NATIONAL WETLANDS INVENTORY

Map Report of Southwestern Nebraska
and Northwestern Kansas
for the 1:100,000 Map Units of:
McCook SW, SE;
Goodland NW, NE, SW, SE;
Scott City NW, NE;
Beloit NW, NE, SW.

U.S. Fish and Wildlife Service
Denver, Colorado
October 1996

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I. INTRODUCTION

The United States Fish and Wildlife Service's National Wetlands Inventory (NWI) is producing maps showing the location and classification of wetlands and deepwater habitats of the United States. Classification of Wetlands and Deepwater Habitats of the United States by Cowardin et al. (1979) is the document used by the NWI to define and classify wetlands. Photointerpretation conventions, hydric soils lists, and wetland plant lists are also used to implement the Cowardin Classification system.

The purpose of this map report is to: (1) provide information on the production of NWI maps, including narrative on imagery and interpretation; (2) provide a descriptive crossreference from NWI wetland codes on the map to common terminology and to representative plant species found on specific wetland sites; and (3) describe local geography, climate, and wetland communities.

II. FIELD RECONNAISSANCE

Field reconnaissance is a necessary procedure in order to accurately interpret aerial photography. Photographic signatures are correlated to the wetland habitat in the field. Collateral information including vegetative communities, soil types, and topographic settings are further evaluated to aid in the photointerpretation process. This information is evaluated for seasonality and conditions existing at the time of photography and at ground truthing.

Project Area

The Southwestern Nebraska and Northwestern Kansas project area is located in the Tall-Grass Prairie Province (Bailey, 1980). Field reconnaissance covered the area of each 1:100,000 quad: McCook SW & SE; Goodland NW, NE, SW & SE; Scott City NW & NE; Beloit NW, NE, & SW; (Appendix A).

Field Personnel

Jaymee Fojtik	-	USFWS, Asst. Wetland Coordinator, Region VI
Michael Broschart	-	SDSU, National Wetland Inventory team
Peter Bergmann	-	SDSU, National Wetland Inventory team
Michael Estey	-	SDSU, National Wetland Inventory team
Dennis Hanson	-	SDSU, National Wetland Inventory team
Michael Kjellsen	-	SDSU, Leader, National Wetland Inventory team

Field Dates

May 10-15, 1996

Aerial Photography

Primary Source Data (100%)
Type: NHAP Color Infra-Red High Altitude
Scale: 1:58,000

McCook SW: 8\20\80, 9\17\80, 9\18\80, 9\21\80
McCook SE: 5\30\81, 5\31\81, 7\11\81, 9\27\81, 10\4\81, 11\6\81
Goodland NW: 6\22\85, 7\3\85, 7\6\85
Goodland NE: 6\16\85, 6\19\85, 6\27\85, 7\3\85, 7\6\85
Goodland SW: 6\19\85, 6\22\85, 7\3\85, 7\6\85
Goodland SE: 6\16\85, 6\19\85, 6\27\85, 7\3\85, 7\6\85
Scott City NW: 6\19\85, 6\22\85, 7\3\85, 7\5\85, 7\6\85, 9\7\85
Scott City NE: 6\12\85, 6\16\85, 6\19\85, 7\3\85, 9\5\85
Beloit NW: 6\19\85, 6\27\85, 7\6\85
Beloit NE: 6\19\85, 6\27\85, 6\28\85, 7\3\85, 7\6\85, 9\5\85
Beloit SW: 6\19\85, 6\27\85

Percent Coverage: All 352 USGS 7.5′ quadrangles were covered with the NHAP photography.

Collateral Data

United States Geological Survey (USGS) Quadrangles
United States Soil Conservation Service (USSCS) Soil Surveys
Bailey's Description of the Ecoregions of the United States (1980)
Water Resources Data, Kansas, Water Year 1993
Water Resources Data, Nebraska, Water Year 1995
National List of Plant Species That Occur In Wetlands: Central Plains (Region V)
Hydric Soils of the United States

III. PHYSICAL DESCRIPTION OF PROJECT AREA

Geography

The Southwestern Nebraska and Norhtwestern Kansas project area is located in the Bluestem-Grama Prairie and the Wheatgrass-Bluestem-Needlegrass sections of the Tall-Grass Prairie Province (Bailey 1980). The region is characterized by flat and rolling plains of moderate relief with well developed drainage systems. Loess and sand deposits cover much of the land surface.

Climate

Annual precipitation in the project area averages 25 in. (63.5 cm.). Drought is more frequent near the western edge of the project area. The average annual temperature is 60° F (15° C).

Vegetation

This region includes tall-grass and mixed-grass species. Bunch grasses and sod-forming species are both present. Many drainages are wooded, however, woody vegetation is rare outside of drainages and floodplains. Because of the generally favorable conditions of climate and soil, most of the area is cultivated and little of the original vegetation remains. Dominant plants found in this province are porcupine grass, prairie dropseed, little bluestem, side-oats grama, junegrass, western wheatgrass, plains muhly, panic grass, and the sedge *Carex pennsylvanica*. Additional species include green needlegrass, needle-and-thread grass, sand dropseed, slender wheatgrass, galleta, and purple three-awn. Broomweed, scurf-pea, sunflowers, goldenrods, snow-on-the-mountain, and ragweed are some of the common forbs that occur in the project area.

Soils

The soils of the Tall-Grass Prairie Province are primarily Mollisols. There are smaller areas of Entisols. Most of the soils have dark upper horizons.

IV. DESCRIPTION OF WETLAND HABITATS IN PROJECT AREA

Riverine

Water Resources Data, Kansas (water year 1993) and Nebraska (water year 1995), were used as collateral data to classify some project area rivers. Classification of the Republican River changes from R2UBF to R2UBH as streamflow increases from west to east on the project area. The break to R2UBG occurs in the vicinity of McCook, NE. The Republican River is classified as R2UBH where it enters the Beloit NE Quad north of Mankato, KS. Frenchman Creek, Rock Creek, Muddy Creek, Stinking Water Creek, Red Willow Creek, and Medicine Creek are classified R2UBG. Streamflow of the Saline and Smoky Hill Rivers increase toward the east of the project area. The Saline River is classified as R4SBC near Wakeeny, KS and R2UBG in the vicinity of Russell, KS. The classification of the Smoky Hill River changes from R4SBC at Elkader, KS to R2UBF near Schoenchen, KS. The South Fork Solomon River is classified as R4SBC near Webster, KS and R2UBF at Woodston, KS. The North Fork Solomon River is classified R2UBF except in the western reaches of the stream where photo signature indicates emergents in the channel or weaker flow. Arikaree River, North Fork Republican River, Big Creek, Bow Creek, and Driftwood Creek are classified R2UBF.

Many intermittent streams exist on the project area. Intermittent streams are classified as R4SBA or R4SBC. Refer to the section CONVENTIONS FOR LINEAR WETLANDS for photo signature information.

Lacustrine

The majority of the lakes on the project area are impounded. The classifications are $L1UBH_h$, $L1UBG_h$, $L2ABF_h$, or a combination of these classifications. Many of these lakes are bordered by persistent emergent vegetation.

Palustrine:

Most wetlands on the project area are palustrine. Palustrine wetlands are located in basins, river floodplains, and many drainages. Many wetlands are tilled for agricultural purposes during dry periods. Other wetlands remain unaltered on untilled prairie or in drainages.

Emergents (PEMA, PEMC, PEMF) and aquatic bed (PABF) are the dominant cover types with smaller areas of scrub-shrub (PSSA, PSSC) and forested (PFOA, PFOC). Saturated wetlands were rare on the project area (PEMB). Field checksites verified representative areas of different wetland types. Field checksites also documented where problem areas existed due to inconsistent wetland photosignatures. Vegetation observed in these wetland habitats were grouped according to class and water regime. Plant species listed in Table 1 and 2 were identified on check sites or field sites and represent only a fraction of all wetland plant species occurring on the project area. Table 3 describes the Cowardin et. al. system and common plants within each classification.

Table 1. Plant Species Observed in Project Area

Palustrine Temporary Emergents: PEMA

Ambrosia trifida, great ragweed
Echinochola spp., barnyardgrass
Eleocharis spp., spikerush
Equisetum spp., horsetail
Helianthus spp., sunflower
Hordeum jubatum, foxtail barley
Kochia spp., fireweed
Polygonum spp., smartweed
Rumex, spp., dock
Solidago spp., goldenrod
Sonchus arvensis, sow thistle
Spartina pectinata, prairie cord grass

Palustrine Seasonal Emergents: PEMC

Carex spp., sedge
Eleocharis spp., spikerush
Juncus spp., rush
Mentha spp., mint
Phalaris arundinacea, reed canary grass
Polygonum, smartweed
Scirpus spp., bulrush
Scolochloa festucacea, whitetop
Spartina pectinata, prairie cord grass
Typha spp., cattail

Palustrine Semi-permanent Emergents: PEMF

Scirpus spp., bulrush
Typha spp., cattail

Palustrine Semi-permanent Aquatic Bed: PABF

Ceratophyllum spp., coontail
Lemna spp., duckweed
Potamogeton spp., pondweed

Palustrine Temporary Scrub-shrub: PSSA

Cornus stolonifera, red osier dogwood
Populus spp., cottonwood
Salix spp., willow

Palustrine Temporary Forested: PFOA

Acer negundo, boxelder
Fraxinus spp., ash
Populus spp., cottonwood

Table 2. Observed wetland vegetation table

A. EMERGENT	
Ambrosia trifida	great ragweed
Carex spp.	sedge
Eleocharis spp.	spikerush
Equisetum spp.	horsetail
Helianthus spp.	sunflower
Hordeum jubatum	foxtail barley
Juncus spp.	rush
Kochia spp.	fireweed
Mentha spp.	mint
Phalaris arundinacea	reed canary grass
Phragmites australis	giant reedgrass
Polygonum spp.	smartweed
Rumex spp.	dock
Scirpus spp.	bulrush
Scolochloa festicacea	whitetop
Solidago spp.	goldenrod
Sonchos arvensis	sow thistle
Spartina pectinata	prairie cord grass
Typha spp.	cattail
B. AQUATIC BED	
Ceratophyllum spp.	coontail
Lemna spp.	duckweed
Potamogeton spp.	pondweed
C. SCRUB-SHRUB	
Cornus stolonifera	red osier dogwood
Populus spp.	cottonwood
Salix spp.	willow
D. FORESTED	
Acer negundo	boxelder
Fraxinus spp.	ash
Populus spp.	cottonwood

Table 3. NWI WETLAND CLASSIFICATION CODES, COWARDIN DESCRIPTION AND COMMON TERMINOLOGY

NWI CODE WATER REGIME	COWARDIN DESCRIPTION	COMMON DESCRIPTION	REPRESENTATIVE VEGETATION
R2UB (F,G,H)	Riverine, lower perennial, unconsolidated bottom	Meandering rivers, low gradient	Unconsolidated bottom
R2US (A,C)	Riverine, lower perennial, unconsolidated shore	Mud, sand, or gravel bars	Unconsolidated shore
R3UB (F,G,H)	Riverine, upper perennial unconsolidated bottom	Mountain streams, major drainage areas	Unconsolidated bottom
R4SB (A,C)	Riverine, intermittent, streambed	Small streams, creeks, or irrigation ditches	Streambed
L1UB (G,H)	Lacustrine, limnetic unconsolidated bottom	Deep lake marshes	Unconsolidated bottom
L2AB (F,G)	Lacustrine, littoral aquatic bed	Shallow lake marshes	*Hippuris vulgaris* (marestail) *Lemna* spp. (duckweed)
L2US (A,C)	Lacustrine, littoral, unconsolidated shore	Dry alkaline lake beds	Unconsolidated shore
PUB (F,G,H)	Palustrine, unconsolidated bottom	Open water, gravel pits	Unconsolidated bottom
PAB (F,G,K)	Palustrine, aquatic bed	Deep basins, impoundments, sewage treatment ponds, beaver ponds	*Hippuris vulgaris* (marestail) *Lemna* spp. (duckweed)

Table 3 (cont.). NWI WETLAND CLASSIFICATION CODES, COWARDIN DESCRIPTION AND COMMON TERMINOLOGY

NWI CODE WATER REGIME	COWARDIN DESCRIPTION	COMMON DESCRIPTION	VEGETATION
PEM (A,B,C,F)	Palustrine, emergent	Basins, depressions, marshes, meadows, springs, seeps, or vegetated drainage areas	Agropyron smithii (western wheat) Beckmania syzigachne (American sloughgrass) Carex spp. (sedges) Distichlis spicata (inland saltgrass) Eleocharis spp. (spikerush) Equisetum spp. (horsetail) Hordeum jubatum (foxtail barley) Juncus spp. (rush) Phalaris arundinacea (reed canary grass) Phleum pratense (timothy) Poa pratensis (Kentucky bluegrass) Polygonum spp. (smartweed) Rumex spp. (dock) Sagittaria spp. (arrowhead) Spartina pectinata (prairie cord grass) Nasturtium officinale (water cress) Scirpus americanus (common threesquare) Scirpus tabernaemontani (softstem bulrush) Typha spp. (cattail)

Table 3 (cont.). NWI WETLAND CLASSIFICATION CODES, COWARDIN DESCRIPTION AND COMMON TERMINOLOGY

NWI CODE WATER REGIME	COWARDIN DESCRIPTION	COMMON DESCRIPTION	VEGETATION
PSS (A,B,C)	Palustrine, scrub-shrub	Willow thicket, river banks or drainage areas	Salix spp. (willow) Rosa spp. (rose) Ribes spp. (currant) Cornus spp. dogwood
PFO (A,B,C)	Palustrine, forested	Cottonwood, river banks, floodplains, or drainage areas	Populus deltoides (eastern cottonwood) Salix spp. (willow) Fraxinus spp. (ash) Acer negundo (boxelder)
PUS (A,C)	Palustrine, unconsolidated shore	Salt flats	Unconsolidated shore

V. WATER REGIME DESCRIPTION

(A) Temporarily Flooded- Surface water present for brief periods during growing season, but water table usually lies well below soil surface. Plants that grow both in uplands and wetlands are characteristic of this water regime.

(B) Saturated- The substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present.

(C) Seasonally Flooded- Surface water is present for extended periods, especially early in the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is extremely variable, extending from saturated to a water table well below ground surface.

(F) Semipermanently Flooded- Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land's surface.

(G) Intermittently Exposed- Surface water is present throughout the year except in years of extreme drought.

(H) Permanently Flooded- Water covers the land surface throughout the year in all years.

VI. IMAGERY AND CONVENTIONS

Most of the NHAP color infra-red emulsion is good quality. The exception is some of the June and July 1985 photography which has a dark purple/maroon emulsion which makes it difficult to distinguish the break between upland and emergent wetland. Photo dates with poor emulsion require extended photointerpretation times to accurately delineate and classify wetland areas. Overall, normal water conditions are indicated on the 1980, 1981, and 1985 photography. However, field conditions were extremely dry during May 1996. Due to the dry conditions, most wetland basins encountered during the field trip where farmed. Some basins exhibited excellent photo signatures yet were difficult to discern in the field. Usually they could be identified by soil changes or poor growth of cultivated crops. Other basins were easily identified in the field but had poor photo signatures. However, most wetland basins are identifiable from the soil surveys and/or topographic maps. These sources provide excellent collateral data. Those few wetland basins encountered in the field that were not farmed contained typical vegetative growth for the season.

Field reconnaissance provided the following mapping conventions for all the imagery based on seasonal and climatic conditions.

GENERAL CONVENTIONS

- All open water impoundments are classified ABF_h unless field reconnaissance and/or collateral data justifies a UBG_h classification.
- Open water dugouts are classified UBF_x and occasionally G_x unless they exhibit an aquatic bed signature. Waste water treatment facilities that contain water are classified as $PABK_x$.
- Intermittent versus perennial riverine classifications were determined by photosignature coupled with other collateral data and in field observations. The perennial or intermittent designations on USGS topographic maps had no bearing on riverine system classification. However, topographic maps are used to aid in the delineation of the channel.

CONVENTIONS FOR BASIN WETLANDS

Temporary Basins

Most temporary emergent basins have distinct borders when found within agricultural fields. But some temporary basins also have indistinct edges in croplands. Temporary emergent basin photosignatures are similar among the various dates of photography covering the project area. However, temporary emergent basins exhibit a wide variety of photosignatures. The following signatures represent temporary emergent basins in cropland and/or pasture:

- solid dark red to maroon or mixed with light gray or white tones;
- solid pink to pink tinged with white;

- solid light to dark green or mixed with red or white tones;
- solid light to dark gray or tinged with red or white;
- white tinged with red or green tones;
- brown intermixed with lime green;
- faded red with a light gray center.

In some agriclutural fields, the break between cropland and temporary wetlands is very subtle. Tilled temporary wetland basins can be distinguished in some cases by the crops being darker than the rest of the surrounding field. Other times tilled temporary wetland basins can be identified by stressed crops that are lighter than the surrounding field. The photosignatures of these temporary basins are:

- dark blue within a light blue field;
- dark green in a light green field;
- reddish-brown to faded red in a green field;
- dark gray to reddish-gray within a gray field;
- faded reddish-blue within either a light bluish-gray or green field;
- light bluish-white in a blue field;
- blue-gray within a red field;
- faded red in a tan field;
- light gray in a red field.

Temporary oxbow basins are sometimes present along riverine and palustrine drainages and have old channel scar shapes. These areas exhibit photosignatures similar to other temporary emergent basins as described above.

Unconsolidated shore temporary wetlands basins are uncommon but some impoundments are given this classification. These wetlands exhibit a solid light gray to white signature.

Seasonal Basins

Seasonal emergent wetland basins are uncommon in the project area. Those present have varying signatures including dark brown, red, or maroon, mottled grays and dark grays, light tan with a red tinge, light blue with a distinct red border, dark blue with a tan ring, dark blue mixed with some red, or dark blue water. Seasonal basins have more distinct borders and richer tones than temporary basins.

Unconsolidated shore seasonal wetlands are usually impoundments and have a blue-gray signature.

Seasonal oxbow basins are found along riverine and palustrine drainages. Photosignatures are black to dark blue water or similar to the photosignatures described above for seasonal basins. Seasonal oxbow basins have the characteristic old channel scar shapes.

Semipermanent Water Regimes

Natural semipermanent emergent basins are rare in this area. Some emergent semipermanent wetlands have a clumped signature that is dark gray mixed with dark red to maroon colors. Other semipermanent emergent wetlands have puffed bluish-orange or mottled reddish-white signatures. The majority of semipermanent wetlands are impounded. Most are unvegetated and are in the aquatic bed class. If seen, an aquatic bed signature is a faded white-pink to bright pink signature. The periphery of some impoundments, and in few cases the entire impoundment, contain semipermanent emergent vegetation which has the characteristic clumping or textured signature. Palustrine semipermanent emergent wetlands are sometimes found in palustrine seasonal linear channels.

Semipermanent oxbows are associated with major river systems. These oxbows exhibit dark blue water, aquatic bed, or a gray/white clumped signature and are classified semipermanent with an aquatic bed and/or emergent class.

Saturated

Saturated areas are very rare in the project area. The signature of the one saturated wetland observed in the field was dark red with olive green. Saturated wetland signatures may be similar to temporary or seasonal wetland signatures. The distinguishing characteristic of saturated wetlands are their location on slopes and association with seeps and springs.

CONVENTIONS FOR LINEAR WETLANDS

Temporary emergent linear wetlands with scrub-shrub and/or forested classes appear red to light red with a gray or dark red understory. Linear wetlands on the project area have a very limited floodplain. Most forested wetlands are confined to the linear channel and do not extend into the area adjacent to the channel, except for floodplains associated with major river systems.

Temporary emergent linears are dark gray, red and gray, reddish-tan, red to light red, light red with tan and olive green, mixed gray and white with a few reds, pinkish-white, olive green with reds, and bluish-red to light blue-red. Temporary emergent linears have a distinct channel on all dates of photography. The deep purple/maroon emulsion shows these linears as maroon, maroon with dark gray, dark gray with reds, or dark reds with some white or light gray spots and having a discernable channel. Photointerpretation of these areas took into account relative strength of the photosignature coupled with other collateral data such as watershed size and gradient.

Seasonal emergent linear wetlands have photosignatures that are dark blue mixed with gray, interspersion of dark blue and dark red, maroon with lighter reds, grays and whites, dark red with gray, dark

olive green with reds, or dark gray with reds. Seasonal linears on the dark purple/maroon emulsion have a dark gray with red and reddish brown signature. Seasonal emergent linears have a very distinct channel.

Semipermanent emergent linear wetlands are uncommon on this project area. Photosignatures are pink (aquatic bed) or a clumped gray/red mottled signature (emergent).

Waterways, runoff areas, and dry channels can be distinguished as upland by their pink to red and/or gray photosignature and lack of a discernable channel. These areas are often associated with agricultural land use.

Linear intermittent riverine systems are classified by signature and watershed size. R4SBC linears generally exhibit an open water or blue gray signature with white banks sometimes visible. Linears with a white substrate signature are classified R4SBA. Small sections of these riverine systems are covered with tree canopy. If the channel was visible within the trees at all, the linear remained in the riverine system. Trees along these streams were found to be upland in the field. However, in some cases the R4SBC channel was not discernible on the photograph and in the field trees were observed growing within the channel. In this situation, the channel was classified a linear PFOA. Close examination of check sites and field sites aided in determining proper classifications of linear riverine wetlands.

Perennial rivers are classified lower perennial with water regimes of F through H. Water regimes are determined by photosignature coupled with the USGS Water Resources Data. White riverine sandbars with non-persistent vegetation or no vegetation are classified R2USA and light blue with white substrate channels associated with the main river channel are classified R2USC.

VII. SPECIAL MAPPING PROBLEMS

Some upland areas have a smooth red signature that is similar to some wetlands. This signature is often found in waterways and drainages. Field reconnaissance indicated this signature to be associated with stands of ragweed in uplands. These areas can be distinguished from wetlands in that the drainage is flat and there is no distinct channel. Dark gray pockets within the red signature were determined to be upland also.

Some linear wetlands are difficult to follow on the imagery when forested or covered by a tree canopy. Their course is determined by the USGS 7.5 minute topographic maps.

Some of the 1985 photography is darker than the rest of the photography. This imagery was delineated more conservatively since field reconnaissance confirmed most of the questionable areas to be upland.

Soil surveys and USGS topographic maps were used extensively in all aspects of delineation. Overall, the consistency of tones and breaks in the imagery promote accurate photographic interpretation.

VIII. MAP PREPARATION

Wetland delineation and classification is in accordance with Cowardin et al (1979). Further wetland mapping guidance is provided by NWI photographic and cartographic conventions in concert with National consistency. Delineations are produced through stereoscopic interpretation of 1:58,000 scale, color infrared photography. NHAP photography was taken during the summer, early fall, or late fall of 1980, 1981, and 1985.

Field check sites were evaluated within all project area quads prior to the actual classification and delineation of wetlands. Field check sites were selected to clarify photosignatures. Wetland photosignatures were identified in the field using vegetation types, soil types, water conditions, and additional input from field personnel.

Collateral data included USGS topographic maps, NRCS soil surveys, USGS water resources data, vegetation, climate, and ecoregional information from various agencies.

The user of the map is cautioned that, due to the limitation of mapping primarily through aerial photointerpretation, a small percentage of wetlands may be unidentified. Since the photography was taken during a particular time and season, there may be discrepancies between the maps and current field conditions. Changes in landscape which occurred after the photography was taken would result in such discrepancies.

Aerial photointerpretation and quality control were completed by the South Dakota Cooperative Fish and Wildlife Research Unit, SDSU, Brookings, S.D. with final quality control conducted by the FWS.

XI. MAP ACQUISITION

To discuss any questions concerning these maps, please contact:

Regional Wetland Coordinator
U.S. Fish and Wildlife Service - Region 6
Denver Federal Center
P.O. Box 25486
Denver, CO 80225

To order maps call 1-605-688-5894

Maps are identified by the name of the corresponding USGS 1:24,000 scale topographic quadrangle name. Topographic map indices are available from the USGS.

X. LITERATURE CITED

Bailey, R.G., 1980. Description of The Ecoregions of The United States. United States Department of Agriculture, Forest Service.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRue, 1979. Classification of Wetlands and Deepwater Habitats of The United States. United States Department of Interior, Fish and Wildlife Service, FWS/PBS-81.

XI. COLLATERAL RESOURCE DATA

Hydric Soils of the United States, 1987. U.S. Department of Agriculture, Soil Conservation Service.

National List of Plant Species That Occur in Wetlands: Central Plains. 1988. United States Department of Interior, Fish and Wildlife Service.

Water Resources Data Kansas, 1993. U.S. Department of Interior, Geological Survey. Prepared in cooperation with the state of Kansas and with other agencies.

Water Resources Data Nebraska, 1995. U.S. Department of Interior, Geological Survey. Prepared in cooperation with the Nebraska Department of Water Resources and with other agencies.

Soil Surveys - U.S. Department of Agriculture, Kansas Agricultural Experiment Station. County surveys and date published:

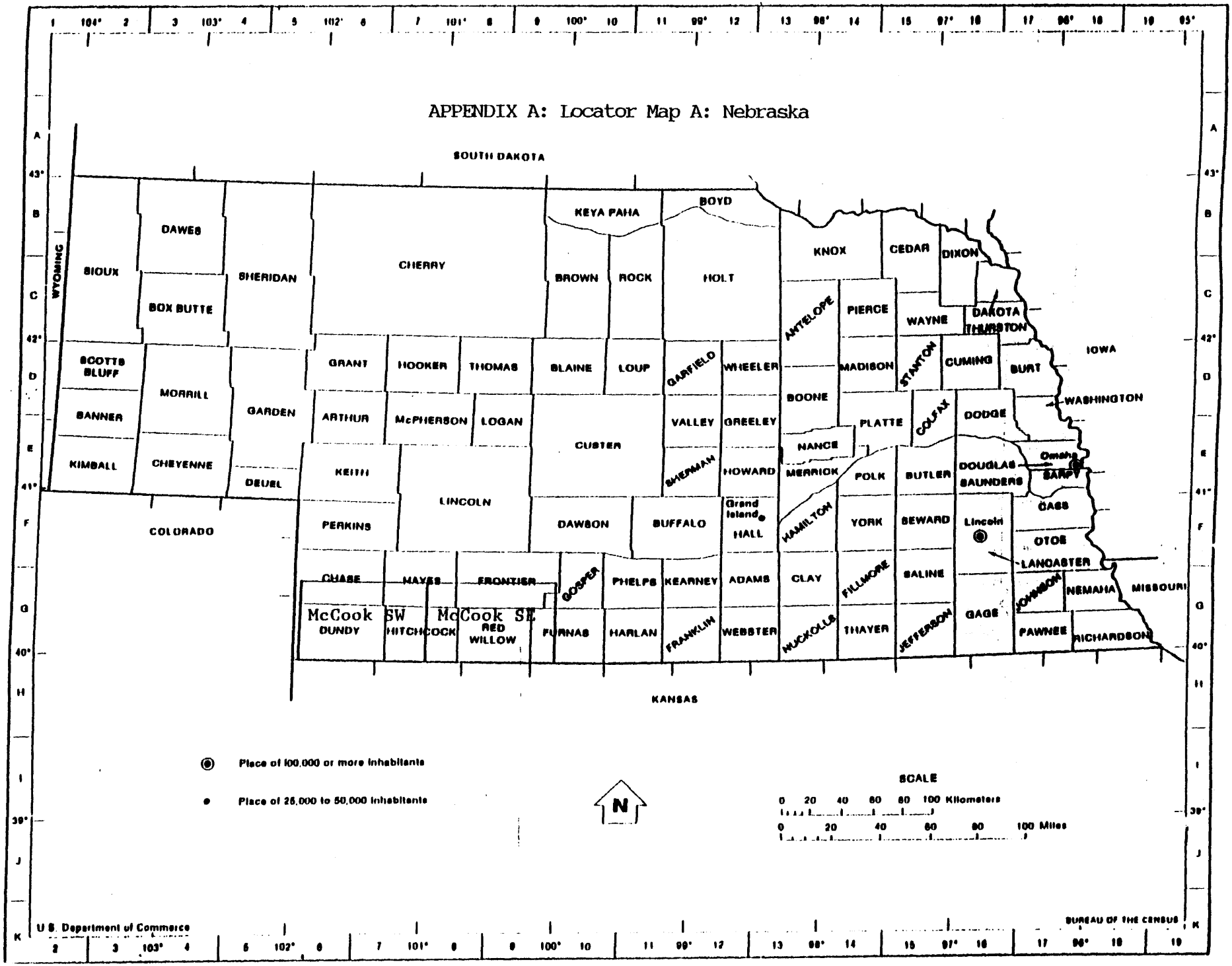
Cheyenne 1989	Phillips 1987	Trego 1990
Decatur 1989	Rawlins 1981	Wallace 1986
Ellis 1975	Rooks 1982	Wichita 1965
Gove 1978	Scott 1965	
Graham 1986	Sheridan 1984	
Jewell 1984	Sherman 1973	
Logan 1964	Smith 1978	
Norton 1977	Thomas 1980	

Soil Surveys - U.S. Department of Agriculture, University of Nebraska Conservation and Survey Division. County surveys and date published:

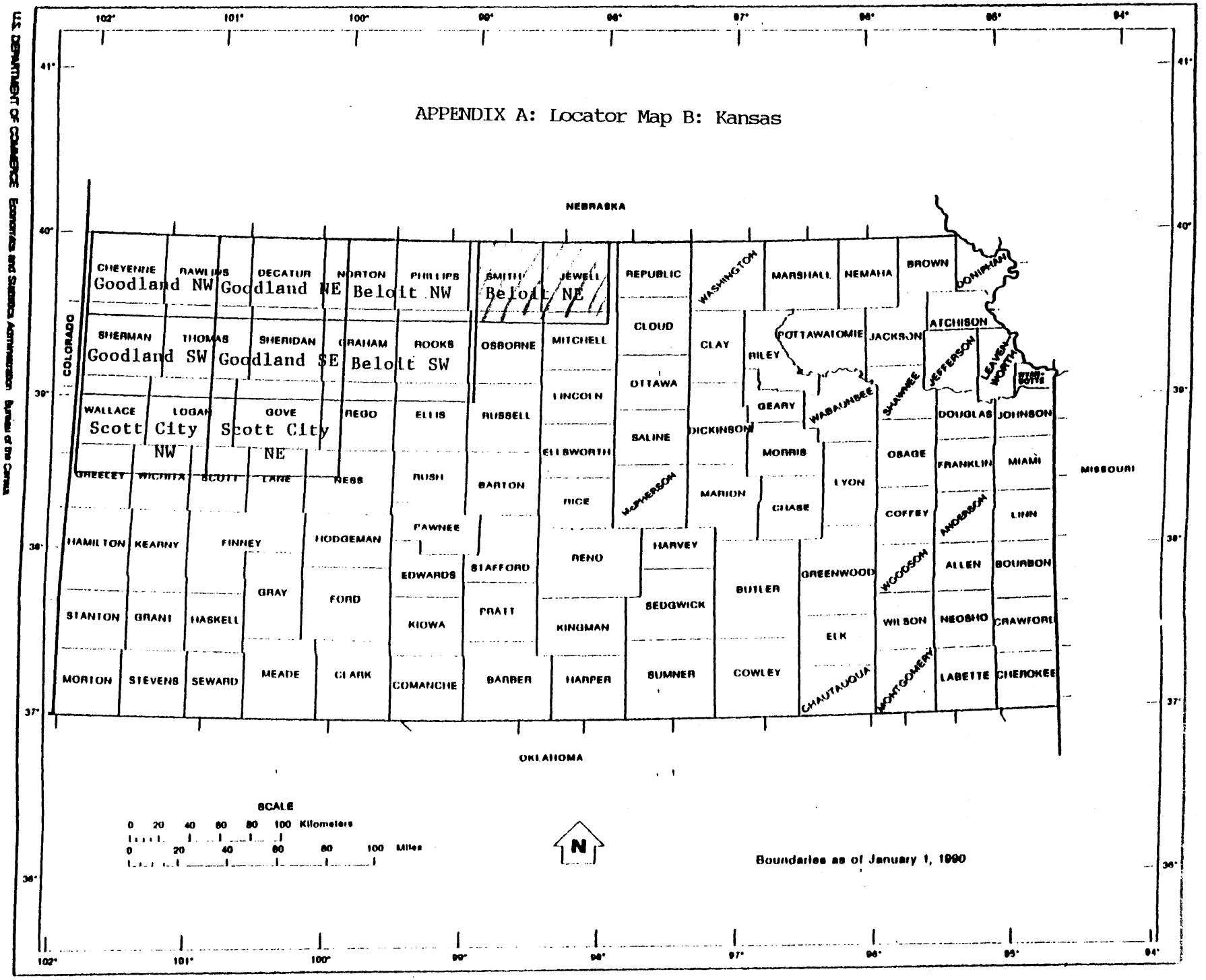
Chase 1982
Frontier 1978
Furnas 1979
Gosper 1981
Hayes 1982

7.5 Minute and 1:250,000 USGS Topographic Maps.

APPENDIX A: Locator Map A: Nebraska



APPENDIX A: Locator Map B: Kansas



U.S. DEPARTMENT OF COMMERCE Economics and Statistics Administration Bureau of the Census