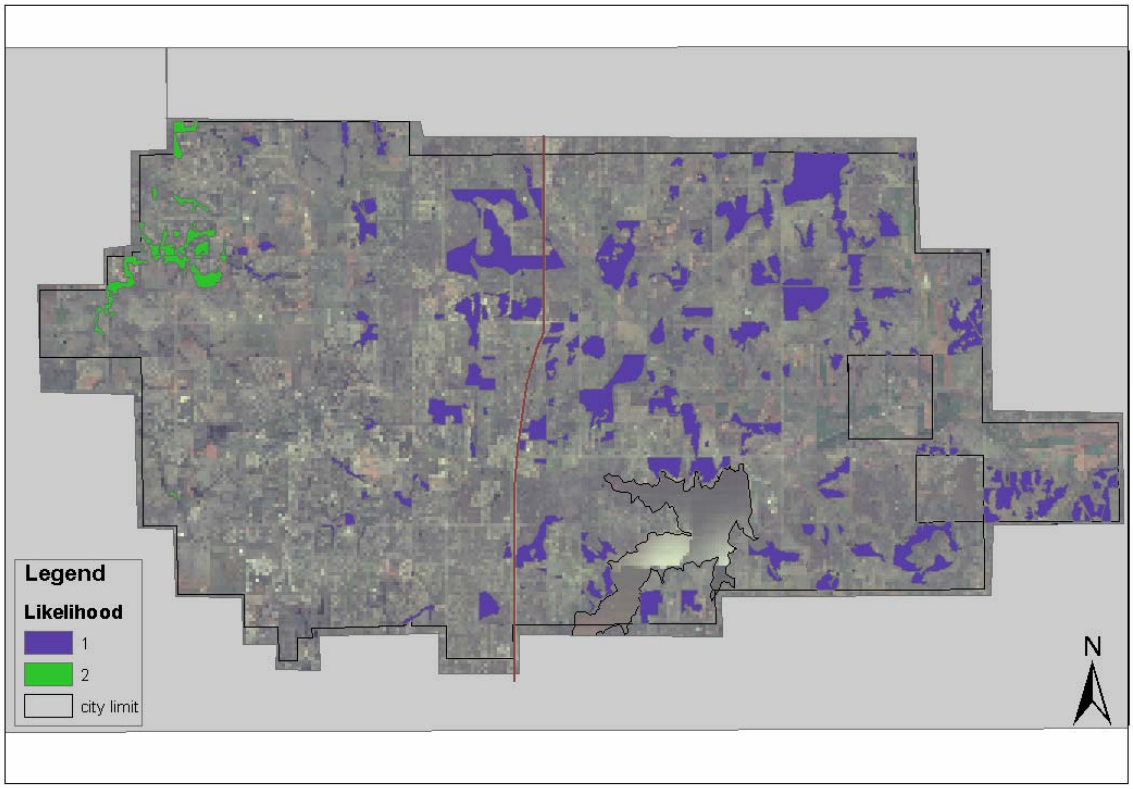
Edmond Sensitive Areas Study
2004

Potential Presettlement Remnants



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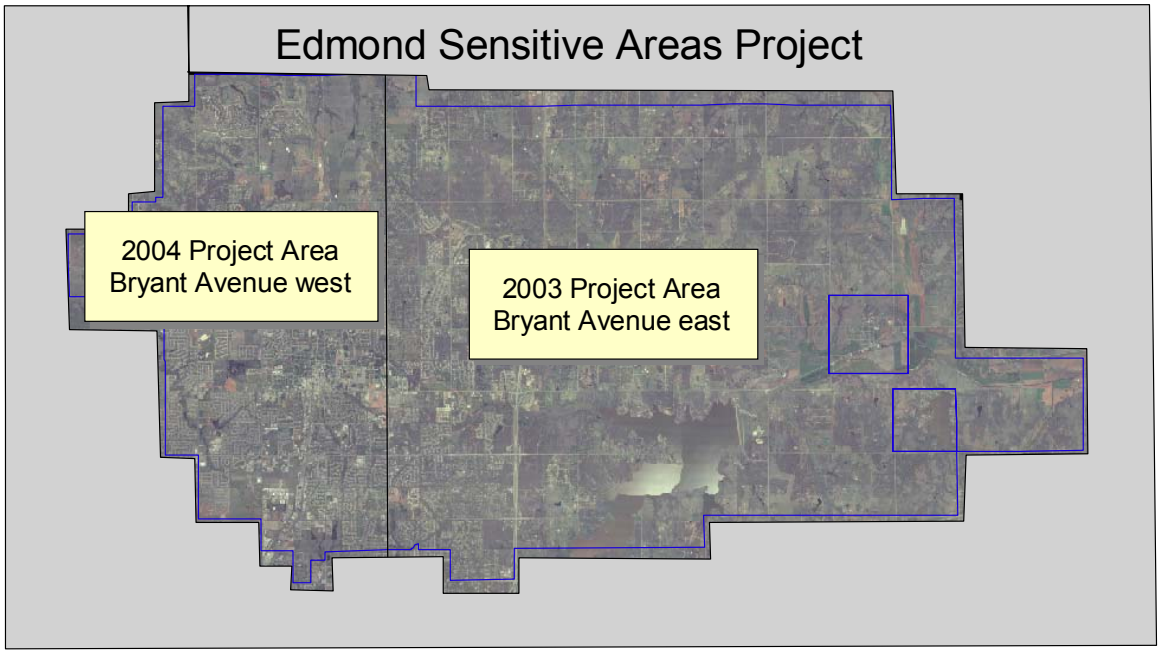
Introduction

The City of Edmond encompasses approximately eighty-seven square miles, many of which are suburban and quasi-rural. Many of these areas are forested with old post oak-blackjack oak forests, called Cross Timbers, and a few areas that are bottomlands. Edmond has shown a commitment to planning for continued growth and tree conservation, and a ready understanding of its forest resource and the forest's value makes effective conservation possible.

In 2003, Cross Timbers Forestry, a forestry consulting firm from Tecumseh, began a project to map sensitive areas within the eastern two-thirds of Edmond. The project identified sensitive areas of three types: areas with sensitive soils, areas of archeological interest, and areas of potential presettlement remnant forests. The project was extended in 2004 to include the remaining western one-third of the city, that is the area west of Bryant Avenue within the city limits. Below is a map that shows the project areas for each year. Data including historic tree cover from 1871, 1930, and 2001, current land use, soil types, and historical and cultural sites were compiled and analyzed for unique attributes and common factors. The analysis indicated that the western one-third of the city contained additional sensitive areas, including potential presettlement remnants. This report outlines the specific findings from the 2004 project and provides a summary of the project findings for the entire city.



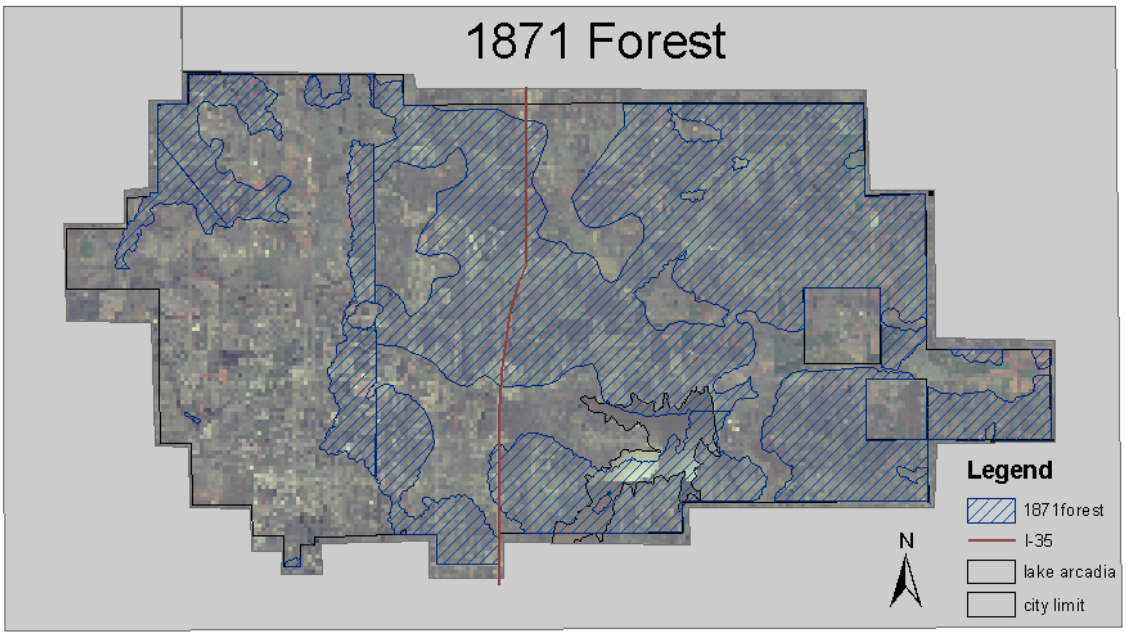
Methodology

The Edmond Sensitive Areas project was continued in 2004 to determine the location of sensitive areas in the western one-third of Edmond, all land west of Bryant Avenue within the city limits. The data sets cover the entire western one-third, regardless of ownership or current land use. A Geographic Information System (GIS) was established for the data sets outlined in the project's data dictionary, and the data sets were then analyzed independently and in combination with each other to locate sensitive areas.

Each of the following data sets is provided as a shape file that can be incorporated into the 2003 project GIS, making the current information compatible with the previous project data. In addition, the data are compatible with Edmond's 2001 digital orthophoto and municipal shape files, such as the city limits, street, and ward shape files. This allows for the comparison of the study data to several other aspects of Edmond and their integration into planning. The areas identified in the various shape files and their associated sizes are approximate. An inventory is needed to determine more specific information and additional attributes of the areas.

1871 Vegetation (1871forest.shp)

The 1871 vegetation theme provides locations of forestland in 1871. This data set covers the entire city limits, both the 2003 and 2004 projects. The density of the forest varied, but all areas shown were categorized as predominantly forest.

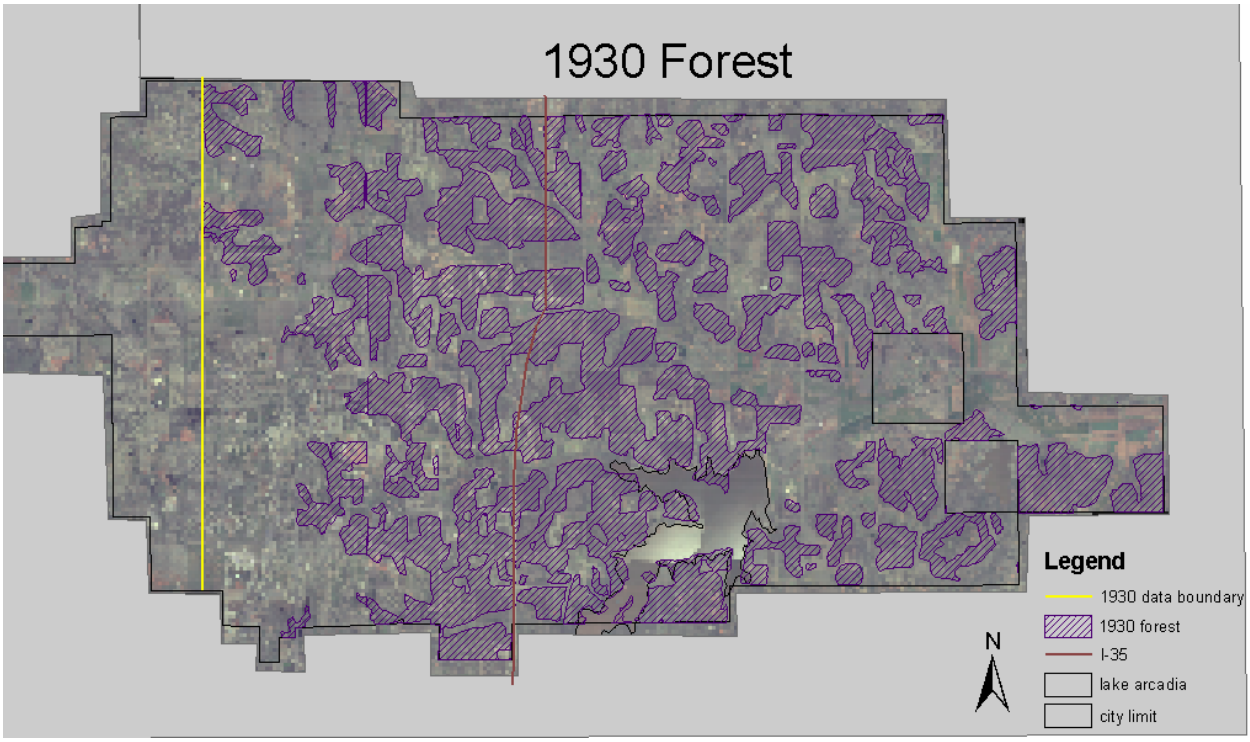


Data: Forests
Year: 1871
Approximate forest area: 31,900 acres
Source: US Department of the Interior

This theme is based on maps created by land surveyors in 1871 and commissioned by the United States Department of the Interior. The maps were provided by the Oklahoma State Archives and digitized by Cross Timbers staff. The forests identified were typical Cross Timbers, densely stocked with many stems to the acre, a closed canopy and little groundcover. The trees would have been predominantly post oak and blackjack oak with elm, hackberry, redbud, and eastern redcedar. There may also have been isolated areas of bottomland hardwoods with sycamore, willow and maple trees. Because this survey was conducted before Native American or European organized settlements, these data are believed to show the historical forest locations with a minimum of, if any, human influence.

1930 Vegetation (1930forest.shp)

The 1930 vegetation theme provides locations of forestland in 1930. As with the 1871 map, this data set contains information for the entire city limits, both the 2003 and 2004 projects.



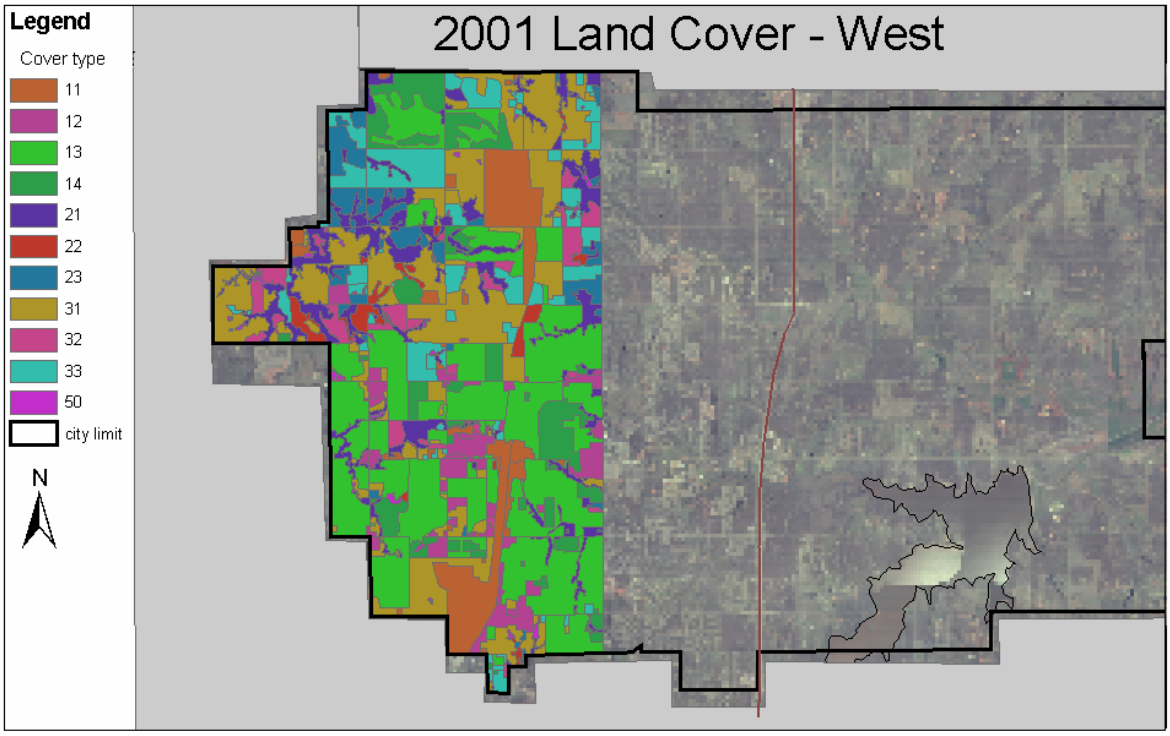
Data: Forests
Year: 1930
Approx. forest area: 19,206 acres
Source: US Department of the Interior

This theme is based on a map commissioned by the United States Department of the Interior, Geological Survey in 1930, provided by the University of Oklahoma Geology Library and digitized by Cross Timbers staff. The species distribution and stocking of these forests would be similar to the areas identified in 1871. These areas would still be heavily stocked in 1930 with post oak and blackjack oak, with occasional redbud, elm, hackberry, and eastern redcedar trees. In comparing the extent of forest in 1871 and 1930, there was approximately 40% less forest in 1930 than in 1871.

Of special note on this shape file is the extent of the information. The maps commissioned by the Department of the Interior only extended to Kelly Road. No information was available west of Kelly; therefore, no forest land is displayed for this area. The boundary of the 1930 map is included as 1930 boundary.shp

2001 Land Cover West (2001 landcover west.shp)

The 2001 land cover theme identifies the land uses or land cover for the 2004 project area based on the 2001 digital orthophoto. The land is categorized into large divisions (urban, forestland, pasture/grassland, agriculture, and water) with more specific divisions within each category. The following page provides a listing and definition of each land cover or land use within the theme.



Data: Land use/cover
Year: 2001
Source: City of Edmond and
Cross Timbers Forestry staff

This map shows the different land uses in Edmond today. The growing development of the area can be seen in the large area in categories 11-14. Forested areas (21-24) and other rural areas (31-40) are decreasing rapidly, with water (50) being the smallest land base.

Land Use Categories

11: Urban, Industrial

12: Urban, Commercial

13: Urban, Residential

14: Urban, Institutional

15: Urban, Transportation

21: Forest cover, 95% or greater tree cover

22: Forest cover, 50-95% tree cover

23: Forest cover, 50-95% tree cover, 5-10% residential

24: Forest cover, bottomland

31: Prairie/pasture, 95% grass

32: Prairie/pasture, 50-95% grass

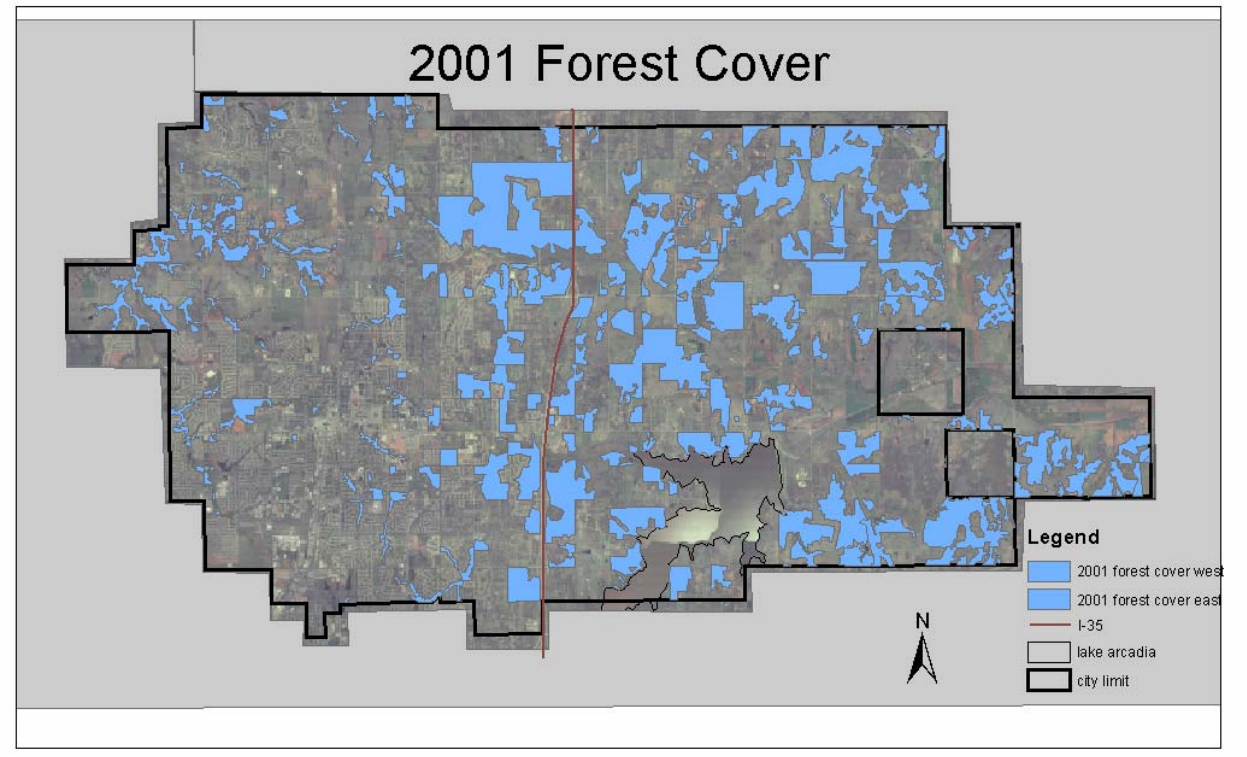
33: Prairie/pasture, 50-95% grass, 5-10% residential

40: Agricultural land

50: Water

2001 Forest Cover (2001 forest cover west.shp and)

The 2001 forest cover theme identifies the areas considered heavily forested (95% or more) based on the 2001 digital orthophoto.

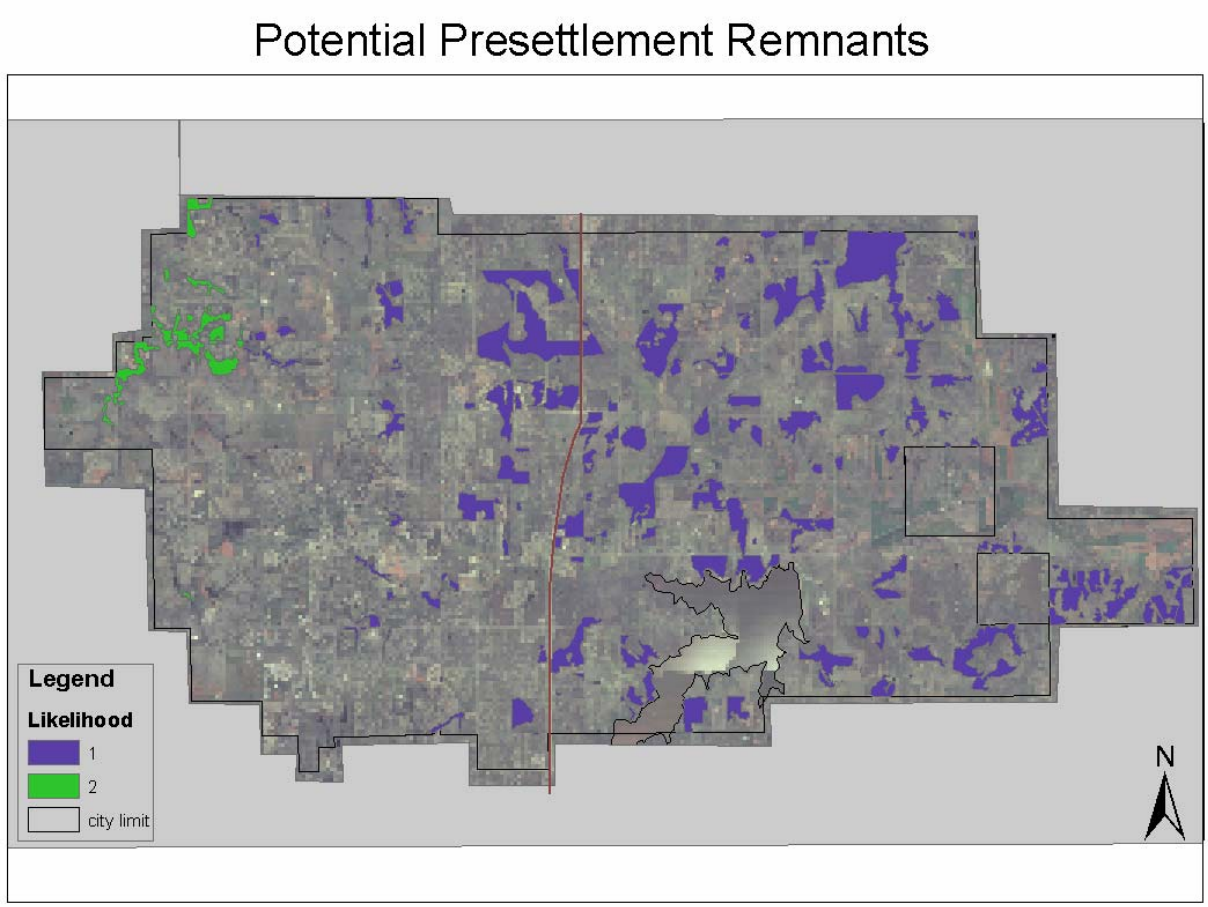


Data: Forest
Year: 2001
Approx. forest area: 13,187 acres
Source: City of Edmond and
Cross Timbers Forestry staff

This map shows how the forest is interspersed with urban and agricultural land throughout Edmond. The growing pressure of urban expansion can be seen readily on this map, and forested areas can be identified that may prove very valuable for greenspace. The forestland identified is generally much smaller parcels than those identified in the eastern two-thirds during the 2003 project. In general, land ownerships are smaller in the more developed western one-third of Edmond, and tree conservation appear to have been a lower priority.

Potential Remnants (potential remnants.shp)

The potential presettlement remnant forest shape file shows areas that were forested in 2001, 1930 and 1871. This map includes data from both the 2003 and 2004 projects, showing two hundred eighty (280) potential remnants.



Data: Forest
Year: 2001, 1930, and 1871
Approx. forest area: 6,300 acres
Source: US Department of Interior and
City of Edmond

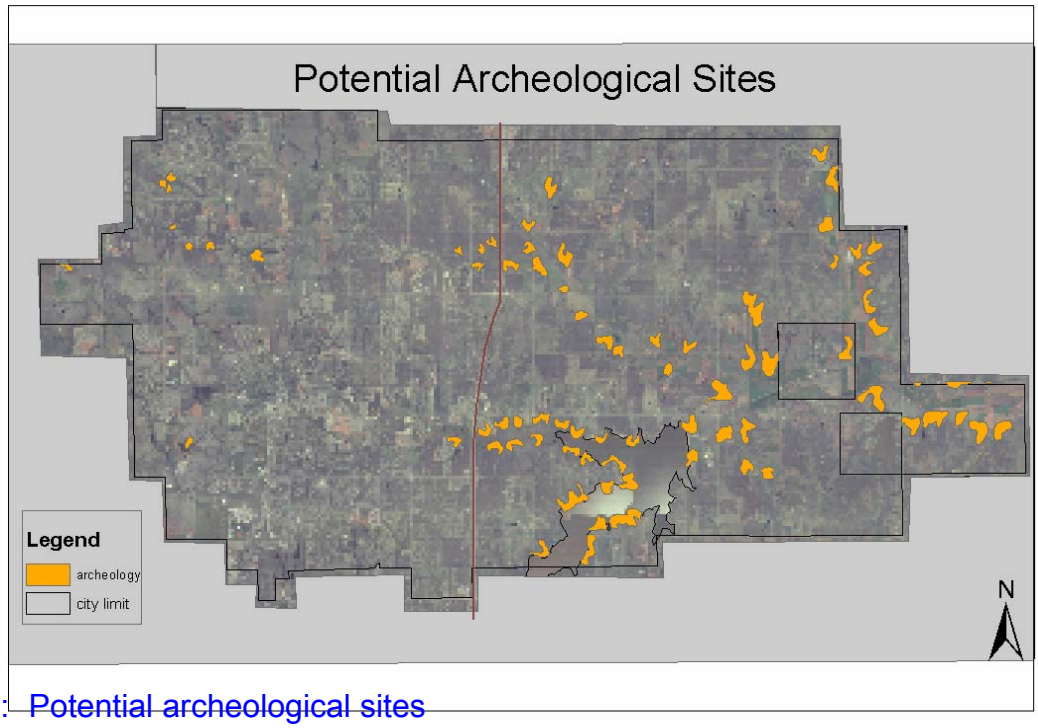
These forestlands show the areas that were forested in 1871, 1930 and the most densely forested areas in 2001. It is not possible to say for certain that these areas were not harvested between 1871 and 2001, but the likelihood is high of finding individual trees or stands of trees that were at least 130 years old in 2001. The potential remnants each have a “likelihood” rating with suggests the level of certainty (or

the likelihood) that the location is a presettlement remnant. For areas in which we have data for all three time periods (1871, 1930 and 2001) the likelihood is “1.” The likelihood rating of “2” is used for areas west of Kelly Road. No 1930 forest data existed for the land west of Kelly; therefore, Cross Timbers Forestry staff extrapolated the probable locations of the forestland and evaluated potential presettlement remnants accordingly.

The composition of the potential remnants identified in the western one-third of the project is similar to that of the eastern two-thirds. The potential remnants are predominantly Cross Timbers forest type, with blackjack and post oaks, redbuds, elms and eastern redcedar. Six identified locations appear to be bottomland areas, rather than more typical upland Cross Timbers. Of note is that five of these six bottomland areas are considered remnant likelihood “2,” that is lower likelihood. Overall, potential remnants are located throughout the city limits; however, the eastern and western study areas show distinct differences in size, location, composition and potential probability for conservation.

Archeological Sites (archeology.shp)

The archeological theme provides the locations of seventy-eight (78) potential archeological sites, with seven potential sites being located in the 2004 project area.



Data: Potential archeological sites
Year: 2003
Approx. site area: 1,944 acres
Source: Oklahoma Archeological Survey and
US Geological Survey topographic maps

The project area was determined to have several potential locations for archeological sites. These are areas identified by Cross Timbers, under the advisement of the Oklahoma Archeological Survey (OAS), that could contain various flakes and isolated artifacts. The method recommended by OAS employs the use of topographic, geologic and vegetative data to locate areas that meet minimum criteria for potential sites. At this time, OAS, the archeological authority in Oklahoma, has not made an extensive survey or identified any of the indicated areas as actual sites in the project area. Should the City of Edmond or OAS desire identify definite archeological sites, a thorough survey would be needed.

Because of the geography of the project location and the use and settlement patterns of prehistoric inhabitants, the archeological sites tend to be predominantly

along creeks and streams, near steep slopes. Very few of the archeological sites are in the same location as potential presettlement remnant forests; however, some of the archeological sites occur where soil characteristics pose a concern, such as high slope or eroded soil. Conservation of the potential archeological sites is best addressed as a separate issue from the forested areas and soil considerations. Conserving the archeological sites may require surveying to determine if artifacts are present and more strict limitations on development than the forest and soil sites. Finally, conserving or preserving these sites may pose greater challenges to general public acceptance because these resources are often harder to define, locate, and observe than old forests and soil issues.

Four periods of human habitation are generally recognized in Oklahoma, the Paleoindian period which stretches from the first suspected human activity in the New World, 10,000 years ago, perhaps more, until 5000 or 6000 BC. Human activities consisted of hunting large animals including mammoths, mastodon, and giant bison. At the end of the Paleoindian period, seven or eight thousand years ago, begins the Archaic period which runs until about 1 AD. During this time period people in North America moved from a reliance on big game for food to forager adaptation with gathering of wild foodstuffs as an important part of their diet. The Woodland period stretches from the Archaic until the advent of the European explorers of the 1400's. During this period North American man began to use the bow and arrow and began to grow domesticated plants such as corn, beans, and squash.

The general area surrounding Edmond has not been surveyed for archeological sites to any large extent with the exception of the land impounded for Arcadia Lake (1973). Surveys indicate that the area never supported a sizable permanent or even semi-permanent human occupation until historic times. All of the sites investigated were scatters of flakes (tool-making debris) with an occasional tool or artifact. The area was utilized on limited basis throughout the Archaic, Woodland, and Plains Village periods. During these occupations the sites might have been short term camp sites used by groups from outside of the immediate region who made occasional trips into the local area during the late Woodland and Plains Village periods. During the late Archaic

and early Woodland periods this area may have been home to a number of nomadic groups.

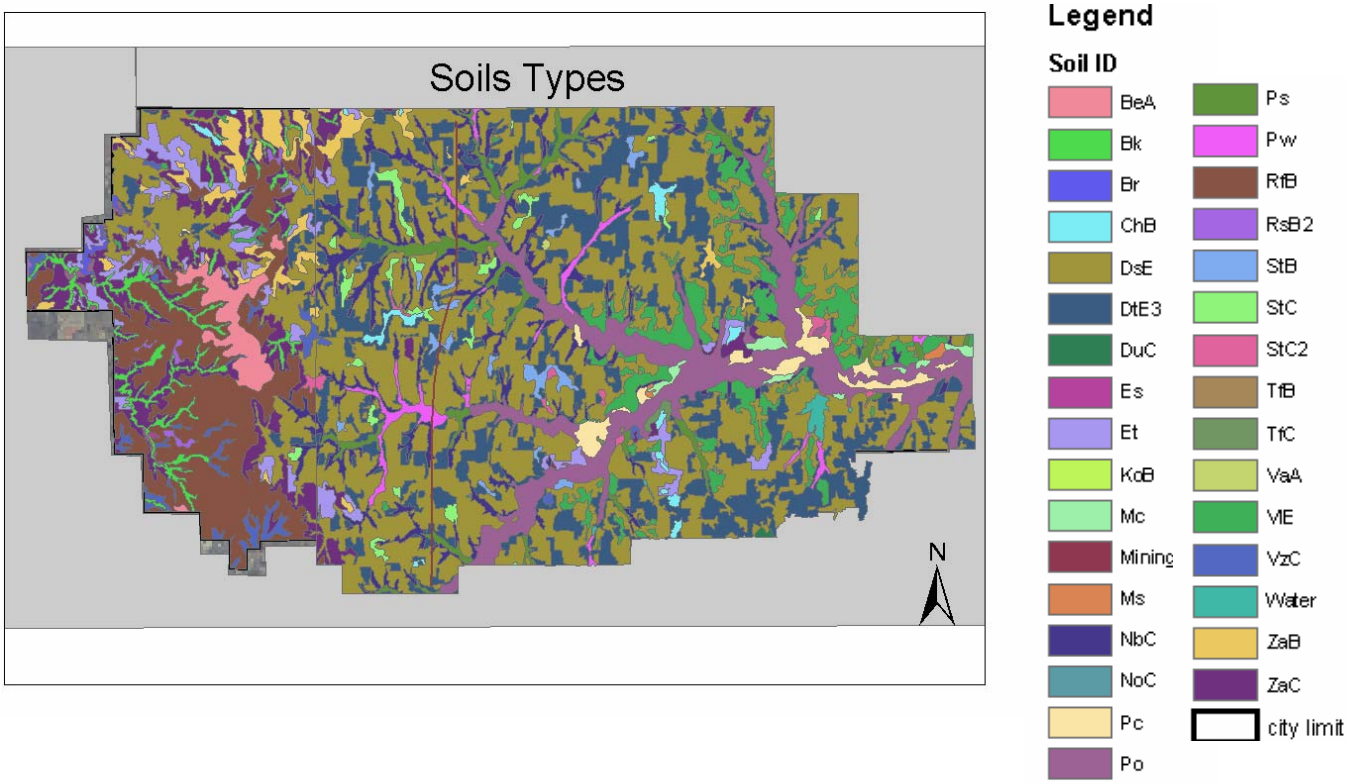
Bibliography

Neal, Larry. 1973. An Assessment of the Prehistoric Cultural Resources of the Proposed Arcadia Reservoir Oklahoma County, Oklahoma. University of Oklahoma , Norman, Oklahoma.

Hartley, John D. 1976. A Resource Survey and Assessment of the Prehistoric Resources of Arcadia Lake, Oklahoma County, Oklahoma. Oklahoma River Basin Survey Project. University of Oklahoma, Office of Research Administration.

Soils Data (soils.shp)

The soils theme provides the locations of each soil type based on the Natural Resources Conservation Service Soil Survey from 1969. Below is a listing of each soil type.



Data: Soil types
Year: 1969
Source: Natural Resources Conservation Service and
Cross Timbers Forestry Staff

BeA – Bethany silt loam, 0 to 1 percent slopes.
Bk - Breaks-Alluvial land complex.

Br – Broken alluvial.

ChB - Chickasha loam, 1 to 3 percent slopes.

DsE - Darnell-Stephenville complex, 3 to 12 percent slopes.

DtE3 - Darnell-Stephenville complex, 3 to 12 percent slopes, eroded.

DuC - Dougherty loamy fine sand, hummocky.

Es – Eroded clayey land.

Et - Eroded loamy land.

KoB - Konawa loamy fine sand, undulating

Mc - Miller clay.

Mining

Ms - Miller-Slickspots complex.

NbC - Noble fine sandy loam, 3 to 8 percent slopes.

NoC - Norge loam, 1 to 3 percent slops.

Pc - Port clay loam.

Po - Port loam.

Ps - Pulaski fine sandy loam.

Pw - Pulaski wet.

RfB - Renfrow clay loam, 1 to 3 percent slope.

RsB2 – Renfrow-slickspots complex, 1 to 3 percent slopes, eroded.

StB - Stephenville fine sandy loam, 1 to 3 percent slopes.

StC - Stephenville fine sandy loam, 3 to 5 percent slopes

StC2 - Stephenville fine sandy loam, 3 to 5 percent slopes, eroded.

TfB - Teller fine sandy loam, 1 to 3 percent slopes

TfC - Teller fine sandy loam, 3 to 5 percent slopes.

VaA - Vanoss loam, 0 to 1 percent slopes.

VlE - Vernon-Lucien complex, 5 to 15 percent slopes.

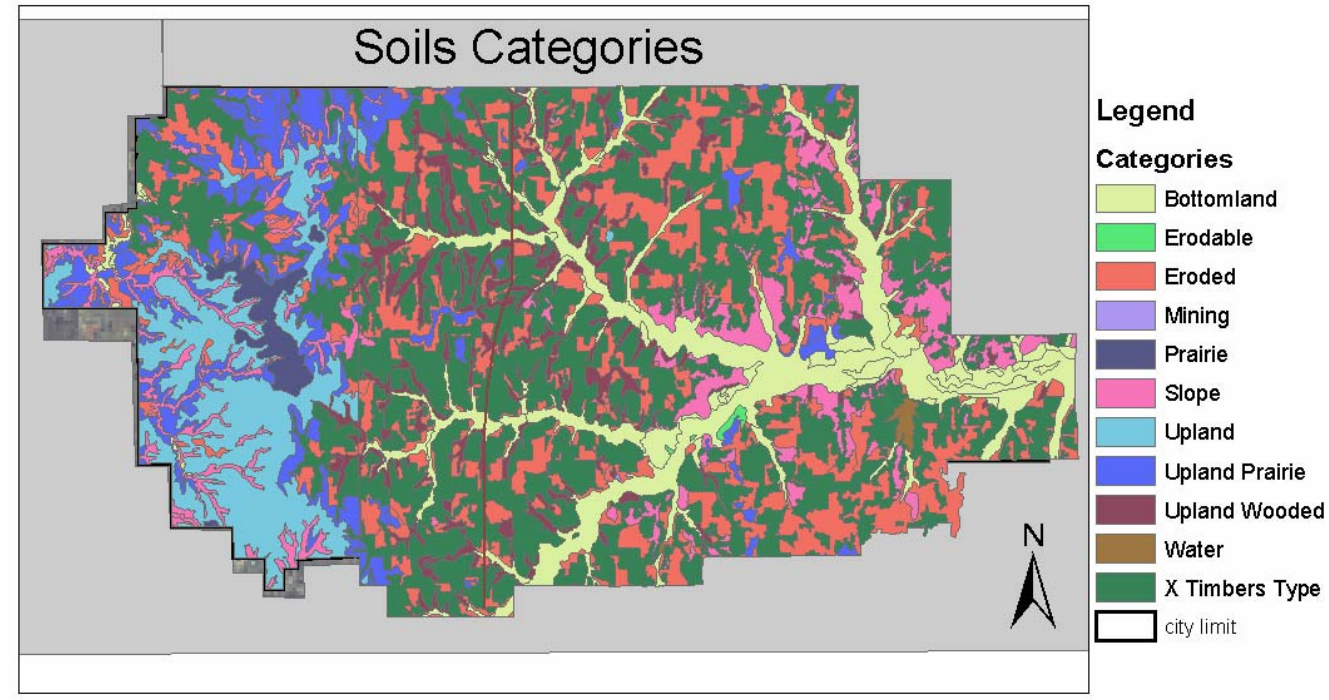
VzC - Vernon-Zaneis complex, 3 to 5 percent slopes.

ZaB - Zaneis loam, 1 to 3 percent slopes.

ZaC - Zaneis loam, 3 to 5 percent slopes.

Soil Categories (soil categories.shp)

The soil categories theme provides soil groupings of similar soil types based on the Natural Resources Conservation Service Soil Survey from 1969.



Data: Soil categories
Year: 1969
Source: Natural Resources Conservation Service and
Cross Timbers Forestry Staff

The ten (10) categories shown above provide a summary of the main soil characteristics found in Edmond. The groupings display the already eroded areas and areas at risk for degradation. Areas considered at risk are the eroded, erodable, slope and bottomland designations.

Wildlife Critical Habitat

The final type of sensitive area considered for Edmond was sensitive wildlife habitat. To determine what threatened, endangered or sensitive species exist in the area, the Oklahoma Natural Heritage Inventory (ONHI) and Oklahoma Department of Wildlife Conservation were contacted. The ONHI reported no threatened or endangered species. However, two species were listed as sensitive species, species for which special interest is noted and more research is needed: the Texas horned lizard and barn owl. Both species have historically lived in west Edmond, but currently there is little data on their exact numbers or their need for further protection. Both species have closed hunting seasons year round. Because their habitat locations can vary, no set of wildlife habitat preservation areas were identified; however, special care should be taken in maintaining their habitat, whenever possible.

The Texas horned lizard is considered sensitive (SS2 class) because the eradication of various ant populations has limited the lizard's food source. Because of the declining population, there is no open season for hunting Texas horned lizards in Oklahoma. The key to increasing the lizard populations is to provide a ready supply of ants for food. Encouraging citizens to limit their use of insecticides will help to revitalize the ant populations, and thereby increase the lizard populations.

The barn owl is predominantly a grassland and edge species that will not venture into heavily forested areas, if they have a more open area available. They tend to nest in abandoned buildings, belfries, barns and grassy areas; however, they will avoid intensively farmed areas because of the high noise and disturbance. Their main food source is rodents. The major reduction in barn owl populations in many states is due to a loss of rodents from urbanization and intensive farming. In addition, egg shell softness has been sighted from heavy pesticide residuals, which has increased fetus mortality. As with the lizard, a ready food source is the key to increasing owl populations; however, allowing increased rodent populations is not likely as these areas become more intensively used for urbanization and agriculture. Edmond city officials should be aware that the lizard and owl are of interest in the area; however, no direct action is needed by the City in relation to them, except to enforce applicable restrictions on the Texas horned lizard, as appropriate.

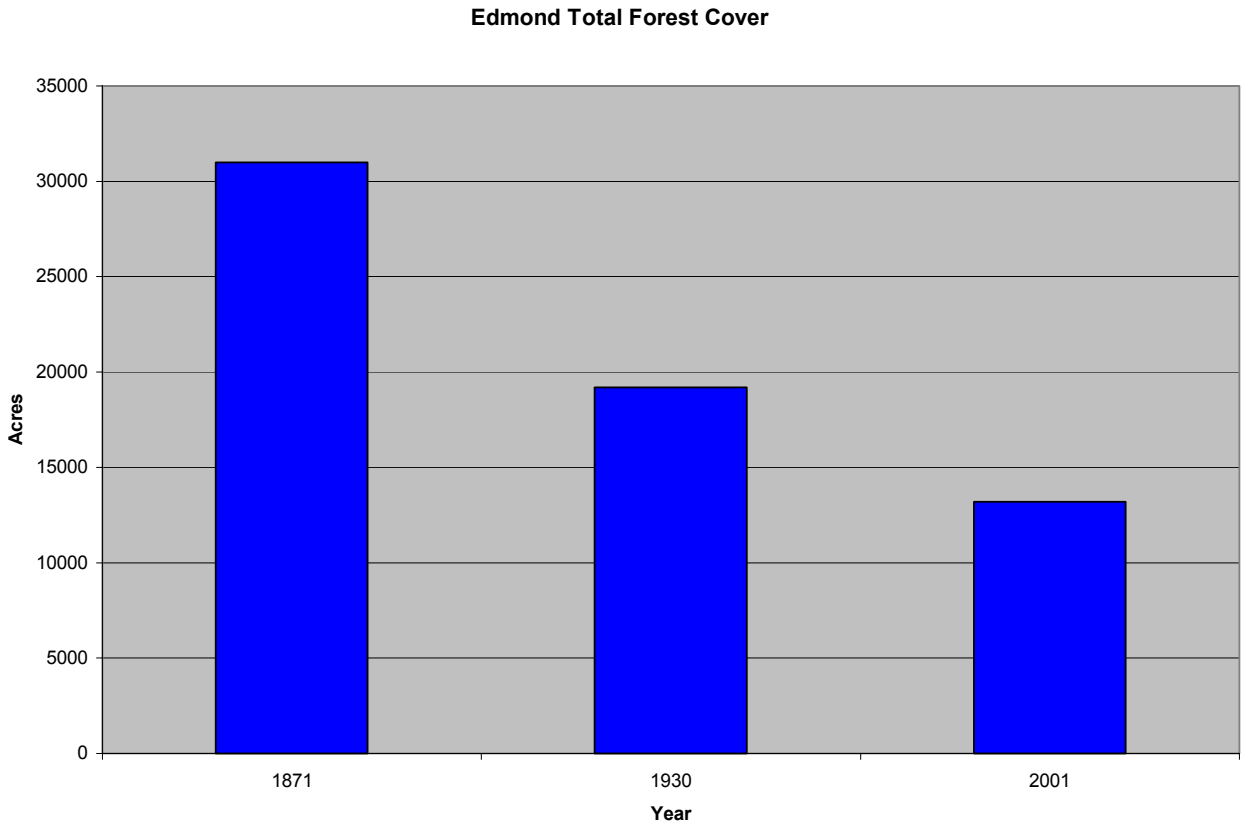
Results

The purpose of this project was to identify sensitive areas throughout the city west of Bryant Avenue. The sensitive areas fall into four main categories: potential presettlement remnants, potential archeological sites, potential erosion locations and sensitive wildlife habitat.

Forest Cover

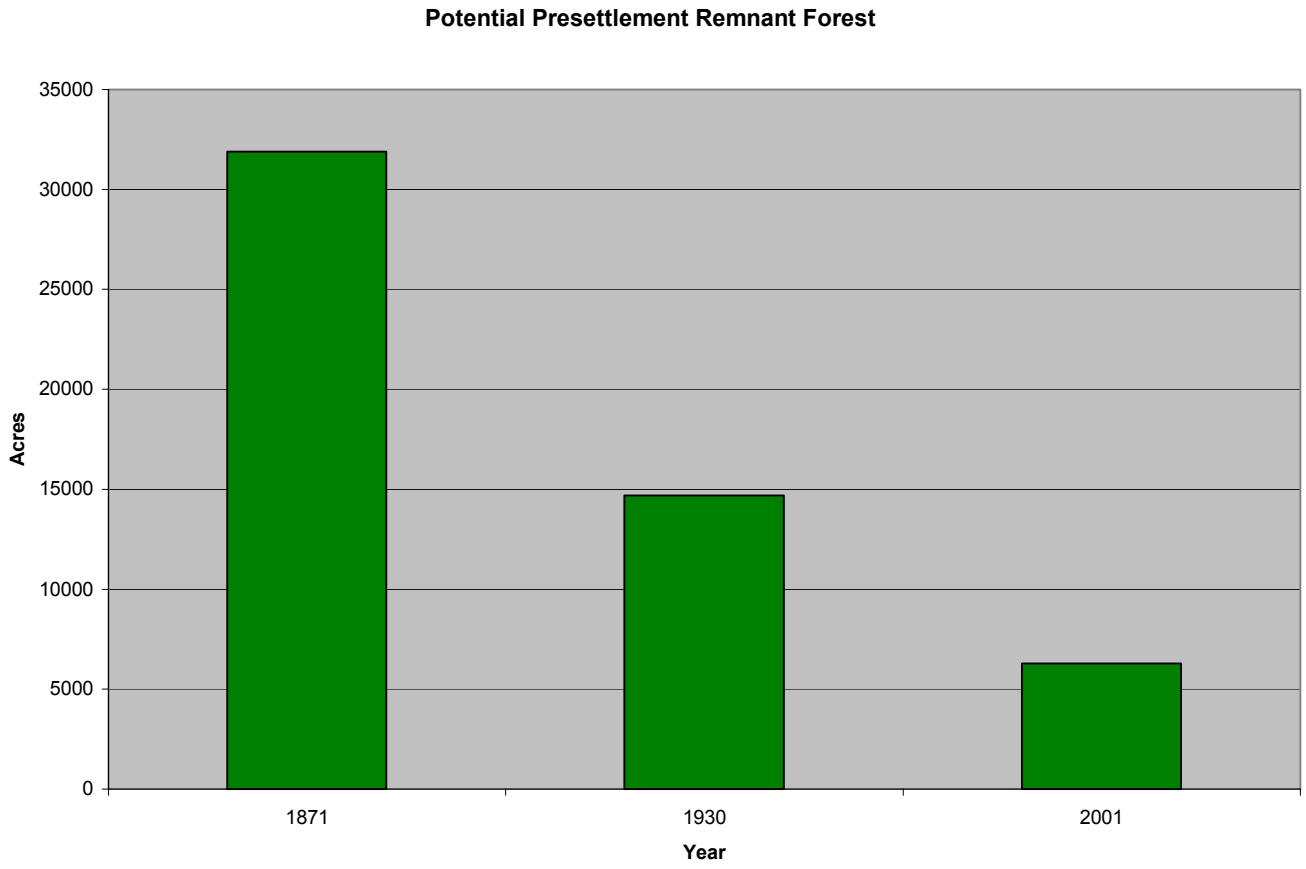
The progression of land use and forest cover from 1871 to 2001 demonstrates the changing needs people have had for the land surrounding Edmond. In particular, the forest cover acreages have been reduced from 31,000 total forest acres in 1871 to 19,000 total forest acres in 1930 to 13,000 total forest acres in 2001. This means that in considering total forest acres, regardless of location, there was a 39% loss in forest cover from 1871 to 1930, and a 58% forest cover loss from 1871 to 2001. However, the remaining forest bears a striking resemblance to the forest of 1871; the species that are common, the size of the trees and the overall appearance of Cross Timbers areas today demonstrate the cyclical nature of the forest and the change it undergoes tree by tree but the amazing continuity and consistency it has as a system for the last 130 years.

The following chart illustrates the progression of forest cover from 1871 to 2001.



Potential Presettlement Remnants

Potential presettlement remnants are areas that were found to have substantial tree cover (95% or greater tree cover) in 1871, 1930 and 2001. Two hundred eighty (280) such sites were found throughout the entire city limits, of which seventy-eight (78) were located west of Bryant. The seventy-eight remnants west of Bryant were categorized with "likelihood" ratings of 1 for high likelihood and 2 for lower likelihood. The USDI forest data for 1930 only extended to Kelly Road; therefore, all potential remnants west of Kelly have a lower likelihood of being remnants, as these potential remnants were extrapolated based on forest patterns. Twenty-three (23) of the potential remnants have a likelihood rating of 2. The following chart illustrates the acreages of potential remnants associated with each time period.



The potential presettlement remnants are a unique resource within Edmond. These areas have seen Edmond grow and progress but have stayed relatively unchanged as functioning ecosystems. The western remnants should be very similar in appearance to the previously identified potential remnants, in that the majority of them are Cross Timbers type. Blackjack and post oak will dominate these sites with a few elms, redbuds, hackberries and eastern redcedar, all of which have been affected by the passage of time and Oklahoma weather. There will be isolated specimens, probably post oaks, that are very large and old; however, the rest of the trees will vary in age, size and health showing the typically wide distribution of these characteristics expected in unmanaged, uneven-aged hardwood forests. A small portion, less than 10%, of the potential remnants appear to be bottomland. These bottomland areas are expected to be populated by willows, sycamore, cottonwoods and pecans, with small pockets of Cross Timbers.

Discussion has gone on throughout the project considering the progression of forest cover in the Edmond area, and for many, the potential remnants have become a symbol of what should be preserved to maintain Edmond's forest and appearance. In analyzing the data, it was determined that 20% of the 1871 forest may still be in existence as presettlement remnants today, that one in five of the trees that existed before settlement still stands today. While this may sound like a small amount of forest to retain over 130 years, this remaining 6,300 acres made up 48% of the forest cover in 2001, meaning that potentially have of Edmond's forest today may be presettlement remnants. The potential remnants become that much more important to consider for conservation because they are an integral part of Edmond's forest cover today.

Another unique characteristic of the potential remnants is their use as baseline data for Cross Timbers forest in the Edmond area. The potential remnants provide a glimpse of what Edmond's forest may have looked like before man's influence. These forested areas have also withstood the pressures of increased human habitation and development, and they have not only survived but have continued to function as ecosystems. Through additional study of these areas, a baseline can be created that displays how these ecosystems have functioned through various types of land use changes, and those interactions may help to predict what pressures the forests may be able to withstand in the future.

Potential Archeological Sites

The second type of sensitive area identified through the project was potential archeological sites. These areas were identified based on mapping criteria as having a high probability of possessing Native American artifacts, such as arrowheads, tools and flecks,. Of the seventy-eight (78) total potential archeological sites, nine (9) of them are located west of Bryant. As with the potential remnant locations, the archeological sites located in this project are based on current techniques for mapping and extrapolation but have not been verified through on-the-ground surveying by the Oklahoma Archeological Survey or Cross Timbers Forestry. They are potential sites and as such serve to narrow the area to be surveyed. Further research is needed to determine

which sites, if any, contain artifacts and what effective conservation practices could be applied to the areas.

Soil Erosion and Degradation

The final type of sensitive areas explored were areas at risk for soil erosion. The soil categories map identifies ten (10) main soil categories that describe their erosion capacity and/or their cover type. The categories most at risk for degradation are eroded, erodable, high slope and bottomland. The eroded and erodable areas have the highest risk because they have already eroded or are similar in type and location to the eroded soils. In addition, soils with high slope will also tend to erode if they are exposed for long periods of time. Finally, bottomland areas can have high water erosion potential, if left exposed for long periods. The soil erosion and degradation areas total approximately 25,500 acres or 39% of the total area of the 2004 project area. Please note that this total includes land that may already be developed. As development is considered for the western one-third of Edmond, soil potential and characteristics can help determine the advisability of potential soil movement projects.

The completion of the Sensitive Areas Study for the entire Edmond city limits has provided vital information on potentially important sites. Sensitive areas have been designated for potential presettlement remnants, archeological sites and soil erosion. In total, there were approximately 32,000 acres identified as potentially sensitive areas, including land that may have been previously developed.

Conclusion and Recommendations

The sensitive areas identified in this project, both in 2003 and 2004, offer a wealth of unique information and ecological benefits to the area. The next steps should focus on continuing to learn more about these areas and their function, as well as codifying Edmond's commitment to their conservation. The potential remnants are the most readily identifiable locations for research. Inventories should determine the relative age of the trees, the age distribution, the species distribution and if a corollary can be made between species and age. In addition, long term research could provide valuable information on the dynamics of the ecosystem and help identify viable conservation techniques. Other sensitive areas can be surveyed in a similar fashion to refine the City's knowledge of its resources. As many of the potential sensitive areas are located on private property, surveys of the individual parcels would provide valuable data to the homeowners and facilitate public education. Techniques for accurately assessing the value of these areas in light of possible conflicting interests will be an important step in the conservation process.

As Edmond continues its Title 22 code revisions, conservation of potential remnants can serve as a focal point for tree conservation. By showing its commitment to very old forested areas, Edmond encourages its developers to value what has brought citizens to Edmond: the beautiful oak landscape. In addition, with the potential remnants making up almost half of the total forest cover in 2001, the conservation of the potential remnants would substantially limit the amount of forest that can be cleared in future projects. The Sensitive Areas Project begins the process of identifying the potential areas for forest conservation, but general acceptance and understanding of the code revisions will be necessary for their successful implementation.

The sensitive areas encompass many different land types and ownership categories, which will make conservation a challenge. Public education on the areas' value and the need for unified efforts among public, residential and commercial landowners will encourage citizen involvement in the conservation effort. By involving various partners, the City builds a base of active supporters working toward the City's goals for conservation. Being the first study of its kind in Oklahoma, Edmond's Sensitive Areas Project sets the standard for evaluating locations that may contain

presettlement remnant forests and other important natural features. This study has shown that a valuable resource exists within Edmond that warrants more research and continued efforts to conserve these sensitive areas.