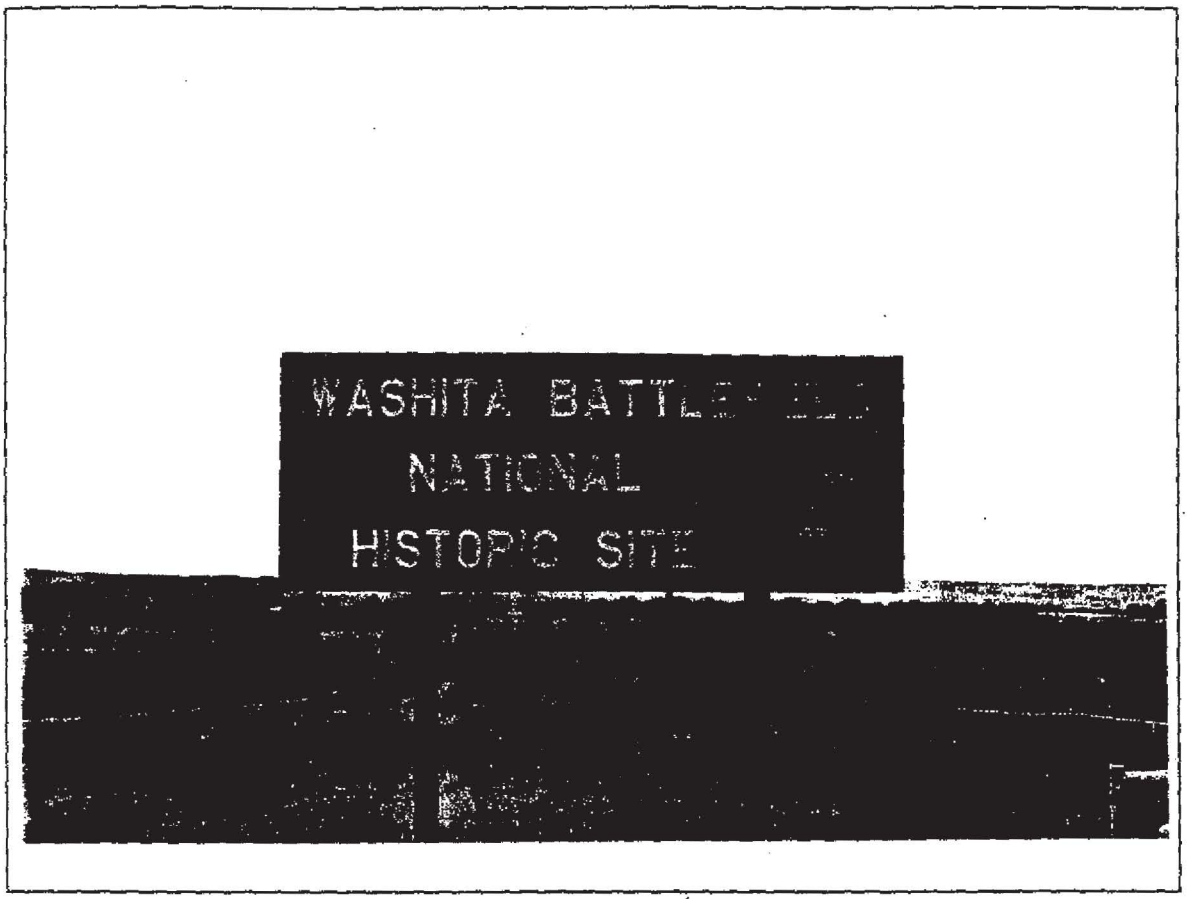
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Washita Battlefield National Historic Site

Vegetation Analysis



August 1998

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Washita Battlefield National Historic Site

Vegetation Analysis

Introduction

The law establishing Washita Battlefield National Historic Site was enacted on November 12, 1996. The park commemorates the dawn attack of the 7th U.S. Cavalry under Lt. Col. George A. Custer on the Southern Cheyenne village of Peace Chief Black Kettle. The site is comprised of approximately 326 acres - the core of the battlefield. This area includes the site of Black Kettle's village, Custer's command post, and troop and Indian positions.

Overview

The emphasis of this project was on performing a vegetation analysis of the park, with recommendations for vegetation management and restoration of the historic scene. During the field work, ancillary observations were recorded on the park's fauna, and water quality data was recorded as well. The field survey was conducted June 22 through July 10, 1998. Ten percent of the park - 32 transects - were set, tagged, photographed, and GPS surveyed. The results are listed by species in Tables 1-10 by common name, percent coverage, or basal area. Refer to Appendix 2 Table 1 for scientific names and exotic species information. The GPS coordinates are listed for future reference (Table 1 of the GIS Addendum). Washita Battlefield NHS Vegetation Transect Map presents the location of each transect (GIS Addendum). All field notes and data sheets are held at the Washita Battlefield NHS in Cheyenne, Oklahoma.

Field conditions: Daytime temperatures ranged as high as 116° F. Weather conditions were in a drought pattern. A burn ban was in effect for Western Oklahoma. Early spring rains were adequate for annual seed germination, but the lack of summer moisture hampered plant development. Most of the plants listed appear to be drought resistant. If the survey had been conducted for a longer period of time, other plant species may have been present or more dominant. The species photolog was not completed, as was previously proposed, due to drought conditions. Many plants were in poor condition and not representative of the species.

The analysis will be presented in nine sections. Please refer to the map section, Figure 3. The field methods are included in this report for the benefit of future research and vegetation surveys. Recommendations are presented following the survey results.

Methods and Materials

As Washita BNHS is a small park of about 328 acres (132 hectares), every predetermined polygon of putative vegetation type was visited. Twelve transacts were taken of the riparian corridor. Each vegetation polygon was classified to the finest floristic level (community element) possible. The classification was based on observations of floristic composition, and scope features, physiognomy, and profile of a plant community. The frequency of combinations of species was used as a criterion to recognize communities. Landscape features were noted because landscape features control environmental factors and constrain the pattern of species combinations.

Pin flags were set around the perimeter of some polygons, for the delineation of the polygon boundaries by GPS technology. Ten percent of each upland polygon was surveyed with a 30 meter transect line and quarter meter open frame. The selection of transects was based upon the NBS/NPS Vegetation Mapping protocol. The location of the transects were determined by visual observations of average species consistency. The transect line was staked and whenever possible, set at a true north and south direction. A monument of rebar marks the south end of the transect for future management purposes. A metal tag with a stamped number, was attached to the rebar monument and recorded in the survey log as well as with the GPS coordinate data.

The transect line was photographed for the general physiognomic appearance of the location. The vegetation within the frame was logged as percent cover and species composition every 10 meters. National Park Service Vegetation Mapping Program Field Methods for Vegetation Mapping (December 1994) forms were completed for each transect.

Field Form 12.1, Identifier/Locator Plot Survey Form
Information includes: polygon code, plot code, provisional community names, state, park name, park site name, quad name, quad code, latitude, longitude, GPS error, survey date, surveyors, direction to plot, plot length, plot width, photo log number, plot permanent, plot representativeness.

Vegetation Description Form
Information includes: plant species, percent cover, strata, Cowardin System classification, Physiognomic class, Diameter at breast height (Basal Area) of tree species above 10 cm diameter.

Environmental Description Form 12-2
Information includes: elevation, slope, aspect, topographic position, landform, surface geology, hydrologic regime, soil taxon/description, soil texture, and soil drainage.

Identification of plants were made in the field or collected for later identification. Approximately 75 plant specimens were pressed and entered into the Washita Battlefield NHS Herbarium.

Only leaves or branches were taken for tree and shrub specimens. No federally listed plant was discovered in the park. Due to the time restraint, not every plant species that is living in the park could be collected. Specimens were accessioned and cataloged according to NPS museum standards.

Riparian Transect Survey Method

The transect lines were set perpendicular to the Washita River approximately every 1050 feet. Rebar with number tags mark each transect. Transect length was determined by the change in vegetation communities or agricultural impacts. Transect lines end at the river bank. The following information was collected at each site: length of transect, soil type, bank stability, substrate, river width, animal or bird activity.

All photographs taken at each transect are filed with the field notes at Washita Battlefield NHS, Cheyenne, Oklahoma.

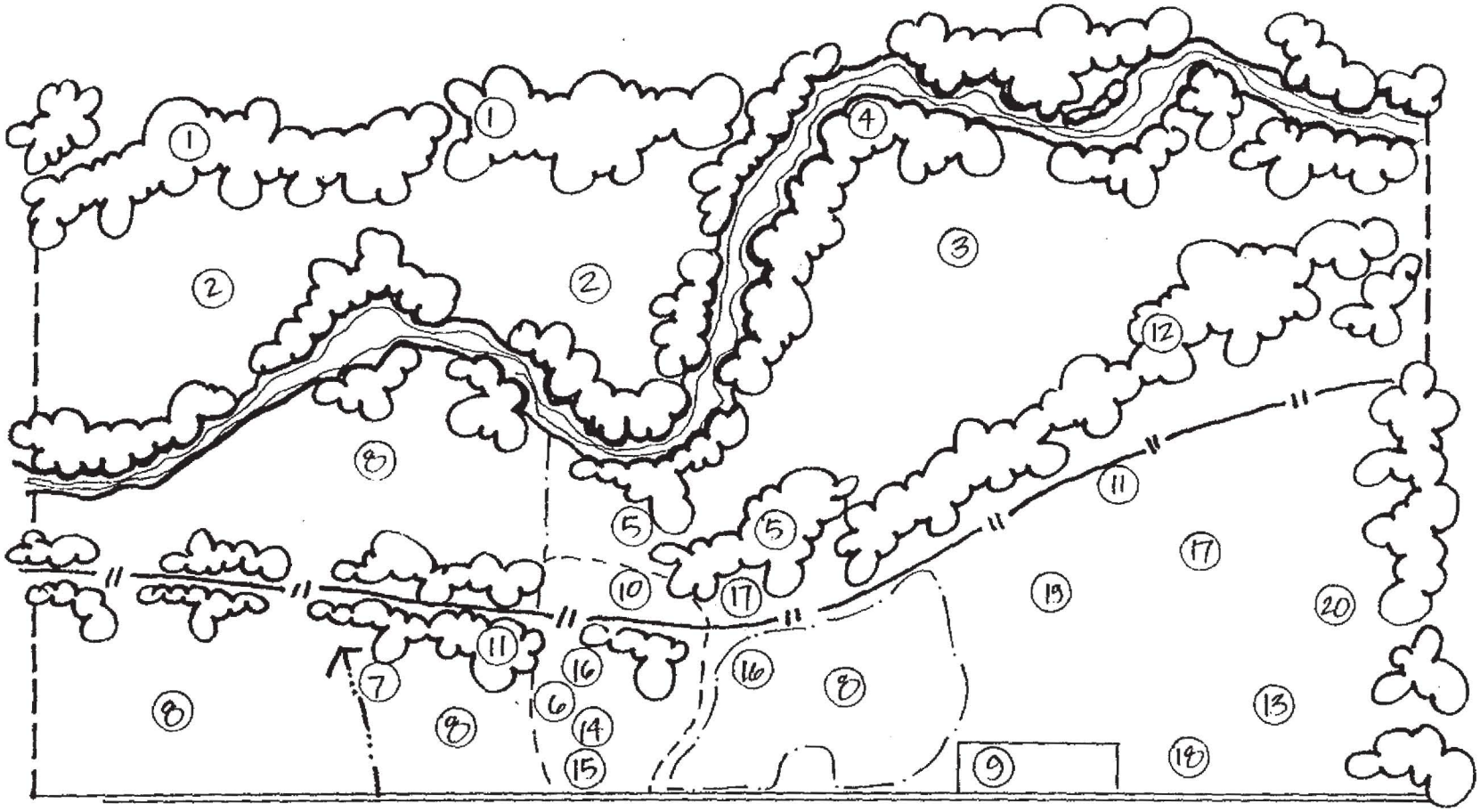
GPS Coordinate Data

The vegetative survey (ground truthing) of the park was completed before the GPS survey was performed. GPS coordinates were logged for the rebar monument location, the Washita River, park boundaries, roads, and railroad (see GPS Addendum).

MAP SECTION

The following 4 maps, produced by Kelly Donahue (IMSF) illustrate the following:

1. **Location Map** (Figure 1) presents the Washita Battlefield National Historic Site with regards to its location in Western Oklahoma.
2. **Map of Preliminary Vegetation Polygons** (Figure 2) was contributed to Washita Battlefield NHS as an overview of what vegetation was present in 1997 and what could be expected in 20 different locations. The Vegetation Analysis was based on this information and is referred to in the result section of the report. The key to this map is helpful in understanding some of the agricultural history of the land before it became a National Park.
3. **Map of Final Vegetation Polygons** (Figure 3) is the result of the Vegetative Analysis. The report is referenced according to the 9 sections.
4. **Soil Map** (Figure 4), this map is based on information derived from the Natural Resources Conservation Services. The soil taxon is noted in the discussion of each section.



LEGEND:

Railroad —— || —— || ——

NPS Property Line ———— ————

Slough ——··· ——··· →

Cultivation Line —— —·— ——·

Farmstead Boundary - - - - - - - - -

Overlook

Canopy Vegetation

PRELIMINARY VEGETATION POLYGONS

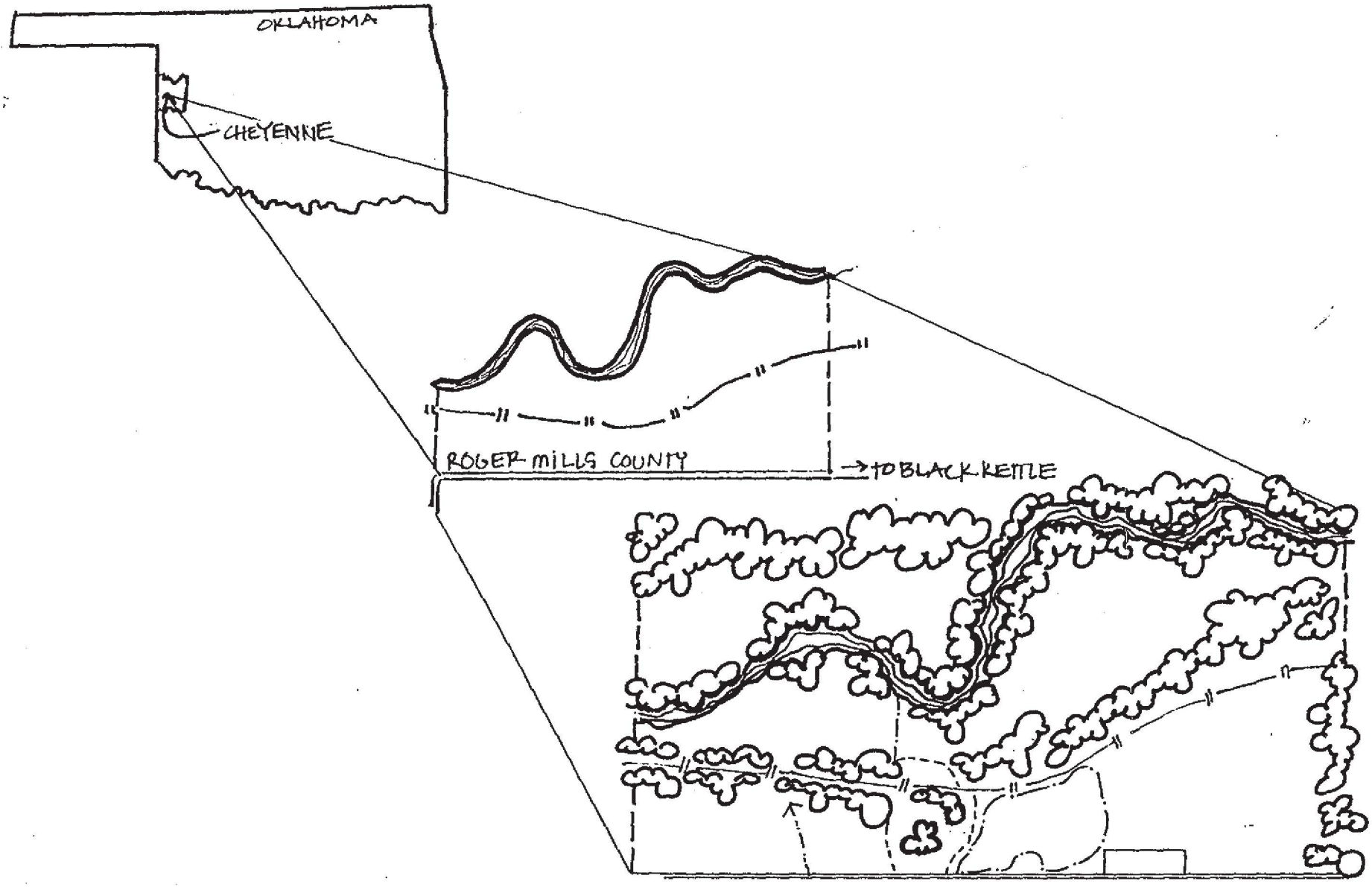
* COURTESY OF BLACK KETTLE NATIONAL GRASSLANDS

FIGURE 1

Washita Battlefield National Historic Site

north

scale 1" = 660'



LOCATION

Washita Battlefield National Historic Site

north

scale 1" = 660'

Preliminary Vegetation Map, Existing Conditions - Key
Contributed by Jill Crowley. Prepared from interviews with Betty Wesner (former property owner) and Reggie Blackwell (District Ranger, Black Kettle National Grasslands).

1 - Low-medium shrubs, and some trees, along south-facing slope. Elm, maybe some shinnery oak.

2 - Area cleared in 1970s for pasture. Prior to clearing, cottonwoods and tamarisk were present here, including some large trees. After clearing, the area was planted to hay grazer, then wheat, then Bermuda grass.

3 - Area cleared for pasture, planted recently in plains bluestem (*Bothriochloa ischaemum*, also known as Old World Bluestem. This grass variety is a hardy exotic species. In the 1970s, this area was divided into three fields; it was planted to Bermuda grass, then wheat, then plains bluestem. As with #2, prior to clearing, cottonwoods covered most of this floodplain area. Aerials from the 1970s (and earlier) show the two drainages which divided the area into three, and cottonwood growing along these drainages.

4 - Riparian vegetation along river, typical of region. Riparian zone used to be much wider, prior to clearing for pasture/fields. Plants in riparian zone include cottonwood (some quite large), willow, elm, salt cedar, switch grass, and plum thickets, some visible beaver activity.

5 - Patch of cheat grass; may be present elsewhere

6 - Cluster of soapberry trees along swale

7 - Natural drainage; until 1920s was a grove of trees. Trees have been cleared, and now it is a mix of Bermuda grass and various shrubs.

8 - Wheat fields, weeds (e.g. bindweed) present in some areas. Areas south of the north-facing slope / railroad berm/ ditch have been terraced. Wheat field area now in floodplain, on west end of core area, was planted in alfalfa prior to 1971.

9 - Mix of native and introduced grasses within Monument/Overlook area. Mowed routinely

10 - Old vegetable garden (fenced rectangular area). Now overgrown in a mixture of weeds.

11 - Shelterbelt (row of elm trees) planted along railroad grade, especially on north side.

12- Trees (mostly willow, some cottonwood) growing along slough

13 - Single Lombardy poplar growing close to residence
13, 15 - Mix of plants around Wesner residence; e,g, mowed Bermuda and buffalo grass, mulberry tree.

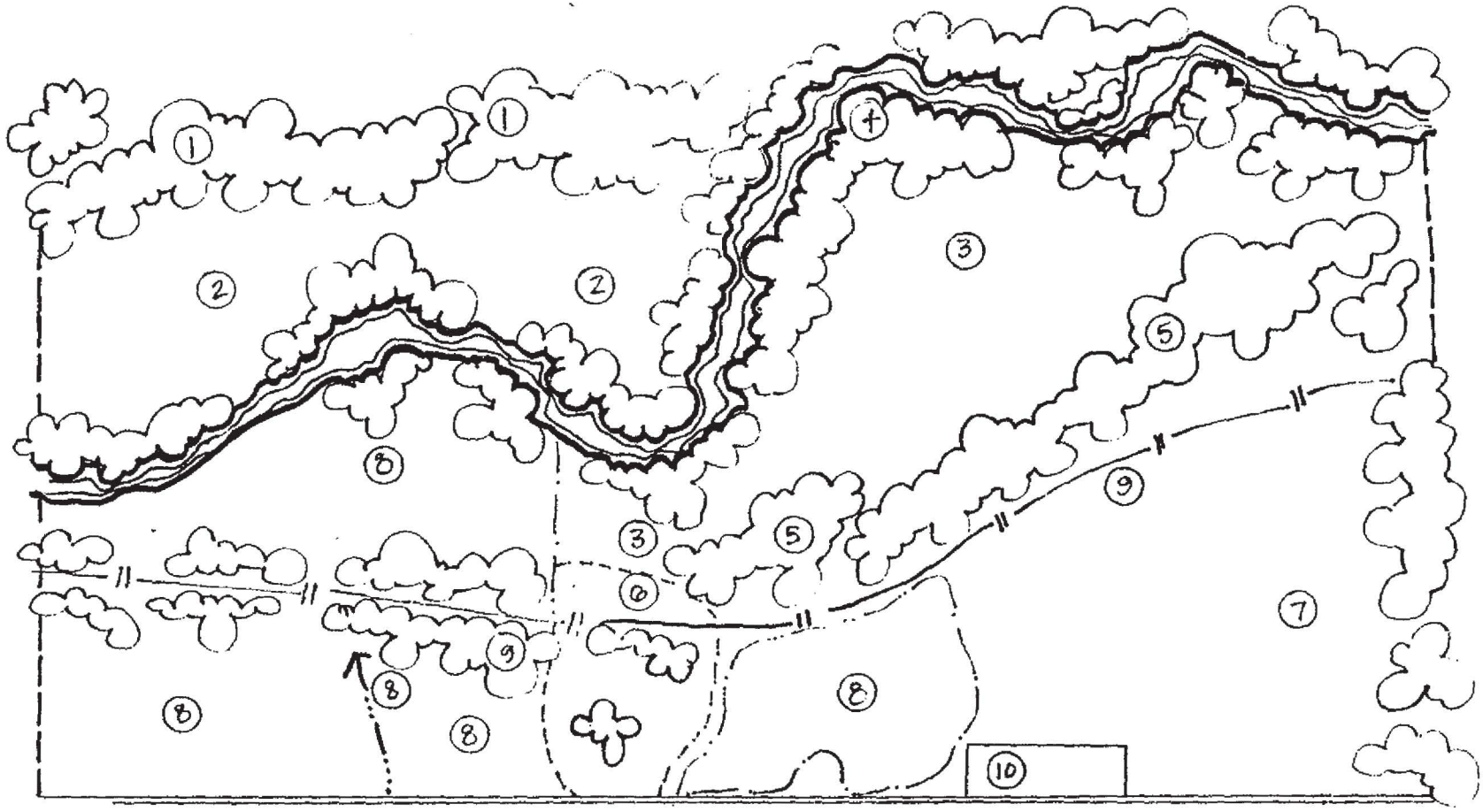
16 - Area of trees between back yard and railroad grade/old vegetable garden

17 - Mixture of weeds (e.g. ragweed), elms, sun flowers, and other plants along railroad grade and around disturbed areas around the farm structures, and tall weeds around site of old structures in southeastern section of core area.

18 - Mostly grasses, primarily little bluestem

19 - Mostly native grasses. This area has not been disturbed (ploughed/terraced/crop planted) during Wesner ownership.

20 - Grasses, primarily native (no intrusive exotics noticed during site visit). Mix of little bluestem, big bluestem, three-ways, some Bermuda grass, some sage and yucca. Area was used to grow wheat in early-mid 1960s, and older variety of plains bluestem was planted here in 1971-2.



LEGEND:

Railroad —— // —— // ——
NPS Property Line ————————
Slough —— ··· —— ·· →
Cultivation Line —— · —— · ——
Farmstead Boundary - - - - - - - - -
Overlook
Canopy Vegetation

FINAL VEGETATION POLYGONS

Washita Battlefield National Historic Site

north

scale 1" = 660'

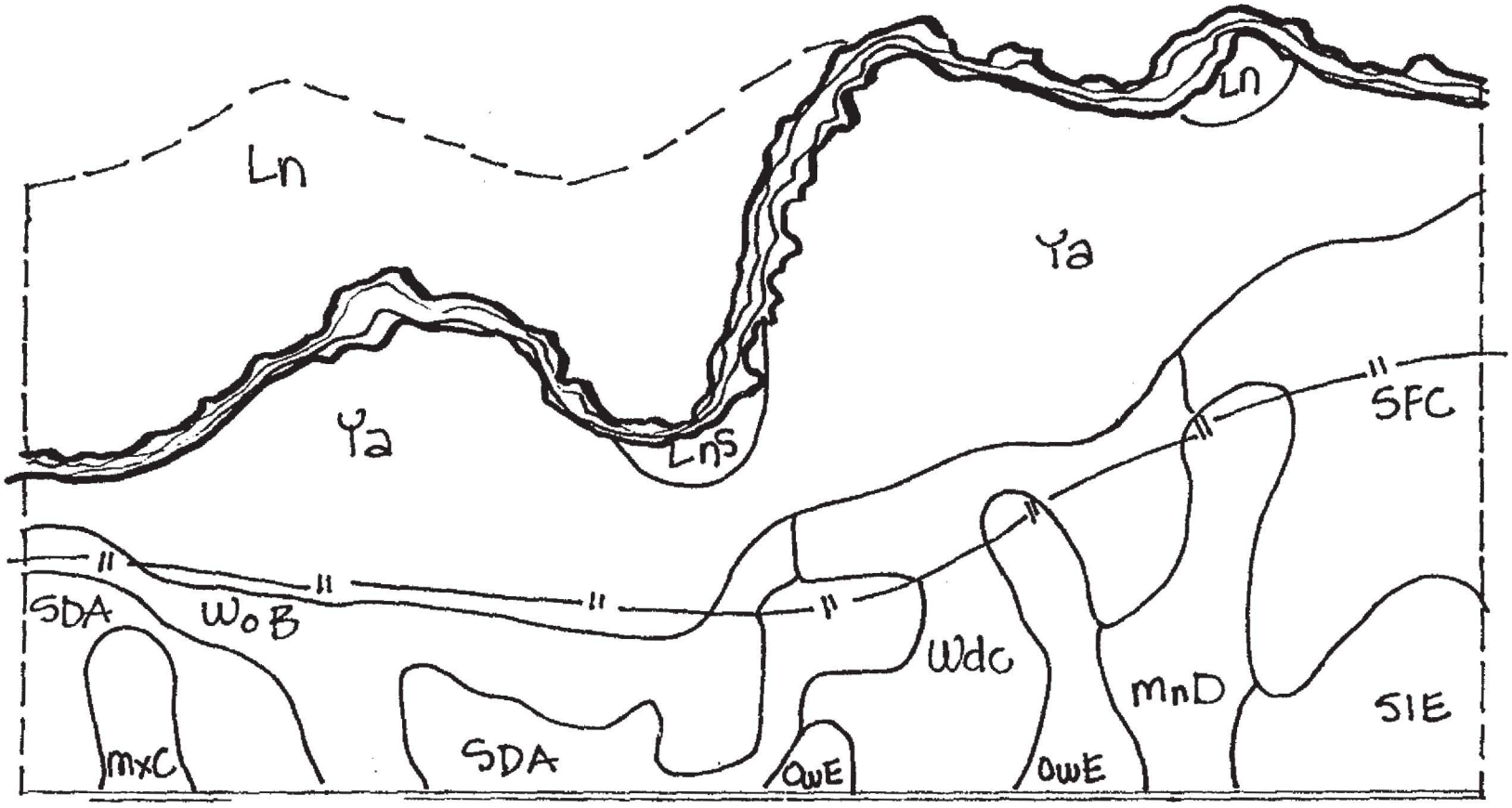
Figure 3 Final Polygon Map Key.

Sections

1 North Bench
2 North Flood Plain
3 Meadow
4 River Riparian
5 South Riparian
6 Farmstead
7 Upland Range
8 Wheat Fields
9 Rail Road Track
10 Park Overlook

Figure 4 Key.

Map Symbol	**Name Soil Taxa**	**Soil Type**	**Slope Percent**
SpA	Spur and Port	silt loam	0 - 1
WoB	Woodward-Quinian	fine sandy loam	5 - 8
MxC	Miles-Springer complex	fine sandy loam loamy fine sand, hummocky	3 - 5
WdC	Woodward	fine sandy loam	3 - 5
MnD	Miles--Nobscot complex	fine sandy loam fine sand	5 - 8
SfE	Springer	loamy fine sand	hilly
SfC	Springer	loamy fine sand, hummocky	3 - 5
Ya	Yahola	fine sandy loam	< 1
PfE	Pratt	loamy fine sand	hilly
Ln	Lincoln	sandy, recent alluvium	0



SOIL MAP

Washita Battlefield National Historic Site north scale 1" = 660'

WASHITA BATTLEFIELD VEGETATION ANALYSIS RESULTS

SECTION I North Bench

Polygon 1

Land Area: 37.8 acres (15.3 hectares). Elevation: 1940 to 1960 feet M.S.L. This bench land is slightly rolling and has breaks and a southern aspect. The North Bench extends beyond the northern park boundary. The soil type is fine sandy loam to silt loam. The soil taxon is Norwood according to Natural Resources Conservation Service (NRCS). The Norwood soil has a high water table, which is supporting Chickasaw plum, American wild olive thickets, hackberry, soapberry, American elm, and Kentucky coffee bean trees. The shrub and upper story canopy is 14.68% of the total North Bench land area. Dominant grass species are little bluestem, grama, and switch grass. This section of the park has never been plowed, yet it does not represent a normal sandy prairie plant community. This area is an ecotone, (transitional area) between the Washita floodplain and the prairie uplands. This ecotone has been established for a long period, which results in a high level of biodiversity among the vegetation (Risser 1995). For example, sand sage, yucca and cactus grow within the shadow of Kentucky coffee bean and hackberry trees.

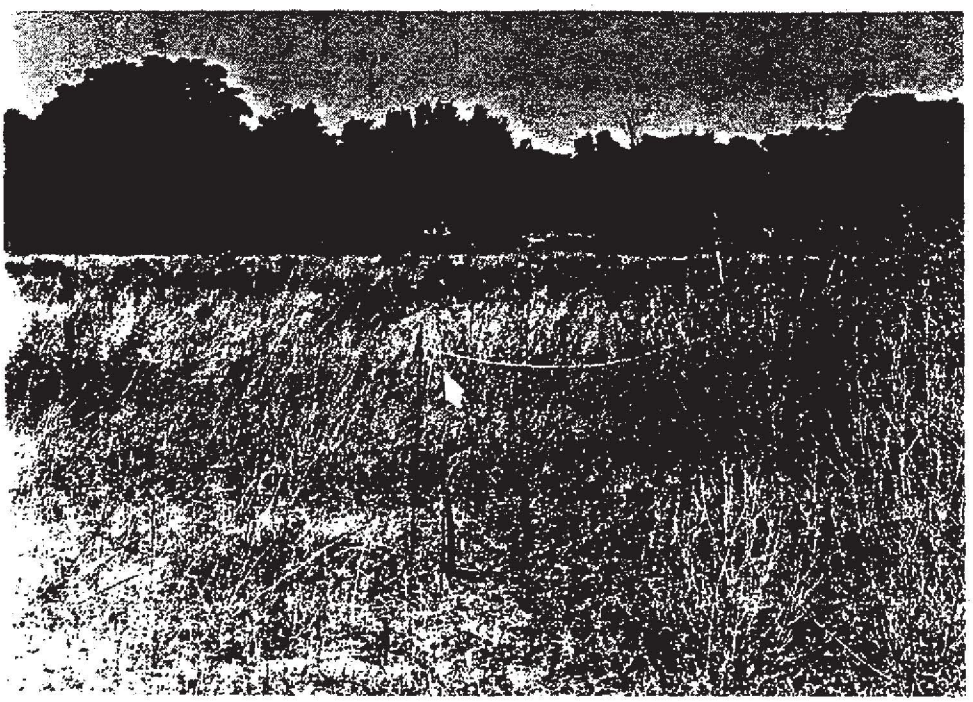
Animals observed in the North Bench Area: turkey vultures, rabbit, gopher, deer, and bob-white quail.

Plants outside of the transect: Kentucky coffee bean, Eastern cottonwood, button bush, cactus, and yucca.

Plants on the transect line are listed in Table 1. Photograph 1 is representative of the North Bench.

Table 1. Plant Species of the North Bench.

Herbaceous Species	Percent Ground Cover	Tree and Shrub Species	Basal Area Square Meters
Sideoats Grama	10	American Wild Olive	79.6
Sand Sage	7.19	American Elm	56.59
Little Bluestem	6.25	Hackberry	46.15
Switch Grass	5.94	Soapberry	32.15
Camphor Weed	5.69	Chickasaw Plum	3
Downy Brome	3.13		
Blue Grama	1.56		
Hairy Grama	1.25		
Silver Leaf Nightshade	1.25		
Red Morning Glory	1.25		
Horse Weed	0.81		
Tall Witch Grass	063		
Sand Bluestem	0.63		
Kentucky Coffee Bean Sapling	0.63		
Drop Seed	0.63		
Western Rag Weed	0.25		
Hackberry Sapling	0.13		
Total Herbaceous Cover	59.06%	Total Basal Area	217.49 m^2



Photograph 1. The North Bench as viewed from the North Floodplain. Trees: American wild olive, American elm, soapberry, Herbaceous cover: yellow clover, bundle flower, mixed grasses.

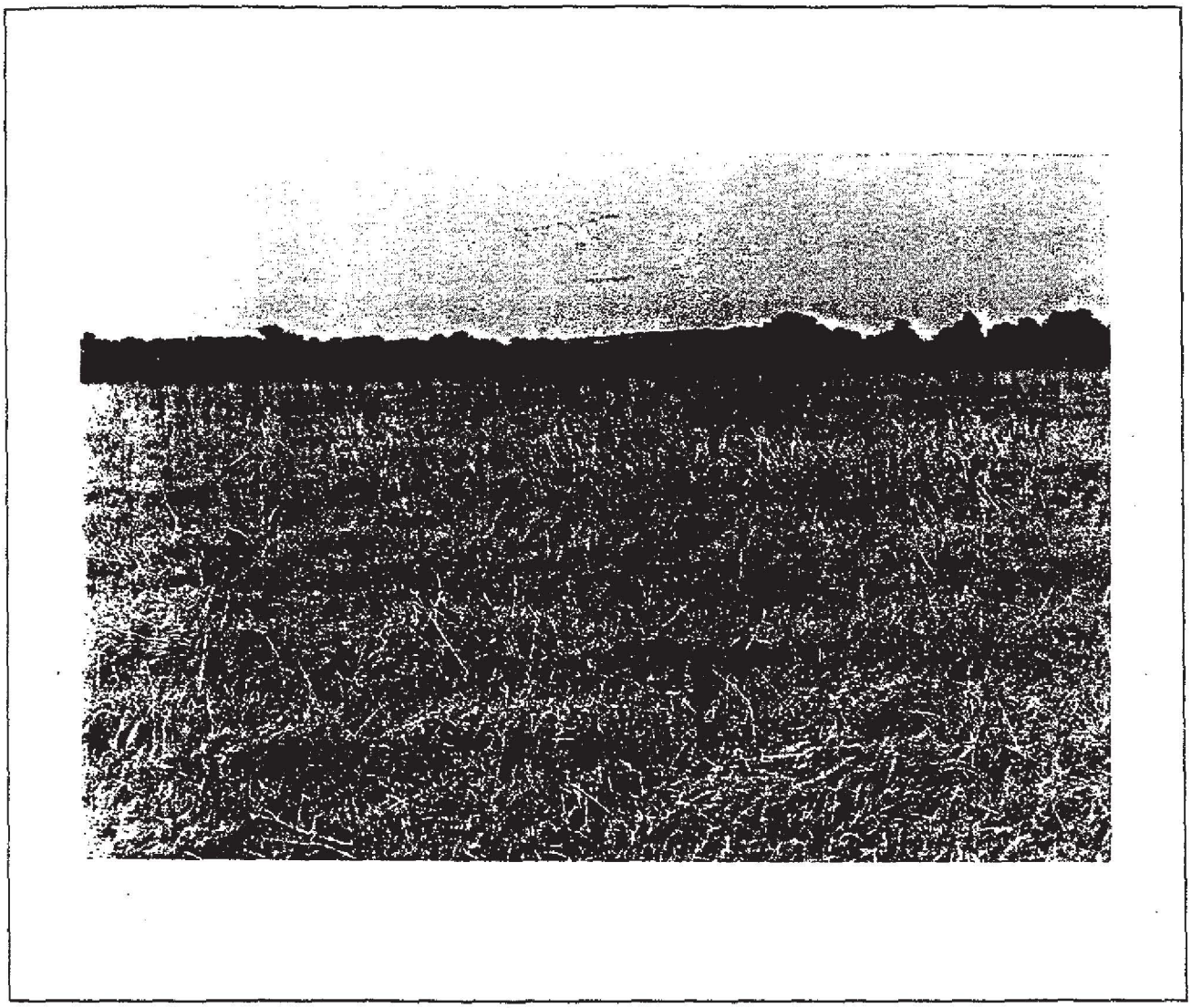
SECTION II North Floodplain

Polygon 2

Land Area: 45.5 acres (18.4 hectares). Elevation: 1935 to 1940 ft. M.S.L. This flood plain is nearly flat, with evidence of old river channels. The soil type is calcareous and sandy to sandy with clay. The soil taxa are Lincoln and Yahola-Port (NRCS). A slim riparian belt approximately 30 ft (10 meters) wide follows the North Bench line along the north/northwest edge of the North Flood Plain and the tree species in the belt are black willow, hackberry, and tamarisk. A few large Eastern cottonwoods are also present. The riparian belt may be wetted by a high water table or surface water contributed by rainfall on the North Bench. Dominant plant species of polygon 2 are yellow sweet clover, bermuda, downy brome grass, bundle flower, and camphor weed. Yellow sweet clover is thought to be a pioneer species which helps to build soil by fixing nitrogen. Bundle flower is also a nitrogen fixer and provides seed for nonmigrating birds (personal interview with Wes Phillips 1998)

Table 3. Plants of the Meadow.

Herbaceous Species	Percent Ground Cover	Herbaceous Species	Percent Ground Cover
Plains Bluestem	80	Kochia	1
Giant Rag weed	0.5	Pale Dock	0.5
Sunflower	0.5	**Total Herbaceous Cover**	**82.5%**



Photograph 2. Meadow, the distant trees are part of the South Riparian zone.

SECTION IV Washita River Riparian

Polygon 4

Land area: 11.7 acres (4.73 hectares). Elevation: 1935 ft. M.S.L. The soil is an alluvial mixture of deep sand with clay and fine sandy loam. The soil taxa are Lincoln and Yahola (NRCS). The

Chickasaw plum thickets are extending from the River Riparian corridor out into the North Floodplain. Approximately 10 acres of the 45.5 acres are Chickasaw plum thickets. It was also noted that young black willow thickets are developing in low areas along the southern border to the flood plain.

This area had once hosted large cottonwoods and tamarisk before it was cleared for pastureland in the 1970s.

Animals observed in the North Floodplain: armadillo, raccoon, and bob-white quail.

Plants observed on the transect line are listed in Table 2.

Table 2. Plant Species of the North Floodplain

Herbaceous Species	Percent Ground Cover	Herbaceous Species	Percent Ground Cover
Yellow Sweet Clover	16.56	Western Ragweed	1
Camphor Weed	8.75	Sandbur	0.94
Downy Brome	8.44	Curlycup Gum Weed	0.63
Bermuda Grass	5.94	Hairy Grama	0.63
Bundle Flower	5.94	Milkweed, 3 species	0.31
Sand Bluestem	2.5	Mustard, 2 species	0.31
Drop Seed	1.88	Horse Weed	0.31
Hedge Nettle	1.56	**Total Herbaceous Cover**	**54.01%**

SECTION III Meadow

Polygon 3 and 5

Land Area: 61.7 acres (24.97 hectares). Elevation: 1935 to 1940 ft. M.S.L. The Meadow is loamy silt bottomland. The soil taxon is Spur & Port (NRCS). The dominant plant species is plains blue Grass (*Bothriochloa ischaemum*), which is an exotic species. Pale dock, bermuda grass, sunflower, and ragweed are present in low alkaline spots. The plains bluestem is well enough established to block the encroachment of opportunistic weed species. At the present time, the dense cover is also curtailing wind erosion.

Table 3. gives the approximate herbaceous plant density for the Meadow, Section 3.

Animals observed in the River Riparian: deer, turkey, beaver, raccoon, great blue heron, duck, and interior least tern.

Plant species were noted at each meter interval along the transect lines. Table 4 is the complete list of 12 transects with an overall percent of both the trees and herbaceous cover.

average width of the River Riparian is 242 ft. (74 Meters). The dominant tree species is Tamarisk. However, the greatest canopy cover is American elm. Table 5 illustrates the percent of both shrubs and trees in the corridor. The dominant grasses are plains bluestem, Bermuda grass and downy brome. Horse weed and hedge nettle are the most dominant broad leaf plants. Cottonwood and black willow are more prevalent on the north side of the river. Tamarisk and American elm form a thick canopy in selected places on the south side of the Washita River.

The riverbanks were rated according to erosion and collapse. In vegetated reaches, bank stability is 58%, with 42% of the banks susceptible to erosion. Along nonvegetated reaches of the river only 16% of the banks are unstable. Nonvegetated banks are generally less steep. Average height of the bank to the water surface is 3 feet. There are several places where the bank is 7 feet high. There are numerous exposed sandbars which could provide habitat for the interior least tern (*Sterna antillarum*), an endangered species. The average width of the river from bank to bank is 21.54 feet (6.57 meters). The portion of the river within the park has been designated, "Primary Contact" by the State of Oklahoma. Water Quality data was collected on July 1, 1998, using a Hach Kit Model FF-1A. Aquatic macroinvertabrates were not collected or counted. Visual observation of aquatic species is listed in Table 4. along with the stream data.

Table 4. Water Quality

Stream Side Data	**5:30 P.M.**	**7:30 A.M.**	**Observations of Aquatic Species**
Flow (cubic feet per second)	9.92 CFS		Coleoptera
Water Depth	5.4 Inches	5.5 Inches	Diptera
Air Temperature	36.7 C	29.4 C	Odonata
Water Temperature	35 C	25.6 C	Fresh Water Clams
Alkalinity	239.4 mg/l		Channel Catfish fry
Hardness	342 mg/l		Smallmouth Bass
Nitrate	23.1 mg/l		Toad
Dissolved Oxygen	8 mg/l	5 mg/l	Frog
pH	8	8	Crayfish

Tree and sub-canopy cover for the River Riparian is approximately 32 percent.

Table 5. Plants of the River Riparian.

Herbaceous Species	Percent Ground Cover	Herbaceous Species	Percent Ground Cover
Downy Brome	10.97	Pale Dock	0.531
Plains Bluestem	7.473	Bee Balm	0.304
Bermuda Grass	6.103	Iron Flower	0.257
Horse Weed	4.459	Western Wheat Grass	0.185
Hedge Nettle	3.05	Sandbur	0.167
Switch Grass	2.211	Smilax	0.165
Rush	1.578	Marshelder	0.135
Canadian Wildrye	1.57	7 Leaf Creeper	0.086
American Elm Sapling	1.093	Cocklebur	0.08
Hackberry Sapling	1.008	Poison Ivy	0.077
Camphor Weed	0.990	Mustang Grape	0.077
W. Rag Weed	0.793	Woolly Plantain	0.058
Soapberry Sapling	0.672	Drop Seed	0.049
Johnson Grass	0.641	Bundle Flower	0.049
Indian Grass	0.574	Milkweed	0.046
Sideoats Grama	0.576	Curlycup Gum Weed	0.024
White Sagewort	0.554	Buffalo Gourd	0.013
Sunflower	0.533	**Total Herbaceous Cover**	**47.13%**
Tree and Shrub Species	**Basal Area Sq. m**	**Tree and Shrub Species**	**Basal Area Sq. m**
American Elm	313.98	Willow Baccharis	7.3
Tamarisk	237.85	American Wild Olive	2
Chickasaw Plum	185.8	Soapberry	2
Black Willow	85.8	Wild Licorice	1.71
Hackberry	45.5		
Eastern Cottonwood	29.36	Total Basal Area	911.3 m^2

Photograph 3 is a representative picture of the river, banks and vegetation.



Photograph 3. Washita River Riparian.

SECTION V South Riparian Polygon 12 and 17

Land Area: 23 acres (9.31 hectares). Elevation 1940 - 1960 ft. M.S.L. Soil type is loamy fine sand, hummocky. The soil taxon is Springer (NRCS). The South Riparian is protected by a bench on the south and the Meadow on the north. This area is believed to be an old river channel. The South Riparian is wetted by a high water table, plus surface water contributed by rains from the Upland Range, and a slough west of the Farmstead. The Eastern cottonwoods are 70 feet tall while some black willows have reached 50 feet. This area has higher plant diversity than the River Riparian. There is 16 different shrub and tree species present. Polygon 5 also includes the bench land north of the former Panhandle Short Line Railroad. The grass is 20 percent more dense than the grass 20 meters south of the rail- road. This thick stand of grass has the potential to filter silt from surface runoff water caused from intensive rainfall on the Upland

Range. The railroad (Figure 1, polygon 11) banks may also serve as a natural berm protecting the bench from heavy sheet erosion and gully building.

Plant species outside the transects: red mulberry, Jimson weed, Midwest indigo, polkweed, wire grass, iron weed, flame-leaf sumac, and American wild olive.

Animals observed in the South Riparian: two female Turkeys with 15 chicks, raccoons, gopher, skunk, white-tailed deer, owls, bats, voles, and glossy snakes.

Trees and shrubs produce a diverse woodland (Photograph 4.) that will be enjoyed by park visitors in all seasons.



Photograph 4. Dense Deciduous Woodland of the South Riparian.

Table 6. Plants of the South Riparian.

Herbaceous Species	Percent Ground Cover	Tree and Shrub Species	Basal Area Square Meters
Plains Blue Grass	14.06	American Elm	231.92
Downy Brome	10.63	Hackberry	142.9
Canadian Wildrye	6.88	Cottonwood	76.5
Bermuda Grass	5.00	Black Willow	67.5
Little Bluestem	4.06	Soapberry	41.3
Sideoats Grama	1.25	Tamarisk	12.56
Drop Seed	1.25	Woolly Bucket	4
Western Wheat Grass	0.94	Button Bush	3.14
Buffalo Gourd	0.94	Chickasaw Plum	3.1
Western Rag Weed	0.13	Indigo Bush	3
Horse Weed	0.13		
All Saplings	1.94		
Total Herbaceous Cover	**58.36%**	Total Basal Area	624.42 m^2

SECTION VI Farmstead

Polygon 6, 10, 14, 15, 16
Land area: 6 acres (2.2 hectares). Elevation: 1940 - 1950 ft. M.S.L. Soil is loamy to fine sandy loam with slight slopes. The soil taxa are Woodward and Yahola (NRCS). This area has been impacted by agricultural activities. Tall abundant exotic weed species have taken over the bare ground left when livestock and buildings were removed from the park. The 6 acres are impacted with kochia, Bermuda grass, down brome. Tree species are soapberry and hackberry. This is an area that will take time to restore.

Photograph 5. Is a representation of the weed problem around the Farmstead.



Photograph 5. Herbaceous Cover: Native and exotic weeds in the former garden. The distant yellow field is one of the wheat fields that have been reseeded, Polygon 8D.

The majority of the weed species listed in table 7 are exotic.

Table 7. Plants of the Farmstead

Herbaceous Species	Percent Ground Cover	Herbaceous Species	Percent Ground Cover
Kochia	36.25	Cheat Grass	1.25
Bermuda Grass	16.25	Yellow Sweet Clover	0.75
Downy Brome	11.88	Lambs Quarter	0.75
Giant Ragweed	3	Sandbur	0.25
Curlycup Gum Weed	2.5		
Sunflower	1.75	**Total Herbaceous Cover**	**58.36%**

SECTION VII Upland Range

Polygon 13, 17, 18, 19, 20
Land area: 46.5 acres (18.8 hectares). Elevation 1940 - 2000 ft. M.S.L. Slopes average is 3.23 %. Aspect is north. Soil is loamy fine sand, hummocky to sandy loam. The soil taxa are Woodward, Miles-Nobscot, and Springer (NRCS). Even though there are 3 soil types in the Upland Range, vegetation varies only in percent coverage. The results yield a typical loamy prairie community (per Black Kettle National Grasslands Survey).

The 5 polygons are averaged together; see Table 8.



Photograph 6. Upland Range, a typical loamy prairie plant community, Little Bluestem and Grama Grass with Sand Sage.

Table 8. Plants of the Upland Range

Herbaceous Species	Percent Ground Cover	Herbaceous Species	Percent Ground Cover
Little Bluestem	42.2	Milkweed (Varieties)	0.6
Sideoats Grama	6.7	Purple Aster	0.5
Sand Sage	3.4	Drop Seed	0.4
Downy Brome	3	Mustard (Variety)	0.4
Camphor Weed	2.9	Bee Balm	0.4
Woolly Plantain	2.81	Silver Leaf Nightshade	0.4
Tumble Grass	2.2	Indian Grass	0.35
Purple Threeawn	2.1	Bush Morning Glory	0.3
Golden Aster	2	Yellow Sweet Clover	0.2
Western Ragweed	1.9	Paint Brush	0.2
Yucca	1.6	Sensitive Briar	0.2
Indian Blanket	0.4	Primrose	0.2
Buffalo Gourd	1.4	Texas Croton	0.2
Kochia	1.2	Wine Cup	0.2
Big Top Dalea	1.1	**Total Herbaceous Cover**	**72.7%**

Plant species outside the transect: cacti, American elm, and smooth sumac.

Animals observed on the Upland Range: coyote, white-tailed deer, red-tail hawk, sand turtle, gopher, and rabbit.

SECTION VIII Wheat Fields

Polygon 7 & 8.
Land Area: 67.2 Acres (27.2 hectares). Elevation: 1970 to 1935 ft. M.S.L. The soil types are loamy bottomland, loam, silt loam, and fine sandy loam. Soil taxa are Spur & Post, Woodward, and Yahola (NRCS). The aspect is generally northward with mild slopes and sloughs. The 67.2 acres were wheat fields in 1997. In the spring of 1998, the park managed seed planting and weed mowing operations.

No transects were taken due to the mowing operations. Table 9 is the grass variety and percent of each species planted.

Table 9. Wheat Fields Seed List.

Seed Variety	Percent
Woodland Sand Bluestem	25
Barton Western Wheat	14.4
Cheyenne Indian Grass	14
Blackwell Switch Grass	12.3
Texoca Buffalo Grass	12.3
Cimarron Little Bluestem	10.5
El Reno Sideoats Grama	9.4
Bends Sand Love Grass	2

SECTION IX Panhandle Short Line Railroad

Polygon 11
Land area: 3.6 Acres (1.47 hectares). Elevation: 1940 to 1949 ft M.S.L. Soil type: excavated soil from local fields, cinders and gravel. The area is slowly returning to its natural state. The banks are eroding away and cuts are filling in. Many exotic plant species are established here. The vegetation survey was conducted by laying 10 transects, 6 meters long, perpendicular to the old railroad.

Animals observed on the Panhandle Short Line Railroad: bobcat, and prairie vole.

Plants observed on the railroad are doing remarkably well considering the poor soil condition. Table 10 list the species and an approximate the percent cover of each.

Table 10. Plants of Panhandle Short Line Rail Road

Herbaceous Species	Percent Ground Cover	Herbaceous Species	Percent Ground Cover
Little Bluestem	8	Green Brier	2
Cheat Grass	8	Pale Dock	2
Kochia	5	Sun Flower	2
Giant Ragweed	5	Bermuda Grass	1
Sand Sage	4	Blue Milkwort	1
Canadian Wildrye	3	Bull thistle	1
Johnson Grass	3	Western Ragweed	1
Camphor Weed	3	Silver Leaf Nightshade	1
Horse Weed	3	White Sagewort	1
Wild Morning Glory	3	Smooth Sumac	1
Yellow Sweet Clover	3	Yucca	1
Bundle Flower	3	Mustard (variety)	0.5
Drop Seed	2	Yellow Spine Thistle	0.5
Sideoats Grama	2	Cacti	0.5
Buffalo Gourd	2	**Total Herbaceous Cover**	**74.5%**
Tree and Shrub Species	**Basal Area sq. m**	**Tree and Shrub Species**	**Basal Area sq. m**
American Elm	21.66	Soapberry	19.63
Hackberry	33.8	Chickasaw Plum	3.8
		Total Basal Area	**78.89 m^2**

Polygon 9, Figure 1 and polygon 10, Figure 2 is the park overlook and monument. This area includes covered picnic tables, the overlook building, and 2 parking lots. The herbaceous cover is a mix of native and introduced grass that is routinely mowed.

Recommendations

Introduction

The Washita Battlefield National Historic Site is comprised of approximately 326 acres - the core of the battlefield. This area includes the site of Black Kettle's village, Custer's command post, and troop and Indian positions recently discovered during a November 1995 survey of the battlefield. In general, the battle site is a natural amphitheater formed by the Washita River. The river flows easterly on a meandering course. Cutting through the red shale of the region, the stream has carved a valley about 1.5 to 2 miles wide. Flanking the valley on the north and south are craggy bluffs and hills of resistant red sandstone standing 250-400 feet above the lowlands (NPS Cultural Landscape Inventory Form, Washita Battlefield NHS, 1998).

Enacting Legislature

110 STAT. 4180, PUBLIC LAW 104-333--NOV. 12, 1996

(A) To protect and preserve the national historic site, including the topographic features important to the battle site, artifacts and other physical remains of the battle, and the visual scene as closely as possible as it was at the time of the battle.

(B) To interpret the cultural and natural resources of the historic site, providing for public understanding and appreciation of the area in such manner as to perpetuate these qualities and values for future generations.

Visual Scene

A desire to maximize quality of the viewshed will require several steps and phases in the restoration of period (1868) vegetation. The following summary of conditions and recommendations may be valuable in achieving the restoration of landscape to 1868 conditions.

A. Condition of the Riparian Areas in Regard to Exotic Species

Riparian corridors are populated by 20% exotic herbaceous species. However, the dominant tree specie of the River Riparian is tamarisk - an introduced specie that has proven to be hard to control in many National Parks in the Southwest. Research is ongoing for alternative means of controlling its spread. The major impacts caused by high populations of tamarisk are: (1) accumulation of salts in the soils below the canopy; (2) high rate of water consumption, thus depriving native species of soil moisture; (3) consumption of soil nutrients thus depriving surrounding native vegetation, and (4) the crowding out of sun-

tolerant understory herbaceous plants.

Recommendations: Destroy all tamarisk trees in the River Riparian corridor as well as the South Riparian. In accordance with the legeslation, the tamarisk is damaging to the visual appearance of the historic vegetation and should receive top priority for control. Seek advice from experts in controlling regrowth.

B. Condition of Riparian Areas in Regards to Size

The natural width of the riparian corridors was curtailed by wheat farming and cattle grazing. It is expected that within several years willow and cottonwood sapling growth will develop and the width of the riparian will increase. This survey has produced evidence that the riparian on the north side of the river is widening. There are young willow thickets and expanding Chickasaw plum thickets encroaching onto the North Flood Plain. The area in which this development is taking place is expected to become the new riparian belt on the north side of the Washita River.

Recommendations: Improve the 1868 landscape by planting cottonwood poles or saplings in the area where there are young willow groves. Their location indicates that the water table is high enough to sustain cottonwood plantings.

C. Conditions of the Riparian Areas in Regards to Cottonwood Density

Information taken from the field survey reveals that only 5% of the basal area of the River Riparian is eastern cottonwood trees. The South Riparian has a 15% eastern cottonwood basal area. There are several reasons why the scarceness of cottonwoods has occurred. There is less flooding due to flood control dams upstream. Cattle eat young cottonwood shoots. The present width of the riparian is unnatural due to agriculture. In the past the river had several channels that provided moisture to cottonwood groves.

Recommendations: As soon as the tamarisk has been destroyed, begin to replace the tamarisk with cottonwood pole plantings. Plant cottonwood poles along the south side of the river in Section 8 if the water table is high enough to support them. Protect the large seed-bearing cottonwood on the south side of the river from beaver. Chicken wire wrapped around the base of the tree may be adequate protection from beaver cutting for 5 years. The 5-year period should provide temporary protection, while young cottonwood and willow saplings are growing. The saplings will provide beaver habitat and food. **This protection is a priority and should be conducted as quickly as possible.**

D. Conditions of Section 8, Wheat Fields

The wheat fields are in a transition state. The reseeding of native grass species and mowing operations to control opportunistic weeds have been accomplished this year (1998). Unfortunately, weather conditions have been poor for seed germination. Reseeding may become necessary.

Recommendations: Avoid planting upland grass species in natural riparian or flood plain areas. Consult with the Black Kettle National Grassland resource staff for information on plant communities with regard to soil type. If reseeding operations become necessary, include native forb and shrub seed for a more natural viewscape and wildlife.

E. Conditions of the Meadow

The meadow is a large (61.7 acres) leveled flood plain that has been seeded to plains bluestem grass. This is an exotic grass species that will require removal and the reestablishment of historic riparian vegetation.

Recommendations: Timing is important in this phase of the management. There are 72 acres of wheat land that have little or no vegetation cover. Weeds have not been controlled in and around the Farmstead. Delaying the reseeding phase in the Meadow is advised to avoid weed seeds being carried by prevailing south winds from these disturbed lands onto the Meadow. Park visitors may not understand the seemingly large amount of disturbed land. At present, the Meadow is aesthetically pleasing, even though the dominant plant species are exotic. After the Section 8 has become established with native vegetation, the Meadow may be reseeded and restored with eastern cottonwood, black willow, and other historic species.

F. Condition of the North Bench

The condition of this area is good. It is a pleasant area that abounds in wildlife, especially birds.

Recommendations: Visitors will enjoy the hike, views, flora and fauna, and solitude of this area. Construct hiking trails to the North Bench.

G. Condition of the South Riparian and Bench Area North of the Railroad Grade.

This area is possibly the most pristine area in the park. This area hosts dense grass cover and large trees and shrubs. The basal area is 15% Eastern cottonwood, and 3% tamarisk. There are a few Siberian elms but American elm provides the majority of canopy cover, with 44%. This is a valuable area for wildlife as well as many plant species. There is still evidence of a remaining channel. It is believed that this area was once an

oxbow or pronounced meander of the Washita River.
The remaining channel is filled with water after rains and the water slowly flows toward the east. There is enough ground and surface water to support this wooded belt - yet there are no cattails or other typical wetland vegetation.
The Upland Range and reseeded Wheat Field (polygon 8A) will become restored to a dense herbaceous cover and act as the sediment trap and reduce the sheet and rill erosion that is now collecting in the railroad cuts. The railroad cuts may have preserved the South Riparian channel from siltation impacts.

Recommendations
Great care should be taken when removing the railroad cuts and banks. Their removal could disrupt the hydrology of the South Riparian. The railroad may be acting as a natural berm protecting the South Riparian from sheet and rill erosion and gully building. Silt appears to be collecting in the railroad cuts instead of the old river channel, and as yet the Upland Range plant communities are too sparse to prevent erosion. It is recommended that the railroad restoration be postponed until ground cover increases. For the protection of the South Riparian, the NPS Geologic Resources Division as well as the NPS Water Resource Division should be consulted for engineering advice and assistance in railroad grade removal and natural landscape reconstruction.

Purchase the section of land that lies directly south of the Washita Battlefield NHS. The hydrology is closely tied to the parkland. There is heavy grazing on the north slope of this section that may be creating rill and sheet erosion. There is gully building 200 feet from the park over look. If the gully-building activity continues to worsen, water runoff could greatly impact the county road as well as the park. This acquired land would give a continuum viewscape of the battle site. This land could be restored with good management practices. The stability of the South Riparian is dependent on the stability of this upland range.

H. Conditions of Upland Range
Despite the drought conditions, the Upland Range is in good condition and is expected to improve with time.

Recommendations: The area may be used for seed collection for reseeding wheat land or other areas of concern within the park. Native forb seed is often unavailable or expensive when bought from commercial growers.

I. Condition of Large Trees in all sections of the Park
Most of the trees are free from disease and are in their natural dynamic state in areas where tamarisk has not developed into the dominant species. The native large trees contribute to the viewscape as well as to wildlife habitat.

Recommendations: Engage an expert to perform tree core dating on selected large trees. Two benefits would be derived from this research: the dating could aid archeologists in the discovery of old river channels, and dating would enhance interpretation of the park.

Considerations

Restoration of Oklahoma Sensitive Wildlife: It is difficult to separate a dynamic biotic regime into separated components. For example, terrestrial insects can not survive without their vegetation habitats, birds become extinct due to the loss of a specific prey and some prairie grasses are revitalized by gopher activity. The animal is depending on the plant or insect and the plant is dependent on the animal or insect. Various animal species inhabited the Washita valley over the past 200 years in accord with the abiotic conditions. The animals were a part of the cultural landscape providing game for indigenous prairie travelers and a balanced ecological food chain. Communications with the Oklahoma Department of Wildlife have brought the following list of species to the attention of the National Park Service. These species may be in the park at present or may migrate back into the park as historical vegetation becomes established. Sometime in the future, a few may be introduced artificially to enhance the 1868 landscape.

I. Sensitive Species of Roger Mills County

Black tailed prairie dog	*Cynomys ludovicianus*
Bell's vireo	*Vireo bellii*
Loggerhead shrike	*Lanius ludovicianus*
Swainson's hawk	*Buteo swainsoni*
Earless lizard	*Holbrookia maculata*
Texas horned lizard	*Phrynosomia cornutum*
Texas longnosed snake	*Rhinocheilus lecontei*

II. Poaching

While GPS work was conducted for the Washita BNHS Vegetation Analysis, a fresh shotgun shell was found on the North Bench. It is recommended that park boundary signs be attached to the north fence. The signs will warn hunters that they will be trespassing on National Park land.

III. County Road

Park boundary signs are needed out of respect for the site as well as wildlife crossing the road. "Caution" or "Reduce Speed" signs would reduce noise as well as protect wildlife.

Preparers

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Consultants

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REFERENCES

Allen, G. Natural Resources Conservation Service, Roger Mills County, Cheyenne, Oklahoma. June 23, 1998. Personal Communication.

Brown, L. 1979. *Grasses an Identification Guide*. Houghton Mifflin Co.

Dykes, S. Resource Ranger, Black Kettle National Grasslands, Cheyenne, Oklahoma. June 24,1998. Personal Communication.

Gould, F. W. 1951. *Grasses of the Southwestern United States*. University of Arizona Press.

Irwin, H. S. 1987. *Roadside Flowers of Texas*. University of Texas Press.

NPS 1998. Cultural Landscape Inventory Form, Washita Battlefield National Historic Site, Level 2 Analysis and Evaluation.

Phillips, J. W. Environmental Protection Specialist, Lake Meredith National Recreation Area and Alibates Flint Quarries National Monument. July 7, 1998. Personal Communication and plant species identification confirmations.

Smith, A. L. May 1998. *Environmental and Management Effects on Plant Species Composition Within Ecological Sites of the Black Kettle National Grassland in Western Oklahoma. (Graduate Thesis) Oklahoma State University, Stillwater, OK.*

Steyermark, J. A. 1963. *Flora of Missouri*. Iowa State University Press.

Risser,P. G.1995. The Status of the Science Examining Ecotones. *BioScience* Vol.45. No. 5 p. 318 - 324.

Natural Resources Conservation Service. 1963. *Soil Survey Roger Mills County, Oklahoma*. U.S. Department of Agriculture.

Vines, R. A. 1960. *Trees, Shrubs and Woody Vines of the Southwest*. University of Texas Press, Austin.

Whitson, T. D., L. C. Burrill, S. A. Dewey, D, W. Cudney, B. E. Nelson, R. D. Lee, R. Parker. 1996. *Weeds of the West*. 5th. Ed. University of Wyoming Press.

Wright, R. A., K. Meador. n.d. The Vegetation of the Lake Meredith Recreation Area, Texas. Department of Biology West Texas State University. Canyon, Texas.

APPENDIX 1

GIS ADDENDUM TO: WASHITA BATTLEFIELD VEGETATION ANALYSIS

GIS ADDENDUM TO: WASHITA BATTLEFIELD VEGETATION ANALYISIS

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10 August 1998

Field collection of Geographic Positioning System (GPS) coverage's for park boundaries, park features, transect locations, and vegetation polygons was completed during the week of July 6-10, 1998, in conjunction with the vegetation analysis field work. The GPS coordinate data was collected using a Trimble Basic Pathfinder GP unit. GPS coordinates were acquired in the NPS standard (Universal Transverse Mercator coordinate system and NAD 1983 datum, zone 14 north, meters). All GPS data was differentially corrected by post-processing the data utilizing base files from the Texas Department of Transportation and Pathfinder Office programming. The coordinate data was used to develop a map utilizing ArcView 3.0.

The attached map, Washita Battlefield Vegetation Transect Map, shows the location of significant park features, the approximate boundary, and the location of vegetation transects listed by tag number. The boundary is approximate, as no survey monuments were found in the field and the boundary fence often was not on the park property line. The attached table, WA-TRSCT, lists the transect points, the field tag number, x and y coordinate data, and the direction and length of the transect.

GPS obtained coordinates of survey transects, vegetation polygons, resource areas, and park boundary will be available for future vegetation classifications. GPS and Geographical Information System data will be archived in hard copy and digital formats and delivered to the park, Inter-Mountain Regional Office, and System Support Office.

Common Name	Family	Genus	Epithet	Native	Exotic	Authority
Field Pennycress	Brassicaceae	*Alyssum*	*alyssoides*		X	L.
Prickly Pear Cactus	Cactaceae	*Opuntia*	*spp.*	X		Engelm.
Kochia	Chenopodiaceae	*Kochia*	*scoparia*		X	(L.) Schrad.
Lambs-quarter	Chenopodiaceae	*Chenopodium*	*berlandieri*	X		
Annual Aster	Compositae	*Aster*	*subulatus*	X		Michx.
Cutleaf daisy	Compositae	*Engelmannia*	*pinnatifida*	X		Gray
Golden Aster	Compositae	*Heterotheca var.*	*stenophyllae*	X		L.
Indian Blanket	Compositae	*Gaillardia*	*pulchella*	X		Foug.
Iron Weed	Compositae	*Vernonia*	*baldwinii*	X		Torr.
Gray Feather	Compositae	*Liatris*	*punctuata*	X		Hook.
Annual Sunflower	Compositae	*Helianthus*	*annuus*	X		L.
Prairie Sunflower	Compositae	*Helianthus*	*petiolaris*	X		Nutt.
Willow Baccharis	Compositae	*Baccharis*	*salicina*	X		
Bush M. Glory	Convolvulacrae	*Ipomoea*	*leptuphylla*	X		Torr.
Red Morning Glory	Convolvulaceae	*Ipomoea*	*coccinea*	X		L.
Wild M. Glory	Convolvulaceae	*Ipomoea*	*trichocarpa*	X		Ell.
Buffalo Gourd	Cucurbitaceae	*Cucurbita*	*foetidissima*	X		H.B.K.
Sedge	Cyperaceae	*Carex*	*Spp*	X		L.
Texas Croton	Euphorbiaceae	*Croton*	*texensis*	X		Kl.
Yellow Sweet Clover	Febaceae	*Melilotus*	*officinalis*		X	(L.) Lam.
Bermuda	Gramineae	*Cynodon*	*dactylon*		X	(L.)Pers.

Common Name	Family	Genus	Epithet	Native	Exotic	Authority
Blue Grama	Gramineae	*Bouteloua*	*gracilis*	X		H.B.K.
Canada Wildrye	Gramineae	*Elymus*	*canadensis*	X		L.
Downy Brome	Gramineae	*Bromus*	*tectorum*		X	L.
Hairy Grama	Gramineae	*Bouteloua*	*hirsuta*	X		Lag.
Joint Grass	Gramineae	*Manisuris*	*cylindrica*	X		(Michx.) Ktze.
Johnson Grass	Gramineae	*Sorghum*	*halepense*		X	(L.) Pers.
Indian Grass	Gramineae	*Sorgastrum*	*nutans*	X		Nash.
Little Bluestem	Gramineae	*Andropogon*	*scoparius*	X		Michx.
Longspine Sandbur	Gramineae	*Cenchrus*	*longispinus*		X	(Hock.) Fern
Plains Blue Grass	Gramineae	*Bothriochloa*	*ischaemum*		X	L.
Cheat Grass	Gramineae	*Bromus*	*scalinus*		X	L.
Sand Dropseed	Gramineae	*Sporobolus*	*cryptandrus*	X		(Torr.) Gray
Sand Bluestem	Gramineae	*Andropogon*	*Hallii*	X		Hack.
Sideoats Grama	Gramineae	*Bouteloua*	*curtipendula*	X		(Michx.) Torr.
Switch Grass	Gramineae	*Panicum*	*virgatum*	X		L.
Tall Witch	Gramineae	*Lepotloma*	*cognatum*	X		Schult.
Threeawn	Gramineae	*Aristida*	*purpurea*	X		Nutt.
Tumblegrass	Gramineae	*Schedon-nardus*	*paniculatus*	X		Nutt.
Western Wheat	Gramineae	*Agropyron*	*Smithii*	X		L.
Rush	Juncaceae	*Juncus*	*Spp*	X		L.
Wire Grass	Juncaceae	*Juncus*	*Balticus var.*	X		L.

APPENDIX 2

1998 ANNOTATED PLANT SPECIES LIST

Appendix 2. Table 1. Species List for Washita Battlefield NHS, 1998. These species were either collected or identified in the field. The abbreviation, var., stands for variety. The list is alphabetized by family.

Common Name	Family	Genus	Epithet	Native	Exotic	Authority
Yucca	Agavaceae	*Yucca*	*glauca*	X		Nutt.
Poison-ivy	Anacardiaceae	*Toxicodendron*	*radicans*	X		(L.) Ktze.
Flame-leaf Sumac	Anacardiaceae	*Rhus*	*copallina*	X		L.
Smooth Sumac	Anacardiaceae	*Rhus*	*glabra var.*	X		L.
Bull Thistle	Asteraceae	*Cirsium*	*vulgare*		X	(Savi.) Tenore
Camphor Weed	Asteraceae	*Heterotheca*	*subaxillaris*	X		Britt. & Rusby
Cocklebur	Asteraceae	*Xanthium*	*strumarium*	X		L.
Curlycup Gumweed	Asteraceae	*Grindelia*	*squarrosa*	X		(Pursh) Dural
Horseweed	Asteraceae	*Conyza*	*canadensis*	X		(L.) Cronq.
Marshelder	Asteraceae	*Iva*	*xanthifolia*	X		Nutt.
Rag Weed	Asteraceae	*Ambrosis*	*confertiflora*	X		DC.
Giant Ragweed	Asteraceae	*Ambrosia*	*trifida*	X		L.
Western Ragweed	Asteraceae	*Ambrosia*	*psilostachya*	X		DC.
Sand Sage	Asteraceae	*Artemisia*	*filifolia*	X		Torr.
Sowthistle	Asteraceae	*Sonchus*	*arvensis*		X	L.
Sun Flower	Asteraceae	*Helanthus*	*annus*	X		L.
White Sagewort	Asteraceae	*Artemisia*	*campwstris*	X		L.
Butterfly Milkweed	Asclepiaceae	*Ascleplas*	*tuberosa*	X		Raf.
Milkweed	Asclepiaceae	*Asclepias*	*viridiflora*	X		Gray

Common Name	Family	Genus	Epithet	Native	Exotic	Authority
Bee Balm or Lemon Horse Mint	Labiatae	*Monarda*	*punctata*	X		L.
Hedge Nettle	Labiatae	*Stachys*	*tenuifolia var.*	X		Willd.
Big Top Dalea	Leguminosae	*Dalea*	*enneandra*	X		Nutt.
Bundle Flower	Leguminosae	*Desmantas*	*illinoensis*	X		Michx.
Golden Dalea	Leguminosae	*Dalea*	*aurea*	X		Nutt.
KY Coffee Bean	Leguminosae	*Gymnocladus*	*dioica*	X		(L.) K. Koch
Mid-west Indigo	Leguminosae	*Amorpha*	*Fruticosa var. angustifolia*	X		Pursh
Partridge Pea	Leguminosae	*Cassia*	*fasciculata*	X		Michx.
Prairie Turnip	Leguminosae	*Psoralea*	*limearfolia*	X		T. & G.
Sensitive-Briar	Leguminosae	*Schrankia*	*uncinata*	X		Willd.
Wild Licorice	Leguminosae	*Glycyrrhiza*	*lepidota*	X		
Green Brier	Liliaceae	*Smilax*	*Herbacea var. asioneura*	X		Hook
Stick-leaf	Loasaceae	*Metzelis*	*nude*	X		Torr. & Gray
Wine Cup	Malvaceae	*callirhoe*	*digitata*	X		Nutt.
Red Mulberry	Moraceae	*Morus*	*rubra*	X		L.
Lizard Tail	Onagraceae	*Stenosiphon*	*linifolius*	X		(Nutt.) Heynh.
MO.Primrose	Onagraceae	*Oenothera*	*macrocarpa*	X		Nuttall
Primrose	Onagraceae	*Oenothera*	*grandiflora var.*	X		
Woodsorrel	Oxalidaceae	*Oxalis*	*dillenii*	X		Jacq. (small)

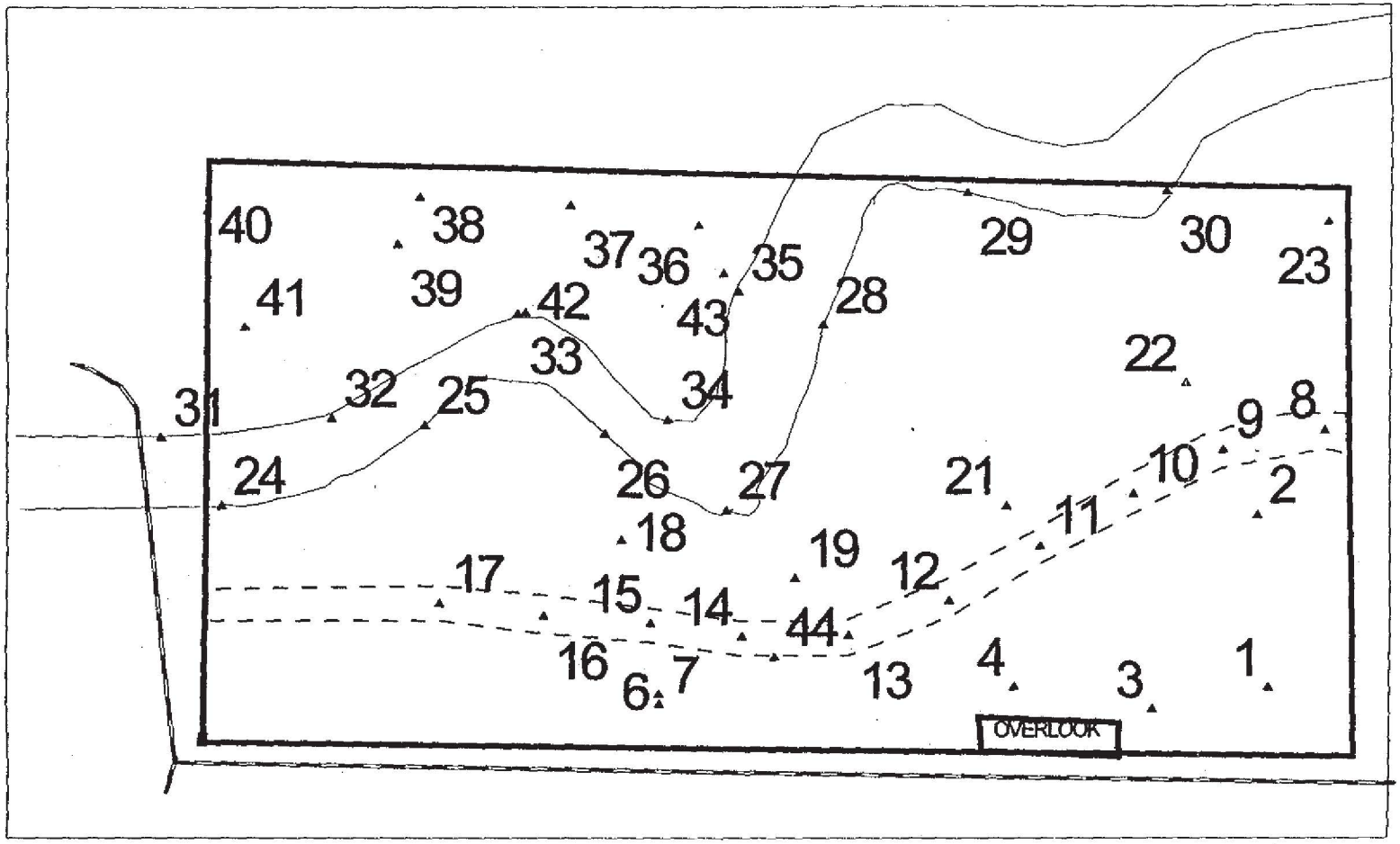
Common Name	Family	Genus	Epithet	Native	Exotic	Authority
Prickly Poppy	Papaveraceae	*Argemone*	*polyanthemos*	X		(Fedde.) G.B.Ownbey
Polkweed	Phytolaccaceae	*Phytolacca*	*americana*	X		L.
Plantago	Plantaginaceae	*Plantago*	*Purshii*		X	Prush
Woolly Plantain	Plantaginaceae	*Plantago*	*patagonica*	X		Jacq.
Annual Wild Buckwheat	Polygonaceae	*Polygonum*	*convolvulus*		X	L.
Blue Milkwort	Polygonaceae	*Polygala*	*longa*	X		Blake
Pale Dock	Polygonaceae	*Rumex*	*altissimus*	X		Wood
Chickasaw Plum	Rosaceae	*Prunus*	*angustifolia*	X		Marsh.
Button Bush	Rubiaceae	*Cephalanthus*	*occidentalis*	X		L.
Black Willow	Salicaceae	*Salix*	*nigra*	X		Marsh.
Eastern Cottonwood	Salicaceae	*Populus*	*deltoides*	X		Marsh.
Soapberry	Sapindaceae	*Spindus*	*Drummondii*	X		Hook & Arn.
Wooly Bucket	Sapotaceae	*Bumelis*	*lanuginosa*	X		(Michx.) Pers.
Yellow Paintbrush	Scrophulari-aceae	*Castilleja*	*purpurea var.*	X		(Nutt.) G. Don
Black Nightshade	Solanaceae	*Solanum*	*nigrum*		X	L.
Buffalobur	Solanaceae	*Solanum*	*rostratum*	X		Dun.
Horse Nettle	Solanaceae	*Solanum*	*carolinence*	X		L.
Jimsonweed	Solanaceae	*Datura*	*stramonium*	X		L.
Silver-leaf Nightshade	Solanaceae	*Solanum*	*elaeagni-folium*	X		
Tamarix	Tamaricaceae	*Tamarix*	*ramosissima*		X	Ledeb.
American Elm	Ulmaceae	*Ulums*	*americana*	X		L.

Common Name	Family	Genus	Epithet	Native	Exotic	Authority
Hackbery	Ulmaceae	*Celtis var.*	*occidentalis*	X		Sarg.
Siberian Elm	Ulmaceae	*Ulmus*	*pumila*		X	L.
Seven-leaf Creeper	Vitaceae	*Parthen-ocissus*	*heptaphylla*	X		(Buckl.) Britt.
Sweet Winter Grape	Vitaceae	*Vitis*	*cinerea*	X		Engelm.

Table 1. WABA NHS vegetation transect GPS coordinates.

POINT	TAG_NUMBER	EASTING	NORTHING	REMARKS
P13-T1	1	436875.3980	3941833.3890	N-30M
P17A-T1	2	436860.2170	3942070.8460	N-30M
P18-T1	3	436714.6210	3941802.7260	N-30M
P19-T1	4	436522.9000	3941834.7750	N-30M
P14-T1	6	436031.2880	3941824.3690	N-20M
P6-T1	7	436032.5480	3941810.0000	N-30M
P11-T1	8	436952.1830	3942186.7180	8M
P11-T2	9	436812.4280	3942160.7650	8M
P11-T3	10	436687.7700	3942100.2690	8M
P11-T4	11	436557.8320	3942029.6440	8M
P11-T5	12	436432.4120	3941954.0450	8M
P11-T6	13	436293.2110	3941905.6660	8M
P11-T7	14	436145.4070	3941904.1450	8M
P11-T8	15	436019.7660	3941921.8350	8M
P11-T9	16	435871.7850	3941931.9760	8M
P11-T10	17	435728.3650	3941949.5960	8M
P5-T1	18	435979.4150	3942037.0730	S-30M
P12-T1	19	436218.7220	3941985.0010	N-40M
P12-T2	21	436511.7520	3942083.9940	N-40M
P12-T3	22	436759.5260	3942251.2650	N-40M
P12T4	23	436955.2730	3942476.3090	N-40M
P4-T1	24	435427.9860	3942083.4210	N-14M
P4-T2	25	435708.5870	3942194.0440	N-5M
P4-T3	26	435956.7570	3942182.2010	N-31M
P4-T4	27	436124.0670	3942077.2990	N-34M
P4-T5	28	436257.7790	3942333.4890	N-43M
P4-T6	29	436456.8970	3942518.6500	N-15M
P4-T7	30	436732.1570	3942521.3320	N-34M
P4-T8	31	435345.2440	3942177.2920	S-11.5M
P4-T9	32	435580.5760	3942202.7680	S-8M
P4-T10	33	435835.9810	3942348.7300	S-47M
P4-T11	34	436043.7790	3942200.9810	S-49M
P4-T12	35	436140.3540	3942380.0130	S-36M
P1-T1	36	436084.9120	3942472.4520	N-40M
P1-T2	37	435908.9320	3942501.2190	N-40M
P1-T3	38	435700.8960	3942513.8890	N-30M
P2-T1	39	435670.3210	3942447.1170	N-30M
P1-T4	40	435408.8260	3942494.7830	N-30M
P2-T2	41	435460.8860	3942331.0050	N-30M
P2-T3	42	435846.8560	3942350.7700	N-30M
P2-T4	43	436119.8560	3942405.6240	N-30M
P16-T1	44	436190.1860	3941875.8330	42x27M

Washita Battlefield National Historic Site
Vegetation Transect Map



400 0 400 800 Meters

Transect by Tag Number
WABA Boundary
R.R. Grade
ROADS
Riparian Zone

N

023	80.000
IMSF-RMO	AUG 98