

IDENTIFICATION AND ASSESSMENT OF ECOLOGICALLY
SIGNIFICANT WETLAND COMMUNITIES IN NORTH CENTRAL,
NORTHWESTERN, AND THE PANHANDLE OF OKLAHOMA:
FINAL REPORT

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Introduction

Wetland ecosystems are a recognized conservation priority, due to the loss of wetland ecosystems throughout the United States (Kusler 1983, Tiner 1984). It is estimated that the United States has lost more than 50% of the wetlands extant in the eighteenth century and is currently losing 400,000 acres per year (Tiner 1984, Dahl 1990). Sixty-seven percent of Oklahoma's original wetlands were lost in the last 200 years (Dahl 1990). Bottomland hardwood forests have suffered an 85% loss in acreage (Brabander, et al. 1985, Neal 1990). Many factors have contributed to the loss and degradation of wetland ecosystems, including real estate development, industrialization, agricultural conversion, and timber harvest (Mitch and Gosselink 1993).

The destruction of wetlands has produced a fragmented landscape which can reduce biological diversity and ecosystem function (Saunders 1991). Wetland ecosystems harbor a higher portion of species relative to terrestrial ecosystems, enhancing the value for biodiversity conservation. As a result, a greater number of plant and animal species are imperiled by the destruction of wetland plant communities. Angermeier and Karr (1994) report that among animal taxa found in wetlands, 20% of fishes, 36% of crayfishes, and 55% of mussels and 7% of mammals and birds were extinct or imperiled.

Objectives

The objective of this study was to locate and document the current vegetation of extant wetland plant communities. We censused wetlands in 27 north-central and northwestern Oklahoma counties. Potential wetland sites were located using a combination of aerial

photography, ground reconnaissance, and consultation with local experts. Once located, quantitative data were collected from the wetland site. In addition to multivariate statistical analysis, site data were deposited in the Oklahoma Natural Heritage Inventory Element Occurrence database. The ONHI database serves as a centralized and continually updated inventory of biological diversity in Oklahoma.

Study Area

Geology and geomorphology is a key factor in determining the distribution of vegetation. The study area consisted of 27 counties in northwest Oklahoma and the panhandle (Figure 1) which covers a diverse range of geomorphology. For example, the High Plains geomorphic province, with gently rolling hills composed of tertiary sands and gravels, includes all of the Panhandle and portions of Ellis, Harper, Roger Mills, and Woodward counties (Curtis and Ham 1979). The most conspicuous wetland features in this area are Playa Lakes and herbaceous riparian communities. The Western Sandstone Hills and Western Redbed Plains provinces are composed of redstone and shale of Permian age and occurs in Harper, Dewey, Woodward, Blaine and Canadian counties (Curtis and Ham 1979). The most conspicuous wetland features in this province is riparian vegetation. The Western Sand Dune Belts follow major stream in the study area (i.e., Canadian, North Canadian, Cimarron, and Salt Fork Rivers) and are composed of Quaternary sand and alluvium (Curtis and Ham 1979). In addition to riparian vegetation, interdunal swale ponds are an important wetland resource in the province. The most extensive geomorphic province in the study area is the Central Redbed Plains, a region of red Permian

shale and sandstone forming rolling hills and broad floodplains (Curtis and Ham 1979). Much of the wetland vegetation in this province is located along major streams. The Northern Limestone Cuesta Plains occur in western Osage, Pawnee and eastern Payne, Kay, Noble and Lincoln counties. The province is composed of limestone capped cuesta plains. The limestone substrate fosters the persistence of prairie vegetation. Finally, the Eastern Sandstone Cuesta plains, a region of Pennsylvanian sandstone, occupies the eastern portion of the study area (Curtis and Ham 1979).

Major streams draining the study area included the Beaver/Canadian, Canadian, Cimarron, Arkansas, Chikaskia, Caney, and Deep Fork Rivers. Floodplain geology of these streams is quaternary alluvium ranging from 25 - 100 feet in depth. Several major reservoirs with established wetland vegetation exist in the study area. Some of the more prominent impoundments include Great Slat Plains, Fort Supply, Optima, Etling, Hulah, Kaw, Hefner, Foss, and Canton.

Potential natural vegetation in the study area ranges from pinyon pine-juniper woodlands and shortgrass prairie to post oak blackjack forest and woodland (Duck and Fletcher 1945). In the western portion of the study area there is a small inclusion of Rocky Mountain front range vegetation, consisting of pinyon pine (*Pinus edulis*) and one-seed juniper (*Juniperus monosperma*) (Hoagland 2000). However, the predominant vegetation of the Panhandle is shortgrass prairie composed of blue grama (*Bouteloua gracilis*) and buffalograss (*Buchloe dactyloides*) (Bruner 1931, Blair and Hubbell 1938, Hoagland 2000).

Vegetation in the western tier counties of the study area fall within the mixedgrass prairie. The dominant species are little bluestem (*Schizachyrium scoparium*), dropseeds

(*Sporobolus* spp.), and sideoats grama (*Bouteloua curtipendula*). However, this region includes several subtypes, such as the shinnery (*Quercus havardii*) and sand sage (*Artemisia filifolia*) shrublands (Bruner 1931, Hoagland 2000). Both vegetation types are restricted to deep sand deposits.

The predominant upland forest type is Post oak (*Quercus stellata*) - blackjack (*Q. marilandica*) (Duck and Fletcher 1945, Rice and Penfound 1959). This vegetation is most abundant in the region known as the cross timbers, which form a mosaic of forest, woodland and grassland (Hoagland et al. 1999). Within this area, tallgrass prairie vegetation becomes increasingly abundant. In fact, the distribution of grassland and forest vegetation is dictated by the prevalence of suppression of fire (Rice and Penfound 1959, Hoagland et al 1999).

Methods

Wetland sites were identified by review of USGS 7.5 minute topographic quadrangles and National Wetland Inventory (NWI) maps. In addition, knowledgeable individuals were contacted from the following state and federal agencies: USDA Natural Resource Conservation Service District/County Offices, Oklahoma Commission District/County Offices, Oklahoma Department of Wildlife Conservation, and United States Fish and Wildlife Service (members of these agencies were extremely helpful and their assistance was deeply appreciated). Potential sites were then reconnoitered and prioritized for evaluation. Landownership was determined and in order to gain access to potential sites.

Quantitative data were gathered at wetland sites using five 10M x10M quadrats arranged in a “cluster.” A cluster consisted of a central quadrat, with an additional quadrat placed in each of the four cardinal directions 20m from the central quadrat. The use of five quadrats depended upon the shape and size of the site. For example, narrow riparian areas may only allow for three quadrats or one quadrat in the case of a small interdunal pond. Once established, every species within the quadrat is recorded. Percent coverage was visually estimated in 5% increments for herbaceous and small woody plants (Mueller-Dumbois and Ellenberg 1974, Barbour et. al 1987, Kent and Coker 1992). When trees were present, the diameter at breast height (DBH = 1.5m) for stems exceeding 2.0 cm in diameter was recorded.

Vegetation data were compiled into a species-by-site matrix for multivariate analysis. Data were analyzed using TWINSpan (Hill 1979, Gauch 1982, Kent and Coker 1992) to determine wetland vegetation types (dominance types, sensu, Cowardin et al., 1979). Species importance values were averaged for each TWINSpan cluster in order to describe the vegetation types they represented. Nomenclature for plant species follows Kartesz (1994).

Results and Discussion

A total of 105 sites were selected for quantitative sampling (Table 1) and 207 species were encountered throughout the study area. The number of plots used at each site varied based upon the size and geometry of the site. The majority of sites were sampled with three quadrats (Table 2), because a number of sites were located in narrow riparian zones or small interdunal ponds.

Twenty-six major and four vegetation subtypes were recognized based upon TWINSPAN results (Table 3). Five sites were initially removed to reduce outlier effects. In addition to gathering quantitative vegetation, sites were placed into the Cowardin et al. (1979) classification scheme (Table 4). Descriptions of each vegetation association follows.

Forest vegetation associations

1. Sycamore (*Platanus occidentalis*) - boxelder (*Acer negundo*) forest vegetation

Habitat: stream margins. Limited to the eastern edge of the study area.

Associated species: river birch (*Betula nigra*), sugarberry (*Celtis laevigata*), ryegrass (*Elymus villosa*), Virginia creeper (*Parthenocissus quinquefolia*).

2. Silver maple (*Acer saccharinum*) - boxelder (*Acer negundo*) forest vegetation

Habitat: stream margins. Limited to the eastern edge of the study area.

Associated species: False indigo (*Amorpha fruticosa*), nettle (*Boehmeria cylindrica*), and poison ivy (*Toxicodendron radicans*).

3. Pecan (*Carya illinoensis*) - sugarberry (*Celtis laevigata*) forest vegetation

Habitat: floodplains, eastern and central portions of the study area.

Associated species: green ash (*Fraxinus pennsylvanica*), deciduous holly (*Ilex decidua*), soapberry (*Sapindus drummondii*), and poison ivy (*Toxicodendron radicans*).

4. Bur oak (*Quercus macrocarpa*) - Shumard oak (*Quercus shumardii*) forest vegetation

Habitat: floodplains. Limited to the eastern and central portion of study area.

Associated species: fish-on-a-pole (*Chasmanthium latifolium*), lowland wildrye (*Elymus villosa*), cottonwood (*Populus deltoides*), switchgrass (*Panicum virgatum*), and American elm (*Ulmus americana*).

Woodland vegetation associations

5. Black willow (*Salix nigra*) woodland vegetation

Habitat: stream margins, ponds, and sloughs. Found throughout the study area, except the Panhandle.

Associated species: peppervine (*Ampelopsis arborea*), false indigo (*Amorpha fruticosa*), boneset (*Eupatorium serotinum*), and water pepper (*Polygonum hydropiperoides*).

Shrubland vegetation associations

6.. Buttonbush (*Cephalanthus occidentalis*) shrubland vegetation

Habitat: margins of sloughs, lakes and man-made impoundments.

Associated species: softstem bulrush (*Scirpus validus*) and waterwillow (*Justicia americana*).

7. Buttonbush - swamp privet (*Forestiera acuminata*) shrubland vegetation

Habitat: slough and lake margins. This community was found in Creek County and represents a western range extension for this species.

Associated species: similar to shrubland vegetation association 5.

8. Sandbar willow (*Salix exigua*) shrubland vegetation

Habitat: margins of sandy streams. Occurs throughout the study area, but to a limited degree in the Panhandle.

Associated species: boneset (*Eupatorium serotinum*), switchgrass (*Panicum virgatum*), Virginia creeper (*Parthenocissus quinquefolia*), camphorweed (*Pluchea odorata*), saltcedar (*Tamarix chinensis*), and American bulrush (*Schoenoplectis americana*). Peachleaf willow (*Salix amygdaloides*) is an associate at Panhandle sites.

Herbaceous vegetation associations

9. Coontail (*Ceratophyllum demersum*) herbaceous vegetation

Habitat: ponds and other aquatic beds. Found throughout much of the study area.

Associated species: duckweeds (*Lemna minor* and *L. valdiviana*), seedbox (*Ludwigia palustris*), and sego pondweed (*Potamogeton pectinatus*).

10. Saltgrass (*Distichlis spicata*) herbaceous vegetation

Habitat: saline soils along floodplains and in playa lakes. Often grades into the American bulrush herbaceous vegetation type.

Associated species: western ragweed (*Ambrosia psilostachya*), saltmarsh aster (*Aster subulatus*), rabbitfoot grass (*Polypogon monspeliensis*), and American bulrush (*Schoenoplectis americana*).

11. Creeping burhead (*Echinodorus cordifolius*) herbaceous vegetation

Habitat: drawdown areas and lake shorelines. Sporadic throughout the study area.

Associated species: blue mud plantain (*Heteranthera limosa*), spanglegrass (*Leptochloa filiformis*), spikerush (*Eleocharis radicans*), and duckweeds (*Lemna* spp. and *Spirodela polyrhiza*).

12. Upright burhead (*Echinodorus berteroi*) herbaceous vegetation

Habitat: drawdown areas and lake shorelines. Sporadic throughout the study area.

Associated species: similar to number 11.

13. Common spikerush (*Eleocharis palustris*) herbaceous vegetation

Habitat: lake shorelines and ponds. Common throughout the study area.

Associated species: barnyard grass (*Echinochloa crus-galli*), smartweed (*Polygonum pensylvanicum*), dock (*Rumex altissimus*), spangletop (*Leptochloa filiformis*), and umbrella sedge (*Cyperus* spp.).

13.a. Common spikerush - pepperwort (*Marsilea vestita*) herbaceous vegetation

Habitat: occurs primarily in interdunal swale ponds, buffalo wallows, and wet depressions.

Associated species: barnyard grass (*Echinochloa crus-galli*), smartweed (*Polygonum pensylvanicum*), spangletop (*Leptochloa filiformis*), and umbrella sedge (*Cyperus* spp.).

14. Blue mud plantain (*Heteranthera limosa*) - longlobed arrowhead (*Sagittaria longiloba*) herbaceous vegetation

Habitat: interdunal ponds. Frequent in western portion of the study area.

Associated species: toothcup (*Ammania coccinea*), barnyard grass (*Echinochloa crus-galli*), spangletop (*Leptochloa fascicularis*), water hyssop (*Bacopa rotundifolia*), and pepperwort (*Marsilea vestita*).

15. Softstem rush (*Juncus effusus*) herbaceous vegetation

Habitat: marshes, seeps, shorelines and sloughs. Limited to eastern portion of the study area.

Associated species: sedges (*Carex* spp.), buttonbush (*Cephalanthus occidentalis*), seedbox (*Ludwigia palustris*) water pepper (*Polygonum hydropiperoides*), and cattails (*Typha* spp.)

16. Water primrose (*Jussiaea peploides*) - water pepper (*Polygonum hydropiperoides*)

herbaceous vegetation

Habitat: lacustrine wetlands

Associated species: buttonbush (*Cephalanthus occidentalis*), hibiscus (*Hibiscus laevis*), and water lotus (*Nelumbo lutea*).

17. Waterwillow (*Justicia americana*) herbaceous vegetation

Habitat: banks and cobble bars along slow moving streams and lake margins. Common in eastern portion of study area.

Associated species: false indigo (*Amorpha fruticosa*), saltmarsh (*Aster subulatus*), rice and cutgrass (*Leersia oryzoides*).

18. Watercress (*Rorippa nasturtium_aquaticum*) herbaceous vegetation

Habitat: seeps, springs and spring-fed streams. Infrequent throughout the study area.

Associated species: toothcup (*Ammania coccinea*), seedbox (*Ludwigia palustris*), and water parsnip (*Berula erecta*).

19. Water lotus (*Nelumbo lutea*) herbaceous vegetation

Habitat: lacustrine wetlands. Most common in the eastern portion of the study area.

Associated species: hibiscus (*Hibiscus laevis*), sego pondweed (*Potamogeton pectinatus*), swamp knotweed (*Polygonum amphibium*) and cattails (*Typha* spp.)

20. Waterlily (*Nymphaea odorata*) herbaceous vegetation

Habitat: lacustrine wetlands. Limited to the eastern portion of the study area and rare in occurrence.

Associated species: coontail (*Ceratophyllum demersum*), sego pondweed (*Potamogeton pectinatus*) and bladderworts (*Utricularia* spp.).

21. Common reed (*Phragmites australis*) herbaceous vegetation

Habitat: stream margins. Common in western portion of study area.

Associated species: salt marsh (*Aster subulatus*), camphorweed (*Pluchea odorata*), dock (*Rumex altissimus*), American bulrush (*Schoenoplectis americana*), and cattails (*Typha* spp.).

22. Swamp knotweed (*Polygonum amphibium*) herbaceous vegetation

Habitat: wet depressions, lakes and ponds. Scattered throughout the study area and infrequent in occurrence.

Associated species: salt marsh (*Aster subulatus*), camphorweed (*Pluchea odorata*), dock (*Rumex altissimus*), American bulrush (*Schoenoplectis americana*), and cattails (*Typha* spp.).

23. Arrowhead (*Sagittaria latifolia*) herbaceous association

Habitat: ponds, interdunal swales, and sloughs. In frequent throughout much of the study area.

Associated species: barnyard grass (*Echinochloa crus-galli*), common spikerush (*Eleocharis palustris*), and blue mud plantain (*Heteranthera limosa*).

24. American bulrush (*Schoenoplectis americana*) herbaceous association

Habitat: floodplains, backswamp, and lake margins. Throughout the study area, but most common in the west and panhandle.

Associated species: salt marsh aster (*Aster subulatus*), saltgrass (*Distichlis spicata*), common spikerush (*Eleocharis palustris*), Torrey's rush (*Juncus torreyi*), and rabbitfoot grass (*Polypogon monspeliensis*).

25. Powdery blue thalia (*Thalia dealbata*) herbaceous vegetation

Habitat: marshes, ponds, and lake margins. Found at only one site in Creek County. Listed by Hoagland (2000) as occurring in southeastern Oklahoma and Jefferson County. This plant had not been previously reported from Creek County.

Associated species: hibiscus (*Hibiscus laevis*), softstem bulrush (*Schoenoplectis tabernamontani*), swamp knotweed (*Polygonum amphibium*), and cattail (*Typha*) species.

26. Cattail (*Typha* species) herbaceous vegetation

Note: three subtypes were described (Table 3). However, they will be considered collectively here. This is because cattails hybridize readily and can be difficult to identify in the field as a result.

Habitat: floodplains, backswamp, and lake margins.

Associated species: water hemlock (*Cicuta maculata*), cardinal flower (*Lobelia cardinalis*), water lotus (*Nelumbo lutea*), frogbit (*Phyla nodiflora*), camphor flower (*Pluchea odorata*), dock (*Rumex altissimus*), American bulrush (*Schenoplectis americana*) and softstem bulrush (*Schoenoplectis tabernaemontani*).

The vast majority of sites sampled were dominated by herbaceous vegetation. This represents the increasing frequency of herbaceous vegetation as one proceeds from east to west in the study area. We also included more sites herbaceous because of the need to better document herbaceous wetland vegetation (Hoagland 2000). In applying this classification for future research, it should be noted that more than one of these vegetation types could occur at a site. This reflects both the spatial trend of saturated to inundated soils and well as the temporal aspect of wetland drawdown. For example, a zone of buttonbush shrubland vegetation often surrounds various herbaceous vegetation types (i.e., water primrose or cattail herbaceous). Or patches of blue mudplantain - loglobed arrowhead herbaceous vegetation are often surrounded by common spikerush vegetation. Likewise, a site will change through time. Water primrose vegetation will give way to burhead vegetation following a drawdown.

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Table 1: Location of wetland cluster-plots sampled in northwest Oklahoma.

| Site # | Site Name | Date Surveyed | County | Township & Range | UTM Coord. | Drainage |
|--------|-----------------------|-------------------|------------|------------------|-------------------|----------|
| 1 | Anderson Creek Bridge | 11 August 1999 | Woods | T27N, R17W, S18 | 40738N 4931E | Cimarron |
| 2 | Beaver WMA_ Slough | 20 August 1998 | Beaver | T4N, R22W, S1 | 40773N 3536E | Beaver |
| 3 | Bezerko mama | 17 June 1999 | Major | T20N, R11W, S3 | 40112N 55725E | Cimarron |
| 4 | Birch Lake | 22 September 1999 | Osage | T24N, R10E, S36 | | Arkansas |
| 5 | Birch lake pond north | 22 September 1999 | Osage | T24N, R10E, S14 | | Arkansas |
| 6 | Bluebells | 7 August 1998 | Kingfisher | T18N, R9W, S1 | 39905N 5804E | Cimarron |
| 7 | Braum's bouquet | 13 August 1998 | Kingfisher | T10N, R7W, S11 | | Canadian |
| 8 | Buffalo Creek | 16 July 1998 | Harper | T27N, R23W, S16 | 407485N 43891E | Cimarron |
| 9 | Buttercups bottom #1 | 17 June 1999 | Major | T22N, R11W, S18 | 40257N 55195E | Cimarron |

| Site # | Site Name | Date Surveyed | County | Township & Range | UTM Coord. | Drainage |
|--------|-----------------------------|-------------------|----------|-------------------|-------------------|-----------|
| 10 | Buttercups bottom #2 | 17 June 1999 | Major | T22N, R11W, S18 | 402565N 5521E | Cimarron |
| 11 | Carrumpa Creek | 11 August 1999 | Cimarron | T2N, R1E, S7&8 | | Beaver |
| 12 | Chandler Deep Fork BLH | 17 September 1998 | Lincoln | T14N, R4E, S32, | 39458N 6893E | Deep Fork |
| 13 | Chandler DF Creek Bridge | 17 September 1998 | Lincoln | T14N, R4E, S28&33 | 394725N 6909E | Deep Fork |
| 14 | Chandler Df marsh | 21 September 1999 | Lincoln | T14N, R4E, S28 | | Deep Fork |
| 15 | Chandler Seward Lake | 17 September 1998 | Lincoln | T14N, R4E, S19 | 39491N 6885E | Deep Fork |
| 16 | Cord cove | 10 August 1999 | Kay | T26N, R2W, S31 | 406185N 63815E | Arkansas |
| 17 | County Road Marsh | 13 August 1998 | Canadian | T10N, R7W, S8 | | Canadian |
| 18 | Creeping bur | 10 August 1999 | Grant | T26N, R6W, S16 | 406515N 60365E | Arkansas |

| Site # | Site Name | Date Surveyed | County | Township & Range | UTM Coord. | Drainage |
|--------|------------------|-------------------|-------------|------------------|------------------|-------------------|
| 19 | Dead Indian Lake | 14 September 1999 | Roger Mills | T15N, R24W, S26 | | Canadian North |
| 20 | Deep Fork Dyke | 25 September 1998 | Okfuskee | T10N, R10E, S21 | 39133N 74999E | Canadian |
| 21 | Devil's canyon | 29 September 1998 | Caddo | T11N, R11W, S25 | 39176N 5623E | Washita |
| 22 | Dolby Springs | 16 July 1998 | Harper | T27N, R24W, S10 | 40759N 4311E | Cimarron |
| 23 | Drill Pond | 7 May 1999 | Logan | T15N, R1E, S23 | 39582N 6654E | Deep Fork |
| 24 | Duckweed | 17 June 1998 | Payne | T17N, R4E, S3 | | Cimarron |
| 25 | East Sandstone | 14 September 1999 | Roger Mills | T12N, R22W, S9 | | Canadian |
| 26 | Easter Parade | 12 August 1999 | Cimarron | T5N, R2E, S11 | | Beaver |
| 27 | Burhead | 10 August 1999 | Woods | T23N, R13W, S7 | 40369N 5326E | Cimarron |

| Site # | Site Name | Date Surveyed | County | Township & Range | UTM Coord. | Drainage |
|--------|-----------------|----------------|----------|----------------------|-------------------|-------------------|
| 28 | Phragmites Rock | 26 August 1999 | Woodward | T23N, R20W, S36 | | North Canadian |
| 29 | Frog Fort | 10 August 1999 | Woods | R23N, T13W, S18 | 403525N 5328E | Cimarron |
| 30 | Frogeyed Pond | 7 August 1998 | Garfield | T24N, R7W, S27 | 404336N 59512E | Arkansas |
| 31 | Frogger Swale | 22 July 1998 | Ellis | T20N, R23W, S33 | 400275N 44145E | Canadian North |
| 32 | Ft. Supply | 25 August 1999 | Woodward | T24N, R22W, S21 | | Canadian North |
| 33 | Ft. Supply S_1 | 25 August 1999 | Woodward | T23N, R22W, S17 | | Canadian |
| 34 | Giant Sag | 10 August 1999 | Alfalfa | T24N, R12W, S16 | 40464N 54645E | Arkansas |
| 35 | Grant's Marsh | 19 August 1998 | Grant | T27N, R8W, S16 | 407415N 58260E | Arkansas North |
| 36 | Greg's Wetland | 12 August 1999 | Woodward | T20N, R17W, S4,5,8,9 | | Canadian |

| Site # | Site Name | Date Surveyed | County | Township & Range | UTM Coord. | Drainage |
|--------|------------------|-------------------|------------|------------------|-------------------|----------|
| 37 | Groen | 7 August 1998 | Garfield | T23N, R7W, S12 | 40381N 5994E | Arkansas |
| 38 | Harper_Beaver | 11 August 1999 | Harper | T27N, R26W, S3&4 | 4078N 4111E | Beaver |
| 39 | Heaven on Wheels | 25 June 1998 | Payne | T19N, R4E, S19 | 39977N 6882E | Cimarron |
| 40 | Heyburn WMA | 16 June 1998 | Creek | T17N, R8E, S12 | 39835N 7336E | Arkansas |
| 41 | High Pressure | 10 August 2000 | Grant | T26N, R6W, S15 | 40647N 6051E | Arkansas |
| 42 | Hajek Marsh | 7 August 1998 | Kingfisher | T18N, R8W, S6 | 39913N 5803E | Cimarron |
| 43 | Horseshoe | 31 July 1998 | Kay | T25N, R1E, S28 | 405395N 66165E | Arkansas |
| 44 | Hudson Lake | 22 September 1999 | Osage | T27N, R12E, S20 | | Arkansas |
| 45 | Hula WMA | 11 June 1998 | Osage | T29N, R10E, S16 | | Caney |

| Site # | Site Name | Date Surveyed | County | Township & Range | UTM Coord. | Drainage |
|--------|--------------------|----------------|----------|------------------|-------------------|----------|
| 46 | Jefferson Carex | 10 August 1999 | gran | T26N, R6W, S13 | 406475N 6070E | Arkansas |
| 47 | Lake Etling | 12 August 1999 | Cimarron | T4N, R2E, S6 | | Beaver |
| 48 | Lake Lattawanna | 6 August 1998 | Logan | T17N, R4W, S35 | 39734N 6267E | Cimarron |
| 49 | Landowner Richard | 2 July 1999 | Grant | T27N, R8W, S5 | 407745N 58135E | Arkansas |
| 50 | Lim-Lon Playa | 11 August 1999 | Beaver | T5N, R21E, S7 | | Beaver |
| 51 | Heteranthera marsh | 25 August 1999 | Major | T22N, R10W, S10 | | CIMARRON |
| 52 | Little Deep Fork | 16 June 1998 | Creek | T16N, R7E, S36 | 396783N 17241E | Canadian |
| 53 | Lone Willow | 25 June 1998 | Payne | T17N, R2E, S1 | 39835N 6772E | Cimarron |
| 54 | Sagittaria Marsh | 21 July 1998 | Dewey | T19N, R20W, S21 | 39961N 4699E | Canadian |

| Site # | Site Name | Date Surveyed | County | Township & Range | UTM Coord. | Drainage |
|--------|-------------------|-----------------|----------|--------------------------|-------------------|-------------------|
| 55 | Loosestrife | 5 August 1999 | Logan | T15N, R2W, S6 | 39639N 6408E | Cimarron |
| 56 | Mesa Marsh | 12 August 1999 | Cimarron | T5N, R1E, S13 | | Beaver |
| 57 | Mother Lode | 10 August 1999 | Woods | T23N, R13W, S7 | 40369N 5336E | Cimarron |
| 58 | N Beaver WMA | 20 August 1998 | Beaver | T4N, R22W, S12 | 407625N 3535E | Beaver |
| 59 | Newkirk Lake | 31 July 1998 | Kay | T28N, R2E, S36 NE/4,NE/4 | 408195N 67653E | Arkansas |
| 60 | Nodosus Marsh | 11 August 1999 | Texas | T3N, R13E, S25 | | Beaver |
| 61 | No_Name Site | 25 August 1999 | Major | T22N, 15W, S33 | | CIMARRON |
| 62 | Okemah Lake | 27 October 1998 | Okfuskee | T12N, R9E, S23 | 393265N 74335E | North Canadian |
| 63 | Overholser Bridge | 25 August 1998 | Oklahoma | T12N, R5W, S13 | 39303N 6203E | North Canadian |

| Site # | Site Name | Date Surveyed | County | Township & Range | UTM Coord. | Drainage |
|--------|------------------------|----------------|----------|------------------|------------------|-------------------|
| 64 | Overholser South | 25 August 1998 | Oklahoma | T12N, R5W, S13 | 39303N 6203E | North Canadian |
| 65 | Packsaddle WMA | 2 July 1998 | Ellis | T16N, R24W, S14 | 39693N 43445E | Canadian |
| 66 | Patchwork Pasture | 25 August 1999 | Woodward | T22N, R19W, S24 | | North Canadian |
| 67 | Pawnee Lake1 | 26 June 1998 | Pawnee | T22N, R5E, S20 | 40265N 6974E | Arkansas |
| 68 | Pawnee Lake2 | 26 June 1998 | Pawnee | T22N, R5E, S19 | 40297N 6971E | Arkansas |
| 69 | Pawnee Lake3 | 26 June 1998 | Pawnee | T22N, R5E, S19 | 40268N 6967E | Arkansas |
| 70 | Pawnee Lake Dam BLH | 26 May 1999 | Pawnee | T22N, R5E, S30 | 40257N 6975E | Arkansas |
| 71 | Ponca Lake | 31 July 1998 | Kay | T26N, R2E, S13 | 40668N 67515E | Arkansas |
| 72 | Potato Pond | 17 June 1999 | Blaine | T17N, R12W, S14 | 39783N 5488E | North Canadian |

| Site # | Site Name | Date Surveyed | County | Township & Range | UTM Coord. | Drainage |
|--------|--------------------------------|-----------------|---------|------------------|-------------------|-------------------|
| 73 | Potomogeton Ponds | 17 June 1999 | Major | T23N, R11W, S33 | 40304N 5552E | Cimarron |
| 74 | Pumper Dock | 17 June 1999 | Major | T20N, R11W, S14 | 400807N 5586E | Cimarron |
| 75 | Red Horse Ck. | 11 August 1999 | Woods | T27N, R17W, S22 | 40736N 4984E | Cimarron |
| 76 | Reverse Potato | 17 June 1999 | Blaine | T17N, R12W, S10 | 39799N 5475E | North Canadian |
| 77 | Roman Nose | 22 October 1998 | Blaine | T17N, R12W, S24 | 39769N 5518E | Cimarron |
| 78 | Rubus Rules | 21 July 1998 | Dewey | T19N, R18W, S9 | 399975N 48931E | North Canadian |
| 79 | So. Beaver WMA | 21 August 1998 | Beaver | T4N, R22W, S10 | 40769N 3508E | Beaver |
| 80 | Salt Plains-Wilson's Meadow | 26 August 1999 | Alfalfa | T27N, R9W, S20 | | Arkansas |
| 81 | Salt Plains_Wilson's Pond | 26 August 1999 | Alfalfa | T27N, R9W, S20 | | Arkansas |

| Site # | Site Name | Date Surveyed | County | Township & Range | UTM Coord. | Drainage |
|--------|--------------------|-------------------|---------|------------------|-------------------|----------|
| 82 | Salt Plains_Bridge | 26 August 1999 | Alfalfa | T27N, R9W, S7 | | Arkansas |
| 83 | Sandpiper Swale | 22 July 1998 | Ellis | T20N, R24W, S36 | 40017N 4366E | Canadian |
| 84 | Sandpit typha | 21 July 1998 | Dewey | T18N, R20W, S22 | 398549N 4713E | Canadian |
| 85 | SH60 Pond | 22 September 1999 | Osage | T26N, R11E, S12 | | Arkansas |
| 86 | Skiatook WMA | 21 September 1999 | Osage | T22N, R9E, S13 | | Arkansas |
| 87 | Skiatook WMA _Buck | 21 September 1999 | Osage | T22N, R10E, S20 | | Arkansas |
| 88 | Sooner Lake South | 30 July 1998 | Noble | T22N, R2E, S12 | 403010N 6759E | Arkansas |
| 89 | Sooner Lake West | 30 July 1998 | Noble | T22N, R2E, S10 | 403025N 67326E | Arkansas |
| 90 | Souter's Bend | 11 June 1998 | Osage | T21N, R7E, S5 | 40227N 7183E | Arkansas |

| Site # | Site Name | Date Surveyed | County | Township & Range | UTM Coord. | Drainage |
|--------|----------------------|-------------------|-------------|------------------|-------------------|-----------|
| 91 | Southard North Marsh | 17 June 1999 | Blaine | T18N, R12W, S4 | 39907N 5467E | Cimmaron |
| 92 | Swamp Privet | 17 September 1998 | Lincoln | T13N, R5E, S6 | 39455N 69728E | Deep Fork |
| 93 | Taloga bridge | 15 July 1998 | Dewey | T18N, R17W, S12 | 398975N 50282E | Canadian |
| 94 | Taylor Lake | 14 September 1999 | Roger Mills | T12N, R23W, S15 | | Canadian |
| 95 | Thalia Throne1 | 24 June 1998 | Okfuskee | T13N, R8E, S1 | 394585N 73455E | Deep Fork |
| 96 | Thalia Throne2 | 24 June 1998 | Okfuskee | T13N, R8E, S1 | 3944N 7345E | Deep Fork |
| 97 | Three sisters | 2 July 1999 | Grant | T27N, R6W, S31 | 40702N 59875E | Arkansas |
| 98 | Trail Creek | 21 July 1998 | Dewey | T18N, R20W, S23 | 398549N 4734E | Canadian |
| 99 | Vulture Marsh | 29 September 1998 | Caddo | T10N, R10W, S28 | 3908N 5677E | Washita |

| Site # | Site Name | Date Surveyed | County | Township & Range | UTM Coord. | Drainage |
|--------|---------------|-------------------|----------|------------------|-------------------|-------------------|
| 100 | Washita NWR1 | 1 July 1998 | Custer | T13N, R20W, S1 | 394215N 47539E | Washita |
| 101 | Washita NWR2 | 1 July 1998 | Custer | T13N, R20W, S1 | 39425N 4753E | Washita |
| 102 | Weleetka lake | 27 October 1998 | Okfuskee | T10N, R11E, S17 | 39137N 7578E | North Canadian |
| 103 | Wet Shoes | 30 July 1998 | Noble | T22N, R2E, S34 | 40237N 6731E | Arkansas North |
| 104 | Wetumka Lake | 25 September 1998 | Okfuskee | T10N, R10E, S33 | 39088N 7501E | Canadian North |
| 105 | Woodward50 | 25 August 1999 | Woodward | T22N, R19W, S9 | | Canadian |

Table 2: Number of plots sampled by site. The first column indicates the actual number of plots sampled, the second columns represents the number of sites sampled with that number of plots, and the third columns sums the total area sampled by a given number of plots.

| Number of plots | Sites | Area sampled (m²) |
|------------------------|--------------|-------------------------------------|
| 1 | 7 | 70 |
| 2 | 29 | 580 |
| 3 | 32 | 960 |
| 4 | 17 | 680 |
| 5 | 20 | 1,000 |
| Total | 105 | 3,290 |

Table 3: Wetland vegetation types from northwestern Oklahoma.

| Wetland vegetation type | No. of Sites |
|---|--------------|
| Forest vegetation | |
| 1. Sycamore (<i>Platanus occidentalis</i>) - boxelder (<i>Acer negundo</i>) forest vegetation | 2 |
| 2. Silver maple (<i>Acer saccharinum</i>) - boxelder (<i>Acer negundo</i>) forest vegetation | 2 |
| 3. Pecan (<i>Carya illinoensis</i>) - sugarberry (<i>Celtis laevigata</i>) forest vegetation | 1 |
| 4. Bur oak (<i>Quercus macrocarpa</i>) - Shumard oak (<i>Quercus shumardii</i>) forest vegetation | 1 |
| Woodland vegetation | |
| 5. Black willow (<i>Salix nigra</i>) woodland vegetation | 1 |

| Wetland vegetation type | No. of Sites |
|---|--------------|
| Shrubland vegetation | |
| 6. Buttonbush (<i>Cephalanthus occidentalis</i>) shrubland vegetation | 13 |
| 7. Buttonbush - swamp privet (<i>Forestiera acuminata</i>) shrubland vegetation | 1 |
| 8. Sandbar willow (<i>Salix exigua</i>) shrubland vegetation | 1 |
| Herbaceous vegetation | |
| 9. Coontail (<i>Ceratophyllum demersum</i>) herbaceous vegetation | 1 |
| 10. Saltgrass (<i>Distichlis spicata</i>) herbaceous vegetation | 1 |
| 11. Creeping burhead (<i>Echinodorus cordifolius</i>) herbaceous vegetation | 2 |

| Wetland vegetation type | No. of Sites |
|--|--------------|
| 12. Upright burhead (<i>Echinodorus berteroi</i>) herbaceous vegetation | 1 |
| 13. Common spikerush (<i>Eleocharis palustris</i>) herbaceous vegetation | 1 |
| 13.a. Common spikerush (<i>E. palustris</i>) - pepperwort (<i>Marsilea vestita</i>) herbaceous vegetation | 2 |
| 14. Blue mud plantain (<i>Heteranthera limosa</i>) - longlobed arrowhead (<i>Sagittaria longiloba</i>) herbaceous vegetation | 7 |
| 15. Soft rush (<i>Juncus effusus</i>) herbaceous vegetation | 1 |
| 16. Water primrose (<i>Jussiaea peploides</i>) - water pepper (<i>Polygonum hydropiperoides</i>) herbaceous vegetation | 6 |
| 17. Waterwillow (<i>Justicia americana</i>) herbaceous vegetation | 1 |
| 18. Watercress (<i>Rorippa nasturtium_aquaticum</i>) herbaceous vegetation | 1 |
| 19. Water lotus (<i>Nelumbo lutea</i>) herbaceous vegetation | 5 |
| 20. Waterlilly (<i>Nymphaea odorata</i>) herbaceous vegetation | 1 |

| Wetland vegetation type | No. of Sites |
|---|--------------|
| 21. Common reed (<i>Phragmites australis</i>) herbaceous vegetation | 2 |
| 22. Swamp knotweed (<i>Polygonum amphibium</i>) herbaceous vegetation | 1 |
| 23. Broadleaf arrowhead (<i>Sagittaria latifolia</i>) herbaceous vegetation | 4 |
| 24. American bulrush (<i>Schoenoplectus americanus</i>) herbaceous vegetation | 9 |
| 25. Powdery blue thalia (<i>Thalia dealbata</i>) herbaceous vegetation | 1 |
| 26. Cattail (<i>Typha</i> spp.) herbaceous vegetation | |
| 26a. Narrowleaf cattail (<i>Typha angustifolia</i>) herbaceous vegetation | 5 |
| 26b. Southern cattail (<i>Typha domingensis</i>) herbaceous vegetation | 29 |
| 26c. Broadleaf cattail (<i>Typha latifolia</i>) herbaceous vegetation | 1 |

Table 4: Wetland classification and heritage rank for northwestern Oklahoma wetland sites.

| Site # | Cowardin et al. (1979) classification unit | | | |
|--------|--|-----------------|-------------|-----------|
| | System | Subsystem | Class | Site rank |
| 1 | Palustrine | - | Emergent | B |
| 2 | Palustrine | - | Emergent | B |
| 3 | Palustrine | - | Emergent | C |
| 4 | Palustrine | - | Scrub-shrub | C |
| 5 | Palustrine | - | Aquatic bed | C |
| 6 | Palustrine | - | Emergent | B |
| 7 | Palustrine | - | Emergent | C |
| 8 | Riverine | Lower Perennial | Emergent | C |
| 9 | Palustrine | - | Scrub-shrub | B |
| 10 | Palustrine | - | Scrub-shrub | B |
| 11 | Palustrine | - | Emergent | B |
| 12 | Palustrine | - | Forested | B |
| 13 | Riverine | Lower Perennial | Emergent | C |

| Site # | Cowardin et al. (1979) classification unit | | | |
|--------|--|-----------|-------------|-----------|
| | System | Subsystem | Class | Site rank |
| 14 | Palustrine | - | Emergent | B |
| 15 | Palustrine | - | Emergent | C |
| 16 | Palustrine | - | Emergent | C |
| 17 | Palustrine | - | Emergent | C |
| 18 | Palustrine | - | Emergent | B |
| 19 | Palustrine | - | Emergent | B |
| 20 | Palustrine | - | Emergent | C |
| 21 | Palustrine | - | Emergent | C |
| 22 | Palustrine | - | Emergent | B |
| 23 | Palustrine | - | Emergent | C |
| 24 | Palustrine | - | Forested | B |
| 25 | Palustrine | - | Scrub-shrub | C |
| 26 | Palustrine | - | Emergent | C |
| 27 | Palustrine | - | Emergent | B |

| Site # | Cowardin et al. (1979) classification unit | | | |
|--------|--|-----------|-------------|-----------|
| | System | Subsystem | Class | Site rank |
| 28 | Palustrine | - | Emergent | C |
| 29 | Palustrine | - | Emergent | B |
| 30 | Palustrine | - | Aquatic bed | C |
| 31 | Palustrine | - | Emergent | B |
| 32 | Palustrine | - | Scrub-shrub | C |
| 33 | Palustrine | - | Emergent | B |
| 34 | Palustrine | - | Emergent | B |
| 35 | Palustrine | - | Emergent | B |
| 36 | Palustrine | - | Emergent | B |
| 37 | Lacustrine | Limnetic | Aquatic bed | C |
| 38 | Palustrine | - | Emergent | B |
| 39 | Lacustrine | Limnetic | Aquatic bed | C |
| 40 | Palustrine | - | Forested | C |
| 41 | Palustrine | - | Emergent | C |

| Site # | Cowardin et al. (1979) classification unit | | | |
|--------|--|-----------|-------------|-----------|
| | System | Subsystem | Class | Site rank |
| 42 | Palustrine | - | Emergent | B |
| 43 | Palustrine | - | Scrub-shrub | C |
| 44 | Palustrine | - | Scrub-shrub | B |
| 45 | Palustrine | - | Forested | C |
| 46 | Palustrine | - | Emergent | C |
| 47 | Palustrine | - | Emergent | B |
| 48 | Palustrine | - | Emergent | C |
| 49 | Palustrine | - | Emergent | C |
| 50 | Palustrine | - | Emergent | C |
| 51 | Palustrine | - | Emergent | C |
| 52 | Palustrine | - | Emergent | C |
| 53 | Palustrine | - | Emergent | B |
| 54 | Palustrine | - | Emergent | B |
| 55 | Palustrine | - | Scrub-shrub | C |

| Site # | Cowardin et al. (1979) classification unit | | | |
|--------|--|-----------|-------------|-----------|
| | System | Subsystem | Class | Site rank |
| 56 | Palustrine | – | Emergent | B |
| 57 | Palustrine | – | Emergent | B |
| 58 | Palustrine | – | Emergent | B |
| 59 | Lacustrine | Littoral | Emergent | C |
| 60 | Palustrine | – | Emergent | C |
| 61 | Palustrine | – | Emergent | C |
| 62 | Palustrine | – | Forested | C |
| 63 | Lacustrine | Littoral | Emergent | C |
| 64 | Lacustrine | Littoral | Emergent | B |
| 65 | Palustrine | – | Emergent | B |
| 66 | Palustrine | – | Emergent | C |
| 67 | Lacustrine | Littoral | Emergent | B |
| 68 | Lacustrine | Littoral | Emergent | B |
| 69 | Lacustrine | Limnetic | Aquatic bed | B |

| Site # | Cowardin et al. (1979) classification unit | | | |
|--------|--|-----------|-------------|-----------|
| | System | Subsystem | Class | Site rank |
| 70 | Palustrine | – | Forested | B |
| 71 | Lacustrine | Littoral | Emergent | C |
| 72 | Palustrine | – | Emergent | C |
| 73 | Palustrine | – | Emergent | B |
| 74 | Palustrine | – | Emergent | C |
| 75 | Palustrine | – | Emergent | C |
| 76 | Palustrine | – | Emergent | C |
| 77 | Lacustrine | Littoral | Emergent | B |
| 78 | Palustrine | – | Emergent | B |
| 79 | Palustrine | – | Emergent | B |
| 80 | Palustrine | – | Emergent | B |
| 81 | Palustrine | – | Aquatic bed | B |
| 82 | Palustrine | – | Scrub-shrub | B |
| 83 | Palustrine | – | Emergent | B |

| | | | | |
|----|------------|-----------------|-------------|---|
| 84 | Palustrine | - | Emergent | C |
| 85 | Palustrine | - | Scrub-shrub | C |
| 86 | Palustrine | - | Scrub-shrub | C |
| 87 | Palustrine | - | Scrub-shrub | C |
| 88 | Lacustrine | Littoral | Emergent | C |
| 89 | Lacustrine | Littoral | Emergent | C |
| 90 | Palustrine | - | Forested | C |
| 91 | Palustrine | - | Emergent | B |
| 92 | Palustrine | - | Scrub-shrub | B |
| 93 | Palustrine | - | Emergent | B |
| 94 | Palustrine | - | Scrub-shrub | B |
| 95 | Palustrine | - | Emergent | B |
| 96 | Palustrine | - | Emergent | B |
| 97 | Palustrine | - | Emergent | B |
| 98 | Riverine | Lower Perennial | Emergent | C |
| 99 | Palustrine | - | Emergent | C |

| | | | | |
|-----|------------|----------|----------|---|
| 100 | Palustrine | - | Emergent | B |
| 101 | Palustrine | - | Emergent | C |
| 102 | Lacustrine | Littoral | Emergent | B |
| 103 | Palustrine | - | Emergent | C |
| 104 | Lacustrine | Littoral | Emergent | C |
| 105 | Palustrine | - | EW | C |

Figure 1: Location of sites. Each site is identified by a number which corresponds to the sample plots listed Table 1.

