A Biological Inventory and General Assessment of Eastern Nebraska Saline Wetlands in Lancaster and Southern Saunders Counties

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A BIOLOGICAL INVENTORY AND GENERAL ASSESSMENT OF EASTERN NEBRASKA SALINE WETLANDS IN LANCASTER AND SOUTHERN SAUNDERS COUNTIES

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A recent inventory of Lancaster and southern Saunders counties identified 133 saline wetlands and 99 potential saline wetlands. The wetlands ranged from 0.4 ha (1 ac) to over 80 ha (200 ac). Information was gathered on the quality, threats, vulnerability, restoration feasibility, and water source of each wetland. Saline wetlands in Lancaster and southern Saunders counties have undergone extensive degradation through commercial, residential, and agricultural development. Recommendations for preservation of saline and potential saline wetlands are given.

† † †

INTRODUCTION

Eastern Nebraska saline wetlands are a regionally unique wetland type occupying floodplain swales and depressions within the Salt Creek watershed in Lancaster and southern Saunders counties of Nebraska (Clausen et al., 1989). These wetlands are primarily palustrine, emergent, temporarily and seasonally flooded, fresh to hypersaline with mineral soils (Cowardin et al., 1979). Pound and Clements (1898), Shirk (1924), and Ungar et al. (1969) showed that plant associations within wetlands are directly correlated to soil salinity and soil saturation levels. Shirk (1924) described the distribution and successional pattern of plant associations within these wetlands. Quantitative descriptions of eastern Nebraska saline wetland plant associations were provided by Ungar et al. (1969).

Floristically, eastern Nebraska saline wetlands are characterized by halophytic plants including spearscale (*Atriplex subspicata*), inland saltgrass (*Distichlis spicata var. stricta*), saltwort (*Salicornia rubra*), prairie bulrush (*Scirpus maritimus* var. *paludosus*), sea blite (*Suaeda depressa*), and narrow-leaved cat-tail (*Typha angustifolia*). These wetlands are unique in that they contain the southernmost permanent population of saltwort (*S. rubra*) in the prairie region (Ungar et al. 1969). They also harbor four plant species described as rare in Nebraska (Clausen et al. 1989) including saltmarsh aster (*Aster subulatus* var. *ligulatus*), heliotrope (*Heliotropium curassavicum*), saltwort (*S. rubra*), and Texas dropseed (*Sporobolus texanus*).

The Nebraska National Heritage Program recognizes two saline wetland community types in Nebraska (Clausen et al., 1989): eastern saline marshes in Lancaster and Saunders counties and western saline marshes along the North Platte River Valley in western Nebraska. Pound and Clements (1898) first described the floristic variations between these two community types. They have some dominant plant species in common, including inland saltgrass (*D. spicata* var. *stricta*) and sea blite (*S. depressa*), but each type also harbors dominant plant species not found in the other type.

Eastern Nebraska saline wetlands have been studied by botanists, ecologists, entomologists and ornithologists for nearly 100 years (Barbour, 1895; Hunter, 1900; Eiche, 1901; Elmore, 1921; Shirk, 1924; Ungar et al., 1969). They have been noted for their rich and abundant insect life, including the tiger beetle (*Cicindela nevadica* var. *lincolniana*), an endemic subspecies (Clausen et al., 1989). They also provide feeding and nesting habitat for a large number of bird species and are particularly important as migration habitat for shorebirds, especially sandpipers (*Calidris* spp.). Over the past 90 years, ornithologists have reported 230 bird species using eastern Nebraska saline wetlands. This represents more than half of the total number of bird species reported for Nebraska (Ducey, 1985).

Once a prominent feature of the Lancaster County landscape, eastern Nebraska saline wetlands have undergone extensive degradation through commercial, residential and agricultural development. Presently, these wetlands are perhaps the most restricted and imperiled natural community type in the State (Kaul, 1975; Clausen et al., 1989). Commercial and residential development pressure on these wetlands continues to increase as the city of Lincoln expands to the north and west.

METHODS

General methods

U.S. Department of Agriculture (USDA) county soil surveys (Elder et al., 1965; Brown et al., 1980) and U.S. Soil Conservation Service (SCS) hydric soils lists (Soil Conservation Service, 1988) for Lancaster and Saunders counties were used to identify soil types that possess the physical and chemical properties necessary to support saline wetlands. The locations of saline hydric soils were identified on county soil survey maps and these were used to establish an initial-study boundary. The boundary was then expanded to adjacent alluvial soils to increase the probability that all saline wetlands in the Salt Creek watershed would fall within the study area. Plant nomenclature used in this study follows the *Flora of the Great Plains* (Great Plains Flora Association, 1986).

Selection of candidate sites

Candidate saline wetland sites were identified from 1981 U.S. Geological Survey (USGS) National High Altitude Photography color infrared photos at 1:24,000 scale, Lancaster County SCS preliminary draft wetland-inventory maps based on 1984 through 1988 color 35mm slides, and 1986 and 1988 U.S. Agricultural Stabilization and Conservation Service (ASCS) color slides for Lancaster County. Candidate wetland sites were traced onto mylar overlays of USGS 7 1/2 minute, color infrared photographs (1:24,000 scale) and each was assigned an individual identification number. A wetland determination for cultivated candidate sites was based on vegetative signatures identified on aerial photographs.

Field survey

All uncultivated candidate sites were field surveyed during September and October of 1989 with only minor exceptions where landowner permission was not granted. Standard delineation procedures were used to identify the presence or absence of a wetland during field surveys (Federal Interagency Committee for Wetland Delineation, 1989). A wetland survey form was developed to standardize the collection of field data.

Identified wetlands were classified as saline, potential saline, or freshwater. Wetlands were classified as saline if saline indicator plant species were prevalent (cover > 25 percent) in at least one emergent, hydrophytic plant association regardless of soil type. Cover estimates were subjectively determined by the surveyors. Wetlands were classified as potential saline when: 1) uncultivated wetlands occurred on saline hydric soils, but saline indicator plants were absent; 2) cultivated wetlands occurred on saline hydric soils; or 3) uncultivated wetlands occurred on saline hydric soils that could not be field surveyed for saline indicator plants due to access restrictions. Wetlands were considered freshwater when: 1) uncultivated wetlands occurred on nonsaline hydric soils and saline indicator plants were absent or not prevalent; or 2) cultivated wetlands occurred on nonsaline hydric soils. No further information was collected for cultivated and freshwater wetlands. Boundaries of surveyed wetlands were adjusted when inconsistencies with photo interpreted boundaries were identified.

Wetland assessment

Information regarding wetland quality, disturbance, present use, surrounding use, threats, vulnerability, restoration feasibility, water source, dominant plant species, and saline indicator plant species was collected for all uncultivated saline and uncultivated potential saline wetlands during field surveys. Wetland quality was assessed by criteria based on the Nebraska Natural Community Element Ranking Criteria for Palustrine Systems (Clausen et al., 1989). Past wetland disturbance caused by drainage, diking, overgrazing, filling, deepening, pollution and farming was determined from surveys, aerial photography interpretation and the authors knowledge of individual sites.

The threats, vulnerability and restoration feasibility of individual wetlands was the authors' opinion based on the growth pattern of the city of Lincoln, the location of primary and secondary roads and the potential for agricultural development. Threats were defined as disturbances thought most likely to degrade a wetland, vulnerability was defined as the likelihood that an individual wetland will be adversely impacted by man in the future, and restoration feasibility was defined as the likelihood that historic wetland characteristics and functions could be restored. High, moderate, or low ratings of vulnerability and restoration feasibility were assigned to each wetland. Vulnerability and restoration feasibility were considered to be moderate unless specific conditions were recognized which warranted a high or low rating.

RESULTS

The study boundary was delineated on a composite map (Fig. 1) of the saline hydric soils in the Salt Creek watershed. Characteristics of the saline hydric soils of Lancaster and Saunders counties are shown in Table I.

A total of 304 candidate sites were identified within the study boundary. Of these 133 were classified as saline wetlands, 99 were classified as potential saline wetlands, and 72 were classified as freshwater wetlands or upland sites. Saline indicator plants that were used to identify saline wetlands are listed in Table II. The size of saline and potential saline wetlands ranged from approximately 0.4 ha (1 ac) to just over 80 ha (200 ac); the majority were less than 8 ha (20 ac). Number of wetlands, field survey data, quality rank, threats, vulnerability, restoration feasibility, and water source for saline and potential saline wetlands are summarized in Table III.

DISCUSSION

The wetlands identified in this inventory represent the minimum number of eastern Nebraska saline wetlands that occur within the study boundary. Other sites may exist but were missed in the survey due to the presence of unmapped saline hydric soils within the study area, soil survey error and difficulties in identifying small, temporary wetlands from aerial photographs. This study identifies the location and general extent of eastern Nebraska saline wetlands. The boundaries described in the study are not intended to delineate exact wetland boundaries and should not be used for that purpose. A detailed ground and historical analysis of individual wetlands are necessary to accurately delineate their boundaries.

The majority of saline wetlands identified in this study (84%) had both saline hydric soils and a prevalence of saline-indicator plants. When a saline wetland could be identified only by its vegetation, (i.e., saline-hydric soils were not mapped for the site), it was assumed that saline-hydric soil inclusions occurred on the site or a soil-mapping error existed. If a wetland had saline-hydric soils but lacked saline-indicator plants, it was assumed that modifications such as drainage, mechanical disturbance, or the pumping of water into the wetland diluted soil-salinity levels and permitted the encroachment of freshwater plants.

Degradation of one wetland component rarely occurs without direct or indirect detrimental impact to the rest of the components. As the number of components degraded or the degree of degradation increases, the feasibility of wetland restoration decreases. Thus the type and extent of wetland degradation dictates the potential for restoration. Complete restoration of degraded saline wetlands depends on the re-establishment of the following wetland components: 1) historic water-holding capacity; 2) native halophytic-plant species; 3) historic salinity levels and other chemical properties; and 4) historic water inputs. The multiple degradation factors negatively affecting eastern Nebraska saline wetlands severely restrict the potential for their complete restoration. However, virtually all of these wetlands have the potential for partial restoration and a small proportion have the potential for nearly complete restoration.

Degraded historic water-holding capacity usually is the wetland component most easily restored. Often simply plugging drainage ditches or tile is sufficient. Reestablishing halophytic plants also appears feasible if other components are intact. Previous reports (Shirk, 1924; Ungar et al., 1969) and a seed bank study by the author indicate that halophytic plants can be grown from seed propagated in the greenhouse or transplanted between wetlands. Reestablishing historic salinity levels and historic water inputs may be difficult. Deepened stream channels within the Salt Creek watershed facilitate removal of salts from the wetlands and also reduce the amount of flood waters entering wetlands. Pumping water from saline aquifers into wetlands may enhance restoration of salinity levels.

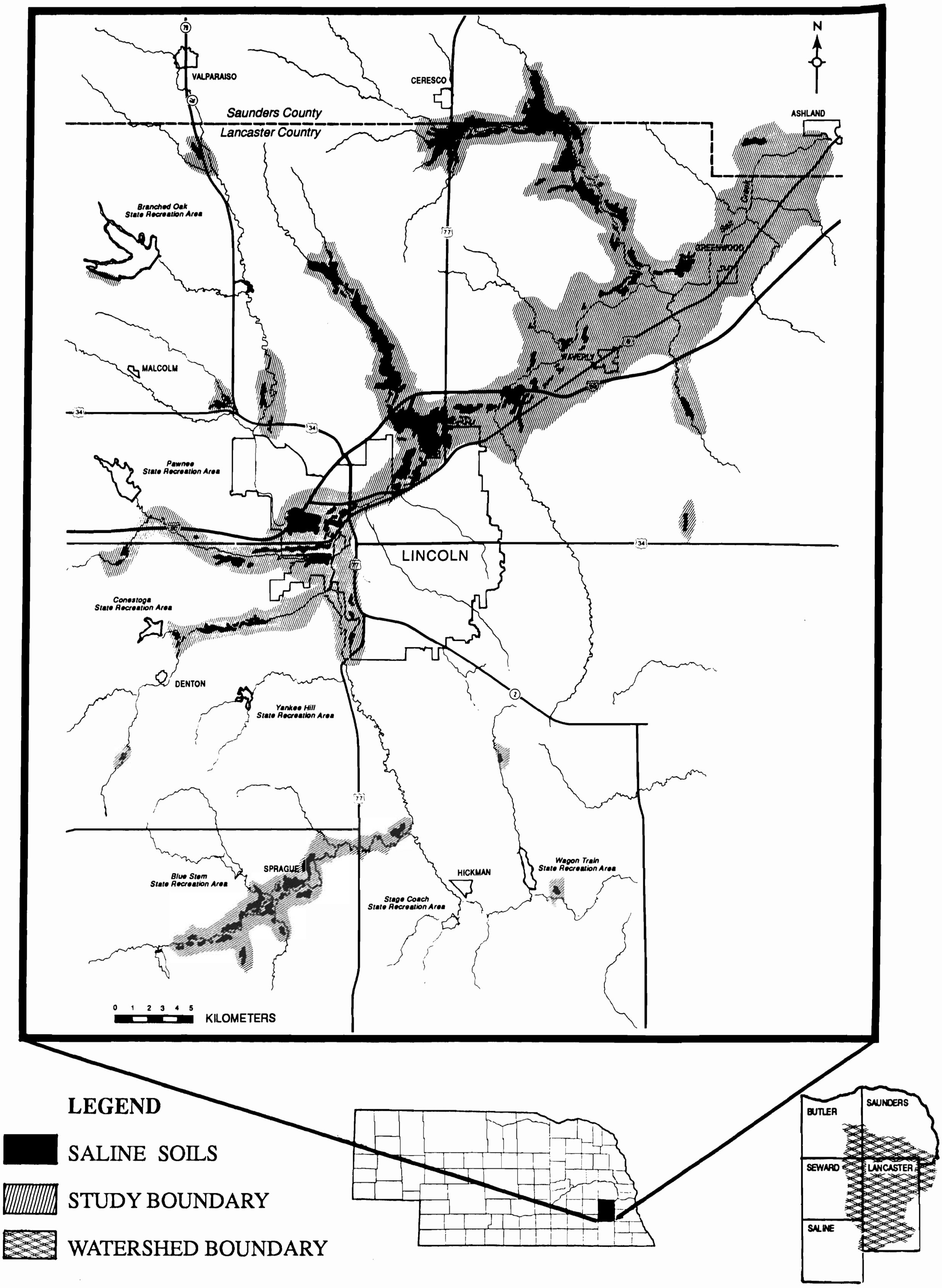

Figure 1. Eastern Nebraska saline-wetland study boundary with saline-hydric soils identified.

Table I. Characteristics of Lancaster and Saunders County saline hydric soils adapted from SCS soil surveys (Elder et al., 1965; Brown et al., 1980) and SCS hydric soils list (Soil Conservation Service, 1988).

Soil Name	Map[1] Symbol	Hydric-Soil Component	Slope	Salinity (Mmhos/cm)	Depth to Water Table (Ft.)
Lancaster County					
Lamo silty-clay loam	Lm	Salmo soil inclusions	0 to 2%	<2	2.0–3.0
Salmo silt loam	Sa	Seasonally high water table inclusions	0 to 2%	4–16	2.0–3.0
Salmo silty clay loam (channeled)	Sb	Entire map unit	0 to 2%	4–16	0.0–2.5
Salmo silty-clay loam	Sc	Entire map unit	0 to 2%	4–16	0.0–2.5
Zoe silty-clay loam	Zc	Entire map unit	0 to 2%	2–8	1.0–3.0
Saunders County					
Rauville silty-clay loam	Ra	Entire map unit	0 to 2%	ND[2]	1.0–3.0

[1]SCS Soil Survey map symbols
[2]ND denotes no available data

Table II. Saline indicator-plant species in eastern Nebraska saline wetlands (Ungar et al., 1969; Clausen et al., 1989).

Scientific name	Common name
Aster subulatus var. *ligulatus*	saltmarsh aster
Atriplex subspicata	spearscale
Distichlis spicata var. *stricta*	inland saltgrass
Iva annua	marsh elder
Ruppia maritima var. *rostrata*	widgeon grass
Salicornia rubra	saltwort
Scirpus maritimus var. *paludosus*	prairie bulrush
Suaeda depressa	sea blite
Typha angustifolia	narrow-leaved cat-tail

Table III. Number of wetlands, field survey data, quality rank, threats, vulnerability, restoration feasibility, and water-source summaries for saline and potential saline wetlands.

	Saline Wetlands		**Potential Saline Wetlands**		
	Soil-saline Vegetation-saline	**Soil-nonsaline Vegetation-saline**	**Soils-saline Vegetation-nonsaline**	**Soils-saline Vegetation-farmed**	**Soils-saline No access**
Number of Sites	112	21	55	31	13
Field Surveyed	YES	YES	YES	NO	NO
Quality Rank					
A	0	0	0	0	ND[1]
B	78	13	13	0	
C	34	8	42	31	
Threats				ND[1]	ND[1]
Commercial Devls.	33	14	18		
Road Development	21	3	12		
Farming (Drainage)	49	5	38		
Grazing	58	3	12		
Natural Erosion	46	2	3		
Other	0	0	0		
Vulnerability				ND[1]	ND[1]
High	45	14	25		
Moderate	52	5	27		
Low	15	2	3		
Restoration Feasibility				ND[1]	ND[1]
High	17	2	1		
Moderate	72	11	29		
Low	23	8	25		
Water Source				ND[1]	ND[1]
Surface Runoff	112	21	55		
Seeps	34	3	5		

[1]ND denotes no available data

Eastern Nebraska saline wetlands will continue to experience degradation from commercial and residential development especially near the city of Lincoln. Improvements in technology which facilitate drainage, stream channelization, and fill activities will make saline wetlands more vulnerable to agricultural development. Only the saline wetlands managed as wildlife habitat by the Nebraska Game and Parks Commission and the Lower Platte South Natural Resource District have low vulnerability.

Results from this study indicate that saline wetlands occur throughout a larger portion of the Salt Creek watershed than previously reported (Fig. 1). A review of soil survey maps of Saunders County also indicates the presence of saline-hydric soils (Rauville silty-clay loam) in the Platte River Valley and to a lesser extent the lower reaches of the Wahoo Creek and Clear Creek drainages (Fig. 2). Preliminary field surveys identified two saline-indicator plants, marsh elder (*Iva annua*) and inland saltgrass (*D. spicata* var. *stricta*), growing

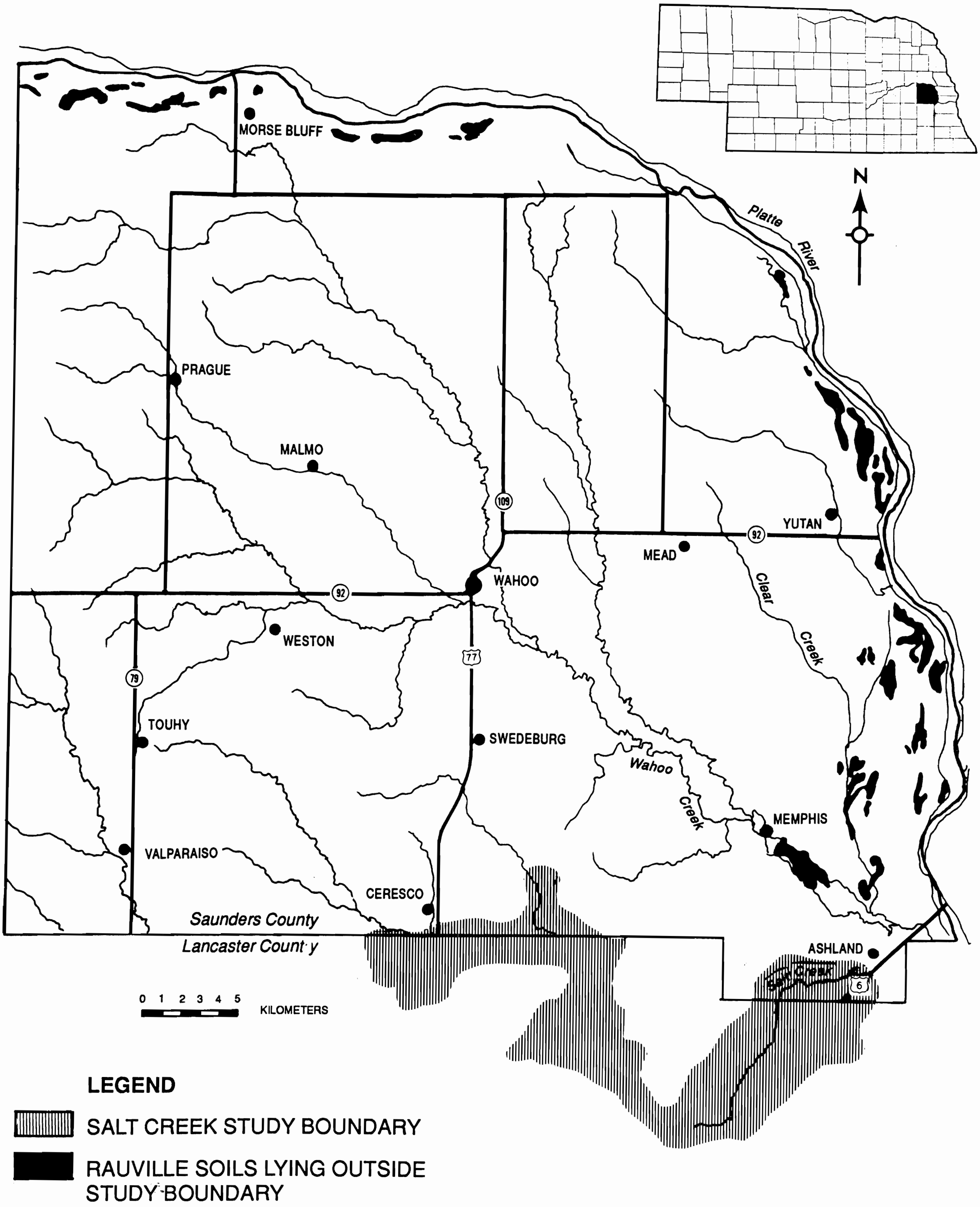

Figure 2. Location of Saunders County Rauville soils which lie outside the Salt Creek watershed.

in limited amounts in these wetlands. It appears these wetlands in the Platte River Valley and the Wahoo Creek and Clear Creek drainages do not possess the high degree of soil salinity or the diversity of halophytic plants as do the saline wetlands within the Salt Creek watershed.

Two additional Saunders County soils appear to have the potential to support saline wetlands. Saline indicator plants have been observed by the authors on some Lamoure silty-clay loam (alkali) and Leshara silt-loam (alkali) soils, although these soils are not recognized as hydric soils or soils with hydric inclusions (Soil Conservation Service, 1988). Additional study is needed to characterize the type, extent, and condition of wetlands on Lamoure and Leshara, as well as Rauville, soils within the Platte River Valley and the Wahoo and Clear Creek drainages of Saunders County.

RECOMMENDATIONS

Efforts must be initiated to maintain the biological and ecological integrity of eastern Nebraska saline wetlands and preserve this unique resource. The minimum size, number and distribution of individual saline wetlands necessary to maintain a stable and naturally functioning wetland complex has not been determined. Extensive biological and ecological studies are needed to determine these values. Until these values are known, as many saline wetlands as possible should be protected within this complex.

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