BASELINE VEGETATION SURVEY

JEFFREY ISLAND
and
COTTONWOOD RANCH

CENTRAL PLATTE RIVER, NEBRASKA

Prepared for:

Central Nebraska Public Power and Irrigation District
Gothenburg, NE

Prepared by:

Elizabeth Lack
Shay Howlin
Karyn Sernka
Western **E**co**S**ystems **T**echnology, Inc.
2003 Central Avenue
Cheyenne, WY 82001

March 28, 2002

BASELINE VEGETATION SURVEY

JEFFREY ISLAND
and
COTTONWOOD RANCH

CENTRAL PLATTE RIVER, NEBRASKA

Prepared for:

Central Nebraska Public Power and Irrigation District
Gothenburg, NE

Prepared by:

Elizabeth Lack
Shay Howlin
Karyn Sernka
Western **E**co**S**ystems **T**echnology, Inc.
2003 Central Avenue
Cheyenne, WY 82001

March 28, 2002

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES cont.

LIST OF TABLES cont.

LIST OF TABLES cont.

EXECUTIVE SUMMARY

The Central Nebraska Public Power and Irrigation District and the Nebraska Public Power District purchased approximately 2,700 ha of property along the central Platte River in two parcels, Jeffrey Island and Cottonwood Ranch. The purchase of this property was required as part of their FERC license to operate hydroelectric power plants on the North Platte, South Platte, and central Platte River systems. Biological monitoring to develop a baseline, and subsequent monitoring to evaluate the effects of planned restoration activities is also required. This report presents the results of a baseline vegetation survey conducted at the Jeffrey Island and Cottonwood Ranch properties in 2001. The survey was designed to collect vegetation data that is representative of the properties as a whole.

Eight land cover types occurred on Jeffrey Island and Cottonwood Ranch. Three were non-vegetated, including Open Water, Open Water Canal, and Wetted Channel. Agricultural fields included those areas that were actively cultivated in monoculture crops at the time of the survey. The remaining cover types were vegetated and are described herein.

Exposed Sand Beach/Bar: Exposed sand beach/bar included areas such as inactive channels, islands, point bars, and areas adjacent to active channels with exposed sandy soils and relatively low vegetative cover. This cover type occurred more frequently at Jeffrey Island (found on 24 transects) than at Cottonwood Ranch (found on 1 transect). Vegetative cover averaged 58 percent at Jeffery Island and averaged 78 percent at Cottonwood Ranch. Plant species found in these areas are adapted to the dry, sandy soils, and are often weedy pioneer species. Common species found in this cover type included western sagewort (*Artemesia campestris),* common sunflower (*Helianthus annus*), yellow sweetclover (*Melilotus officinalis*), common ragweed (*Ambrosia artemisiifolia*), and grasses such as downy brome (*Bromus tectorum*) and sand dropseed (*Sporobolus cryptandrus*). Occasional depressions or low spots in this cover type with standing water or groundwater near the soil surface supported emergent wetland species.

Emergent Wetland: Emergent wetlands were found on saturated and inundated soils where water depths did not exceed one meter. At Jeffrey Island and Cottonwood Ranch, emergent wetlands were found in swales, drainages, and along riverbanks, pond margins, and ditches. At Cottonwood Ranch, emergent wetlands were also found in some inactive river channels that cut through the forest. Emergent wetlands occurred on 17 of 35 transects at Jeffrey Island and on 12 of 13 transects at Cottonwood Ranch. Vegetative cover in emergent wetlands averaged 74 percent at Jeffrey Island and averaged 84 percent at Cottonwood Ranch. Common species found in the emergent wetlands included cattail (*Typha latifolia*), which was often found in dense, monotypic stands, various bulrushes (*Scirpus* spp.) and sedges (*Carex* spp.), reed grasses such as common reed (*Phragmites australis*) and reed canarygrass (*Phalaris arundinaceae*), and northern fog-fruit (*Lippia lanceolata*). Dense patches of sandbar willow were found at some emergent wetland sites, but most were dominated by herbaceous species.

Forest: Forests occupied river terraces and large and small islands within the floodplain that have sufficient substrate over groundwater to allow root development and aeration (floodplain forests). Forests were also found in draws, fields, and drainages outside the floodplain (upland forests). Forests were found along all transects except for two, Transects 25 and 26 at Jeffrey Island. The mean density of all trees (11 species) at Jeffrey Island was 68 per ha, and the mean density of all shrubs/saplings (20 species) in the understory was 241 per ha. The mean density of all trees (11 species) at Cottonwood Ranch was 133 per ha, and the mean density of all shrub/saplings (13 species) in the understory was 1,635 per ha.

Cottonwood (*Populus deltoides*) was the most common tree on both properties; the average density at Jeffrey Island was 35 trees per ha and the average density at Cottonwood Ranch was 43 trees per ha. In general, the cottonwoods were more mature at Cottonwood Ranch than at Jeffrey Island, as evidenced by an average diameter of all cottonwoods at Cottonwood Ranch of 46 cm compared to 36 cm at Jeffrey Island. Other common species on both properties included green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), Eastern red cedar (*Juniperus virginiana*), and white mulberry (*Morus alba*). The species composition of the understory included a mix of young trees less than 5 cm diameter (saplings) and shrubs, with slightly more tree species than shrub species. However, the species with the greatest mean density at both properties was a shrub, rough-leaved dogwood (*Cornus drummondii*). The mean density of rough-leaved dogwood was 64 stems per ha at Jeffrey Island, followed by false indigo (*Amorpha fruticosa*) (52 stems per ha) and prairie wild rose (*Rosa arkansana*) (21 stems per ha). The mean density of rough-leaved dogwood at Cottonwood Ranch was 1,010 stems per ha, followed by American elm (431 stems per ha) and Eastern red cedar (131 stems per ha). The sapling data indicate a successional trend toward a green ash/American elm community. River-bank grape (*Vitus riparia*) was a common woody vine in the forest understory, along with poison-ivy, a sub-shrub. The percent plant cover of the herbaceous understory in the forests was 71 percent at Jeffrey Island and 79 percent at Cottonwood Ranch. Grasses such as downy brome, Kentucky bluegrass (*Poa pratensis*), Canada wild rye (*Elymus canadensis*), dichanthelium (*Dichanthelium oligasanthes*), prairie cordgrass (*Spartina pectinata*), and sand dropseed were the most common herbaceous understory speices. Other common species included common ragweed, black medick (*Medicago lupulina*), Virginia creeper (*Parthenocissus quinquefolia*), white avens (*Geum candensis*), and seedlings of rough-leaved dogwood.

Grassland: Grasslands occurred both on drier, elevated soils that are not subirrigated and on subirrigated soils within the floodplain. Grasslands were found along all transects except for three, Transects 34 and 35 at Jeffrey Island and Transect 36 at Cottonwood Ranch. The percent plant cover on the grasslands was 95 percent at Jeffrey Island and 93 percent at Cottonwood Ranch. This cover type was dominated by a mix of native and non-native grasses and forbs. Common native grasses included windmill grass (*Chloris verticillata*), switchgrass (*Panicum virgatum*), prairie cordgrass, sand dropseed, little barley (*Hordeum pusillum*), foxtail barley (*Hordeum jubatum*), and Kentucky bluegrass (this species is considered both native and introduced); common non-native grasses included downy brome, quackgrass (*Agropyron repens*), tall wheatgrass (*Agropyron*

elongatum), and green foxtail (*Setaria viridis*). Common forbs found on the grasslands included common ragweed, hemp (*Cannabis sativa*), black medick, and bull thistle (*Cirsium vulgare*).

INTRODUCTION and BACKGROUND

The Central Nebraska Public Power and Irrigation District (Central) and the Nebraska Public Power District (NPPD), collectively the Districts, purchased approximately 2,800 ha of property along the central Platte River in two parcels, Jeffrey Island and Cottonwood Ranch. The purchase of this property was required as part of their FERC license to operate hydroelectric power plants on the North Platte, South Platte, and central Platte River systems. In addition to the purchase of the land, a number of restoration activities are planned. Biological monitoring to develop a baseline and subsequent monitoring to evaluate the effects of restoration activities is also required. One area of monitoring deals with the existing vegetation communities (baseline) and the communities that will develop in response to the restoration activities. This report presents the results of a baseline vegetation survey conducted at the Jeffrey Island and Cottonwood Ranch properties in 2001. The survey was designed to collect vegetation data that is representative of the properties as a whole.

The Jeffrey Island property is an 11.3 km-long, 1.6 km-wide strip of land along the Platte River between Lexington and Overton, Nebraska. The total area is approximately 1,600 ha. The Cottonwood Ranch property is located approximately eight km down-river from Jeffrey Island and is approximately 5 km-long and 1.6 to 3.2 km wide. The total area is approximately 1,072 ha. Both areas presently consist of open grassland, braided river channels, vegetated islands, exposed sand bars, and riparian and upland forest. The Cottonwood Ranch property also contains some cropland and some former cropland presently being renovated to a wetland/grassland complex. Approximately 81 ha of forest at Jeffrey Island has been or is being cleared to enhance open channel habitat. Most of this cleared area was logged prior to Central taking possession of the property and slash and stumps must be removed to maintain the habitat and control noxious weeds.

Jeffrey Island and Cottonwood Ranch are located in the Central Platte River Valley of the Great Plains of Nebraska. Jeffrey Island is within Dawson County, and Cottonwood Ranch is within Dawson and Phelps Counties. The Central Platte River Valley experiences a semi-arid, continental climate that includes long, hot, and dry summers, moderately long, cold, and dry winters, with precipitation events occurring mostly in late spring and early summer. Precipitation for this region typically originates in the Gulf of Mexico. Average annual precipitation is 62 cm at nearby Kearney, Nebraska (USDI BOR 2000). The highest amount of precipitation falls as rain between the months of April and June, and approximately 80% falls between April and September (USDI BOR 2000). Average temperatures recorded for Kearney range from –5°C for the low (January) and 25°C for the high (July). The lowest temperature recorded in the Central Platte River Valley was -36C° and the highest was 47°C. The growing season is moderate, averaging approximately 160 days above freezing (USDI BOR 2000).

The Central Platte River Valley surface geology consists primarily of recent alluvial deposits and wind-distributed (eolian) loess and sand layers deposited over older sandstone, limestone, and shale formations. The Platte River valley, islands, and adjacent terraces are characterized by sand and gravel beds (mixed alluvium) and silty alluvium deposited during recent times. These beds overlie Quaternary silts, clays, sands, and gravels, which in turn are deposited directly on Tertiary Ogallala Formation sandstones (also the primary source of groundwater) (USDI BOR 2000). Most soil associations in the Central Platte River Valley formed from eolian loess and sand on uplands and

alluvial deposits on floodplains.

The Central Platte River Valley topography is a mixture of low sand and loess hills, intermittent and perennial drainageways, relatively flat, loess plains, and a wide floodplain associated with the Platte River (USDI BOR 2000). Both Jeffrey Island and Cottonwood Ranch properties are flat, and bisected by various channels of the Platte River. The elevation at Jeffrey Island is approximately 716 m and at Cottonwood Ranch approximately 695 m.

The Platte River originates at the junction of the North Platte and South Platte Rivers near the town of North Platte, Nebraska, approximately 130 km west of the properties. The Platte River flows east across central and eastern Nebraska to its junction with the Missouri River near Omaha, Nebraska. Surface water and the connected groundwater aquifers of the Platte River and its tributaries are used for water projects, domestic water supplies, irrigation, industrial water supplies, and hydroelectric power generation (USDI BOR 2000). Other factors associated with water projects include flood control, recreation, and wildlife habitat/fisheries support.

The predominant land use in the Central Platte River Valley is irrigated agricultural land, particularly row crops, including corn *(Zea may*s), soy beans *(Glycine ma*x), sunflowers *(Helianthus annuu*s), and potatoes *(Solanum tuberosum*). Smaller acreages are used to irrigate alfalfa *(Medicago sativ*a) and exotic grasses for hay and to grow dry-farmed winter wheat *(Triticum aestivum*). Winter wheat acreages usually are associated with fallow or bare ground due to preservation of soil moisture and nutrients in alternate years. Areas that are not farmed or committed to other land use practices support the grassland, wetland, and forest vegetation types, as found at Jeffrey Island and Cottonwood Ranch and described in the ensuing discussion.

METHODS

The survey was conducted along 48 evenly spaced transects (35 at Jeffrey Island and 13 at Cottonwood Ranch) crossing the properties from north to south through system-wide anchor points previously established in the main channel of the Platte River (Figures 1 and 2). Anchor points for the transects are spaced 0.4 river-km apart. Transects varied in length from approximately 0.4 km to 4 km. The location of each transect was provided by the Districts on color IR aerial photographs (scale 1:12,000). The UTM coordinates for the north and south end points of each transect were also provided by the Districts. These coordinates were used to locate the transects on the ground using a Trimble GeoExplorer 3 GPS unit (note: the unit was set at NAD27, Zone 14).

Land cover types were identified along each transect based on previously described "land cover map units" (USDI BOR 2000). Land cover types were identified in the field while sampling each transect and cross-referenced with the color IR aerial photos. In general, an area had to be at least 10 m in length along a transect to be counted as a separate land cover type; for example, a 4-m wide slough dominated by emergent wetland vegetation within a forest cover type would not be counted as a separate land cover type. UTM coordinates were recorded at each change in land cover type. Land cover types included the following:

Land Cover Type (map unit name, if different)	Description	NVCS Plant Association(s)[1] (as described in USDI BOR 2000)
AF – Agricultural Field	Areas under cultivation during the time of the 2001 vegetation survey. Crops included alfalfa and sunflower. This cover type may also include irrigation ditches, access lanes, and haystacks.	NA
ESB – Exposed Sand Beach/Bar (Barren Beach/Bar)	Areas with exposed sandy soils and low vegetative cover (typically ~50%). Includes inactive channels, islands, point bars, and areas adjacent to some active channels.	NA
EW – Emergent Wetland (Emergents)	Occurs on saturated and inundated soils, where water depths do not exceed one meter, e.g. on/near seeps, springs, drainages, pond margins, swales, riverbanks, and in ditches.	*Typha* spp. – *Scirpus* spp. Great Plains Herbaceous Vegetation
F – Forest (Wooded – Floodplain and Upland)	Occupies river terraces and large and small islands within the floodplain that have sufficient substrate over groundwater to allow root development and sufficient aeration, as well as draws, fields, and drainages outside the floodplain. Trees typically range from 4–15 meters tall depending on age and species.	*Populus deltoides – Fraxinus pennsylvanica/Cornus drummondii* Temporarily Flooded Woodland *Fraxinus pennsylvanica – Ulmus* (*rubra, americana*)/*Cornus drummondii* Temporarily Flooded Woodland *Fraxinus pennsylvanica – (Acer negundo)/Cornus drummondii* Temporarily Flooded Woodland *Juniperus virginiana – (Morus rubra)* Floodplain Woodland *Fraxinus pennsylvanica – Ulmus americana* Woodland Alliance *Juniperus virginiana* Woodland Alliance

Land Cover Type (map unit name, if different)	Description	NVCS Plant Association(s)[1] (as described in USDI BOR 2000)
G – Grassland (Upland and Lowland Grasses)	Upland grasslands occur on drier, often elevated soils that are not subirrigated; lowland grasslands occur on subirrigated soils within the floodplain. The vegetation is predominantly herbaceous with some native tall grasses, but introduced grass species are dominant on many areas.	Upland Grassland not described Lowland Grasses: *Poa pratensis* – (*Andropogon gerardii*) Semi-natural Herbaceous Vegetation *Bromus inermis* – (*Andropogon gerardii*) Semi-natural Herbaceous Vegetation *Andropogon gerardii* – *Panicum virgatum* Mesic Tallgrass Prairie *Agropyron intermedium* – (*Andropogon gerardii*) Semi-natural Herbaceous Vegetation
OW – Open Water	Pit, pond, or lake. Excavated or dammed water storage structures, such as old gravel pits, or structures to provide livestock water.	NA
OWC – Open Water Canal	Constructed water conveyance channel located outside the river channel.	NA
WC – Wetted Channel (Channel)	The active, inundated river from bank-to-bank at the time of sampling.	NA

[1]NVCS – National Vegetation Classification System (TNC and ERSI 1994)

Herbaceous vegetation was sampled using the "modified step-point sampling" method (Evans and Love 1957; Owensby 1973). This sampling was conducted to document species composition and relative abundance within all land cover types (except wetted channel, open water, open water canal, and agricultural field) along the length of each transect. For agricultural fields actively planted in monocultures, the crop type was recorded. Fallow agriculture fields were treated as grassland cover types. Other cover types (wetted channel, open water, and open water canal) were not inventoried for plant species composition, but their length along each transect was recorded. Step point sampling was conducted every two meters along each transect using a "point-frame" as described in Owensby (1973). Percent plant cover by species was calculated as the number of hits of each species divided by the total number of hits. Percent non-plant cover by category type was calculated as the number of hits of each non-plant type (bare ground, leaf litter, downed woody, or open water) divided by the total number of hits. The relative percent plant cover by species was calculated as the number of hits of each species divided by the total number of vegetative hits. The sampling team consisted of a sampler and a recorder. A minimum of 100 plants were sampled along each transect.

In forest cover types, the standard point-center quarter plot method was used (Knight 1994). Point-center quarter plots were established every 100 m within a forest cover type. To avoid edge effect, the plots were established a minimum of 25 m within a forest cover type. The UTM of each point was recorded using the Trimble GeoExplorer 3 GPS unit. The area around each point-center was divided into four imaginary quarters, with the transect line as the north-south bisector. In each quarter, the distance from the center point to the nearest live tree greater than 5-cm dbh (diameter at breast height , defined as 1.3 m above the ground as measured from the uphill side of the tree) was recorded, along with its dbh and species. In addition, the distance to the nearest live shrub/sapling (dbh less than 5 cm) and it species in each quadrat was recorded. A tree or shrub/sapling must have occurred within 30 m of the center point in any quarter to be counted. Distances were measured using a fiberglass tape and dbhs were measured using a steel diameter tape. Again, the sampling team consisted of a sampler and a recorder.

When unknown species were encountered during sampling, specimens were collected and numbered for later identification. *Flora of the Great Plains* (Great Plains Flora Association 1986) was used as the authority for plant species identification (which also serves as the source for the common plant names used in this document). Additional assistance in plant identification was provided by Mr. Bill Whitney, botanist with the Prairie Plains Institute, Aurora, NE.

All field data were input into a Microsoft Access™ database. Data entry was double-checked and verified. Microsoft Access™ and SAS™ (Statistical Analysis Software) were used to analyze the data. Each cover type was described based on the quantitative results of the vegetation survey and general observations made during the survey. The data were summarized to provide species lists, percent area of each cover type along each transect, percent cover of herbaceous species and relative percentage of each species present, and woody plant density and average diameters for trees and shrub/saplings.

Total tree density at each transect was calculated as the number of trees found over the area searched, using the formula:

$$Total \quad D = \frac{n-1}{\sum_{i=1}^{N}\sum_{j=1}^{k}\frac{\pi}{4}r_{ij}^{2}}$$

where n is the number of trees found, r_{ij} is the distance to the nearest tree in the j^{th} quadrat of the i^{th} point, k is the number of quadrats at each point, and N is the number of sample points along the transect (Laycock and Batcheler 1975). This equation can be used to account for quadrats without trees (i.e., no trees within 30 m of the center point) by including the area of the quadrat searched in the denominator but excluding the count of a tree from the numerator. Density for each tree species at each transect was calculated by multiplying the total density of the transect by the relative abundance of each species at the transect. Calculations for the shrub/sapling density were identical to the tree density calculations.

Total tree density for each property was calculated using the formula above, with all points on the property. The variance of this estimate was calculated using the variance of a ratio (Cochran 1977).

The sample size for calculating mean tree density (and standard error) by property is based on the number of transects with the forest cover type (33 for Jeffrey Island [2 transects did not have forest cover type at Jeffrey Island] and 13 for Cottonwood Ranch). The tree density by species was calculated for each property by multiplying the total tree density for the property by the relative abundance of each species on the property. Calculations for the shrub/sapling density were identical to the tree density calculations.

RESULTS

The results of the baseline vegetation survey include a description of the land cover types that occur on Jeffrey Island and Cottonwood Ranch, as well as a summary of data collected presented in a series of data tables included at the end of this report. The Microsoft Access97™ database of all data collected is included on a CD ROM located on the back cover of this report. Data were summarzied by property and by transect. The data tables include the following:

- Tables 1-1 through 1-2. Complete species list by property.
- Tables 2-1 through 2-2. Percentage of each land cover type by property.
- Tables 3-1 through 3-2. Percent cover of herbaceous layer by property.
- Tables 4-1 through 4-2. Woody plant density and average diameter by property.
- Tables 5-1 through 5-48. Herbaceous layer species list by transect.
- Tables 6-1 through 6-2. Percentage of each land cover type by transect.
- Tables 7-1 through 7-48. Percent cover of herbaceous layer by transect.
- Tables 8-1 through 8-2. Woody plant density and average diamater by transect.

In addition to these data tables, the UTM coordinates of the land cover types found along each transect are presented in Appendix A and the UTM cooridnates of each point-center quarter location are presented in Appendix B.

Land Cover Types

A total of eight land cover types occurred on Jeffrey Island and Cottonwood Ranch. Jeffrey Island consisted of grassland (46 percent), forest (37 percent), exposed sand beach/bar (7 percent), wetted channel (6 percent), emergent wetland (4 percent), and open water (0.2 percent). Cottonwood Ranch consisted of forest (48 percent), grassland (27 percent), agricultural field (11 percent), wetted channel (9 percent), emergent wetland (4 percent), open water canal (0.08 percent), and exposed sand beach/bar (0.04 percent). Three land cover types were non-vegetated, including open water, open water canal, and wetted channel; these are described in Table 1. Agricultural fields included those areas that were actively cultivated monoculture crops (alfalfa, sunflower) at the time of the survey; agricultural fields were only found at Cottonwood Ranch (Figures 1 and 2; Table 2-2). The remaining cover types were vegetated and are described in detail below:

Exposed Sand Beach/Bar: Exposed sand beach/bar included areas such as inactive channels, islands, point bars, and areas adjacent to active channels with exposed sandy soils and relatively low vegetative cover. This cover type occurred more frequently at Jeffrey Island (found on 24 transects)

than at Cottonwood Ranch (found on 1 transect); at Jeffrey Island it was most common in the western half of the property and was primarily associated with the channel that runs along the southern border of the property (Figure 1). Vegetative cover on exposed sand beach/bars averaged 58 percent at Jeffrey Island (transect average ranged from 37 to 78 percent) and averaged 78 percent at Cottonwood Ranch. Plant species found in these areas are adapted to the dry, sandy soils, and are often weedy pioneer species. Common species found in this cover type included western sagewort (*Artemesia campestris),* common sunflower (*Helianthus annus*), yellow sweetclover (*Melilotus officinalis*), common ragweed (*Ambrosia artemisiifolia*), and grasses such as downy brome (*Bromus tectorum*) and sand dropseed (*Sporobolus cryptandrus*). Occasional depressions or low spots in this cover type with standing water or groundwater near the soil surface supported emergent wetland species such as various sedges (*Carex* spp.), three-square bulrush (*Scirpus americana*), rabbitfoot grass (*Polypogon monspeliensis*), and prairie cordgrass (*Spartina pectinata*).

Emergent Wetland: Emergent wetlands were found on saturated and inundated soils where water depths do not exceed one meter. At Jeffrey Island and Cottonwood Ranch, emergent wetlands were found in swales, drainages, and along riverbanks, pond margins, and ditches. At Cottonwood Ranch, emergent wetlands were also found in some inactive river channels that cut through the forest. These wetlands are shown as bright-red braided bands parallel to the existing channels on Figure 2. Emergent wetlands occurred on 17 of 35 transects at Jeffrey Island and on 12 of 13 transects at Cottonwood Ranch. Vegetative cover in emergent wetlands averaged 74 percent at Jeffrey Island (transect average ranged from 38 to 100 percent) and averaged 84 percent at Cottonwood Ranch (transect average ranged from 68 to 100 percent). Low vegetative cover (less than 50 percent) was uncommon in emergent wetlands, and appeared to be associated with newly developing wetlands; however, most wetlands were well-developed. Common species found in the emergent wetlands included cattail (*Typha latifolia*), which was often found in dense, monotypic stands, various bulrushes (*Scirpus* spp.) and sedges, reed grasses such as common reed (*Phragmites australis*) and reed canarygrass (*Phalaris arundinaceae*), and northern fog-fruit (*Lippia lanceolata*). Dense patches of sandbar willow (*Salix exigua*) were found at some emergent wetland sites, but most were dominated by herbaceous species.

Forest: Forests occupied river terraces and large and small islands within the floodplain that have sufficient substrate over groundwater to allow root development and sufficient aeration (floodplain forests). They were also found in draws, fields, and drainages outside the floodplain (upland forests). Forests were found along all transects except for two, Transects 25 and 26 at Jeffrey Island. The forests on Jeffrey Island generally graded from dry, upland forest with an open understory at the western end of the property to floodplain forests with a dense understory at the eastern end of the property. Cottonwood Ranch forests were primarily floodplain forests with a dense understory, however the forests graded into upland forest at the northwest and southeast corners of the property. The mean density of all trees (11 species) at Jeffrey Island was 68 per ha (95% CI: 41-94), and the mean density of all shrubs/saplings (20 species) in the understory was 241 per ha (95% CI: 106-375; Table 4-1). The mean density of all trees (11 species) at Cottonwood Ranch was 133 per ha (95%

CI: 85-181), and the mean density of all shrubs/saplings (13 species) in the understory was 1635 per ha (95% CI: 290-2978; Table 4-2).

Cottonwood (*Populus deltoides*) was the most common tree on both properties; the average density at Jeffrey Island was 35 trees per ha and the average density at Cottonwood Ranch was 43 trees per ha. In general, the cottonwoods were more mature at Cottonwood Ranch than at Jeffrey Island, as evidenced by an average diameter of all cottonwoods at Cottonwood Ranch of 46 cm as compared to 36 cm for Jeffrey Island. However, the single largest cottonwood sampled was found at Jeffrey Island with a diameter of 143 cm. Other common species included green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), Eastern red cedar (*Juniperus virginiana*), and white mulberry (*Morus alba*). Boxelder (*Acer negundo*), Russian olive (*Eleagnus angustifolia*), peachleaf willow (*Salix amygdaloides*), hackberry (*Celtis occidentalis*), and slippery elm (*Ulmus rubra*) were also present, but more sporadic in their occurrence. Rough-leaved dogwood (*Cornus drummondii*), a shrub, occasionally reached tree-like proportions with a diameter of greater than 5 cm.

The species composition of the understory included a mix of young trees less than 5 cm diameter (saplings) and shrubs, with slightly more tree species than shrub species. However, the species with the greatest mean density at both properties was a shrub, rough-leaved dogwood. The mean density of rough-leaved dogwood was 64 stems per ha at Jeffrey Island, followed by false indigo (*Amorpha fruticosa*) (52 stems per ha) and prairie wild rose (*Rosa arkansana*) (21 stems per ha). The mean density of rough-leaved dogwood at Cottonwood Ranch was 1,010 stems per ha, followed by American elm at 431 stems per ha and Eastern red cedar at 131 stems per ha. The sapling data indicate a successional trend toward a green ash/American elm community. River-bank grape (*Vitus riparia*) was a common woody vine in the forest understory, along with poison-ivy (*Toxicodendron rydbergii*), a sub-shrub.

The average percent cover of the herbaceous understory in the forests at Jeffrey Island was 71 percent (transect average ranged from 63 to 84 percent), the average percent cover at Cottonwood Ranch was 79 percent (transect average ranged from 67 to 89 percent). Leaf litter and bare ground were most prevalent in those parts of the forest with a dense overstory or dense shrub understory, which limit the amount of light reaching the herbaceous layer. The herbaceous understory in the forests on both properties was fairly diverse, with 115 species recorded at Jeffrey Island and 97 species recorded at Cottonwood Ranch. Grasses such as downy brome, Kentucky bluegrass (*Poa pratensis*), Canada wild rye (*Elymus canadensis*), dichanthelium (*Dichanthelium oligasanthes*), prairie cordgrass, and sand dropseed were the most common herbaceous understory species. Other common species include common ragweed, black medick (*Medicago lupulina*), Virginia creeper (*Parthenocissus quinquefolia*), white avens (*Geum candensis*), and seedlings of rough-leaved dogwood.

In general, the forests on the properties showed no sign of disease, of infestation, or significant decline, with the exception of a small area of open forest at the southern end Transects 17 through 19 on Jeffrey Island where most of the trees (primarily green ash, cottonwood, and mulberry) were dead or dying; the cause of this decline was not apparent (Figure 1). Cattle grazing was evident in the forests at the eastern end of Jeffrey Island and throughout most forests on Cottonwood Ranch. Game trails were common throughout all forests. The forest at the northern end of Transects 27 through 30 on Jeffrey Island had been previously disturbed from selective cutting with occasional slash/debris piles. The forest at the northern end of Transects 24 through 26 on Jeffrey Island were being cut at

the time of the survey, and therefore were not sampled (Figure 1).

Grassland: Grasslands occurred both on drier, elevated soils that are not subirrigated and on subirrigated soils within the floodplain. Grasslands were found along all transects except for three, Transects 34 and 35 at Jeffrey Island and Transect 36 at Cottonwood Ranch. Species composition varied by subtle changes in the grassland, such as topography and soils. For example, slight depressions tended to be dominated by prairie cordgrass and other mesic species as compared to the surrounding area. Likewise, the species composition tended to shift to a dominance of sand dropseed, Canada wild rye, or little barley (*Hordeum pusillum*) in areas with sandy soils. Like the herbaceous forest understory, the species diversity on grasslands was relatively high; 86 species were recorded on the Jeffrey Island grasslands and 79 species on the Cottonwood Ranch grasslands. Vegetative cover was high on the grasslands, averaging 95 percent at Jeffrey Island (transect average ranged from 73 to 100 percent) and averaging 93 percent at Cottonwood Ranch (transect average ranged from 77 to 100 percent). This cover type was dominated by a mix of native and non-native grasses and forbs. Common native grasses included windmill grass (*Chloris verticillata*), switchgrass (*Panicum virgatum*), prairie cordgrass, sand dropseed, little barley, foxtail barley (*Hordeum jubatum*), and Kentucky bluegrass (this species is considered both native and introduced); common non-native grasses included downy brome, quackgrass (*Agropyron repens*), tall wheatgrass (*Agropyron elongatum*), and green foxtail (*Setaria viridis*). Common forbs found on the grasslands included common ragweed, hemp (*Cannabis sativa*), black medick, and bull thistle (*Cirsium vulgare*).

Most of the grasslands on both properties were or had been subject to cattle grazing in recent years. At Jeffrey Island, cattle grazing was confined to the eastern-most end of the property at the time of sampling in 2001. Jeffrey Island grasslands are managed using both rotation grazing and burning to maintain the grassland and avoid encroachment of non-desirable vegetation (Peyton, pers comm. 2001). Other management practices include aerial spraying to control thistles. Cattle grazing was evident on most of the grasslands on Cottonwood Ranch, except for some of the grasslands along Transects 37, 38, 43, and 44 at Cottonwood Ranch, which were abandoned cropland.

LITERATURE CITED

Cochran, W. G. 1977. Sampling Techniques, third edition. John Wiley and Sons, New York, NY.

Evans, R.A. and R.M. Love. 1957. The step-point method of sampling – a practical tool in range research. Journal of Range Management. 10:208-212.

Great Plains Flora Association. 1986. Flora of the Great Plains. University of Kansas Press, Lawrence, KS. 1402pp.

Knight, D.H. 1994. Methods for sampling vegetation. University of Wyoming, Department of Botany, Laramie.

Laycock, W.A., and C.L. Batcheler. 1973. Comparison of Distance-Measurement Techniques for Sampling Tussock Grassland Species in New Zealand. Journal of Range Management 28(3). P 235 – 239.

Ownesby, C.E. 1973. Modified step-point system for botanical composition and basal cover estimates. Journal of Range Management. 26:302-303.

The Nature Conservancy (TNC) and Environmental Research Systems Institute (ERSI). 1994. NBS/NPS Vegetation Mapping Program: Standardized National Vegetation Classification System. Arlington, VA.

U.S. Department of the Interior (USDI) Bureau of Reclamation. 2000. Central Platte River 1998 Land Cover/Use Mapping Project Nebraska. Prepared by the Remote Sensing and Geographic Information Group (RSGIG) of the Bureau of Reclamation's Technical Service Center as Technical Memorandum No. 8260-00-08. Prepared for the Platte River EIS Team. October 20.