perennials.

**Central Cordgrass
Wet Prairie
(CEGL002224)**

**Central Wet-Mesic
Tallgrass Prairie
(CEGL002024)**

**Johnson Grass
(Not recognized by
NVCS; invasive
species can be
dominant.)**

**Herbaceous Old
Field
(Not recognized by
NVCS; invasive
species can be
dominant.)**

**Fescue Field (Not
recognized by
NVCS)**

2. Community is dominated by sedges (*Carex* spp.), flatsedges (*Cyperus* spp.), and rushes (*Juncus* spp.) 0.5-1.5m tall. Typical species include: crested sedge (*Carex cristatella*), troublesome sedge (*C. molesta*), woolly sedge (*C. pellita*), awlfruit sedge (*C. stipata*), blunt broom sedge (*C. tribuloides*), and fox sedge (*C. vulpinoidea*). Other graminoids may include: spikerushes (*Eleocharis* spp.), rushes (*Juncus* spp.), and bulrushes (*Scirpus* spp.). This community occurs on nearly level floodplains, often surrounding channels, or in basins. This community is flooded for much of the growing season, but may dry out in late summer.
1. Community dominated by forbs, herbaceous vines, woody vines or woody shrubs. Graminoids are present but they do not dominate the community.
7. Community with abundant shrubs, young trees or woody vines. Dominant woody vines include trumpet creeper (*Campsis radicans*), eastern poison ivy (*Toxicodendron radicans*), and grape (*Vitis* spp.). Commonly encountered tree species include eastern cottonwood (*Populus deltoides*), sandbar willow (*Salix interior*), and boxelder (*Acer negundo*). Herbaceous species commonly encountered include panicleleaf ticktrefoil (*Desmodium paniculatum*), honeyvine (*Cynanchum laeve*), goldenrods (*Solidago* spp.), lateflowering thoroughwort (*Eupatorium serotinum*), Virginia groundcherry (*Physalis virginiana*), and rough cocklebur (*Xanthium strumarium*)
7. Community is dominated by forbs and herbaceous vines. Shrubs, small trees and woody vines are a minor component, generally less than 20 percent cover
8. Weedy annuals and perennials are abundant. Dominants include great ragweed (*Ambrosia trifida*), rough cocklebur (*Xanthium strumarium*), roughfruit amaranth (*Amaranthus tuberculatus*), honeyvine (*Cynanchum laeve*), fragrant flatsedge (*Cyperus odoratus*), lateflowering thoroughwort (*Eupatorium serotinum*), field bindweed (*Convolvulus arvensis*), Indianhemp (*Apocynum cannabinum*), and Carolina horsenettle (*Solanum carolinense*).
8. Knotweeds (*Polygonum* spp.) and sedges (*Cyperus* spp.) dominate. Annuals are abundant due to frequent flooding. Other common species include beggarticks (*Bidens* spp.) and flatsedges (*Cyperus* spp.). This community occurs in shallow depressions that may flood in the spring but typically dry out in the summer.

**Central Midwest
Sedge Meadow
(CEGL005272)**

**Bottomland Woody
Old Field (Not
recognized by
NVCS; invasive
species can be
dominant.)**

**Herbaceous Old
Field
(Not recognized by
NVCS; invasive
species can be
dominant.)**

**Midwest Ephemeral
Pond (CEGL002430)**

V. SPARSE HERBACEOUS COMMUNITIES

Uppermost stratum primarily herbaceous species, < 25% cover. . Vegetation is scattered to nearly absent and patchily distributed.

1. A diverse suite of hardy annuals dominate. Woody stems, if present, include willow (primarily *Salix interior*) and common buttonbush (*Cephalanthus occidentalis*). These tend to be sparse and stunted, with evidence of repeated damage due to flooding, including broken stems and debris deposition in the branches. This community occurs along river shorelines, islands, pointbars, and flats. Vegetation is very sparse, highly dynamic and irregular in structure because of repeated flooding and changing river conditions. The soil is composed mostly of sand with lesser amounts of clay and silt.

1. Knotweeds (*Polygonum* spp.) and flatsedges (*Cyperus* spp.) dominate. Annuals are abundant due to frequent inundation, usually standing water. Other species commonly include beggarticks (*Bidens* spp.), and barnyardgrass (*Echinochloa crus-galli*). Less common diagnostic species include lanceleaf fogfruit (*Phyla lanceolata*), valley redstem (*Ammannia coccinea*), and upright burhead (*Echinodorus berteroii*). Sandbar willow (*Salix interior*) and buttonbush (*Cephalanthus occidentalis*) may be present, but tend to lack the flood damage characteristic of the above community. This community occurs in shallow depressions that may flood in the spring but typically dry out in the summer. A wide variety of forbs and graminoids may colonize the exposed, mostly silt substrate.

**Riverine Sand Flats
(CEGL002049)**

**Midwest Ephemeral
Pond (CEGL002430)**

VI. MARSH COMMUNITIES

Herbaceous vegetation dominates and the community is flooded for extended periods of time, usually for at least six months.

1. Community is dominated by graminoids such as sedges (*Carex* spp), flatsedges (*Cyperus* spp.), cattail (*Typha* spp), and bulrush (*Schoenoplectus* spp.).

2. Soils and water are saline or acidic

3. Soils are saline. Community is comprised of herbaceous plants ranging in size from 0.5-1.0 meters tall. Trees and other wood plants are almost completely absent. Dominant plant species include saltgrass (*Distichlis spicata*), red swampfire (*Salicornia rubra*), cosmopolitan bulrush (*Schoenoplectus maritimus*), eastern annual saltmarsh aster (*Symphyotrichum subulatum*), foxtail barley (*Hordeum jubatum*), annual marsh elder (*Iva annua*), Texas dropseed (*Sporobolus texanus*), and Pursh seepweed (*Suaeda calceoliformis*). Vegetation may be patchy with the wettest saline areas containing bare ground.

**Eastern Great Plains
Saline Marsh
(CEGL002043)**

3. Soils are not saline, but are flooded with acidic groundwater.

Vegetation is dominated by herbaceous vegetation but scattered shrubs may be present. Dominant herbaceous vegetation includes broadleaf cattail (*Typha latifolia*), narrowleaf cattail (*Typha angustifolia*), and a variety of sedges (*Carex* spp.). *Sphagnum* spp. is present in some communities. Commonly encountered shrubs include northern spicebush (*Lindera benzoin*), sassafras (*Sassafras albidum*), and farkleberry (*Vaccinium arboreum*).

**Great Plains Acidic
Seep (CEGL002235)**

2. Soils and waters are neither saline nor acidic

4. Sites are dominated by bulrushes (*Schoenoplectus* spp.)

5. The diagnostic dominant species is river bulrush (*Schoenoplectus fluvialis*), which forms almost mono-dominant patches. Other associated species include: narrowleaf cattail (*Typha angustifolia*), broadleaf cattail (*Typha latifolia*), softstem bulrush (*Schoenoplectus tabernaemontani*), and broadfruit bur-reed (*Sparganium eurycarpum*). Sites are seasonally flooded but water typically draws down by late summer.

**River Bulrush Marsh
(CEGL002221)**

5. Vegetation varies from zones dominated by short emergent plants to annual and perennial hydrophytes greater than 1 m tall. Dominate herbaceous vegetation includes: Softstem bulrush (*Schoenoplectus tabernaemontani*), river bulrush (*Schoenoplectus fluvialis*) hardstem bulrush (*Schoenoplectus acutus*), narrowleaf cattail (*Typha angustifolia*), and broadleaf cattail (*Typha latifolia*). Knotweeds (*Polygonum* spp.) may be present as well as floating-leaved aquatics such as Carolina mosquitofern (*Azolla caroliniana*), duckweeds (*Lemna* spp.), common duckmeat (*Spirodela polyrrhiza*), and common bladderwort (*Utricularia macrorhiza*). Soils are shallow to deep, very poorly drained, consisting of peats, mucks, or mineral materials. This community is a transition between wet meadows and deep marshes

**Bulrush–Cattail–Bur-reed Shallow Marsh
(CEGL002026)**

References

- NatureServe, 2011, NatureServe Explorer: An online encyclopedia of life [web application], Version 7.1: NatureServe, Arlington, Virginia, (www.natureserve.org/explorer), accessed 15 April, 2011, www.natureserve.org/explorer.
- Struckhoff, M.A., Grabner, K.W., and Stroh E.D, 2010, Vegetation communities at Big Muddy National Fish and Wildlife Refuge, Missouri: U.S. Geological Survey Open-File Report 2011-1038, 29 p. with Appendix.
- The Nature Conservancy, 1994, Standardized National Vegetation Classification System; Report to U.S. Dept. of Interior: The Nature Conservancy, Arlington, Virginia and Environmental Systems Research Institute, Redlands, California, 94 p., plus appendices, biology.usgs.gov/npsveg/classificationrpt.pdf.
- U.S. Department of Agriculture, Natural Resource Conservation Service, 2011, The PLANTS Database: National Plant Data Center, Baton Rouge, LA, Also available at <http://plants.usda.gov>, 15 April, 2011.