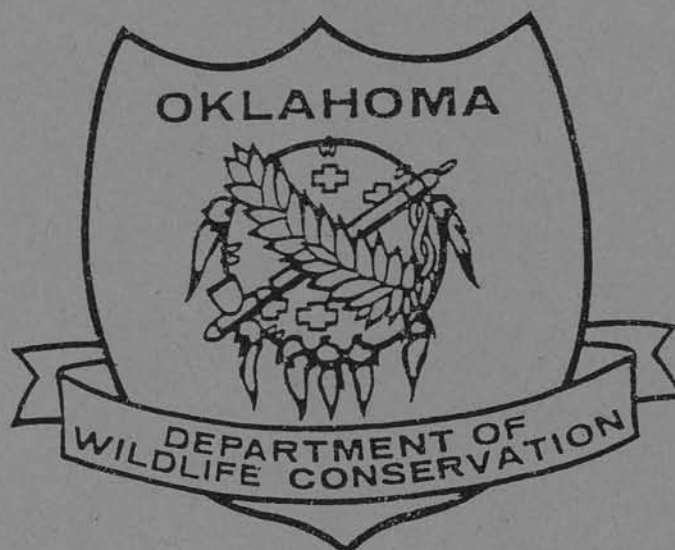


FINAL PERFORMANCE REPORT



FEDERAL AID GRANT NO. T-17-P-1

**WILDLIFE HABITAT IN OKLAHOMA TERRITORY AND THE
CHICKASAW NATION, CIRCA 1870**

OKLAHOMA DEPARTMENT OF WILDLIFE CONSERVATION

June 1, 2004 through December 31, 2007

FINAL PERFORMANCE REPORT

State: Oklahoma

Grant Number: T-17-P-1

Grant Program: State Wildlife Grants

Grant Title: Wildlife Habitat in Oklahoma Territory and the Chickasaw Nation,
circa 1870

Grant Period: June 1, 2004 – December 31, 2007

Principal Investigator: Bruce Hoagland

Abstract:

Habitat loss is the greatest threat facing wildlife species. This project created a land cover map of Oklahoma using General Land Office plats circa 1871. Such maps provide both a snapshot of past habitat conditions and a baseline for comparison with the modern distribution of wildlife habitat. General Land Office plats were acquired from the Archives Division of the Oklahoma Department of Libraries, georeferenced and digitized. Plat features were categorized as hydrology, transportation, land cover, or settlement. Each of these categories were further subdivided. For example, land cover consisted of natural (i.e., grassland, forests, etc.) and agricultural (cultivated lands, orchards, etc.). A total of 1,348 plats were digitized and joined into a comprehensive map. Grassland (6.2 million hectares) was the most extensive land cover type, followed by forest-woodland (2.6 million hectares). A sawmill, two lime kilns, a sandstone quarry, and several stores are examples of settlement features encountered. Land in cultivation was 7,600 hectares, and several named ranches were present. Future studies should include comparisons between the 1870s map and modern data sources such as the Gap Analysis map in order to quantify habitat change.

Introduction:

Habitat loss is the greatest threat facing wildlife species. In order to assess change in the quality and spatial distribution of wildlife habitat, a baseline needs to be established (Mladenoff and Howell 1980, Smith et al., 1993). The most useful tool for reconstructing past habitat conditions is the plats and field notes produced by the General Land Office (GLO) beginning in the 18th century (Fagin and Hoagland 2002). Following passage of the Land Ordinance, surveyors were dispatched to conduct a cadastral survey of lands west of the Allegheny Mountains. Surveyors were charged with establishing a baseline and primary meridian in states and territories, which were then used as reference points for the division of land into 36 mile² townships (Stewart 1935). Surveyors then divided townships into 1 mile² sections. It was the job of each surveyor and his crew to walk the section lines and construct monuments demarcating the section intersections and quarter section points. Upon returning, surveyors drew township plats from the data gathered in the field (White 1984). The resulting maps display the location of prairie, forest, and wetland habitats, among others (Bourdo 1956, White 1984. See figure 1 for an example of an Oklahoma plat). The plats and field notes compiled by the GLO surveyors have

proven to be instrumental aides for land managers and restoration ecologists in riparian, grassland, and Midwest woodland habitat restoration (Nuzzo 1986, Galatowitsch 1990, Whitney and DeCant 2001).

This project was initiated to develop a 19th century land cover map for Oklahoma. The GLO surveys of Oklahoma were initiated in 1871 by Ehud Darling (Hoagland 2006). The process began with the establishment of an Initial Point in Murray County (Oklahoma has two: the second is located in the southwest corner of the panhandle). Surveyors platted townships in what would become Oklahoma Territory (excluding the panhandle), the Chickasaw Nation, and lands held by the Quapaw, Seneca, Modoc, Ottawa, Shawnee, Wynadotte, and Peoria tribes in far northeast Oklahoma (Figure 2). Species of greatest conservation need within this area include the Arkansas River Shiner, eastern spotted skunk, northern bobwhite, greater and lesser prairie chickens, snowy plover, American woodcock, barn owl, loggerhead shrike, black-capped vireo, Bell's vireos, and others. The development of a land cover map from GLO plats circa 1871 will provide an important baseline for analysis of habitat change for conservation planners.

Objective:

To create a land cover map from GLO plats of Oklahoma Territory and the Chickasaw Nation. The project will be considered complete once all of approximately 800 plats have been digitized, edited and joined into a land cover map. It should be noted that digitizing for portions of the study area begun as part of specific projects funded by the National Park Service and the Oklahoma Department of Wildlife, but ceased as projects ended. To date, 538 plats have been digitized and a partial map completed. This map includes Osage, Roger Mills, Harper, Woodward, and Ellis Counties as well as all the townships south of the baseline. Thus, the protocols and methodology for completing the proposed project have been established and tested.

Methods:

General Land Office plats and field notes were acquired from the Archives Division of the Oklahoma Department of Libraries (ODL). The project began by digitizing data from paper copies of the GLO plats, but it was learned that scanned copies of the plats had been prepared through collaboration between ODL and the Oklahoma Department of Transportation. The resulting images were in .bmp format and had to be georeferenced. The digital plats were acquired in late summer of 2004 and scripts were developed to georeference the images in ArcInfo Workstation (ESRI, Redlands, CA).

Using the scanned, georeferenced images greatly enhanced accuracy and reduced digitizing time. With paper plats, data entry personnel were required to mount the plat onto the digitizing tablet and prepare the plat for digitizing. The scanned images from ODL allowed the data entry personnel to view both the image and the GIS coverage simultaneously. Previously, the user digitized a paper plat on a digitizing tablet and thereby created a digital image or "coverage" displayed on a computer monitor. Once the image and digital coverage are layered, quality control of digitizing process is easily facilitated.

Once the scanned images were georeferenced, all information on the plat was digitized as either a vector or point feature. Vector features consisted of hydrology, transportation, and land cover features (Figure 3). Land cover was further divided in natural, representing grassland, forests, etc., and agricultural, which included cultivated lands (Figure 4). The hydrology layer consists of vector files of streams. Point features were included in the settlement layer, which divided into commercial, civic, and residences (Figure 5). Anthropogenic land cover and the built environment were included in this study in order to better assess the human impact on the early settlement environment. The land cover and settlement layers were summarized using the ESRI module "spatial analyst."

Results:

A total of 1,348 GLO survey plats were digitized for this study. The resulting map displays all land cover and other features mapped by the GLO surveyors (Figure 6). Results for each major coverage type are presented below.

Land Cover:

Delineation of land cover was successful. The plats in conjunction with the surveyor field notes, which were available on fiche, allowed data entry personnel to readily determine the boundaries and extent of the land cover types mapped by surveyors. However, interpreting the work of surveyor H.C.F. Hackbusch was often problematic because he did not follow convention and symbology adopted by other surveyors. This was particularly vexing when mapping riparian vegetation, as clearly can be seen in the west-central portion of Figure 6. Note the dendritic network of riparian vegetation trending west that comes to an abrupt end. The townships to the west of that line were surveyed by Hackbusch. At the time when funding ended, data entry personnel had engaged in an intensive review of Hackbusch's field notes in order to interpolate the location of riparian vegetation in those townships. We are continuing to add the missing riparian polygons into the map.

The most extensive cover type mapped by the surveyors was forest-woodland and grasslands (Table 1). The term forest-woodland was used in this study because it is impossible to distinguish between these two woody vegetation categories on the GLO plats (forests are distinguished by trees with interlocking crowns, woodlands are areas where tree crowns do not interlock and an understory of grass species is present). Both woody vegetation types exist in western and central and are most confounding in the mosaic of forest, woodland, and grassland vegetation in the cross timbers region (Rice and Penfound, Hoagland et al.).

The limited occurrence of certain vegetation types was surprising. For example, surveyors mapped a single cottonwood grove (Figure 7). Cottonwood vegetation is prevalent along major rivers in current-day Oklahoma. In fact, there is a dispute over the extent of cottonwood vegetation in pre-settlement times versus today. It has been documented on the Platte and Arkansas Rivers that cottonwoods have increased in extent

and abundance. Analysis of data from the surveyor's field notes might clarify the condition and extent of cottonwood vegetation in western Oklahoma.

It was also anticipated that surveyors might have mapped the occurrence of prairie dog towns. Since large dog towns were mentioned in the early travel narratives such as Captain Randolph Marcy's, it seemed plausible that surveyors might map these features, as they would pose a hindrance to transportation. However, no prairie dog towns were recorded. In fact, only one buffalo wallow was mapped (Figure 8). It is also noteworthy that surveyor's in the study area did not record the occurrence of large fires or areas of wind-thrown trees, which has proven useful in studies of disturbance history.

Hydrology and Transportation:

Although all streams on the plats were digitized, there are a number of caveats surrounding analysis of these data. Although considerable confidence can be placed in the accuracy of surveyors' data for large order streams (i.e., Washita, Canadian, Cimarron and other Rivers, or Mud, Beaver, and Cache Creeks), the opposite is true for smaller order streams. Surveyors simply denoted such streams with a wiggly line or "bric-a-brac" pattern. Again, difficulty was encountered digitizing streams mapped by Hackbusch.

Surveyors mapped transportation features such as trails, cattle trails, wagon roads, and roads. The transportation network was most extensive in the Chickasaw Nation, which had been settled longer than areas to the west, although some roads did extend to Fort Arbuckle. An extensive road network had also developed in northeast Oklahoma. The surveyors mapped the Chisholm Cattle Trail, which was established in 1867. The Great Western Trail does not appear on the plats because it would not open until the end of the 1870s. The only railroad to appear on the plats was in the northeast portion of the study area. It was in this region that the Missouri-Kansas-Texas railroad, or the Katy, first entered Indian Territory in 1870.

Settlement:

Surveyors mapped a considerable number of structures in the 1870s. Over 300 residences were mapped, mostly in the Chickasaw Nation, 39 of which the owner's surname is provided (Table 2). Twenty-three negro huts or houses, as labeled by the surveyors, were also mapped. Some of these were likely Chickasaw freedmen, although one house occurs in Major County (Figure 9). Surveyors also mapped the location of numerous Native American dwellings, an example of which is presented in Figure 10. Surveyors mapped the location of Bureau of Indian Affairs offices as well as tribal capitals and domiciles (Table 3 and 4). All of the educational institutions mapped were located within the Chickasaw Nation (Table 4). In addition, four active military installations were mapped. By the time of the survey period, Fort Washita had been abandoned.

Commercial establishments were limited in number at the time, but several interesting features appear. For example, two limekilns were mapped in the Arbuckle Mountains, a region of several active limestone and dolomite quarries today. The sandstone quarry was also in that region. A sawmill was also operational in the eastern portion of the study

area, most likely an extension of lumbering in the Choctaw Nation to the east. The function of the second mill listed could not be ascertained.

Agriculture was a budding industry in the study area, as indicated by the low number of hectares in cultivation (Table 1). It is surprising that only one cotton gin was mapped in the Chickasaw Nation. Cotton was an important crop for both the Choctaw and Chickasaw Nations. In fact, ten cotton gins were operating in the Choctaw Nation by 1840 and were processing 1,000 bales annually. Livestock constituted an important component of agriculture in the Chickasaw Nation and six ranches were documented by surveyors (Table 6). However, it is impossible to assess from the GLO plats just how much land was in pasturage. Certainly some of the land designated as grassland in the Chickasaw Nation was being grazed, but the extent of which cannot be determined.

Discussion:

The goals of this project were attained with only a few minor exceptions. The biggest setback was contending with township plats surveyed by Hackbusch. Although the availability of scanned plats accelerated the work, the unorthodox mapping conventions of Hackbusch proved a hindrance. Extracting the bearing tree data from the surveyors' field notes, and mapping those locations on the township grid could enhance the 1871 land cover map. This would allow for a more detailed determination of forest types and the analysis of tree density in order to distinguish forest from woodland. A preliminary analysis is being conducted in the Arbuckle Mountain region and in the northeast portion of the study area. The results of this effort have been successful and we can now map the location of bearing tree species recorded by the surveyors (Fagin and Hoagland in prep).

It would also be useful to compare the 1870 map with subsequent surveys and the Gap Analysis map for Oklahoma. Prior to allotment of tribal lands, the entire state of Oklahoma was resurveyed in the 1890s. A comparison of land cover change between the 1870s and 1890s GLO surveys revealed a startling decline in forest and woodland areas and rapid increase in cultivated land and road networks. Funding either or both of these projects would further enhance the ability of conservation planners to make sound decisions when managing Oklahoma's natural heritage.

Significant Deviations:

Maps were also discovered for land cover locations in Ottawa County. Even though these sections were outside the previously stated location area, we decided to include them.

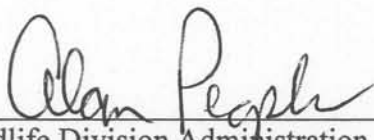
Literature Cited:

- Bourdo, E.A. 1956. A review of the General Land Office Survey and its use in quantitative studies of former forests. *Ecology* 37: 754-768.
- Fagin, T. & B.W. Hoagland. 2002. In search of the forest primeval: The use of land survey records in reconstructing past landscapes and evaluating human impact. *North American Geographer* 4: 1-20.
- Galatowitsch, S.M. 1990. Using the original land survey notes to reconstruct presettlement landscapes in the American west. *Great Basin Naturalist* 50: 181-191.
- Hoagland, B.W. 2006. Township and Range Survey System. In C.R. Goins and D. Goble, *Historical Atlas of Oklahoma*. University of Oklahoma Press, Norman.
- Hoagland, B.W., I. Butler, F. L. Johnson & S. M. Glenn. 1999. Ecology and vegetation of the Cross timbers in Kansas, Oklahoma and Texas. In: Anderson, R. C., Fralish, J and J.Baskins. *The savanna, barren and rock outcrop communities of North America*. Cambridge University Press.
- Mladenoff, D.J. and E.A. Howell. 1980. Vegetation change on the Gogebic Iron range (Iron County, Wisconsin) from 1860s to present. *Transaction of the Wisconsin Academy of Sciences, Arts, and Letters* 68: 74-89.
- Rice, E. L., and W. T. Penfound. 1959. The upland forests of Oklahoma. *Ecology* 40:592-608.
- Shutler, A. and B.W. Hoagland. 2004. Vegetation in the cross timbers, Carter County, Oklahoma, 1871. Oklahoma. *Proceedings of the Oklahoma Academy of Science* 84: 19-26.
- Smith, B.E., P.L. Marks, and S. Gardescu. 1993. Two hundred years of forest cover changes in Tompkins County, New York. *Bulletin of the Torrey Botanical Club* 120: 229-247.
- Stewart, L.O. 1935. *Public Land Surveys: history, instructions, methods*. Collegiate Press, Ames, Iowa.
- White, C.A. 1984. A history of the rectangular survey system. U.S. Department of Interior, Bureau of Land Management.
- Whitney, G.G. and J.P. DeCant. 2001. Government land office surveys and other early land surveys. In: D. Egan and E.A. Howell, *Historical Ecology Handbook*, Island Press, Washington, D.C.

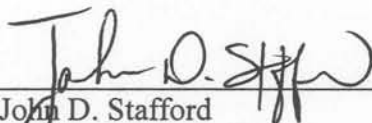
Prepared by: Dr. Bruce Hoagland
Oklahoma Biological Survey

Date: March 18, 2008

Approved by:



Wildlife Division Administration
Oklahoma Department of Wildlife Conservation



John D. Stafford
Federal Aid Coordinator
Oklahoma Department of Wildlife Conservation

Table 1. Area occupied by each major land cover type, circa 1871.

Land Cover Type	Area in Hectares
Natural	
Forest and Woodland	2,584,039
Brush Prairie	184,878
Grassland	6,232,737
Wetland	9,013
Agricultural	
Cultivated	7,550
Garden	12
Orchard	34

Table 2. Summary of residence information from settlement layer. 1871.

Residence	Number of Structures
Adobe House	1
Allen's, Doctor	1
Barney	1
Berckeron	1
Bimm, Mr.	1
Blue, Jack	1
Cabin	4
Campbell	1
Chandler's, Mrs.	1
Christian	2
Colbert	1
Colcaine Farm	4
Collin's, J.	1
Courtney's, Mrs.	1
Criner	1
Deer, Bob	1
Deserted Houses	2
Eastman	1
Fitzpatrick	1
Flood, Nelson	1

Residence	Number of Structures
Franklin, Bartlett	1
Gamlof, Zelfyr	1
George, A.	1
Govenor (illegible) House	1
Govenor Brown House	1
Hapsburgh	4
Hays, Rufus	1
Hint, Smith	1
House	2
House, Illegible	4
Howell	1
Hut	1
James, E.	1
Jemming	1
Kemp	1
Little John	1
Log Cabin	1
Log House	1
Love	1
Love, H.	1
Lucy	1

Residence	Number of Structures
Mathenson	1
Maxfield	1
Monterieff	1
Negro Houses	5
Negro Huts	18
Negro Settlement	9
Parker, Captain	3
Paul, Sam	1
Paul, Smith	2
Pettifer	2
Port	1
Randall	1
Ruff	1
Seeley, H.	1
Seeley, J.	1
Smith	1
Stone Wall	1
Sturn, Doctor	1
Thomas, T.	1
Toeta, Ann	1
Unidentified Residences	219

Residence	Number of Structures
Waits	3
Washington, George	2
White	1
Williams, Mr.	2

Table 3. Summary of Native American establishments mapped by surveyors circa 1870.

Institution	Number of Structures
Cheyenne-Arapahoe Indian Agency	18
Indian Agency Mission House	1
Indian Agency Stores	5
Indian Agency Wigwams	7
Indian Cabin	1
Indian Cabin	1
Indian House	1
Indian House, Cherokee	3
Indian House, Delaware	1
Indian Settlement	9
Indian Settlement, Caddo	3
Indian Village	5
Indian Village, Caddo	6
Old Indian Village	8
Sack Fox Agency	4

Table 4. Summary of civic institutions from settlement layer, 1871.

Institution	Number of Structures
Cemetery	
Grave Yard	2
Education	
Bloomfield Academy	1
Lebanon Academy	2
Rock Academy	1
Roger Sons Academy	1
School House	6
Government	
Initial Monument	1
Tishomingo Capital	1
Tishomingo Post Office	7
Infrastructure	
Bridge	1

Institution	Number of Structures
Military	
Buell's Supply Camp	1
Camp Auger	1
Fort Cobb	1
Fort Arbuckle Military Reservation	14
Fort Washita (Abandoned)	1
Mess Hall	1

Table 5. Summary of commercial operations from settlement layer, 1871.

Institution	Number of Structures
Commercial Indian Building	1
Colbert's Ferry	1
Ferry	2
Lime Kiln	1
Mill	1
Old Lime Kiln	1
Sand Stone Quarry	2
Stage Stand	1
Stage Station	1
Steam Saw Mill	1
Store	7
Wash Hole	1

Table 6. Summary of agricultural structures and establishments mapped by surveyors circa 1870.

Institution	Number of Structures
Misc. Features	
Cattle Corral	7
Cattle Yard	1
Corn Crib	1
Cotton Gin	1
Haystack	1
Ranches	
Clouds Ranch	5
Indian Ranch	1
Nortons Ranch	1
Senells Ranch	1
Stage Ranch	1

INDIAN TERRITORY

Sec. 13. Sec. 14. Sec. 15.

Sec. 23. Sec. 24. Sec. 25.

Sec. 26. Sec. 27.

Sec. 34. Sec. 35. Sec. 36.

Cherokee Town

Horse Creek

Horse Pasture

New Post

MILITARY RESERVE

SPECIAL MONUMENT

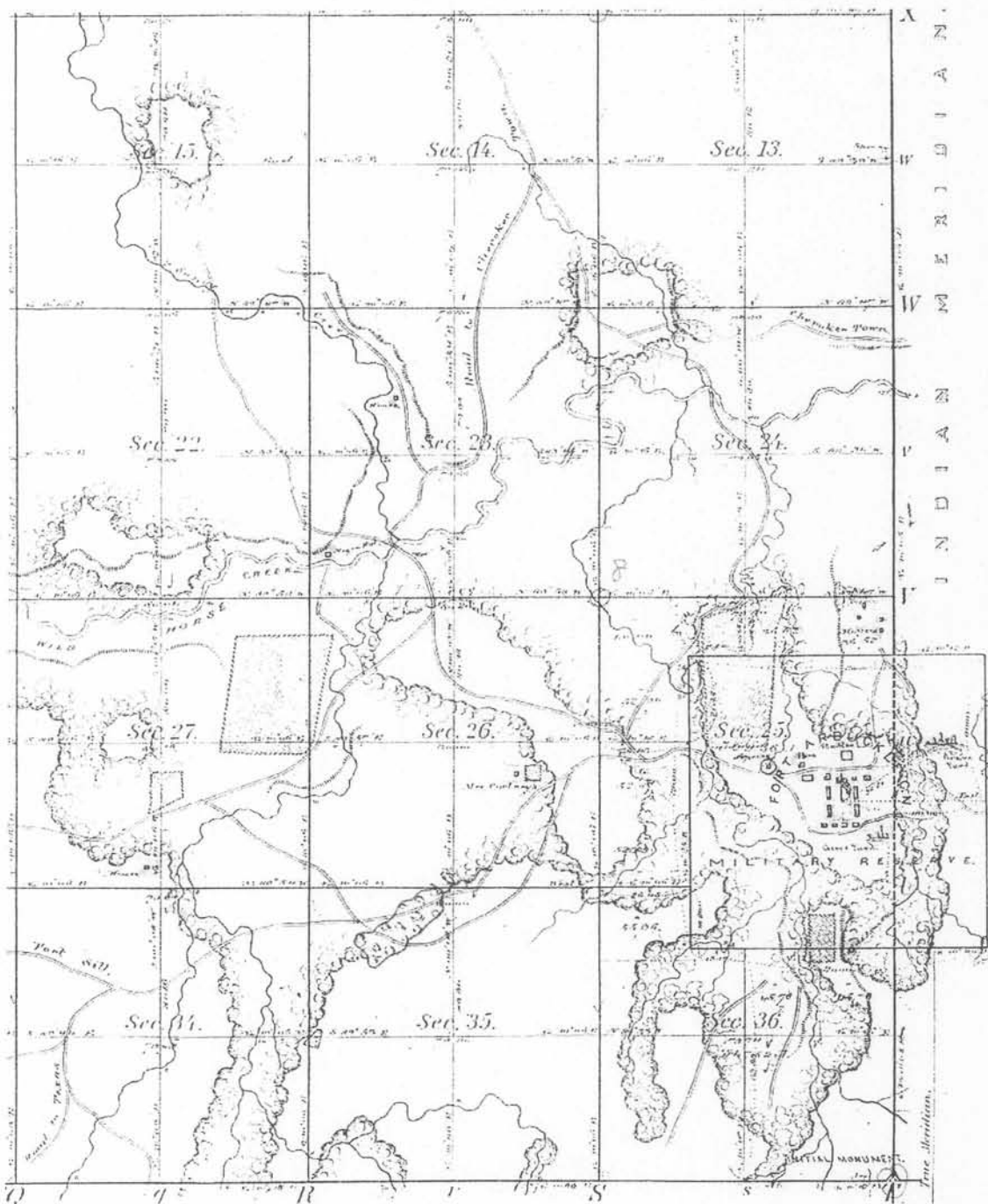


Figure 2. The study area included all regions in light gray.

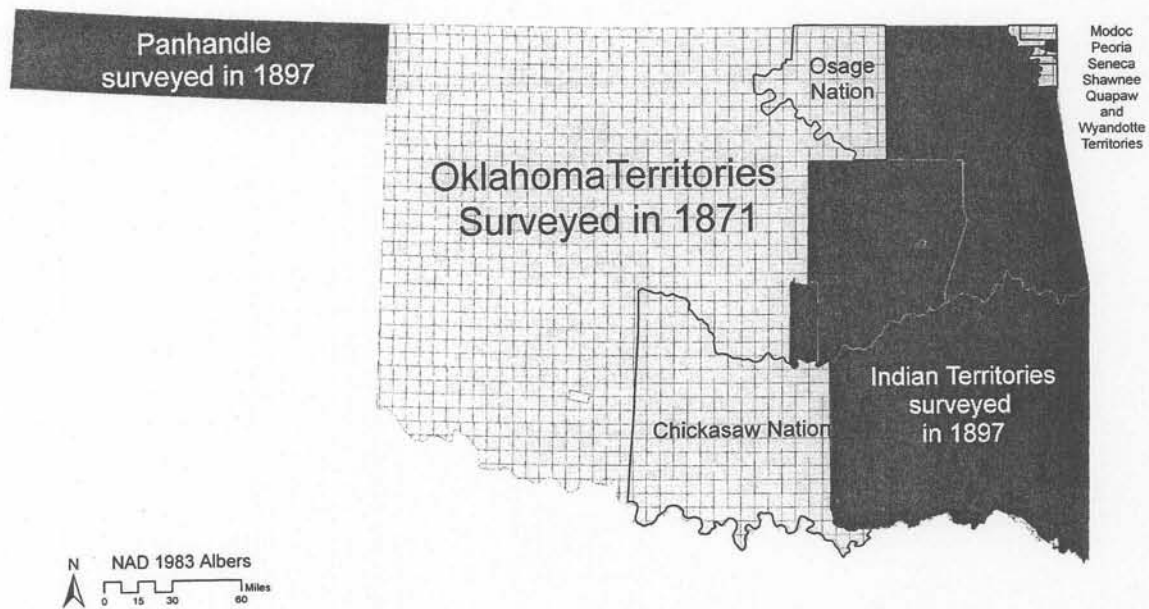


Figure 3. GIS Coverages created for this project.

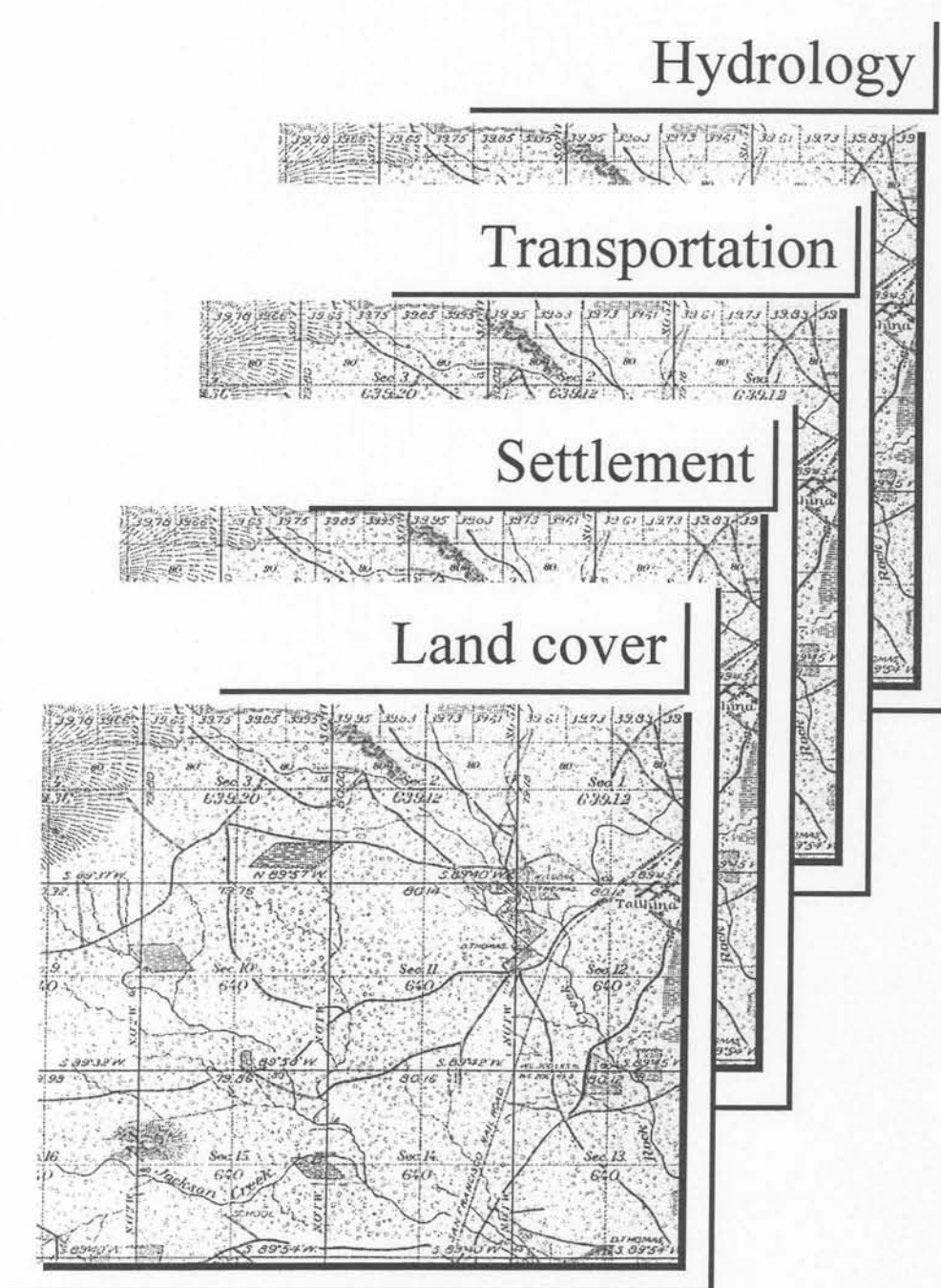


Figure 4. Schematic representation of the elements in the category of land cover.

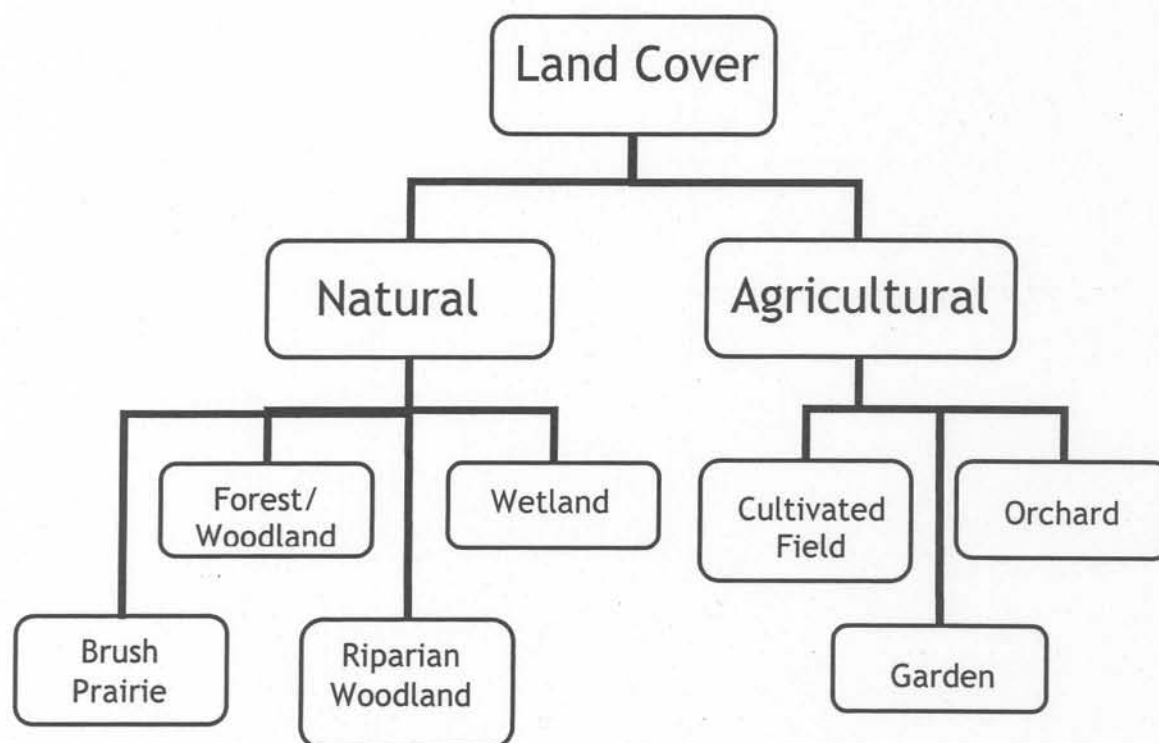


Figure 5. Schematic representation of the elements in the category of Settlement.

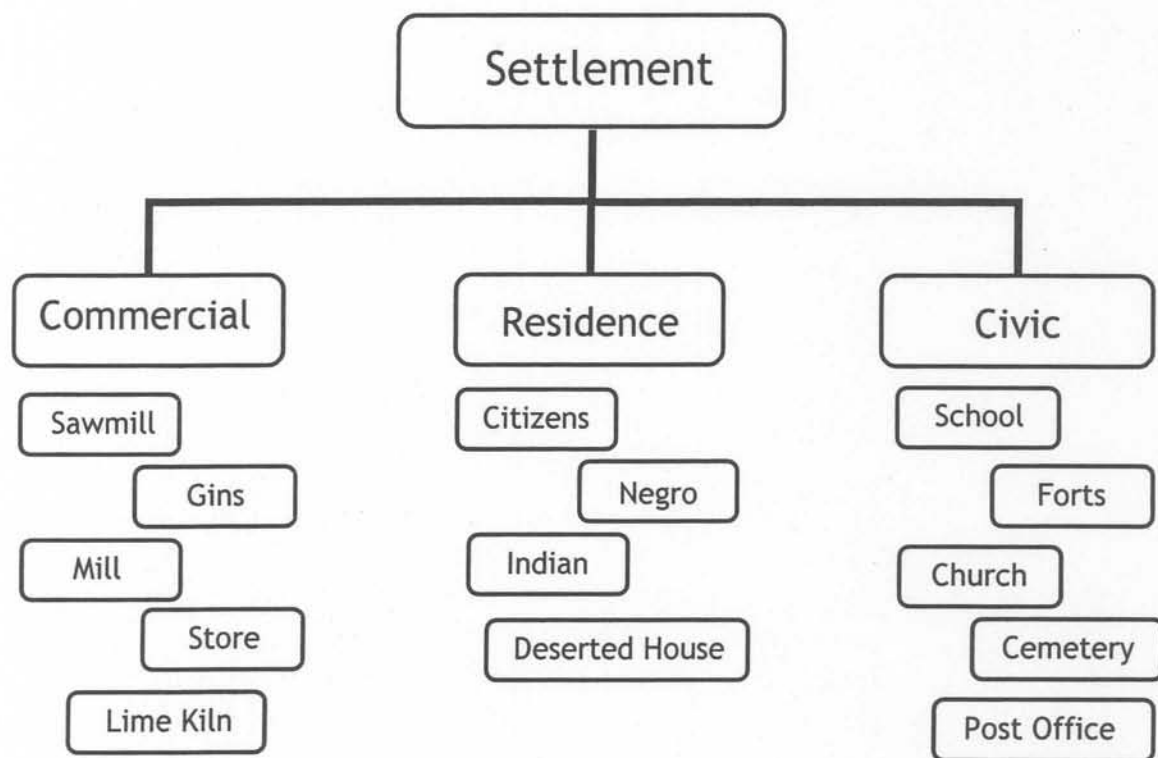


Figure 6. Land Cover of the Chickasaw Nation and Oklahoma Territory circa 1871.

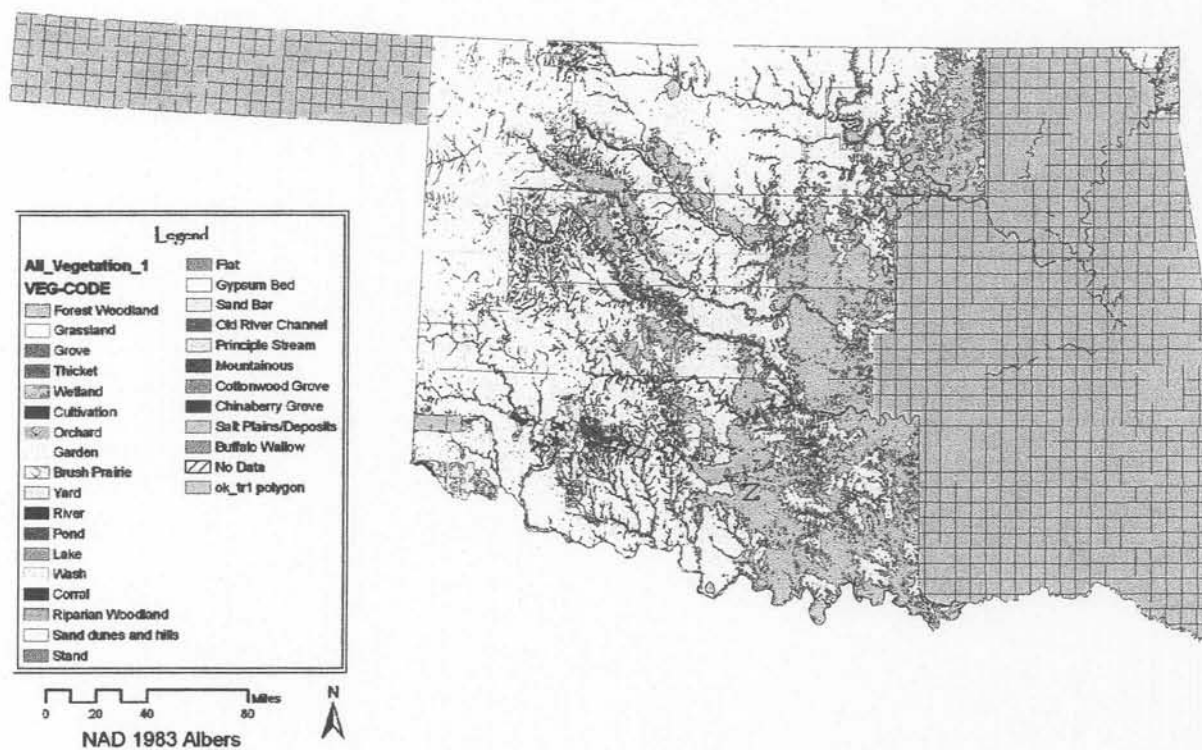


Figure 7. Location of a cottonwood grove mapped by surveyors circa 1871.

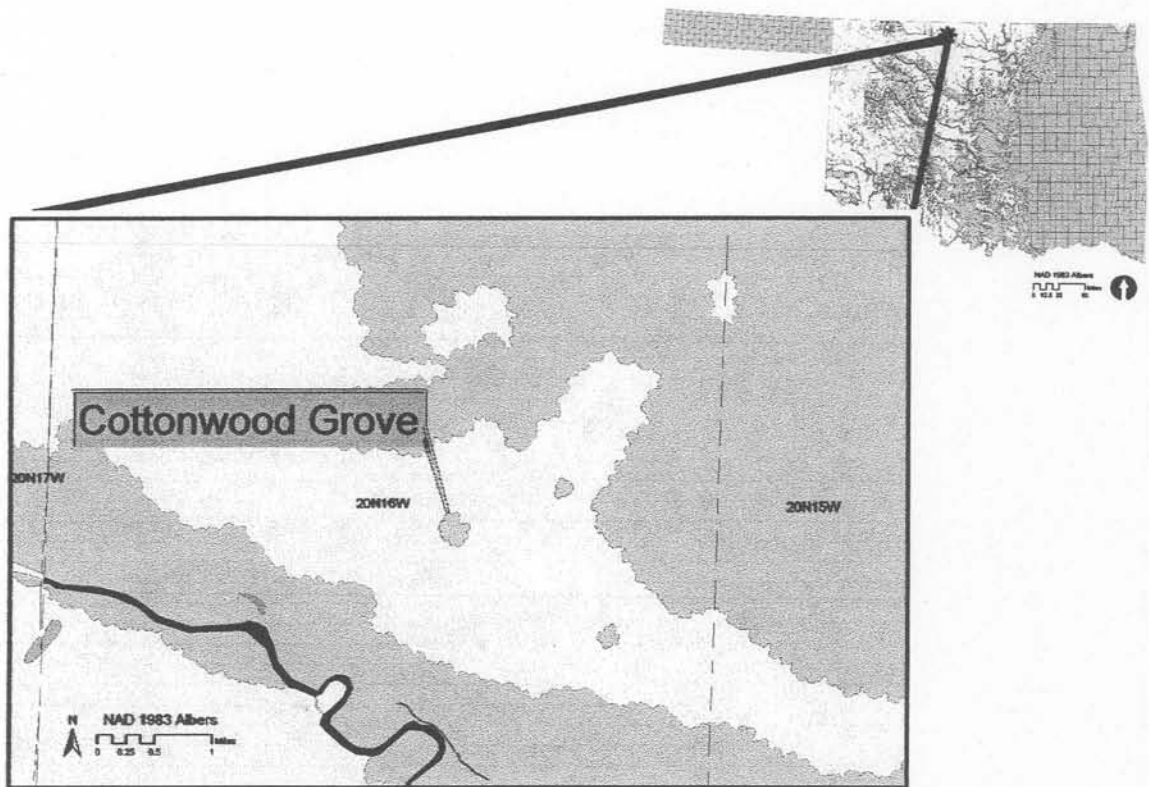


Figure 8. Location of a buffalo wallow, the only one mapped by surveyors circa 1871.

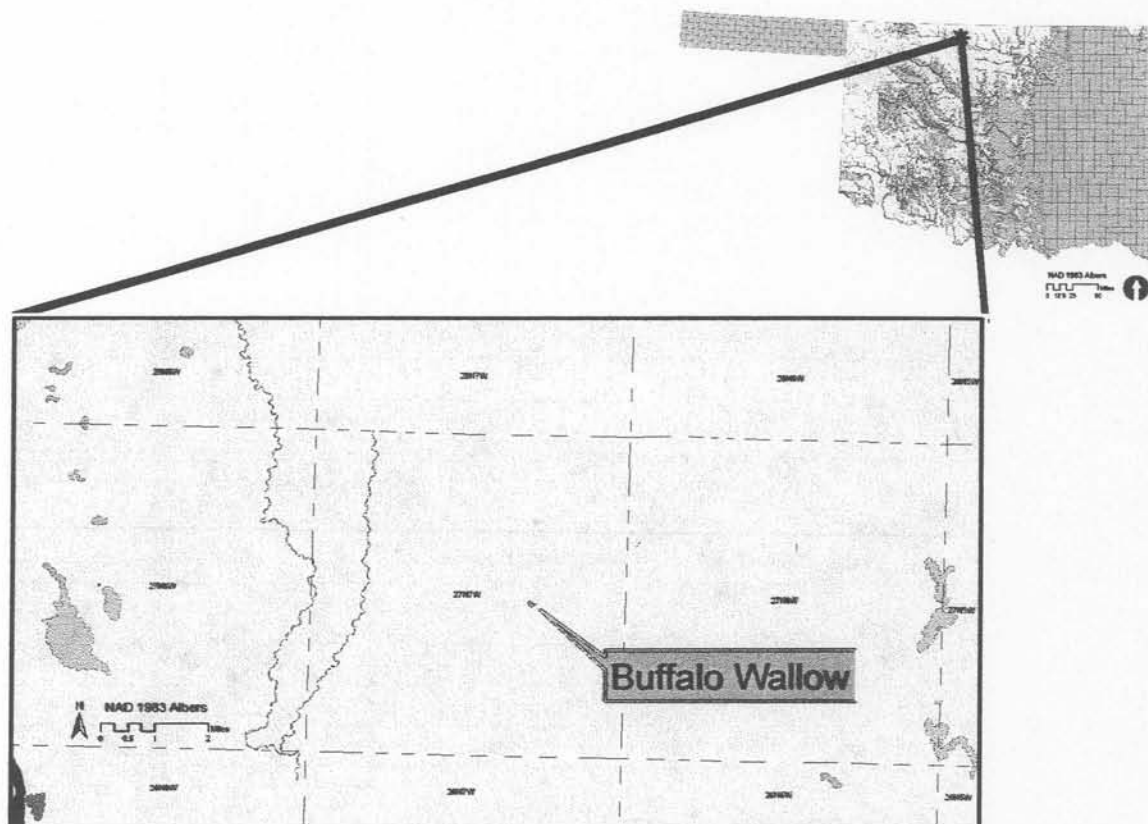


Figure 9. Location of a “negro huts” in present day Garvin County, circa 1871.

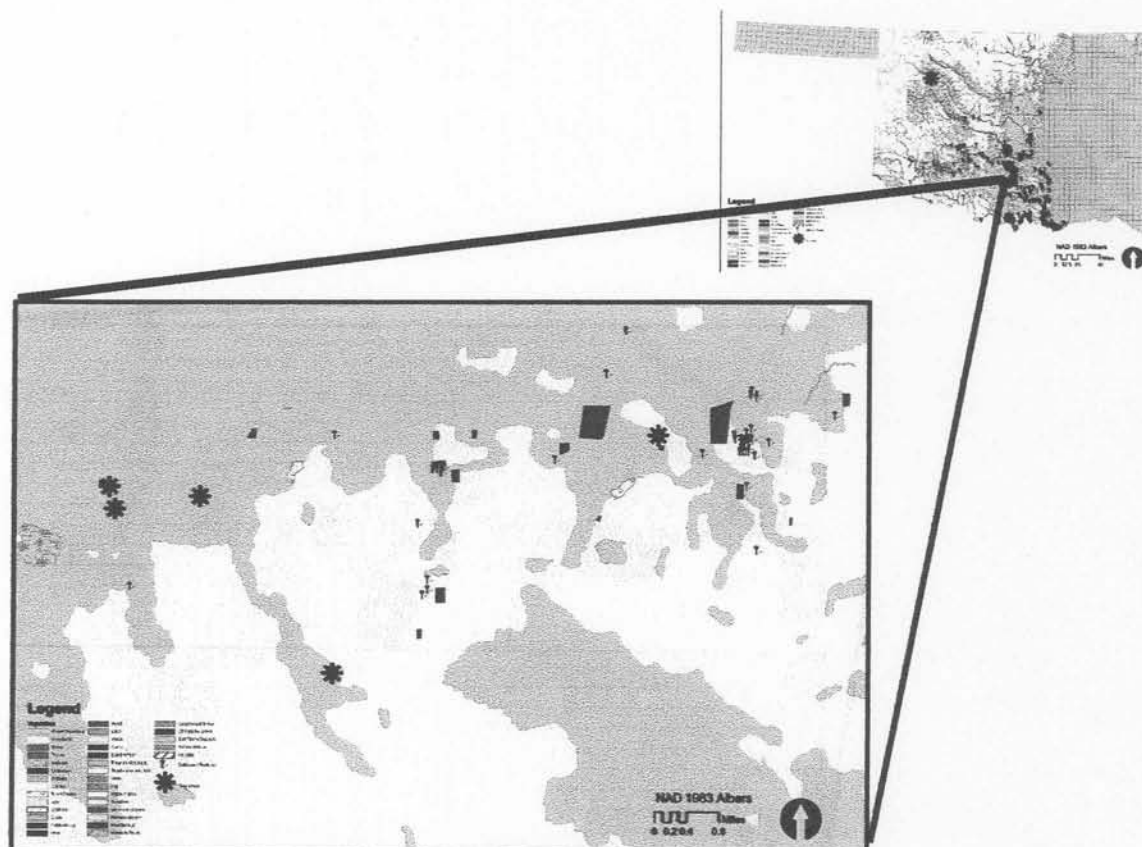


Figure 11. A cluster of residences and agricultural fields along the Canadian River in present day Pottawatomie County, circa 1871.

